




S2-FGJV-ENV-PLN-0008

## SNOWY 2.0 MAIN WORKS – BIODIVERSITY MANAGEMENT PLAN

Approval Record			
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Document Revision Table		
Rev.	Date	Description of modifications / revisions
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B	18.03.2020	For consultation
C	02.06.2020	Revised to include and address conditions of approval
D	15.06.2020	Revised to address Snowy Hydro comments
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H	09.10.2020	Appendix G updated to address DPIE comments
I	12.10.2020	Appendix G updated to address DPIE comments

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## ABBREVIATIONS AND DEFINITIONS

Acronym	Definition
ACH	Aboriginal Cultural Heritage
AFL	Agreement for Lease
APZ	Asset Protection Zone
BAM	Biodiversity Assessment Method
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BCD	Biodiversity and Conservation Division – DPIE (previously OEH)
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
CoA	Conditions of Approval
DAWE	Commonwealth Department of Agriculture Water and the Environment (formerly Department of the Environment and Energy)
DEC	NSW Department of Environment and Conservation (now Department of Planning, Industry and Environment)
DECC	Department of Environment and Climate Change (now Department of Planning, Industry and Environment)
DoEE	Department of the Environment and Energy (now DAWE)
DoI Water	NSW Department of Industry – Lands & Water
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
EMS	Environmental Management Strategy
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPL	Environment Protection Licence
Future Generation	Future Generation Joint Venture
Future Generation-PMS	Project Management System
GDE	Groundwater Dependent Ecosystem
HBT	Hollow-bearing Tree
KNP	Kosciuszko National Park
KTP	Key Threatening Process
Main Works EIS	<i>Snowy 2.0 Main Works - Environmental Impact Statement</i>
MNES	Matters of National Environmental Significance
NPW Act	NSW <i>National Parks and Wildlife Act 1995</i>
NPW Regulation	NSW <i>National Parks and Wildlife Regulation 2009</i>
NPWS	NSW National Parks and Wildlife Service

Acronym	Definition
OEH	NSW Office of Environment and Heritage (now Department of Planning, Industry and Environment)
PCT	Plant Community Type
Plan	This Biodiversity Management Plan
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
Project, the	Snowy 2.0 Main Works
REMMs	Revised environment management measures
Submissions Report or RTS	<i>Snowy 2.0 Main Works – Response to Submissions</i>
Snowy Hydro	Snowy Hydro Limited
TECs	Threatened Ecological Community
TPZ	Tree Protection Zone
WoNS	Weed of National Significance

## 1. INTRODUCTION

### 1.1. Project Description

#### 1.1.1. Overview

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

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.

Salini Impregilo, Clough and Lane have formed the Future Generation Joint Venture (Future Generation) and have been engaged to deliver both Stage 2 of Exploratory Works and Snowy 2.0 Main Works. This management plan has been prepared for the Snowy 2.0 Main Works project.

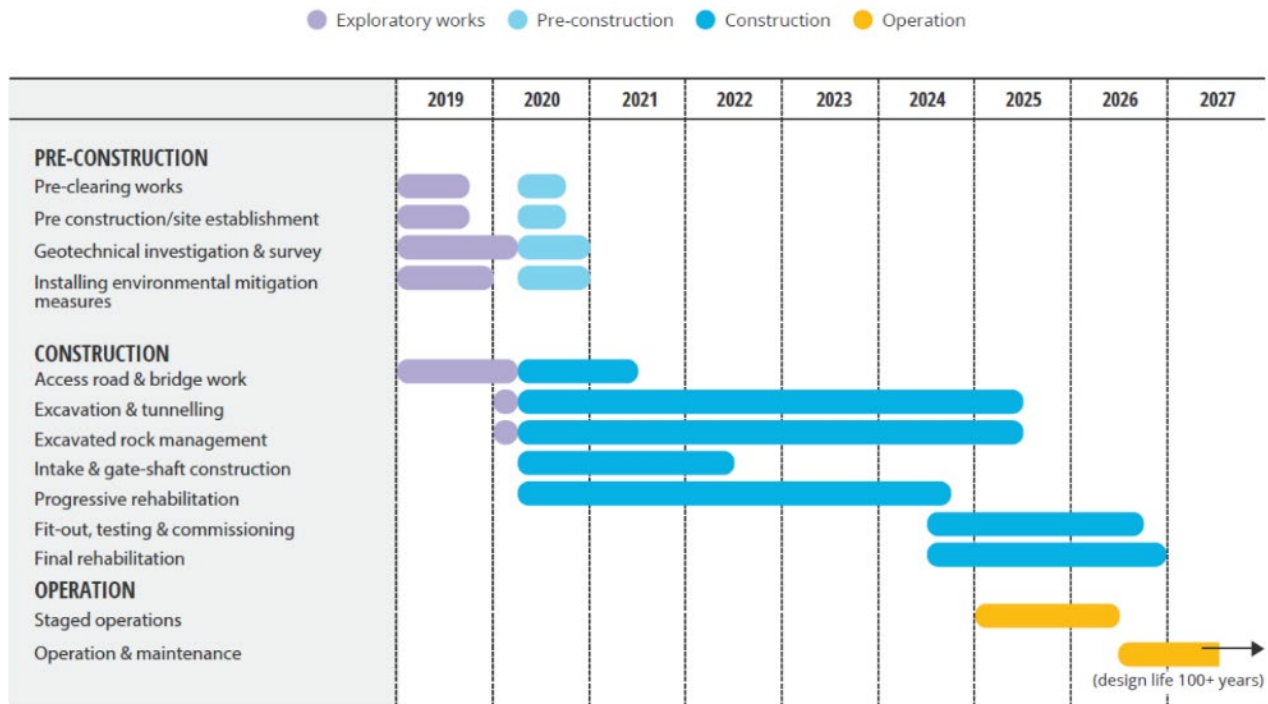
#### 1.1.2. Construction Activities and Program

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

- pre-construction preparatory activities including dilapidation studies, surveys, investigations, access etc;
- exploratory works including:
  - an exploratory tunnel to the site of the underground power station;
  - horizontal and test drilling;
  - a portal construction pad;
  - an accommodation camp;
  - 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 Main Works construction program is summarised in Figure 1-1.



**Figure 1-1: Timing of Snowy 2.0 Main Works**

Snowy 2.0 Main Works includes numerous work areas as shown in Figure 1-2. These work areas include:

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



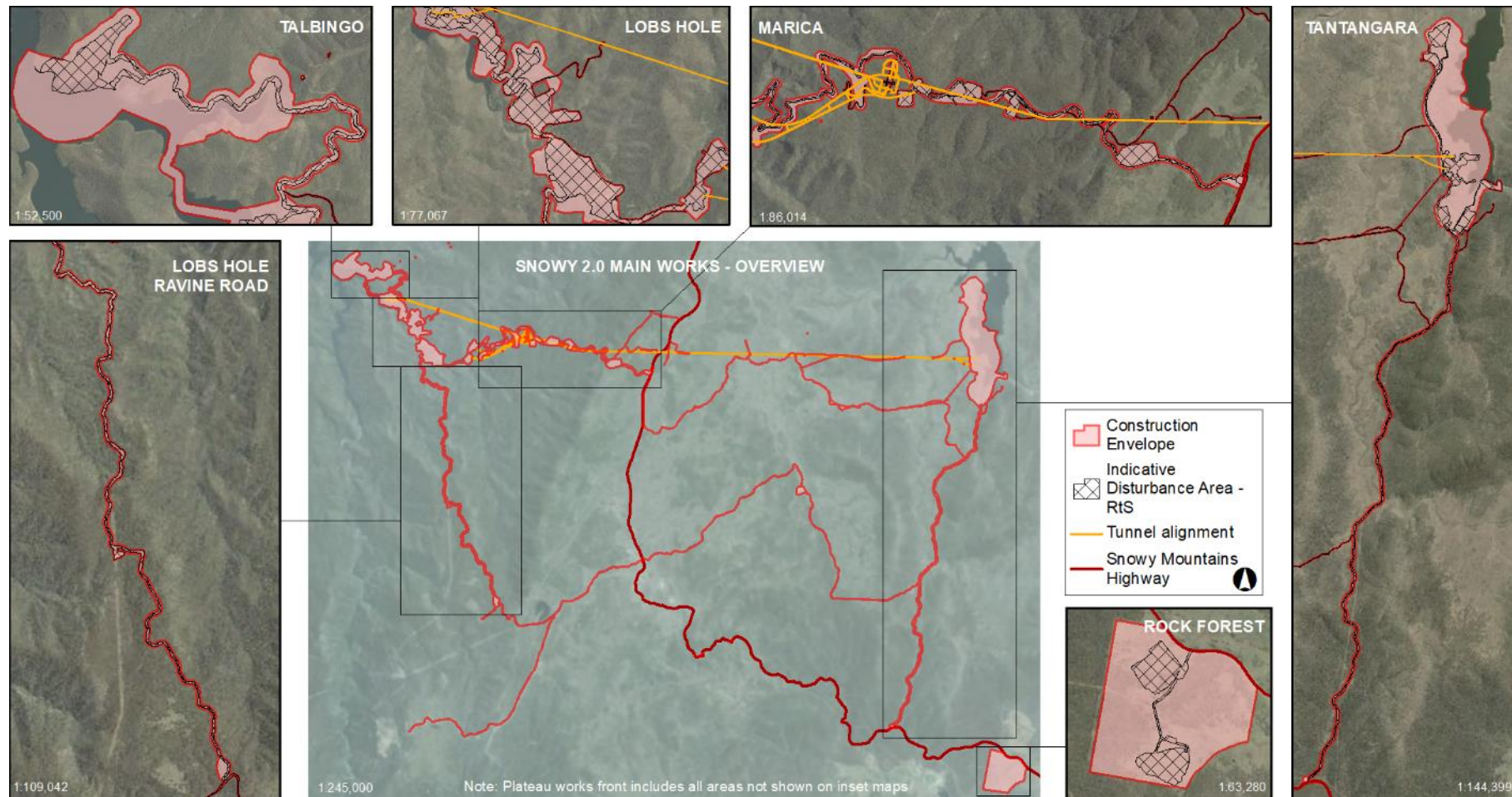


Figure 1-2: Snowy 2.0 Main Works work areas



## 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) 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 *Environmental Impact Statement 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 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, 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 or the Department) in September 2019 and was publicly exhibited between 26 September 2019 and 6 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 Report (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*).

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. Schedule 2, Condition 8 of the Infrastructure Approval requires surrender of the Exploratory Works approval (SSI 9208) within 6 months of the commencement of construction for Main Works. The Exploratory Works management plans will be incorporated into the Main Works plans in accordance with Schedule 2, Condition 9.

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.

In addition to the State approval, a referral (EPBC 2018/8322) was prepared and lodged with the Commonwealth Department of Agriculture, Water and Environment (DAWE) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Commonwealth Minister's delegate determined on 5 December 2018 that Snowy 2.0 Main Works is a "controlled action" under the EPBC Act. The EPBC Act referral decision determined that the Project will be assessed by accredited assessment under Part 5, Division 5.2 of the NSW *Environmental Planning and Assessment 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 Infrastructure Approval and Submissions Report is outlined in Table 1-1. An example of the terminology is shown 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 indicative disturbance area as detailed in Table 1-2.
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	

## 1.4. Works within the Construction Envelope

The disturbance area for the project is 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.

Where project works are required to occur in locations outside of the disturbance area, Future Generation will review the proposed area of clearing against the limits included within condition 5 of schedule 2 (SSI 9687). 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. Following completion of the detailed design and within 3 years of the commencement of construction a review of the final clearing area will be carried out in accordance with schedule 3, condition 13 (SSI 9687) to identify differences with the maximum disturbance area.

**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

Note that the areas in Table 1-2 relate to direct disturbance and clearing and do not include the indirect impacts of this disturbance and clearing.



**Figure 1-3: Indicative disturbance area and construction envelope**

## 1.5. Environmental Management System

The overall environmental management system for the project is described in the 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.

This Biodiversity Management Plan (BMP or plan) forms part of Future Generation's environmental management framework as described in the EMS. This plan aims to transfer the relevant requirements of the approval documents into a management plan which can be practically applied on the project site.

This document has been prepared for construction of the Snowy 2.0 Main Works project, and supersedes the existing Stage 1 and Stage 2 Exploratory Works Biodiversity Management Plans. It does not address the operational phase of the project. The Stage 1 and Stage 2 Exploratory Works Biodiversity Management Plans will continue to remain in place until they are superseded by the management plans for Main Works, which will occur following their approval by the relevant authority. Refer to Figure 1-4 for the relationship between this and other environmental management plans for the project.

## 1.6. Purpose and objectives of this plan

The purpose of this BMP is to address the construction environmental management requirements detailed in:

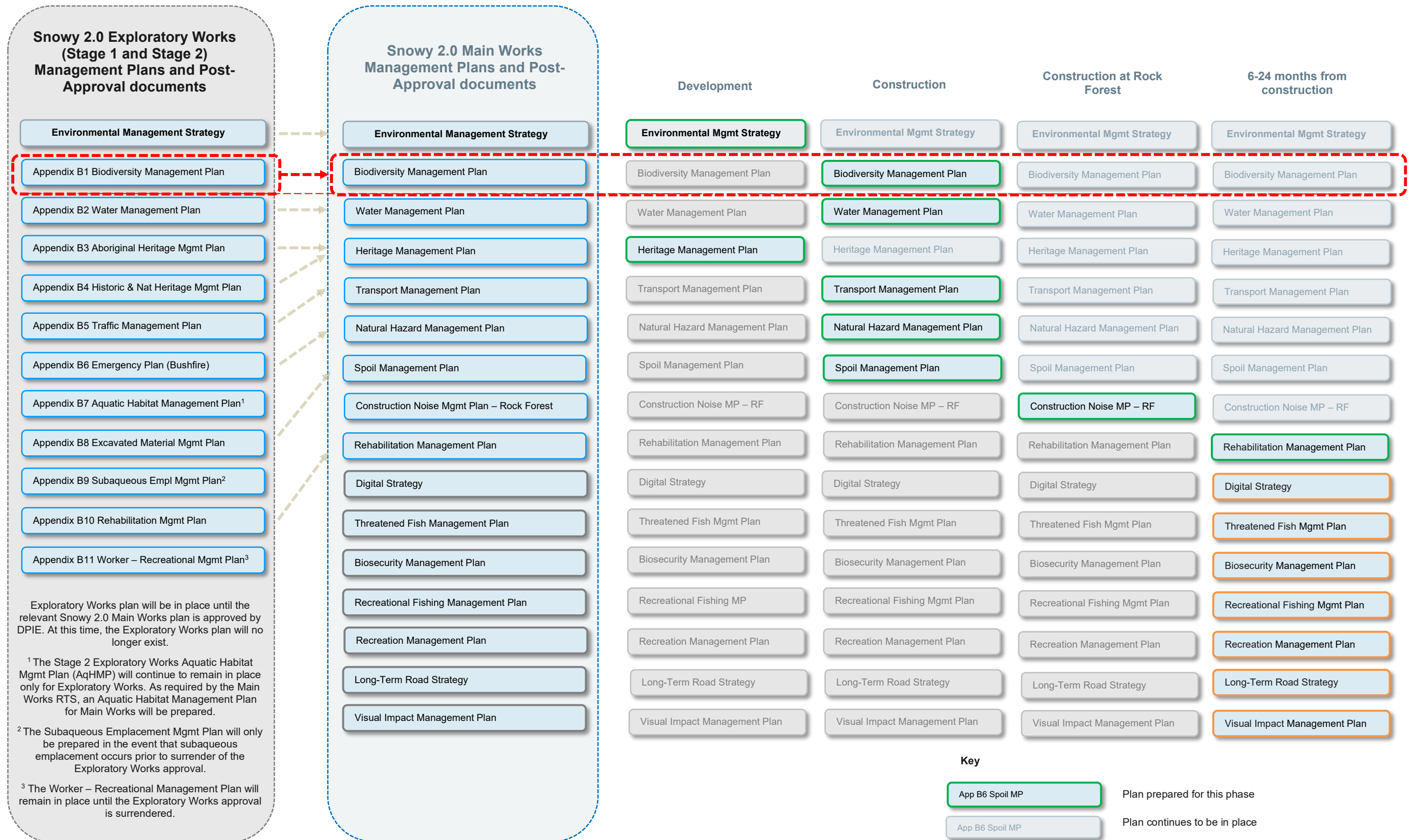
- the Infrastructure Approval (SSI 9687) (Approval) issued for Snowy 2.0 Main Works on 20 May, 2020;
- the Infrastructure Approval (SSI 9208) (Approval) issued for Snowy 2.0 Exploratory Works on 7 February 2019 and modified on 2 December 2019 and 27 March 2020;
- the *Main Works Snowy 2.0 - Environmental Impact Statement (v1, 13/09/2019)*;
- the *Main Works Snowy 2.0 – Preferred Infrastructure Report and Response to Submissions (v1, 28/02/2020)* including:
  - the REMMs within Appendix C;
  - the revised *Biodiversity Development Assessment Report (BDAR)* in Appendix G (v2, 24/02/2020);
- the *Exploratory Works for Snowy 2.0 - Environmental Impact Statement*;
- the *Exploratory Works for Snowy 2.0 – Modification 1 Assessment Report*;
- the *Exploratory Works for Snowy 2.0 – Modification 2 Assessment Report*; and
- the REMMs within the Exploratory Works RTS.

The key objective of this plan is to detail management measures and inform site procedures for implementation so that biodiversity impacts are avoided, minimised and within the scope permitted by the Infrastructure Approval. To achieve this, Snowy Hydro and Future Generation will:

- ensure appropriate measures are implemented to address relevant conditions of approval and REMMs listed within the Submissions Report, as detailed within Section 0 of this Plan;
- detail the existing biodiversity values identified within the project footprint during the Main Works EIS and RTS including, but not limited to, threatened species habitats and native vegetation;
- ensure reasonable and feasible measures are implemented during construction to avoid or minimise biodiversity impacts;
- establish a biodiversity monitoring program; and
- establish a pre-clearing procedure and permit system.

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. Construction personnel will be required to undertake works in accordance with the mitigation measures identified in the site-specific documents.





#### Key

App B6 Spoil MP	Plan prepared for this phase
App B6 Spoil MP	Plan continues to be in place
App B6 Spoil MP	Plan not yet required to be prepared or no longer in place
Biosecurity MP	New post-approval documents required for Main Works
Biosecurity MP	Plan prepared for this phase by Snowy Hydro

Figure 1-4: Relationship to other environmental management plans

## 1.7. Preparation of this plan

In accordance with schedule 3, condition 18(a) of the Infrastructure Approval, this BMP has been prepared by suitably qualified and experienced biodiversity expert(s).

This plan was prepared by:

- Alexander Graham;
- Adam Costenoble; and
- Nathan Garvey (Appendix B – Biodiversity Monitoring Program).

## 1.8. Consultation

In accordance with schedule 3, condition 18(a) of the Infrastructure Approval, this plan has been prepared in consultation with;

- National Parks and Wildlife Service (NPWS);
- Biodiversity and Conservation Division (BCD); and
- Department of Agriculture, Water and Environment (DAWE).

The plan was issued to relevant stakeholders for review and comment. Comments from consultation have been incorporated into this plan where appropriate. A summary of consultation is provided in Table 1-3 below.

**Table 1-3: Consultation undertaken for this plan**

Date	Consultation	Outcomes
03/04/2020	Presentation to BCD and NPWS on the status of the project and the structure of the draft BMP.	Areas of interest to the agencies were identified for refinement including, fauna strike mitigation and biodiversity monitoring.
08/05/2020	Initial presentation to BCD and NPWS on the proposed fauna-strike mitigation strategy that Future Generation propose to implement during construction.	Agreement was that fauna fencing within the national park was not appropriate, speed management monitoring measures were refined, agencies expressed their expectation for small mammal underpasses to be incorporated in the main project access roads (particularly upper Lobs Hole Ravine Road) during construction and through to operations of the project. Comments were addressed in Rev. D of the plan.
15/06/2020	Rev. D of the BMP issued to NPWS and BCD for review and comment.	Matters raised in review comments were discussed by phone with agencies on 26 June, 3 July and 9 July 2020. Comments were addressed in Rev. F of the plan.
26/06/2020	Rev. E of the BMP issued to DAWE for review and comment	Comments received on 24/07/2020 and addressed in Rev. F of the plan.
26/06/2020	Phone meeting with NPWS, Snowy Hydro and Future Generation to discuss key issues from NPWS review of Rev. D.	Key areas of concern were identified and discussed including GDE monitoring and weed and pest management/control and fauna underpasses. Response to comments and clarifications were provided in Rev. F of the plan.
03/07/2020	Phone meeting with BCD, NPWS, Snowy Hydro and Future Generation to discuss key issues from BCD review of Rev. D.	Key areas of concern were identified including GDE monitoring, threatened species monitoring, fauna underpasses, plan structure and relationship to other plans and level of detail included. Response to comments and clarifications were provided in Rev. F of the plan. Follow up meeting with BCD species specialists and NPWS arranged.

Date	Consultation	Outcomes
09/07/2020	Phone meeting with BCD species specialists to discuss BCD comments on Rev. D.	BCD provided further comment on monitoring program methodology and weed and pest control triggers. Monitoring program was revised and further discussion arranged. Weed and pest meeting arranged for discussion with NPWS.
13/07/2020	Phone discussion with NPWS regarding weed and pest control management on the project.	Future Generation agreed to implement a routine chemical weed spraying program and vertebrate pest control program for the duration of the construction. Management plan updates incorporated in Rev F accordingly.
14/07/2020	Further phone discussion with BCD species specialists in relation to biodiversity monitoring program	Weed monitoring program was revised, scoping of threatened flora monitoring clarified, small mammal monitoring techniques revised. Updates incorporated in Rev F of the plan.
24/07/2020	Discussion with BCD and NPWS discussing outlining responses to management plan comments.	Follow up meetings to discuss key issues including GDE monitoring and fauna strike planned for following week.
28/08/2020	Email from DPIE to Snowy Hydro regarding comments on Monitoring Plan, fauna underpass risk assessment and the Fauna Strike Strategy	Future Generation and Snowy Hydro addressed the comments relating to: <ol style="list-style-type: none"> <li>1. Strategy for vehicle strike mitigation and risk assessment for underpasses</li> <li>2. Scope of monitoring plan</li> <li>3. Bogs and Fens</li> <li>4. Post construction recommendations</li> </ol>
28/08/2020	Email from DAWE to Future Generation regarding supplementary comments on BMP	Comments relating to adaptive management approach to Alpine Bogs and Fens and comments on the groundwater level functionality.
10/09/2020	Discussions with BCD and NPWS regarding fauna underpasses	Meeting to discuss the fauna strike mitigation strategy and underpasses risk assessment and key aspects of monitoring program.
11/09/2020	Phone call to DAWE following up on their comments on the plan	Future Generation asked if DAWE would like any further workshops to go through any of their comments. They declined and said that it is ultimately up to DPIE to approve plan. Agreed that a comments response table would be sent back to DAWE with their comments when plan finalised with DPIE comments.
17/09/2020	Phone call to BCD to discuss comments on the Biodiversity Monitoring Plan	Agreement to update monitoring plan to include commitment to review monitoring requirements in design.
23/09/2020	Discussions with BCD and NPWS regarding fauna underpasses	Meeting to discuss the revised Fauna Mitigation Strategy, and inclusion of underpasses – Appendix G will be updated to incorporate this.
25/09/2020	Rev E of Fauna Mitigation Strategy resubmitted back to DPIE.	Updated following agency consultation and comments above.
28/09/2020	Rev E of the Biodiversity Monitoring Program submitted back to DPIE.	Updated following agency consultation and comments above.



## 2. ENVIRONMENTAL REQUIREMENTS

### 2.1. Legislation

Legislation relevant to biodiversity includes:

- *Environmental Planning and Assessment Act 1979* (EP&A Act);
- *National Parks and Wildlife Act 1974* (NPW Act);
- *Biodiversity Conservation Act 2016* (BC Act);
- *Fisheries Management Act 1994* (FM Act);
- *Biosecurity Act 2015*; and
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

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

### 2.2. NSW Conditions of Approval

Table 2-1 details the conditions from the Main Works Infrastructure Approval (SSI 9687) which relate to biodiversity management. Cross references for where each condition is addressed are included in the table.

**Table 2-1: Main Works conditions of approval (SSI 9687) relevant to biodiversity management**

Condition	Requirement	Where addressed												
Schedule 2, Condition 5	<p>The Proponent must comply with the restrictions in Table 1 below.</p> <p><i>Table 1. Restrictions on Approval</i></p> <table><tr><th>Matter</th><th>Exploratory Works</th><th>Main Works</th><th>Total</th></tr><tr><td>Maximum Disturbance Area</td><td>126 Ha</td><td>504 Ha</td><td>630 Ha</td></tr><tr><td>Maximum Native Vegetation Clearing</td><td>107 Ha</td><td>425 Ha</td><td>532 Ha</td></tr></table>	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	Section 1.4 Table 5-1 – BM20
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											
Schedule 3, Condition 13	<p>Within 3 years of the commencement of construction, the Proponent must submit a report via the Major Projects Portal that:</p> <p>(a) identifies the final disturbance area of the Main Works;</p> <p>(b) calculates the difference between the maximum disturbance area and the final disturbance area of the Main Works; and</p> <p>(c) calculates the value of the outstanding biodiversity offset payment on a proportionate basis.</p>	Table 6-1												
Schedule 3, condition 18	<p>Prior to carrying out any construction, unless the Planning Secretary agrees otherwise, the Proponent must prepare a Biodiversity Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:</p> <p>a) be prepared by a suitably qualified and experienced biodiversity expert/s in consultation with the NPWS, BCD and DAWE;</p> <p>b) describe the detailed measures that would be implemented to comply with the biodiversity mitigation requirements in condition 17 above;</p>	<p>This plan</p> <p>Section 1.7 and 1.8</p> <p>Refer to schedule 3 condition 17 below</p>												

Condition	Requirement	Where addressed
	c) include strategy to address the requirements in condition 17(e), including: <ul style="list-style-type: none"> <li>a detailed risk assessment to identify the locations where underpasses would be built during the upgrade of the road network; and</li> <li>a trigger, action and response plan for reducing speed limits on the road network on site to minimise fauna strike;</li> </ul>	Table 5-1 - BM02 and BM03, Appendix G
	d) include a program to monitor, evaluate and publicly report on: <ul style="list-style-type: none"> <li>the effectiveness of these measures; and</li> </ul>	Section 6.2 and Appendix B
	<ul style="list-style-type: none"> <li>compliance against the performance measures in condition 15 above, including:               <ul style="list-style-type: none"> <li>establishing a suitable control site;</li> <li>baseline monitoring of the condition of the relevant Alpine Sphagnum Bogs and Associated Fens;</li> <li>detailed criteria for determining the impact of the development on the performance measures; and</li> <li>a program to monitor the impacts of the development against the detailed criteria.</li> </ul> </li> </ul>	Table 5-1 - BM20 and Appendix B Reporting outlined in Section 6.5
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 Kellys Plains Volcanics (see the figures in Appendix 2): <p>a) negligible change to the shallow groundwater regime supporting the bogs and associated fens when compared to a suitable control site; and</p>	Section 4.2.2.1 Groundwater Management Plan Section 5.3
	b) negligible change in the ecosystem functionality of the bogs and associated fens.	Section 5.3
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 these 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:	Section 5.3 & 5.3.1
	a) the significance of the impacts on the bogs and associated fens;	
	b) the relevant values from the Biodiversity Offsets Payment Calculator; and	
	c) the likely cost of carrying out the conservation actions required to offset these impacts on the bogs and associated fens.	
	<i>Note: These funds will be added to the funds paid under condition 12 and managed in accordance with the notes under that condition.</i>	
Schedule 3, condition 17	The Proponent must:	Table 5-1 - BM05, BM06, BM07, and BM08, Appendix C
	a) ensure the development does not adversely affect the native vegetation and habitat outside the disturbance area;	Table 5-1 - BM05, Section 5.2
	b) minimise the clearing of native vegetation and habitat within the disturbance area;	
	c) minimise the trimming of trees required for safety purposes along the approved road network within the Kosciuszko National Park and adjoining the disturbance area;	Table 5-1 BM16

Condition	Requirement	Where addressed
	d) minimise the impacts of the development on threatened flora and fauna species or ecological communities within the disturbance area and its surrounds, including the: <ul style="list-style-type: none"> <li>• Alpine Sphagnum Bogs and Associated Fens;</li> <li>• Alpine She-oak Skink;</li> <li>• Alpine Tree Frog;</li> <li>• Booroolong Frog;</li> <li>• Broad-toothed Rat;</li> <li>• Caladenia montana;</li> <li>• Clover Glycine;</li> <li>• Eastern Pygmy-possum;</li> <li>• Gang-gang Cockatoo;</li> <li>• Hoary Sunray;</li> <li>• Kiandra Leek Orchid;</li> <li>• Leafy Anchor Plant;</li> <li>• Mauve Burr-daisy;</li> <li>• Max Mueller's Burr-daisy;</li> <li>• Raleigh Sedge;</li> <li>• Slender Greenhood;</li> <li>• Smoky Mouse;</li> <li>• Spotted tailed Quoll;</li> <li>• Southern Myotis;</li> <li>• Thelymitra alpicola;</li> <li>• White-bellied Sea-eagle;</li> </ul>	Table 5-1 - BM03, BM22, BM05, BM07, BM12, BM24, BM25, BM17 and BM20, Appendix C, Appendix D, Appendix E, Appendix F and Appendix G
	e) minimise potential fauna strike in sensitive habitats on the road network within the site, including reducing speed limits between sunset and sunrise and constructing suitable underpasses;	Table 5-1 - BM02 and BM03, Appendix G
	f) undertake pre-clearance surveys;	Table 5-1 - BM09, Appendix C
	g) maximise the salvage of resources within the disturbance area for reuse in the restoration of vegetation and habitat on site, including native vegetative material, hollows logs, ground timber, and topsoil containing vegetative matter and native seed bank;	Table 5-1 - BM15, BM28 and BM30
	h) collect seeds for use in the ecological rehabilitation of the site;	Table 5-1 - BM28, BM29, Appendix C
	i) minimise the spread of weeds, pathogens and feral pests on site, and import or export of these matters to or from the site, including the Phytophthora, Chytrid Fungus, African Lovegrass and Ox-eye Daisy;	Table 5-1 - BM32, BM33 and BM34, Appendix F
	j) minimise the generation and dispersion of sediment to watercourses, particularly the Yarrangobilly River and Wallace Creek;	Surface Water Management Plan Section 5
	k) minimise the light spill from night works, including using directional and LED lighting; and	Table 5-1 - BM23
	l) minimise bushfire risk.	Bushfire Management Plan (Appendix A of Natural Hazard Plan)
Schedule 3, condition 19	The Proponent must implement the approved Biodiversity Management Plan.	This document Section 1.6

## 2.3. Commonwealth Conditions of Approval

The Commonwealth EPBC Act conditions of approval (2018/8332) of relevance to this plan are detailed in Table 2-2. Cross references for where each condition is addressed are included in the table.

**Table 2-2: Commonwealth conditions of approval relevant to biodiversity management during construction**

Condition	Requirement	Where addressed
<b>General</b>		
Part A, condition 2	The approval holder must not clear outside of the construction envelope as identified at <a href="#">Appendix A</a> .	Table 5-1 - BM05, BM06, BM07, and BM08, Appendix C
Part A, condition 3	The disturbance area must not exceed 504 hectares (ha).	Section 1.4 Table 5-1 – BM20
<b>Terrestrial Biodiversity</b>		
Part A, condition 5	Within the construction envelope, the approval holder must not clear more than: <ul style="list-style-type: none"> <li>a. 425 ha of native vegetation;</li> <li>b. 84.29 ha of habitat for the Smoky Mouse;</li> <li>c. 22.87 ha of habitat for the Alpine Tree Frog;</li> <li>d. 61.47 ha of habitat for the Broad-toothed Rat;</li> <li>e. 80.83 ha of habitat for the Alpine She-oak Skink;</li> <li>f. 197.95 ha of habitat for the Eastern Pygmy-possum;</li> <li>g. 81.86 ha of habitat for the Latham's Snipe; and</li> <li>h. 1.03 ha of the Alpine Bogs and Fens.</li> </ul>	Table 5-1 - BM05, BM06, BM08, BM20 & Appendix C
Part A, condition 8	To minimise impacts on protected matters, the approval holder must comply with conditions 17 – 19 of the NSW approval relating to biodiversity management.	Refer to the relevant conditions in Table 2-1
Part A, condition 9	The Biodiversity Management Plan required under condition 18 of the NSW approval must: <ul style="list-style-type: none"> <li>a. be consistent with relevant statutory documents; and</li> <li>b. include provisions to make biodiversity monitoring data (excluding sensitive ecological data) available as part of the monitoring, evaluation and reporting program required by condition 18d of the NSW approval.</li> </ul>	Appendix B Reporting outlined in Section 6.5
Part A, condition 10	Once the Biodiversity 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.	Section 1.6

## 2.4. Revised Environmental Management Measures

Environmental safeguards and management measures are included in the Main Works EIS in Section 6.3.5. During preparation of the Submissions Report, REMMs were developed and are included in Appendix C of the Submissions Report. The relevant environmental management measures from the Main Works assessment are listed in Table 2-3. Additional REMMs were detailed in the BDAR of the RTS of which the measures which relate to construction management

are included in Table 2-4. Table 2-5 includes the relevant REMMs from the Exploratory Works (SSI 9208) assessment.

**Table 2-3: Revised environmental management measures from Main Works RTS**

Impact	Reference	Revised environmental management measure	Where addressed
Fauna strike to Smoky Mouse and Eastern Pygmy possum	ECO1	<p>Management measures to mitigate the potential impacts of fauna strike are currently being considered. These measures may include:</p> <ul style="list-style-type: none"> <li>reduced speed limit along Lobs Hole Ravine Road and Marica Trail at night, when fauna species are likely to be most active;</li> <li>fencing of these roads to prevent access to the road surface; and</li> <li>construction of fauna underpasses.</li> </ul> <p>The adopted measures will be agreed in consultation with DPIE.</p>	Table 5-1 - BM02 and BM03, Appendix G
Spread of weeds	ECO2	A weed and pathogen monitoring program will be implemented, with a weed control program to be implemented if weeds are identified along road verges. This may include wash-down stations to be constructed at a suitable location, with wash down for weeds as well as <i>P.cinnamomi</i> .	Table 5-1 - BM32 BM34 and BM38, Appendix B, Appendix B
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.	Table 5-1 – BM21, BM20, section 5.3, Groundwater Management Plan
Removal of native vegetation and threatened species habitat	ECO4	A Biodiversity Management Plan will be prepared and implemented during construction. It will include the following measures:	This Plan
		<ul style="list-style-type: none"> <li>establishment of exclusion zones where required around retained vegetation, including fencing and signage;</li> </ul>	Table 5-1 – BM05, BM06, BM07 and BM08, Appendix C, Section 5.2
		<ul style="list-style-type: none"> <li>pre-clearing surveys conducted prior to clearing, including translocation of fauna into areas of retained vegetation;</li> </ul>	Appendix C, Appendix E
		<ul style="list-style-type: none"> <li>vegetation clearing undertaken in accordance with the two-stage process;</li> </ul>	Table 5-1 – BM09, Appendix C
		<ul style="list-style-type: none"> <li>mulching and stockpiling of cleared native vegetation for use during rehabilitation;</li> </ul>	Table 5-1 - BM28, BM15, BM28 and BM30
		<ul style="list-style-type: none"> <li>retention of hollows logs and limbs for placement within retained vegetation and reuse during rehabilitation where practicable;</li> </ul>	Table 5-1 - BM28, BM15, BM28 and BM30
		<ul style="list-style-type: none"> <li>collection of native seeds and alpine sod for propagation; and</li> </ul>	Table 5-1 - BM28, BM15, BM28 and BM30
		<ul style="list-style-type: none"> <li>establishment of native plant nursery and propagation of endemic native species for use in rehabilitation works.</li> </ul>	To be included in the Main Works Rehabilitation Management Plan as per Sch 3. Condition 10
	ECO5	A threatened species monitoring program will be designed and implemented to assess impacts arising from clearing.	Table 5-1 – BM22, Appendix B

Impact	Reference	Revised environmental management measure	Where addressed
Increase in predatory and pest species	ECO6	A pest and predator monitoring program will be designed and implemented to ensure Main Works does not result in a significant increase in numbers of pest and predatory species and impacts to threatened species remain within prediction.	Section 8 and 9 of Appendix B for monitoring, Appendix F for control.

**Table 2-4: Management measures from the RTS BDAR which relate to construction activities**

Impact	Reference*	Recommended management measure	Where addressed
Removal of native vegetation and threatened species habitat.	BDAR-01	Minimisation of clearing during construction, wherever possible.	Table 5-1 – BM05
	BDAR-02	Establishment of exclusion zones around retained vegetation, including fencing and signage.	Table 5-1 – BM06 Section 5.2
	BDAR-03	Pre-clearing surveys conducted prior to clearing, including translocation of fauna into areas of retained vegetation.	Table 5-1 – BM12, Appendix C, Appendix E
	BDAR-04	Vegetation clearing undertaken in accordance with the two-stage process.	Table 5-1 – BM09, Appendix C,
	BDAR-05	Mulching and stockpiling of cleared native vegetation for use during rehabilitation.	Table 5-1 – BM28
	BDAR-06	Retention of hollows logs and limbs for placement within retained vegetation and reuse during rehabilitation.	Table 5-1 – BM15 and BM30
	BDAR-07	Design and implementation of a threatened species monitoring program to ensure impacts arising from clearing are within prediction.	Table 5-1 – BM22, Appendix B
	BDAR-08	Underboring, rather than open trenching, of the southern communication route beneath Boggy Plain.	Table 5-1 BM26
	BDAR-09	Targeted surveys for Alpine Tree Frog to be completed prior to construction within sections of the Plateau and Peninsula.	Table 5-1 BM18
	BDAR-10	Targeted surveys for flora species to be completed within sections of the Plateau, the Peninsula and Ravine Bay prior to construction.	Table 5-1 BM19
Increase in weeds and pathogens.	BDAR-11	Weed control prior to construction works being undertaken, where possible.	Section 5.1.2 of Appendix F, Table 5-1 BM38
	BDAR-12	Appropriate disposal and management of weeds during clearing works.	Table 5-1 – BM32, BM34 and BM38, Appendix F
	BDAR-13	Active weed control within 50 m of key infrastructure in areas where significant weeds occur, such as Tantangara Reservoir.	Table 5-1 – BM32, BM34 and BM38, Appendix F
	BDAR-14	Construction of wash-down stations at a suitable location.	Table 5-1 – BM32, BM34 and BM38, Appendix F
	BDAR-15	Washdown required for weeds as well as <i>P. cimmamomi</i> .	Table 5-1 – BM32, BM34 and BM38, Appendix F

Impact	Reference*	Recommended management measure	Where addressed
	BDAR-16	Design and implementation of a weed and pathogen monitoring program.	Section 9 of Appendix B
	BDAR-17	Re-vegetation of cleared areas as quickly as possible following construction.	Table 5-1 BM37
Increase in predatory and pest species.	BDAR-18	Design and implementation of a pest and predator monitoring program to ensure Main Works does not result in a significant increase in numbers of pest and predatory species and impacts to threatened species remain within prediction.	Monitoring detailed in Section 8 of Appendix B
Light and noise pollution during night works.	BDAR-19	Use of directional lighting to retain lighting within works areas as much as possible.	Table 5-1 – BM23
Fragmentation, resulting in reduction in connectivity.	BDAR-20	Implementation of measures to avoid fragmentation, such as underpasses.	Table 5-1 - BM02 and BM03, Appendix G
Fauna vehicle strike	BDAR-21	<p>Management measures to mitigate the potential impacts of fauna strike are currently being considered. These measures may include consideration of the following options:</p> <ul style="list-style-type: none"> <li>reduced speed limit along access roads at night, when fauna species are likely to be most active;</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>fencing of these roads to prevent access to the road surface; and</li> <li>construction of fauna underpasses.</li> </ul> <p>The adopted measures will be agreed in consultation with DPIE during detailed design.</p>	Table 5-1 - BM02 and BM03, Appendix G
Groundwater drawdown, resulting in changes in hydrology of GDEs.	BDAR-22	Implementation of a groundwater and GDE monitoring program to ensure groundwater drawdown and associated impacts to GDEs are within prediction.	Table 5-1 – BM21, Section 5.3, Appendix B
* These reference numbers have been included for convenience in this plan and were not used in the BDAR			

**Table 2-5: Exploratory Works (SSI 9208) REMMs relevant to biodiversity**

Impact	Ref #	Environmental management measure	Where addressed
Impacts to biodiversity	ECO01-EW	The Biodiversity Management Plan (BMP) will include the following:	
		<ul style="list-style-type: none"> <li>identification of guidelines relevant to construction, the matters they apply to and what is required to ensure compliance;</li> </ul>	Section 2.6



Impact	Ref #	Environmental management measure	Where addressed
		<ul style="list-style-type: none"> <li>pre-disturbance inspection requirements to identify features of conservation significance and select appropriate management measures and environmental controls which will include:               <ul style="list-style-type: none"> <li>exclusion fencing around all areas of retained significant vegetation and fauna habitat adjacent to construction compounds and the camp;</li> </ul> </li> </ul>	Appendix C  Table 5-1 – BM06 and BM08
		<ul style="list-style-type: none"> <li>where works are to be undertaken within the 50 m buffer zone, all vegetation, rocks, logs and other shelter are to be carefully inspected for frog species; and</li> </ul>	Table 5-1 – BM11
		<ul style="list-style-type: none"> <li>vegetation clearing is to follow a two-staged process based on non-habitat and habitat vegetation.</li> </ul>	Table 5-1 – BM09
		<ul style="list-style-type: none"> <li>tree assessment and management protocols consistent with AS 4970-2009 Protection of trees on development sites; and</li> </ul>	Table 5-1 – BM31
		<ul style="list-style-type: none"> <li>terrestrial and aquatic weed, pest and pathogen prevention and management protocols which will include:               <ul style="list-style-type: none"> <li>construction of wash-down stations or the use of alternate hygiene protocols at suitable locations where practicable;</li> <li>wash-down or alternate hygiene protocols will be applied to all vehicles prior to movement from Link Road to Lobs Hole Ravine and vice versa where practicable;</li> <li>implementation of a weed and pathogen monitoring program;</li> <li>implementation of a weed control program if weeds are identified within the site;</li> <li>no food waste will be left outside in open areas accessible to feral animals and waste will be stored appropriately in lidded, inaccessible bins and disposed off-site;</li> <li>remote camera monitoring for feral animals at the accommodation camp;</li> <li>a predator control program will be implemented, in conjunction with OEH and NPWS, to control feral animals;</li> <li>all equipment and vessel components, such as propellers, hulls, anchors and any other equipment used should be inspected for pest aquatic plants (particularly fragments of Canadian pondweed (<i>Elodea canadensis</i>) known to be present in Talbingo Reservoir) and pest fish;</li> <li>vessels and vehicles should be washed down and cleaned prior to arriving at the boat ramp to be launched onto the reservoir and before travelling off-site from the reservoir; and</li> <li>all personnel working within the waters should be instructed on how to identify potential pests.</li> </ul> </li> </ul>	Table 5-1 – BM32, BM34 and BM38, Appendix B, Appendix F
		<ul style="list-style-type: none"> <li>pre-clearance procedures; and</li> </ul>	Table 5-1 – BM09, Appendix C
		<ul style="list-style-type: none"> <li>an unexpected threatened species finds procedure.</li> </ul>	Table 5-1 – BM04, Appendix D
ECO02-EW		Other than for Yarrangobilly River Bridge, Wallaces Creek Bridge and sections of Mine Trail Road and Lobs Hole Road required for permanent infrastructure ground disturbance within the avoidance footprint (Yarrangobilly River and Smoky Mouse habitat) will be prohibited and marked with environmental controls as an exclusion area.	Table 5-1 – BM10 and BM08

Impact	Ref #	Environmental management measure	Where addressed
	ECO03-EW	The accommodation camp will be sited in areas of lower quality vegetation where practicable.	Addressed through detailed design
Impacts on threatened species	ECO04-EW	Potential impacts to Threatened Species will be managed and measured through the Biodiversity Management Plan during construction. The Biodiversity Management Plan will include: <ul style="list-style-type: none"> <li>• Murray Crayfish monitoring program (Talbingo Reservoir);</li> <li>• Smoky Mouse monitoring program; and</li> <li>• Booroolong Frog monitoring program.</li> </ul>	Table 5-1 – BM22, Appendix B
	ECO05-EW	Vehicle traffic movements along Upper Lobs Hole Ravine Road will be: <ul style="list-style-type: none"> <li>• limited to day time hours only (except for emergencies). Day time hours are to be taken as between First Light and Last Light;</li> <li>• limited to 40km/h; and</li> <li>• where practicable, reduced through the use of Talbingo Reservoir to barge heavy machinery, construction equipment and materials.</li> </ul>	Not relevant to Main Works, refer to Condition 18(c) in Table 2-1
	ECO06-EW	During Exploratory Works frog exclusion fencing will be installed in key areas where infrastructure is located in close proximity to Booroolong Frog primary habitats such as the bridge crossings. The fencing will be designed to minimise frogs from being able to access the road crossing.	BCD have advised that frog exclusion fencing is not appropriate and, as such, will not be used.
	ECO07-EW	Fauna spotters will check areas adjacent to Yarrangobilly River prior to clearing for Booroolong Frog and translocate them to adjacent habitats away from impacts.	Table 5-1 – BM11, Appendix E
	ECO08-EW	During construction the Yarrangobilly River buffer zone will be revegetated and weed species removed, where practicable.	Table 5-1 – BM36, Appendix F
	ECO09-EW	Where works are to be undertaken within the 50 m buffer zone of Yarrangobilly River, all vegetation, rocks, logs and other shelter are to be carefully inspected for frog species.	Table 5-1 – BM11
Impacts on fish eggs and larvae due to extraction of water from Talbingo Reservoir sedimentation	ECO10-EW	The water pipeline intake will be designed to prevent adult fish from entering the intake and discourage adult fish from approaching the intake which may include: <ul style="list-style-type: none"> <li>• incorporation of an enclosed, dark and long passage approach to the intake;</li> <li>• if feasible, screening of the intake with at least 5 mm 3 mm mesh screen;</li> <li>• if feasible, installation of a coarse mesh (e.g. cm aperture) screen / cage a few metres around the intake and removal and control of any aquatic vegetation and wood debris within and immediately adjacent to the intake location; and</li> <li>• if feasible, limiting the approach water velocity at the headwall during normal operation ideally to 0.1 m/s.</li> <li>• locate the intake pump in deeper water where possible; and</li> <li>• allow for pump start up procedures involving initial slow water velocity to reduce likelihood of aquatic biota being drawn into the pump.</li> </ul>	Addressed through detailed design

Impact	Ref #	Environmental management measure	Where addressed
Impacts to fish passage	ECO11-EW	The permanent bridges at Yarrangobilly River and at Wallaces Creek will be designed with consideration of Policy and Guidelines for Fish Habitat Conservation Update 2013 (DPI 2013) and Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries 2003).	Addressed through detailed design
	ECO12-EW	<p>The temporary bridges at Yarrangobilly River and at Wallaces Creek will be designed, constructed and removed to</p> <ul style="list-style-type: none"> <li>where practicable implement measures in line with the guidelines for temporary structures in Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update) (DPI 2013) and recommended crossing design considerations in Fairfull and Witheridge (2003) which includes:               <ul style="list-style-type: none"> <li>temporary in-stream structures will avoid spanning the full width of the waterway channel to ensure base flow conditions are maintained down the waterway where practicable;</li> <li>maintaining some unmodified channel so that a weir effect or flow through rock interstices only is not created where practicable; and</li> <li>temporary in-stream structures will be inserted during low-flow periods where practicable</li> </ul> </li> <li>ensure any build-up of debris which potentially obstructs fish passage will be removed; and</li> <li>the temporary structures will be removed and the river channel rehabilitated following construction of the permanent bridges.</li> </ul>	Addressed through detailed design
	ECO13-EW	Construction and removal of the temporary bridge at Yarrangobilly River will avoid or minimise in stream works during the migration time of Macquarie Perch (October to January) where possible.	Table 5-1 – BM27
Smoky Mouse	M1.2-EW	The existing Smoky Mouse monitoring program will be extended to include the Marica area.	Table 5-1 – BM22, Appendix B
Fauna strike	M1.3-EW	Restrictions on vehicle movements in the Marica area limited to speeds of 20 km/h between dusk and dawn.	Not relevant to Main Works, refer to condition 18(c) in Table 2-1
Vegetation	MOD 2 – 006-EW	The Biodiversity Management Plan will be updated to include: <ul style="list-style-type: none"> <li>procedures for dangerous tree removal and vegetation trimming; and</li> </ul>	Table 5-1 – BM16
		<ul style="list-style-type: none"> <li>a protocol for post-approval vegetation removal.</li> </ul>	Not applicable to Main Works

## 2.5. Permits and Licences

This project has been designated CSSI and assessed under Part 5 of the EP&A Act. Under sections 5.23 and 5.24 of the EP&A Act, certain separate approvals and licences are not required.

Due to the potential for significant impacts on Matters of National Environmental Significance (MNES), a referral (EPBC 2018/8322) was prepared and lodged with the Commonwealth Department of the Environment and Energy (now DAWE) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Commonwealth Minister's delegate determined on 5 December 2018 that Snowy 2.0 Main Works is a "controlled action" under the

EPBC Act. The EPBC Act referral decision determined that the Project will be assessed by accredited assessment under Part 5, Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979*. Following the NSW EP&A Act approval, the Commonwealth granted approval for the project on 29 June 2020.

Environment Protection Licence (EPL) 21266 has been issued for the project for the scheduled activity of extractive activities. The EPL details conditions which must be complied with when undertaking the extractive activities works.

The premises boundary for the Exploratory Works EPL will be expanded to encompass both Exploratory Works and Main Works activities and the governing scheduled activity for Main Works will be electricity generation.

Snowy Hydro entered into an Agreement for Lease (AFL) with the NSW Minister for the Environment on 18 December 2018 for Snowy 2.0. Subject to the terms of the AFL, Future Generation will be granted rights to access the areas required for construction under Works Access Licences and Construction Leases.

Ecologists will hold a Scientific Licence under Part 2 of the BC Act (including Animal Ethics Approval under the *Animal Research Act 1985*) for fauna handling/rescue and survey work. Where rescued fauna require rehabilitation and care, only wildlife rehabilitation organisations authorised under Part 2 of the BC Act may be used.

As this project has been designated CSSI and assessed under Part 5 of the EP&A Act, permits relating to fish passage or dredging or reclamation works are not required.

## 2.6. Guidelines

The guidelines considered in the development and implementation of this BMP include:

- *Saving our Species Hygiene Guidelines*, State of New South Wales and Department of Planning, Industry and Environment 2020;
- *DPI Policy and Guidelines: Aquatic Habitat Management and Fish Conservation*, NSW Fisheries. 1999;
- *Regional Pest Management Strategy 2012–17, Southern Ranges Region: a new approach for reducing impacts on native species and park neighbours*, Office of Environment and Heritage [now DPIE BCD] 2012, Sydney;
- *Ecology and Management of Vertebrate Pests in NSW*, NSW Department of Primary Industries 2018;
- PestSmart standard operating procedures for feral animal control, Centre for Invasive Species Solutions (<https://pestsmart.org.au/>);
- *Saving our Species Monitoring, Evaluation and Reporting Guidelines for conservation projects*, OEH NSW 2018; and
- relevant recovery plans, priority action statements and best practice guidelines.

### 3. EXISTING ENVIRONMENT

This section summarises existing terrestrial flora and fauna within and adjacent to the project including species, communities and habitats based on the information contained in Section 6.3 and of the Main Works EIS and Appendix G of the Main Works RTS. Appendix G includes the revised BDAR.

The Snowy 2.0 Main Works will be constructed within the South Eastern Highlands, NSW South Western Slopes and Australian Alps Interim Biogeographic Regionalisation of Australia (IBRA) regions and primarily within the Kosciuszko National Park (KNP). The Project area intersects a number of major watercourses, including the Yarrangobilly River, Eucumbene River, Murrumbidgee River, Gooandra Creek, Tantangara Creek and Nungar Creek.

The Project area is located within KNP, which is largely vegetated across its 673,543 ha extent, with intact remnant vegetation extending into a further 1.6 million ha across the Australian Alps. The extent of vegetation across KNP provides a high degree of connectivity.

There are no areas of outstanding biodiversity value, as defined in Part 3 of the BC Act, within a 1,500 m buffer of the Project area.

#### 3.1. Vegetation Communities

Plant Community Types (PCTs) are a NSW classification used to identify native vegetation plant communities. Site surveys identified 20 PCTs comprising 1,281 ha of native vegetation within the construction envelope (Figure 3-1 and Appendix A1). The three most abundant PCTs, which constitute 63% of the native vegetation mapped within the construction envelope, include:

- PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion (372.42 ha);
- PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion (222.75 ha); and
- PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion (212.91 ha).

Table 3-1 includes a complete list of the PCTs mapped within the construction envelope. The extents of the mapped PCTs are shown in Figure 3-1 (overview) and Appendix A1 (detailed).

One threatened ecological community (TEC), listed as an Endangered Ecological Community under both NSW and Commonwealth legislation, has been confirmed within the construction envelope (6.06 ha):

- NSW *Biodiversity Conservation Act 2016* (BC Act)
  - PCT 637 – Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions; and
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
  - Alpine Sphagnum Bogs and Associated Fens.

##### 3.1.1. January 2020 Bushfire

On 4 January 2020, the Snowy 2.0 project site and overall northern section of Kosciuszko National Park was impacted by a significant bushfire. 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 post-bushfire recovery of the surrounding areas is of key concern to KNP stakeholders.

Following the bushfire, the vegetated areas within and adjacent to the project has exposed soil which is susceptible to introduced weed invasion and a reduction in habitat features which makes native fauna more vulnerable to feral animal predation. As such, the weed and pest animal monitoring program has been increased from the initial levels carried out during Exploratory Works to ensure that any adverse impacts can be adaptively managed throughout the bushfire recovery period. This elevated level of monitoring extends to the additional work areas opened up for Main Works as detailed in Appendix B.



**Table 3-1: Plant community Types mapped within the construction envelope (Main Works RTS, EMM 2020)**

Plant community type	Vegetation formation	Vegetation class
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**	Dry Sclerophyll Forests (Shrub/grass sub- formation)	Upper Riverina Dry Sclerophyll Forests
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	Dry Sclerophyll Forest (Shrubby sub-formation)	Southern Tableland Dry Sclerophyll Forests
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**	Dry Sclerophyll Forest (Shrubby sub-formation)	Southern Tableland Dry Sclerophyll Forests
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**	Wet Sclerophyll Forests (Grassy sub-formation)	Southern Tableland Wet Sclerophyll Forests
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**	Dry Sclerophyll Forests (Shrub/grass sub- formation)	Upper Riverina Dry Sclerophyll Forests
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**	Grassy Woodlands	Southern Tableland Grassy Woodland
PCT 311 – Red Stringybark - Broad-leaved Peppermint - Nortons Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion	Dry Sclerophyll Forests (Shrub/grass sub- formation)	Upper Riverina Dry Sclerophyll Forests
PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion <sup>T **</sup>	Alpine Complex	Alpine Bogs and Fens
PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Wet Sclerophyll Forests (Grassy sub-formation)	Montane Wet Sclerophyll Forests
PCT 643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion	Alpine Complex	Alpine Heath
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	Grassy Woodlands	Subalpine Woodlands
PCT 679 – Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion**	Grassy Woodlands	Subalpine Woodlands
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	Dry Sclerophyll Forests (Shrubby sub-formation)	Southern Tableland Dry Sclerophyll Forests
PCT 952 – Mountain Gum - Narrow-leaved Peppermint - Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion	Grassy Woodlands	Subalpine Woodlands
PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	Dry Sclerophyll Forests (Shrubby sub-formation)	Southern Tableland Dry Sclerophyll Forests
PCT 999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion	Dry Sclerophyll Forests (Shrubby sub-formation)	Southern Tableland Dry Sclerophyll Forests



Plant community type	Vegetation formation	Vegetation class
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	Grassy Woodlands	Subalpine Woodlands
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Grassy Woodlands	Subalpine Woodlands
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Grasslands	Temperate Montane Grasslands
PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion**	Grasslands	Temperate Montane Grasslands

<sup>T</sup> *Threatened Ecological Community (EPBC Act and BC Act)*

<sup>\*\*</sup> *Groundwater Dependent Ecosystem (GDE) see Section 3.2*

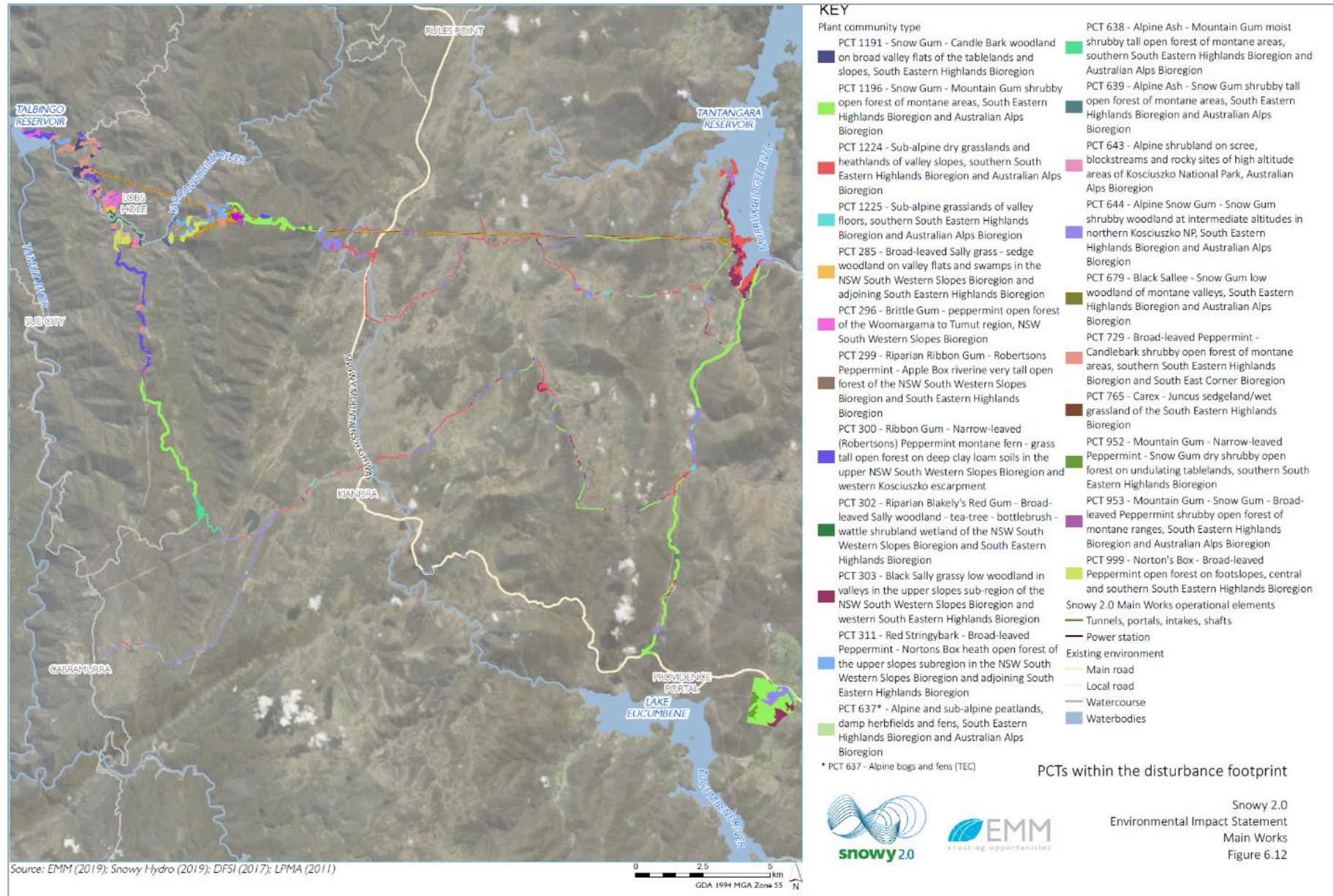


Figure 3-1: PCTs within the construction envelope (EIS, EMM)

### 3.2. Groundwater Dependent Ecosystems

Plant communities with varying degrees of groundwater dependence within the project area are listed in Table 3-2. All other communities were considered to be non-dependent on groundwater. The majority of entirely/obligate GDEs occur across the high plains of the Plateau and Tantangara.

GDEs within the survey area are deemed to have high ecological value based on their occurrence within KNP, good water quality and quantity parameters, and aquifer structure given limited disturbance, patch size criteria given high levels of connectivity, and delivery of ecosystem services.

The location of GDEs within the construction envelope can be determined through cross referencing the PCTs listed in Table 3-2 with the mapping provided in Appendix A1. GDEs are further discussed in the Biodiversity Monitoring Program -Appendix B.

**Table 3-2: Groundwater dependent ecosystems**

Groundwater dependence	Mapped plant community type (PCT)
Entirely/obligate dependence on groundwater	<ul style="list-style-type: none"> <li>PCT 637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion;</li> <li>PCT 1225 - Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion.</li> </ul>
Facultative proportional dependence on groundwater	<ul style="list-style-type: none"> <li>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;</li> <li>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</li> <li>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.</li> </ul>
Facultative – opportunistic dependence on groundwater	<ul style="list-style-type: none"> <li>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;</li> <li>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</li> <li>PCT 679 - Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion.</li> </ul>

### 3.3. Threatened Flora

Ten threatened flora species were recorded within the construction envelope. Nine species are listed under the BC Act, and three are listed under the EPBC Act. A further three threatened flora species were recorded outside but adjacent to the Construction Envelope. These species are summarised in Table 3-3 and shown in Figure 3-2.

There were no threatened flora species recorded in the Talbingo Reservoir. New records of Clover Glycine were recorded near Tantangara, which previously only had a very limited extent within KNP. The plateau (Plateau and Tantangara Reservoir) contains abundant records of threatened flora species.



**Table 3-3: Threatened flora species recorded within and adjacent to the construction envelope**

Species name	Common name	Threatened status		Location recorded					
		EPBC Act <sup>1</sup>	BC Act <sup>2</sup>	Talbingo	Lobs Hole	Marica	Plateau	Tantangara	Rock Forest
<i>Caladenia montana</i>	-		V		✓	✓			
<i>Calotis glandulosa</i>	Mauve Burr-daisy	VU	V				✓	✓	✓
<i>Calotis pubescens</i>	Max Mueller's Burr Daisy		E1				✓	✓	
<i>Carex raleighii</i>	Raleigh Sedge		E1				✓	✓	
<i>Discaria nitida</i>	Leafy Anchor Plant		V			✓	✓	✓	
<i>Glycine latrobeana</i>	Clover Glycine		E4A				✓	✓	
<i>Leucochrysum albicans</i> var. <i>tricolor</i>	Hoary Sunray	EN							✓
<i>Prasophyllum innubum</i> *	Brandy Marys Leek-orchid	CE	E4A				✓		
<i>Prasophyllum retroflexum</i>	Kiandra Leek Orchid		V				✓	✓	
<i>Pterostylis alpina</i> *	Alpine Leek Orchid		V				✓	✓	
<i>Pterostylis foliata</i>	Slender Greenhood		V			✓			
<i>Rutidosia leirolepis</i> *	Monaro Golden Daisy	VU	V				✓	✓	
<i>Thelymitra alpicola</i>	Alpine Sun Orchid		V				✓		

<sup>1</sup> EPBC Act categories: VU- Vulnerable; EN- Endangered, CR- Critically Endangered

<sup>2</sup> BC Act categories: V- Vulnerable; E1- Endangered; E4A- Critically endangered

\* these species were recorded outside of but adjacent to the construction envelope and will not be impacted by the Project

### 3.4. Threatened Fauna

Twenty-five threatened fauna species listed under the BC Act have been recorded within and adjacent to the disturbance footprint, with six of these species also listed under the EPBC Act. These species are summarised in Table 3-4 and shown in Figure 3-3.

The ravine (Talbingo Reservoir, Lobs Hole and Marica areas) contains limited threatened flora but has a number of threatened bird and mammal species, including the Eastern Pygmy-possum and Smoky Mouse which were recorded within habitat along Lobs Hole Ravine Road and at Marica. The Booroolong Frog was also recorded along the Yarrangobilly River at Lobs Hole.

The plateau contains abundant records of threatened herpetofauna species including Alpine Tree Frog and Alpine She-oak Skink.

Table 3-4: Fauna species recorded within and adjacent to the construction envelope

Species name	Common name	Threatened status		Location recorded					
		EPBC Act <sup>1</sup>	BC Act <sup>2</sup>	Talbingo	Lobs Hole	Marica	Plateau	Tantangara	Rock Forest
EPBC Act Migratory species									
<i>Gallinago hardwickii</i>	Latham's Snipe	M				✓	✓	✓	
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M				✓	✓		
<i>Hirundapus caudacutus</i>	White-throated Needletail	M, VU						✓	
BC Act Ecosystem credit species									
<i>Artamus cyanopterus</i>	Dusky Woodswallow		V	✓	✓	✓	✓	✓	✓
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper		V		✓				
<i>Daphoenositta chrysoptera</i>	Varied Sittella		V		✓	✓		✓	
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	EN	V			✓			
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V		✓	✓	✓	✓	
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle <sup>b</sup>		V	✓	✓			✓	
<i>Hieraaetus morphnoides</i>	Little Eagle <sup>b</sup>		V				✓		
<i>Lophoictinia isura</i>	Square-tailed Kite <sup>b</sup>		V				✓		
<i>Miniopterus schreibersii oceanensis</i>	Large Bent-winged Bat <sup>b</sup>		V	✓	✓	✓	✓	✓	
<i>Neophema pulchella</i>	Turquoise Parrot		V		✓				
<i>Ninox strenua</i>	Powerful Owl <sup>b</sup>		V		✓				
<i>Pachycephala olivacea</i>	Olive Whistler		V		✓				
<i>Petroica boodang</i>	Scarlet Robin		V		✓	✓	✓	✓	✓
<i>Petroica phoenicea</i>	Flame Robin		V		✓	✓	✓	✓	✓
<i>Stagonopleura guttata</i>	Diamond Firetail		V		✓				
<i>Tyto novahollandiae</i>	Masked Owl <sup>b</sup>		V		✓				
BC Act Species credit species									
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo		V	✓	✓	✓	✓	✓	✓
<i>Cercartetus nanus</i>	Eastern Pygmy-possum		V		✓	✓			
<i>Cyclodomorphus praealtus</i>	Alpine She-oak Skink	EN	E1			✓	✓	✓	
<i>Litoria booroolongensis</i>	Booroolong Frog	EN	E1		✓	✓			
<i>Litoria verreauxii alpina</i>	Alpine Tree Frog	VU	E1				✓	✓	

Species name	Common name	Threatened status		Location recorded					
		EPBC Act <sup>1</sup>	BC Act <sup>2</sup>	Talbingo	Lobs Hole	Marica	Plateau	Tantangara	Rock Forest
<i>Mastacomys fuscus</i>	Broad-toothed Rat	VU	V			✓	✓	✓	
<i>Myotis macropus</i>	Southern Myotis		V		✓				
<i>Petroica rodinogaster</i>	Pink Robin		V	Recorded outside Project footprint					
<i>Pseudomys fumeus</i>	Smoky Mouse	EN	E4A		✓	✓			

<sup>1</sup> EPBC Act categories: VU- Vulnerable; EN- Endangered, M- Migratory

<sup>2</sup> BC Act categories: V- Vulnerable; E1- Endangered; E4A- Critically endangered

<sup>b</sup> Confirmed Breeding habitat for this ecosystem-credit species is treated as a species-credit for the purpose of offsetting



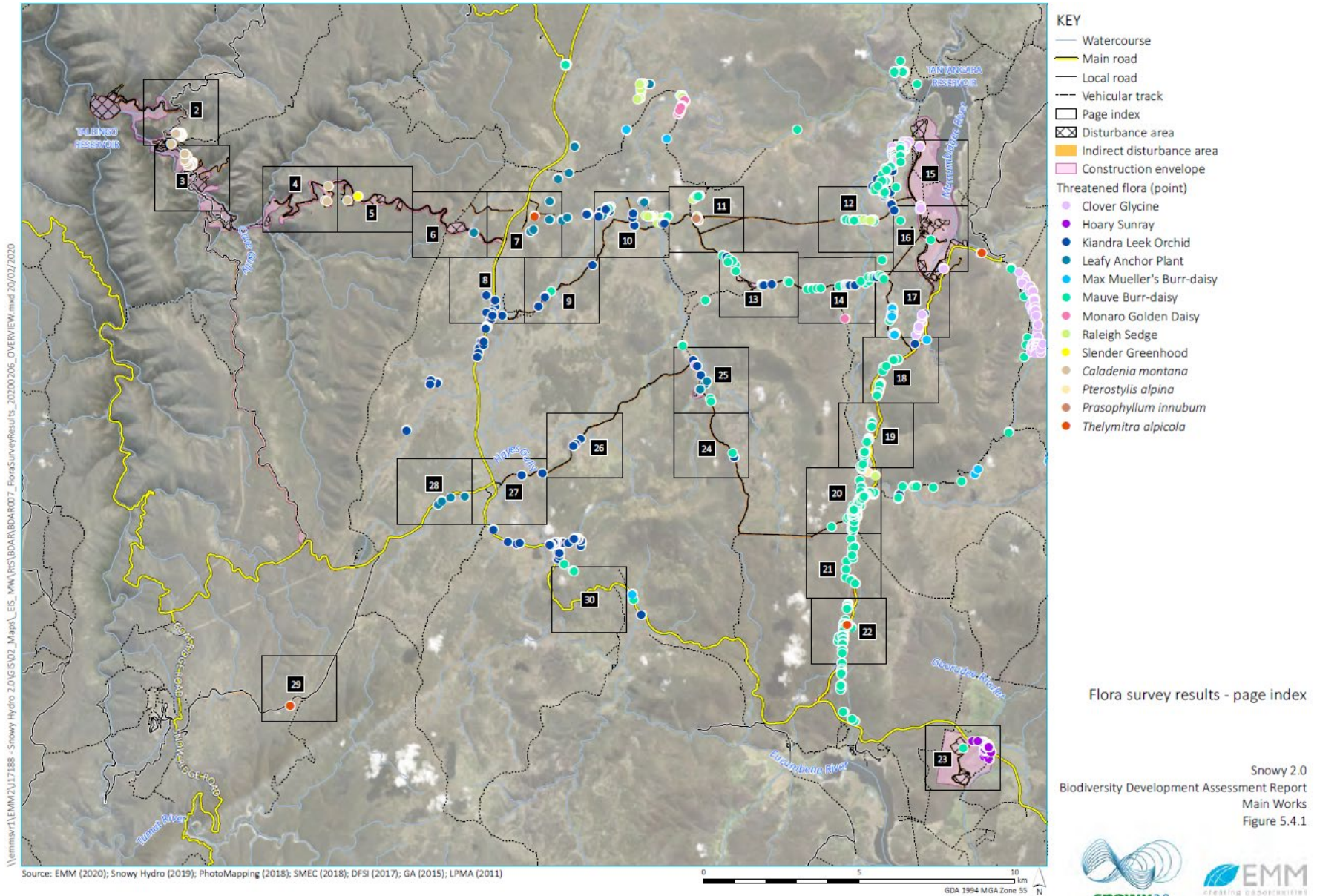


Figure 3-2: Threatened flora within the construction envelope (RTS BDAR, EMM 2020)



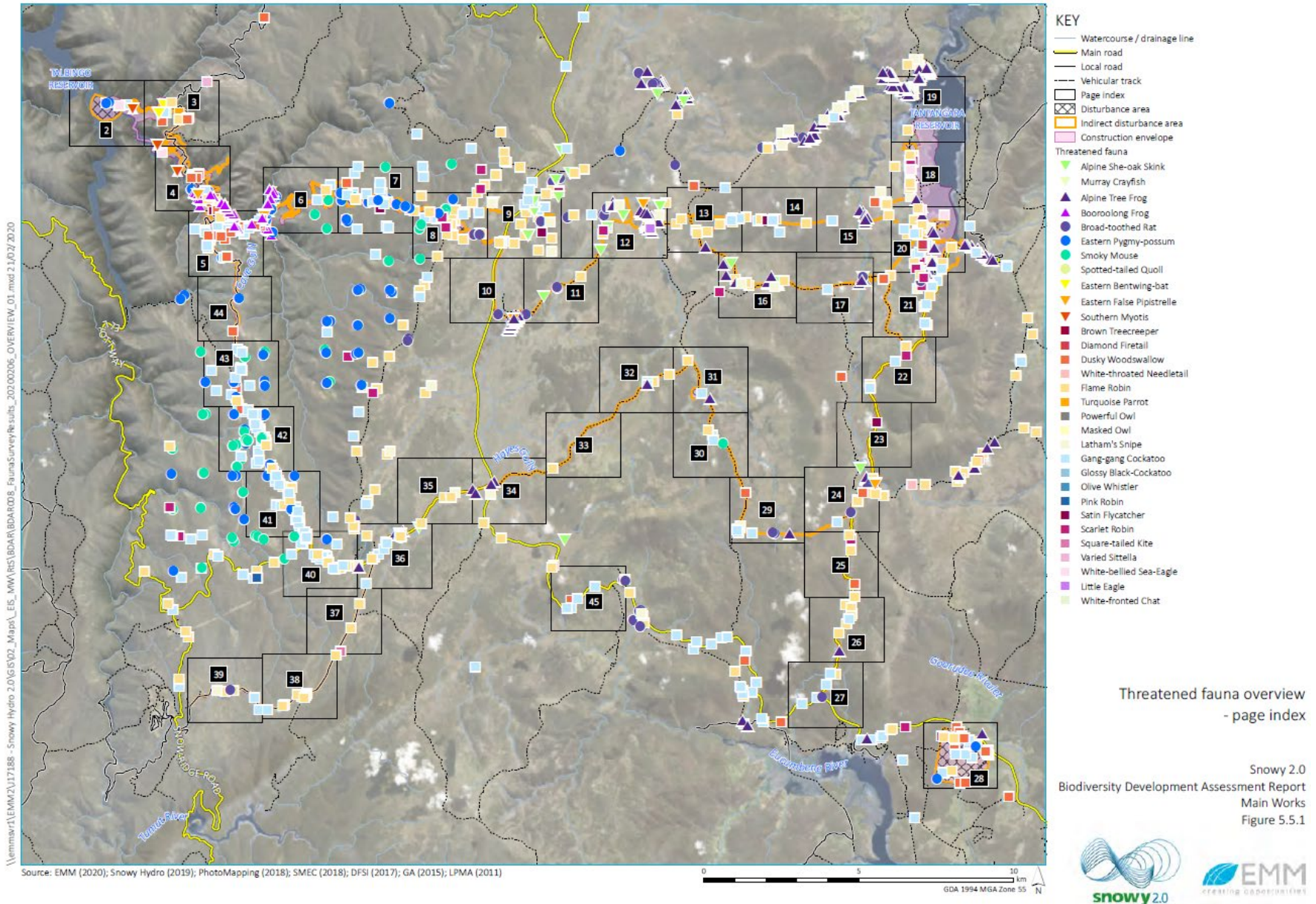


Figure 3-3: Threatened fauna within the disturbance area (RTS BDAR, EMM 2020)

### 3.5. Fauna Habitat

Fauna habitat features relevant to the project include:

- habitat trees including hollow-bearing trees;
- flowering shrubs and feed tree species;
- caves, crevices and escarpments;
- burrows;
- waterways; and
- ground litter and logs.

Fauna habitat features are abundant within areas subject to limited disturbance, such as the upper section of Lobs Hole Ravine Road, Marica and Plateau. Areas which have been subject to disturbance have fewer fauna habitat features.

As detailed in Section 3.4, a range of threatened fauna and flora occur within the construction envelope. Habitat polygons have been mapped for BC Act species-credit species as detailed in Section 4.

### 3.6. Pest Species

There are numerous introduced species in the KNP region, including feral cats, foxes, feral horses dogs and deer. Within the Main Works footprint, the main pest species of concern are Feral Cats (*Felis catus*) and Red Foxes (*Vulpes vulpes*), as a growth in their population would have detrimental (impacts on native animals. Predation by Feral Cats and Red Foxes are listed as Key Threatening Processes (KTPs) under the BC Act and EPBC Act with impacts from Feral Cats also listed as a key threat to the Smoky Mouse. Introduced predators are also considered a threat to Eastern Pygmy-possums.

### 3.7. Weeds

Areas which have experienced considerable disturbance within the Main Works footprint exhibit evidence of weeds. Key weed species identified during flora surveys for Main Works include:

- African Lovegrass (*Eragrostis curvula*);
- Bird's-foot Trefoil (*Lotus* spp.);
- Blackberry (*Rubus* spp.);
- Browntop Bent (*Agrostis capillaries*);
- Cat's Ear/Flatweed (*Hypochaeris* spp.);
- Cocksfoot (*Dactylis glomerata*);
- Dandelion (*Taraxacum officinale*);
- Hawthorn (*Crataegus monogyna*);
- Mullein/Aarons Rod (*Verbascum thapsus* and *V. virgatum*);
- Musk Monkey Flower (*Mimulus moschatus*);
- Ox-eye Daisy (*Leucanthemum vulgare*);
- Patterson's Curse (*Echium plantagineum*);

- Sheep Sorrel (*Rumex acetosella*);
- Spear Thistle (*Cirsium vulgare*);
- St John's Wort (*Hypericum perforatum*);
- Sweet Briar (*Rosa rubiginosa*);
- Sweet Vernal Grass (*Anthoxanthum odoratum*);
- Yarrow (*Achillea millefolium*); and
- Yorkshire Fog Grass (*Holcus lanatus*).

Many of these species are prevalent in areas previously disturbed. The prevalence of Ox-eye Daisy around Tantangara is a key issue of concern and strict hygiene protocols will be required to avoid spreading this highly invasive species during construction activities. Other key weed species of concern, that currently do not occur or only occur in low numbers in KNP include African Lovegrass and Serrated Tussock (*Nasella trichotoma*). Care must be taken to ensure that these species are not transported into KNP during construction activities.

### 3.8. Pathogens

Infection of native plants by *Phytophthora cinnamomi* is listed as a key threatening process under the BC Act and EPBC Act. *Phytophthora cinnamomi* can lead to death of trees and shrubs, resulting in devastation of native ecosystems (SOS Hygiene Guidelines, DPIE 2020). Infection of susceptible communities with *P. cinnamomi* leads to:

- changes in the structure and composition of the native plant communities;
- a significant reduction in primary productivity and functionality; and
- habitat loss and degradation for dependent flora and fauna.

Impacts from *P. cinnamomi* have been identified as a key threat to the Smoky Mouse.

Chytrid fungus (*Batrachochytrium dendrobatidis*) is known to cause Chytridiomycosis, an infectious disease that affects amphibians worldwide. This disease has been linked to extinction and declines in several frog species across Australia and is listed as a key threat to the Alpine Tree Frog and Booroolong Frog. The key risk is the spread of the fungus between infected and uninfected populations.



## 4. ENVIRONMENTAL ASPECTS AND IMPACTS

### 4.1. Impact Summary

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 that could cause impacts to biodiversity are identified in Table 4-1. The extent of these impacts will depend on the nature, extent and magnitude of construction activities and their interaction with the natural environment (Column 2).

**Table 4-1: Biodiversity aspects, impacts and environmental factors**

Environmental Aspects (Construction activities that may impact biodiversity)	Environmental Impacts	Environmental Factors (Conditions)
<ul style="list-style-type: none"> <li>• Clearing native vegetation</li> <li>• Topsoil stripping</li> <li>• Bulk earthworks</li> <li>• Soil movement and transfer</li> <li>• Material stockpiles and emplacement areas</li> <li>• Bridge construction and waterway crossings</li> <li>• Operation of compounds</li> <li>• Movement of vehicles</li> <li>• Use of artificial lights</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of native vegetation</li> <li>• Loss of threatened ecological communities</li> <li>• Loss of threatened species habitat</li> <li>• Loss of riparian vegetation</li> <li>• Potential for fauna mortality</li> <li>• Disturbance of river/creek beds and banks</li> <li>• Drawdown of groundwater, resulting in impacts to GDEs</li> <li>• Increased noise, vibration and dust levels resulting in indirect impacts including disturbance of fauna species, and consequent abandonment of habitat, or changes in behaviour (including breeding behaviour)</li> <li>• Increase in predatory and pest animal species, resulting in increased predation and competition and a consequent reduction in populations</li> <li>• Lighting for night works, resulting in indirect impacts including disturbance to fauna species and changes in occupancy or behaviour</li> <li>• Increase in weeds and pathogens, resulting in degradation of retained native vegetation and habitat</li> <li>• Potential for adverse impact on frogs and aquatic ecology</li> <li>• Reduced habitat connectivity inhibiting fauna movements, lowering reproduction and gene flow</li> <li>• Other fragmentation of habitats and associated impacts to connectivity and fauna movement</li> <li>• Mobilisation of sediments during periods of wet weather leading to decline in water quality and species habitats.</li> </ul>	<ul style="list-style-type: none"> <li>• Site conditions and prior site disturbance</li> <li>• Water quality</li> <li>• Weed and pest animal presence and abundance</li> <li>• Soil types and the mobilisation of sediments</li> <li>• Bushfire</li> </ul>

## 4.2. Direct and indirect impacts of vegetation clearing

The Revised BDAR from the Main Works RTS (EMM, 2020) established that the clearing of vegetation would have direct and indirect impacts to native vegetation and threatened species habitats. The impacts defined in the Revised BDAR are shown in Table 4-2 and Table 4-3 for native vegetation and threatened species respectively. As detailed in Table 3-4, threatened species impacted by the project include ecosystem-credit and species-credit species. Impacts to ecosystem-credit species are tracked through impacts to relevant PCTs only and do not require further tracking of habitat impacts. As such, only species-credit habitats were mapped for the BDAR and summarised in Table 4-3. Clearing of these biodiversity features (PCTs, threatened species and their habitats) will be tracked throughout construction of the project as detailed in section 5.

### 4.2.1. Direct Impacts

The direct impacts of Main Works will be associated with impacts arising from the clearing works for construction of the project. Direct impacts are characterised as:

- clearing of areas of native vegetation;
- clearing of threatened species habitat;
- clearing of threatened ecological communities (TECs); and
- disturbance of river/creek beds and banks.

Areas subject to direct impact will be permanently cleared and will not regenerate due to the construction of permanent infrastructure. Following completion of construction, some areas may be revegetated, however, for the purposes of the environmental assessment all cleared areas have been assessed as permanently removed. Areas directly impacted are those areas which are situated within the final disturbance footprint for the project. Pre-clearance management measures and clearing procedures aim to minimise the direct impacts of the project (Section 5).

#### 4.2.1.1. Cumulative Direct Impacts

The Snowy 2.0 project is comprised of a suite of discrete planning approvals because of differing spatial and temporal aspects of the project. The overall location of Exploratory Works and Main Works approvals overlap in some areas. For clarity, Table 4-2 and Table 4-3 provides clearing predictions indicated in each approval as well as the cumulative total for vegetation and habitat clearing.

### 4.2.2. Indirect Impacts

Indirect impacts, if unmitigated, are characterised as:

- increased noise, vibration and dust levels resulting in disturbance of fauna species, and consequent abandonment of habitat, or changes in behaviour (including breeding behaviour);
- lighting for night works, resulting in disturbance to fauna species and changes in occupancy or behaviour;
- drawdown of groundwater resulting in impacts to groundwater dependant ecosystems (see section 4.2.2.1);
- increase in weeds and pathogens, resulting in degradation of retained native vegetation and habitat; and
- increase in predatory and pest animal species, resulting in increased predation and competition and a consequent reduction in populations.



For the purposes of the BDAR it was assumed that all vegetation within 20 m of the disturbance footprint will experience indirect impacts as a result of the project. The management measures in Section 5 aim to minimise and mitigate the predicted indirect impacts of the project on biodiversity values.

#### **4.2.2.1. Groundwater Dependent Ecosystems**

The EIS/RTS used modelling to predict that tunnelling for the project would result in groundwater drawdown. The Revised BDAR (section 6.4.2) predicted that 6.93 ha of PCT 637 Alpine Bogs and Fens could experience greater than 0.5 metres of drawdown. The Revised BDAR predicted that PCT 637 was at high risk of predicted impact at the modelled level of drawdown. However, it is not yet clear if the shallow water hydrology of the GDE patches are interconnected to the deeper groundwater system, that is, the GDEs may be perched and independent of the deeper groundwater system. As such, the true extent of GDE impact is not yet known. The impact may vary from the 6.93 ha predicted for PCT 637 Alpine bogs and fens. Monitoring of deep and shallow groundwater during construction of the project will determine the extent to which deep groundwater and shallow GDE water is connected and which GDE patches, if any, are impacted by the project.

Deep and shallow groundwater levels will be monitored in accordance with the Groundwater Monitoring Program (as detailed in the Water Management Plan). Once the extent of impact has been confirmed then follow up actions will be carried out in accordance with section 5.3.

**Table 4-2: Cumulative direct impacts (ha) to native vegetation as indicated in Table 7.8 of the RTS BDAR (EMM, 2020)**

Plant community type	Exploratory Works	Main Works	Total
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**	5.54	6.85	12.39
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	48.37	25.6	73.97
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**	-	1.04	1.04
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**	10.52	34.74	45.26
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**	12	2.83	14.83
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**	0.31	26.66	26.97
PCT 311 – Red Stringybark - Broad-leaved Peppermint - Nortons Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion	2.87	8.91	11.78
PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion <sup>T **</sup>	-	1.03	1.03
PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	-	8.6	8.6
PCT 643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion	0.18	0.08	0.26
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	-	60.75	60.75
PCT 679 – Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion**	-	0.03	0.03
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	24.1	21.4	45.5
PCT 952 – Mountain Gum - Narrow-leaved Peppermint - Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion	0.35	-	0.35
PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	1.41	7.98	9.39

Plant community type	Exploratory Works	Main Works	Total
PCT 999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion	1.28	12.4	13.68
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	0.55	9.24	9.79
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	5.15	108.18	113.33
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	0.15	80.83	80.98
PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion**	<0.01	7.09	7.09
<b>TOTALS</b>	<b>112.78<sup>#</sup></b>	<b>424.24</b>	<b>537.85<sup>#</sup></b>

<sup>T</sup> Threatened Ecological Community (EPBC Act and BC Act)

\*\* Groundwater Dependent Ecosystem (GDE)

<sup>#</sup> Where there is a discrepancy between this total and the maximum disturbance area detailed in Table 1-2 the maximum area detailed in Table 1-2 will prevail for compliance purposes

Table 4-3: Cumulative direct impacts (ha) to threatened species habitat as indicated in Table 7.8 of the RTS BDAR (EMM, 2020)

Mapped Species polygons		Species Listing		Exploratory Works (ha)	Main Works (ha)	Total (ha)
Scientific name	Common Name	EPBC Act <sup>1</sup>	BC Act <sup>2</sup>			
Flora						
<i>Caladenia montana</i>	-	-	V	-	0.77	0.77
<i>Calotis glandulosa</i>	Mauve Burr-daisy	VU	E1	-	7.8	7.8
<i>Calotis pubescens</i>	Max Mueller's Burr-daisy	-	E1	-	0.57	0.57
<i>Carex raleighii</i>	Raleigh Sedge	-	E1	-	0.25	0.25
<i>Discaria nitida</i>	Leafy Anchor Plant	-	V	-	40 individuals	40 individuals
<i>Glycine latrobeana</i>	Clover Glycine	VU	E4A	-	0.57	0.57
<i>Prasophyllum retroflexum</i>	Kiandra Leek Orchid	-	V	-	1.45	1.45
<i>Pterostylis foliata</i>	Slender Greenhood	-	V	0.28	0.28	0.56
Fauna						
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (breeding habitat only)	-	V	0.91	2.08	2.99
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	-	V	76.17	197.95	274.12
<i>Cyclodomorphus praealtus</i>	Alpine She-oak Skink	EN	E1	-	80.83	80.83
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (breeding habitat only)	-	V	-	17.53	17.53
<i>Litoria booroolongensis</i>	Booroolong Frog	EN	E1	2.49	1.33	3.82
<i>Litoria verreauxii alpina</i>	Alpine Tree Frog	VU	E1	0.03	22.87	22.90
<i>Mastacomys fuscus</i>	Broad-toothed Rat	VU	V	-	61.47	61.47
<i>Myotis macropus</i>	Southern Myotis	-	V	-	2.72	2.72
<i>Ninox connivens</i>	Barking Owl	-	V	0.01	-	0.01
<i>Pseudomys fumeus</i>	Smoky Mouse	EN	E4A	1.9	84.29	86.19
<i>Tyto novaehollandiae</i>	Masked Owl	-	V	0.91	-	0.91

<sup>1</sup> EPBC Act categories: VU- Vulnerable; EN- Endangered, M- Migratory

<sup>2</sup> BC Act categories: V- Vulnerable; E1- Endangered; E4A- Critically endangered

### 4.3. Impacts to Matters of National Environmental Significance (MNES)

Several Matters of National Environmental Significance (MNES) have been identified as occurring or having potential to occur in the project area. Impacts to these MNES were assessed in the EPBC Act Referral for the project (2018/8332) and in the RTS BDAR.

The KNP constitutes a component of the national heritage listed Australian Alps National Parks and Reserves (AANP), which is considered a key part of a unique Australian mountainous region. In terms of biodiversity, the AANP supports a rich and unique assemblage of cold-climate specialist species that have evolved unique physiological characteristics, enabling them to survive in an environment subject to extreme climate variation. The AANP supports a diversity of flora and cold climate adapted and endemic fauna species.

The BDAR assessed the likelihood for these species to occur within the project area and after detailed survey and assessment quantified the impacts to these MNES. The project design was refined during the assessment process to avoid and minimise impacts to MNES wherever possible. The impacted MNES have individually been discussed elsewhere in this plan (Section 1 and 4.2) and were comprehensively addressed in the BDAR. For ease of reference Table 4-4 provides a summary of residual impacts to the MNES recorded within the project area.

The RTS BDAR determined that the project would result in a significant impact to two MNES:

- Smoky Mouse (*Pseudomys fumeus*); and
- Alpine Tree Frog (*Litoria verreauxii alpina*).

The remaining MNES were assessed as unlikely to be significantly impacted because of the abundance of high-quality habitat in the immediate surrounds of the project.

All MNES occurring within the project area will be managed in accordance with the biodiversity management measures being implemented for the project as detailed in Section 5. Where appropriate, MNES species will be the subject of an ongoing monitoring program as detailed in Appendix B. The Alpine Sphagnum Bogs and Fens ecological community may be subject to additional indirect impacts resulting from groundwater drawdown as detailed in section 4.2.2.1. This ecological community will be subject to additional monitoring as detailed in section 5.3.

**Table 4-4: Summary of direct impacts to MNES**

Species name	Common name	Threatened status		Impact area (ha) or # individuals
		EPBC Act <sup>1</sup>	BC Act <sup>2</sup>	Direct impact
EPBC Act Listed Ecological Communities				
Alpine Sphagnum Bogs and Associated Fens		EN	E1*	1.03
EPBC Act Listed Flora				
<i>Calotis glandulosa</i>	Mauve Burr-daisy	VU	V	7.8
<i>Glycine latrobeana</i>	Clover Glycine	VU	E4A	0.57
EPBC Act Listed Fauna				
<i>Gallinago hardwickii</i>	Latham’s Snipe	M	-	8.12**
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M	-	329.56

Species name	Common name	Threatened status		Impact area (ha) or # individuals
		EPBC Act <sup>1</sup>	BC Act <sup>2</sup>	Direct impact
<i>Hirundapus caudacutus</i>	White-throated Needletail	M, VU	-	Only recorded flying overhead. No roosting habitat mapped in the project area.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	EN	V	335.22
<i>Cyclodomorphus praealtus</i>	Alpine She-oak Skink	EN	E1	80.83
<i>Litoria booroolongensis</i>	Booroolong Frog	EN	E1	2.49
<i>Litoria verreauxii alpina</i>	Alpine Tree Frog	VU	E1	22.90
<i>Mastacomys fuscus</i>	Broad-toothed Rat	VU	V	61.47
<i>Pseudomys fumeus</i>	Smoky Mouse	EN	E4A	86.19

<sup>1</sup> EPBC Act categories: VU- Vulnerable; EN- Endangered, M- Migratory

<sup>2</sup> BC Act categories: V- Vulnerable; E1- Endangered; E4A- Critically endangered

\* Listed as PCT 637 – Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions under NSW BC Act.

\*\* Includes PCT637 and PCT1225 that occurs in the disturbance area.

## 5. ENVIRONMENTAL MANAGEMENT MEASURES

### 5.1. Management Measures

A range of environmental requirements and control measures are identified in the Main Works EIS, Submissions Report and the Infrastructure Approval. Safeguards and management measures will be implemented to avoid, minimise or manage impacts to biodiversity.

Specific safeguards and management measures to address biodiversity impacts of the project are identified in Table 5-1. These management measures will be the responsibility of Snowy Hydro or their contractors. Regardless of the allocation of responsibilities within this plan, the responsible party is to be assigned in accordance with the Contract.



**Table 5-1: Biodiversity management measures**

ID	Measure / Requirement	When to implement	Source document
<b>TRAINING</b>			
BM01	Training will be provided to all project personnel, including relevant sub-contractors on biodiversity management practices and the requirements from this plan through inductions, toolbox talks and activity-specific training.	Pre-construction	Good Practice
BM02	Drivers will be informed of their requirements to manage speed and report fauna strike and near-miss incidents as specified in the Fauna Strike Mitigation Strategy in Appendix G of this Plan.	Pre-construction and construction	Appendix G
<b>PRECLEARING AND CLEARING</b>			
BM03	Implement the Fauna Strike Mitigation Strategy as detailed in Appendix G. This includes managing speed limits of vehicles on access roads and undertaking a risk assessment to identify locations for installing fauna underpasses for fauna if deemed necessary.	Construction	Sch 3, Cond 18(c) Sch 3, Cond 17(d)
BM04	In the event that threatened species, active breeding habitat of threatened species or endangered ecological communities are unexpectedly identified during construction, the Unexpected Threatened Species Finds Procedure included in Appendix D will be followed.	Construction	REMM ECO01-EW, Good practice
BM05	During the detailed design of the project, impacts to native vegetation and mapped threatened species habitats will be minimised where feasible and reasonable as detailed in section 5.2.	Detailed design	Sch 3, Cond 17(b) and (d); SSI 9208, Sch 3, Cond 6(b)
BM06	Exclusion zones will be established around areas of retained vegetation prior to clearing that particular area. Where required, these areas will be fenced using appropriate fencing materials and designated and signed as no-go zones or environmentally sensitive areas.	Pre-construction and construction	Sch 3, Cond 17(a); Appendix C; SSI 9208, Sch 3, Cond 6(b)
BM07	A pre-clearing survey will be undertaken prior to the commencement of clearing. The site inspection will: <ul style="list-style-type: none"> <li>flag key habitat features, and</li> <li>identify nearby habitat suitable for the release of any that may be encountered during clearing works.</li> </ul> Details of preclearing survey requirements are detailed in Appendix C.	Pre-construction and construction	Sch 3, Cond 17(a) and (d); Appendix C; SSI 9208, Sch 3, Cond 6(b)

ID	Measure / Requirement	When to implement	Source document
BM08	<p>Clearing limits/disturbance footprint will be delineated using highly visible, durable, continuous barrier such as safety flagging, UV stabilised rope, or other similarly robust and durable material. Delineation will be installed consistently where possible to reduce the risk of error or misinterpretation of boundaries.</p> <p>Where a continuous rope is impractical due to terrain and vegetation density, highly visible flagging will be placed on vegetation to maintain line of sight of the clearing boundary.</p> <p>"Environmental Protection Area" signs (or similar wording) will be placed in prominent positions along the exclusion fencing.</p>	Pre-construction and construction	Sch 3, Cond 17(a); Appendix C; SSI 9208, Sch 3, Cond 6(b)
BM09	The Pre-clearing and Clearing Procedure provided in Appendix C will be implemented during construction. This procedure includes two-stage clearing for fauna habitat features.	Pre-construction and construction	Sch 3, Cond 17(f); SSI 9208, Sch 3, Cond 6(b); REMM ECO4; REMM BDAR-04; REMM ECO01-EW; REMM MOD2-006-EW
BM10	Except where an approved design requires it, such as bridge crossings, all ground disturbance within mapped riparian avoidance areas is prohibited.	Pre-construction and construction	REMM ECO02-EW
BM11	Pre-clearing inspections in locations within 50 metres of watercourses or reservoirs will include thorough searches for frogs.	Construction	REMM ECO01-EW; REMM ECO07-EW, REMM ECO09-EW
BM12	Fauna detected during pre-clearing surveys will be relocated into areas of retained vegetation in accordance with the Preclearing and Clearing Procedure (Appendix C) and Fauna Handling and Rescue Procedure (Appendix E).	Construction	Sch 3, Cond 17(d); REMM BDAR-03
BM13	Where manual relocation of frogs is required, the hygiene requirements outlined in the Fauna Handling and Rescue Procedure (Appendix E) will be implemented to prevent the spread of Chytrid fungus.	Construction	Sch 3, Cond 17(d);
BM14	Habitat trees within areas to be cleared will be marked during the pre-clearing inspection by the Ecologist. GPS coordinates for all habitat trees identified will be recorded during the pre-clearing survey.	Construction	Appendix C
BM15	Where a HBT is felled, the tree hollows will be salvaged, and the salvaged sections reused as hollow replacements for the rehabilitation of the site.	Construction	Sch 3, Cond 17(g); SSI 9208, Sch 3, Cond 6(b); REMM ECO4; REMM BDAR-06

ID	Measure / Requirement	When to implement	Source document
BM16	Where dangerous trees, which are located adjacent to the disturbance area (but within the construction envelope), present a safety hazard that requires intervention, they will be managed/removed such that the impact to native vegetation is minimised. Where safe to do so, corrective pruning is preferable to tree removal and should be performed in accordance with Australian standard <i>AS 4373-2007 Pruning of Amenity Trees</i> . All clearing impacts associated with dangerous tree removal/management will be accounted for in the project-wide clearing tracking.	Construction	Sch 3, Cond 17(c)
BM17	HBTs marked for removal will be checked by the Ecologist prior to felling/ disturbance and any animals found will be relocated to adjacent habitat. Ecologists will capture and/or remove fauna that have the potential to be disturbed as a result of clearing activities. To prevent injury and mortality of fauna, an ecologist will be present at the time of felling HBTs. Further details are provided in the Fauna Handling and Rescue Procedure included in Appendix E.	Construction	Sch 3, Cond 17(d)
BM18	Targeted surveys for Alpine Tree Frog to be completed prior to construction within sections of the Plateau and Peninsula.	Pre-construction and construction	REMM BDAR-09
BM19	Targeted surveys for flora species will be completed within sections of the Plateau, the Peninsula and Ravine Bay prior to construction.	Pre-construction and construction	REMM BDAR-10
<b>MONITORING</b>			
BM20	The clearing of native vegetation will be monitored so that impacts to mapped plant community types and threatened species habitats do not exceed those defined in the assessment reports and project approvals. Further detail included in section 5.2.2.	Pre-construction / Construction	Sch 3, Cond 17(d) Sch 2, Cond 5
BM21	Monitor impacts on Groundwater Dependant Ecosystems as detailed within the Groundwater Management Plan. The GDE monitoring program will be implemented to assess actual impacts against predicted. If non-negligible GDE impacts are reported, the follow-up actions specified in section 5.3 will be implemented.	Construction	Sch 3, Cond 18(d) and Sch 3, Cond 15; REMM ECO3; REMM BDAR-22 Annexure A (Groundwater Monitoring Program) of the Groundwater Management Plan

ID	Measure / Requirement	When to implement	Source document
BM22	Carry out threatened species, weed, pest and pathogen monitoring throughout the construction program as detailed in the Biodiversity Monitoring Program (Appendix B).	Construction	Sch 3, Cond 17(d) REMM ECO5 REMM BDAR-07 REMM ECO04-EW
<b>THREATENED SPECIES MANAGEMENT</b>			
BM23	Where possible and safe to do so, construction lighting and resulting glare will be minimised. All lighting will be directed downward toward work activities, away from the night sky and away from known locations of light-sensitive habitat.	Construction	REMM BDAR-19
BM24	Where practicable, open trenches along the communications cable route, which have potential to trap fauna, will be inspected for trapped fauna daily for the duration that the trap-hazard remains in place. If trapped fauna are observed within the excavation, branches or other material can be provided to allow the fauna to self-rescue. If trapped fauna are unable to escape, the Project Ecologist or a person skilled in handling the fauna encountered will safely remove and release the animal in accordance with the approved Fauna Handling and Rescue Procedure (Appendix E). Where it may take time for the project ecologist or fauna handler to attend site, the project ecologist will be contacted and advice will be sought regarding the appropriate management of the fauna present within the trench. Should the project ecologist deem it to be more appropriate to remove the fauna in a timely manner (to reduce stress or exposure), removal will be undertaken in accordance with the recommendations of the project ecologist. Threatened species will be managed in accordance with the Unexpected Threatened Species Find Procedure.	Construction	Sch 3, Cond 17(d)
BM25	Where open trenches along the communications route are unable to be inspected daily (as per BM24), temporary provisions to assist trapped fauna in self-rescue will be provided in the trench. Such measures may include the placement of branches, soil ramps or other material which an animal could climb up to escape the trench.	Construction	Sch 3, Cond 17(d)
BM26	Where practicable, under-boring will be used beneath Boggy Plain rather than open trenching along the southern communication route.	Construction	REMM BDAR-08
BM27	Construction and removal of the temporary bridge at Yarrangobilly River will avoid or minimise in stream works during the migration time of Macquarie Perch (October to January) where possible.	Construction	REMM ECO13-EW
<b>HABITAT RETENTION AND RESTORATION</b>			
BM28	A collection of indigenous native seed and alpine sods will be collected from areas identified to be disturbed, for propagation and use in the final rehabilitation works.	Construction	Sch 3, Cond 17(g) & (h); SSI 9208, Sch 3, Cond 6(b); REMM ECO4

ID	Measure / Requirement	When to implement	Source document
BM29	Native vegetative material and topsoil containing vegetative matter and native seed bank will be salvaged and stored for beneficial reuse in the rehabilitation of the site.	Construction / Post-construction	Sch 3, Cond 17(g); SSI 9208, Sch 3, Cond 6(b); REMM ECO4; REMM BDAR-05
BM30	Woody debris including felled trees, hollow logs, and mulch, and bush rock will be re-used on site for habitat improvement where possible.	Construction / Post-construction	Sch 3, Cond 17(g); SSI 9208, Sch 3, Cond 6(b); REMM ECO4; REMM BDAR-06
BM31	Where feasible and reasonable, trees to be retained within the construction envelope will be managed in accordance with AS 4970-2009 Protection of trees on development sites.	Construction	REMM ECO01-EW
<b>WEED AND PATHOGEN MANAGEMENT</b>			
BM32	Measures to prevent the introduction and/or spread of pests and disease-causing agents such as bacteria and fungi (Inc. chytrid) will be implemented in accordance with the Weed, Pest and Pathogen Management Plan within Appendix F.	Construction	Sch 3, Cond 17(i); SSI 9208, Sch 3, Cond 6(b); REMM ECO2; REMM BDAR-11
BM33	Prior to disturbance of riparian areas along Kellys Plain Creek, soil testing for the presence of harmful <i>Phytophthora</i> sp. will be carried out to determine if existing pathogens are present at the site.	Construction	Sch 3, Cond 17(i)
BM34	Pathogen measures as detailed within Appendix F– Weed, Pest and Pathogen Management Plan will be implemented to minimise the introduction and spread of weeds and pathogens. These include in-situ washdown procedures to minimise the dispersal of existing weeds and pathogens across the project area.	Construction	Sch 3, Cond 17(i); SSI 9208, Sch 3, Cond 6(b); REMM ECO2; REMM BDAR-15
BM35	Hygiene controls including washdown and inspection procedures will be carried out to minimise the spread of biosecurity matters including terrestrial and aquatic weeds, pest and pathogens as detailed in the Weed, Pest and Pathogen Management Plan (Appendix F).	Construction	Sch 3, Cond 17(i);
BM36	A chemical weed control program will be implemented as detailed in the Weed, Pest and Pathogen Management Plan (Appendix F)	Construction	REMM ECO08-EW

ID	Measure / Requirement	When to implement	Source document
BM37	To minimise the establishment of weeds, cleared areas will be revegetated as soon as reasonably practicable following construction	Construction	REMM BDAR-17
<b>PEST MANAGEMENT</b>			
BM38	Implement controls on construction activities that mitigate against the spread of feral pests as detailed in the Weed, Pest and Pathogen Management Plan (Appendix F)	Construction	SSI 9208, Sch 3, Cond 6(b); REMM ECO2; REMM ECO6; REMM BDAR-18
BM39	A vertebrate pest control program will be implemented for the duration of construction as detailed in the Weed, Pest and Pathogen Management Plan (Appendix F).	Construction	Sch 3, Cond 17(d), REMM ECO6.



## 5.2. Impact mitigation through detailed design

### 5.2.1. Disturbance area and clearing limits

An indicative disturbance area was developed for the project's Preferred Infrastructure Report (PIR). This indicative disturbance area was used to determine the likely clearing quantum of native vegetation and threatened species habitat for impact assessment and offset calculation purposes.

The Infrastructure Approval (SSI 9687) used the indicative disturbance area to define overall limits on native vegetation clearing for the project (Schedule 2, Condition 5). In addition, the Commonwealth EPBC Act approval (2018/8332) defined limits of impacts to specific threatened species habitat (Part A, Condition 5). These limits of disturbance are detailed in Table 5-2.

**Table 5-2: Clearing limits defined in the project approvals**

Aspect	Exploratory Works	Main Works	Total
Maximum Native Vegetation Clearing	107 ha	425 ha	532 ha
Smoky Mouse habitat	1.9	84.29	86.19
Alpine Tree Frog	0.03	22.87	22.90
Broad-toothed Rat	-	61.47	61.47
Alpine She-oak Skink	-	80.83	80.83
Eastern Pygmy Possum	76.17	197.95	274.12
Latham's Snipe	-	81.86	81.86
Alpine Bogs and Fens	-	1.03	1.03

### 5.2.2. Detailed design development

It was anticipated in the Submissions Report that the disturbance area for the project would shift as the project design evolved and the approval therefore allowed for variation to the disturbance area under the following conditions:

- the disturbance area is to be contained wholly within the defined construction envelope of the project (the approval permits certain activities, such as monitoring, to be undertaken outside the construction envelope), and
- the clearing impact of the final disturbance area is consistent with that detailed in Table 5-2.

The process detailed in Figure 5-1 below shows the steps of the internal review process that will be followed to ensure that the project clearing is consistent with the project approval.

### 5.2.3. Threatened species avoidance

The scope of the Biodiversity Monitoring Program (

Biodiversity Monitoring Program will be reviewed and, if necessary, revised to include monitoring for the additionally impacted species.

The siting of passing bays along the communications route on the Plateau will be such that threatened flora individuals identified during the EIS/RTS will be avoided. If it is not possible to avoid these threatened flora, the monitoring program will be revised as detailed above.

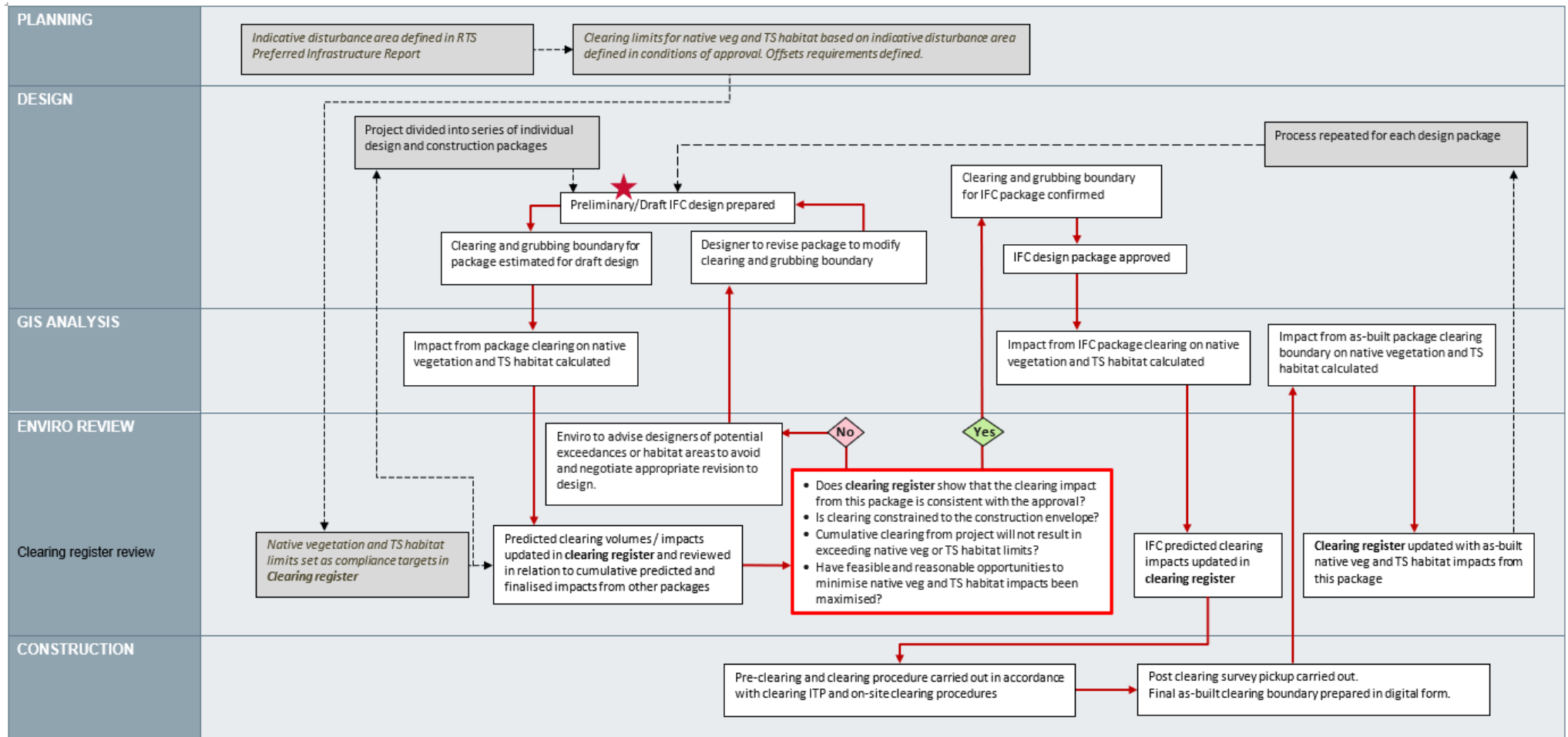


Figure 5-1: Conceptual depiction of internal clearing impact review process (typically starts at the star)

### 5.3. Groundwater Dependant Ecosystem monitoring and impact mitigation

As discussed in section 4.2.2.1, tunnelling for the project has potential to result in drawdown of groundwater and an associated adverse impact on GDEs. Monitoring of groundwater levels will be carried out in accordance with the Groundwater Monitoring Program (Water Management Plan). If the shallow groundwater regime in GDE patches shows a drawdown in exceedance of the 80<sup>th</sup> percentile and this drawdown is subsequently found to be attributable to the project, then a non-negligible impact to the shallow groundwater system will be confirmed.

No additional biometric monitoring, such as floristics or vegetation condition, is proposed to assess the impact on ecosystem function as a result of drawdown. This is because, functional impacts can take a substantial amount of time to present and be detected. Instead, shallow groundwater levels will be used as a proxy for ecosystem function in the GDE patches.

Where there is a confirmed change to the shallow groundwater regime (as determined by the Groundwater Monitoring Program), an adverse impact to ecosystem function is assumed to follow. At the time of registering a confirmed impact to groundwater levels in GDE patches, the Project will notify agency stakeholders and will investigate with experts if ameliorative steps are available to recover the groundwater levels in the GDE patches. Where it is agreed with stakeholders that practicable mitigation measures are feasible and reasonable, these will be undertaken in attempt to prevent loss of ecosystem function.

If ameliorative actions are not viable to recover the groundwater levels in GDE patches, or if attempted mitigation measures have failed, offsets for the affected patches will be paid directly.

This approach of assuming an ecological impact based on groundwater levels alone, provides offset funds for conservation measures in a timely fashion without requiring extensive and prolonged ecosystem monitoring. Offsets will be secured in accordance with Schedule 3, Condition 16 of the Infrastructure Approval (SSI 9687). Further detail on the proposed offsetting arrangement is included in section 5.3.1 below.

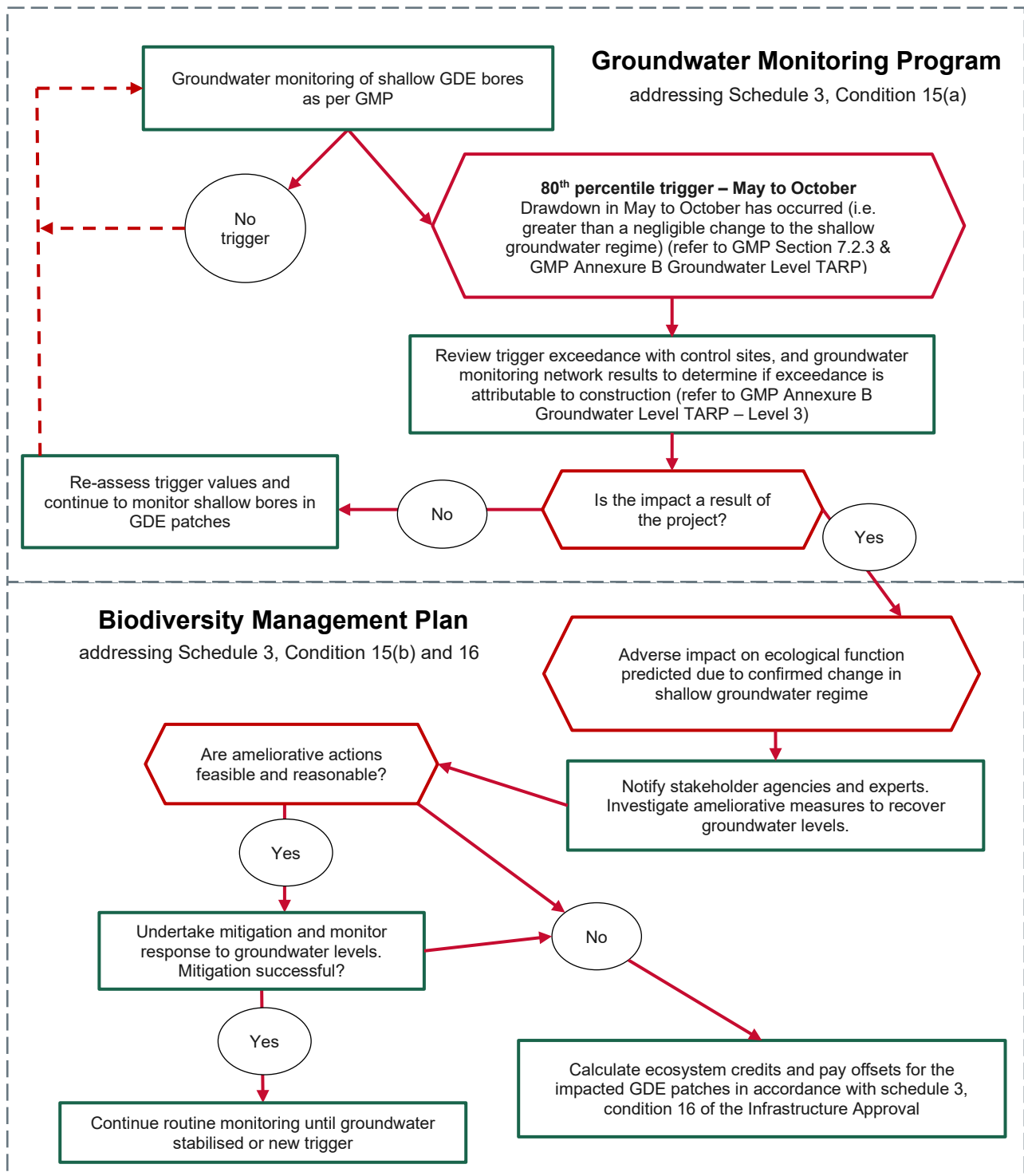
Figure 5-2 provides an outline of the GDE monitoring process as addressed in the Groundwater Monitoring Program and this BMP. Shallow groundwater monitoring locations are shown in Figure 5-3.

#### 5.3.1. Determination of offset requirements for impacted GDE

Comprehensive vegetation mapping was undertaken for the Revised BDAR during the project assessment. At that time, approximately 86 ha of PCT 637 was mapped. For each of these patches, vegetation condition was recorded so that subsequent offsets can be calculated. The Revised BDAR, which relied on the modelled groundwater drawdown prediction, identified that up to 6.93 ha of PCT 637 would experience drawdown of 0.5m or more. This prediction will be tested through the groundwater monitoring program which will monitor the shallow groundwater regime across the predicted impact area.

The BDAR assessed all patches of PCT 637 in the predicted drawdown area as being in high condition. The Biodiversity Assessment Method (BAM) calculator determines that these patches are valued at 34.29 ecosystem credits per hectare for offsetting purposes.

The final determination of offset liability will be determined by the Planning Secretary through consultation with NPWS and DAWE in accordance with schedule 3, condition 16 of the Infrastructure Approval. Any GDE offset payment will be added to the funds paid under schedule 3, condition 12 of the approval (SSI 9687) and these funds will be managed in accordance with the notes under that condition.



**Figure 5-2: Outline of GDE monitoring process and division of responsibility across GMP and BMP**



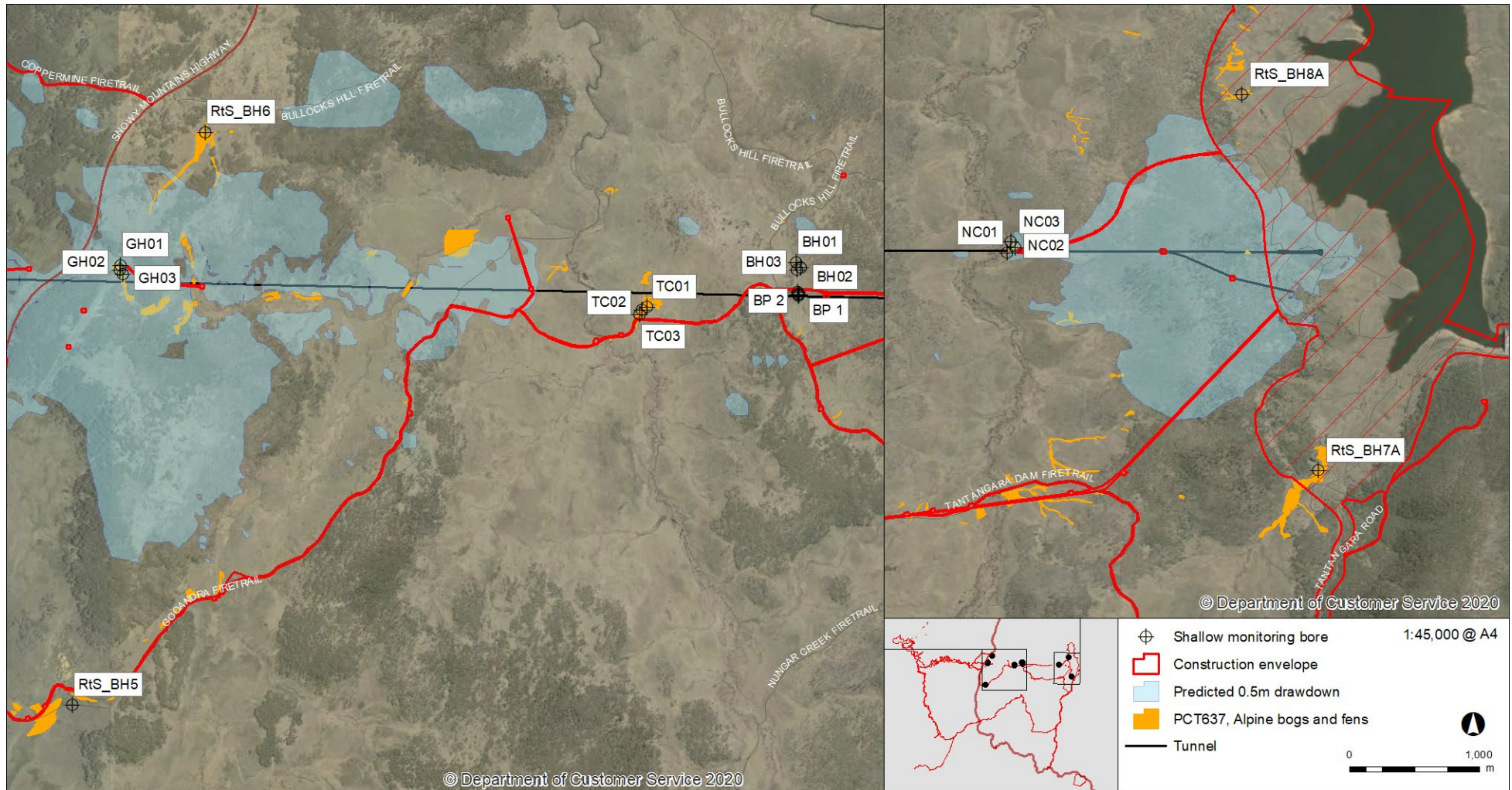


Figure 5-3: Shallow groundwater monitoring locations for GDE



## 6. COMPLIANCE MANAGEMENT

### 6.1. Roles and Responsibilities

Future Generation'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 BMP.

### 6.2. Monitoring and Inspection

The following monitoring programs will be implemented to assess the impacts of the project in relation to the environmental approvals. The monitoring activities which comprise the overarching Biodiversity Monitoring Program (Appendix B) include:

- Threatened flora monitoring for:
  - *Glycine latrobeana* (Clover Glycine); and
  - *Prasophyllum retroflexum* (Kiandra Leek Orchid).
- Small terrestrial mammal occupancy monitoring for:
  - Smoky Mouse (*Pseudomys fumeus*);
  - Broad-toothed Rat (*Mastacomys fuscus*); and
  - Eastern-pygmy possum (*Cercartetus nanus*).
- Amphibian occupancy monitoring for:
  - Alpine Tree Frog (*Litoria verreauxii alpina*); and
  - Booroolong Frog (*Litoria booroolongensis*).
- Alpine She-oak Skink Monitoring
- Feral animal monitoring; and
- Weed and pathogen monitoring.

In addition to the programs detailed above, regular inspections will be undertaken during construction in accordance with Table 6-1.

**Table 6-1 - Monitoring and inspection**

Monitoring details	Record	Responsibility	Frequency
Inspection of the performance and effectiveness of revegetation; and exclusion fencing, exclusion signage, adherence to exclusion zones, and weeds when works are being undertaken in the vicinity.	Environmental Inspection Checklist	Environment Officer	Weekly
Pre-clearing inspection	Clearing/Land disturbance permit	Foreman / Environment Officer	24-hours prior to clearing
Threatened species, habitat or populations	Unexpected Threatened Species, Find Register	Foreman / Environment Officer	As discovered
Fauna handling and rescue	Fauna Handling Record Sheet	Foreman / Environment Officer	As discovered

Monitoring details	Record	Responsibility	Frequency
Vegetation and habitat clearing tracking	Clearing Register	Environment Manager or delegate	Progressively updated with clearing and grubbing across the project
Fauna strike mitigation – driver reporting on near misses and incidental observations	Incidental fauna register	Environment Officer	Weekly
Additional Biodiversity Offset Payment Report – final disturbance area of main works and calculations of offsets in accordance with Schedule 3 Condition 13	Report	Snowy Hydro Limited	Within 3 years of commencement of Construction

### 6.3. Training

All site personnel will undergo the Future Generation site induction training which includes threatened species and habitat protection management measures.

The induction training will address elements related to biodiversity management including, but not limited to:

- existence and requirements of this BMP;
- relevant legislation;
- roles and responsibilities for biodiversity management; and
- biodiversity mitigation and management measures.

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

- clearing procedures;
- no-go zones;
- threatened species within the project area;
- feral animal reporting requirements;
- fauna strike speed limits and reporting requirements;
- unexpected finds procedure for threatened species; and
- hygiene procedures for weeds and pathogens.

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

### 6.4. Auditing

Internal audits will be undertaken to assess the effectiveness of the management measures and compliance with this BMP, the Infrastructure Approval, and other relevant approvals, licences and guidelines. An independent audit of the project is required by Schedule 4, condition 9 and 10 of the infrastructure approval (SSI 9687). Details of audit requirements are included in Section 8 of the EMS.

## 6.5. Reporting and Incidents

An annual report will be prepared to report on the variety of biodiversity matters addressed in this plan. This report, which will be made available to NPWS, DAWE and BCD, will include the following matters:

- summary of weed and vertebrate pest control activities undertaken since last report (as detailed in Appendix F);
- account of all clearing activities including tracking against clearing limits and threatened species habitat limits;
- post-clearing ecology reports since last report (as detailed in Appendix C);
- results of threatened species, groundwater-dependant ecosystem, weed and pest monitoring (as detailed in Appendix B);
- account of fauna strike mitigation strategy management actions (as detailed in Appendix G);
- account of any relevant incidents and non-compliances; and
- efficacy of the implemented biodiversity management measures against the performance measures included in section 6.5.1 of this plan.

Where possible, threatened species, weed and pest monitoring results will informally be provided to NPWS, DAWE and BCD as they become available to assist with conservation activities being undertaken in the locality by those agencies (further detail included in Appendix B).

A public version of this report will be made available in accordance with schedule 3, condition 18(d) of the infrastructure approval (SSI 9687) and condition 9(b) of the commonwealth approval.

Details on incident reporting is included in section 7 of the EMS. Environmental incidents relating to biodiversity may include but not be limited to:

- clearing or damage to vegetation outside of the designated clearing areas;
- unauthorised damage or interference to threatened species, endangered ecological communities or critical habitat; or
- unauthorised/accidental death or injury of native fauna within the project site.

### 6.5.1. Performance measures

This plan has been prepared to ensure the project satisfies the biodiversity-related requirements of the infrastructure approval (SSI 9687) as listed in section 2.2. Performance measures have been derived from relevant conditions of approval as detailed in Table 6-2 below. These performance measures will be used as a guide to measure the efficacy of the management plan controls and will aid in the refinement of management measures where required. The efficacy of the implemented management measures will be reported to regulators as detailed in section 6.5 above.

**Table 6-2: Performance measures for assessing efficacy of implemented management controls**

No.	Performance Measure	Relevant COA
1	The project will not exceed the maximum native vegetation clearing of 532 Ha.	Schedule 2, Condition 5
2	The project will ensure that if the shallow groundwater regime is impacted and results in a measurable change to the ecosystem function of the Alpine Bogs and Fens vegetation community, that appropriate biodiversity offsets will be calculated and paid.	Schedule 3, condition 15 & 16

No.	Performance Measure	Relevant COA
3	Other than where permitted by the Infrastructure Approval, the disturbance area will be restricted to within the approved construction envelope of the project.	Schedule 3, condition 17(a)
4	Direct impacts to threatened species habitats will be generally in accordance with those quantified in the revised BDAR as summarised in section 4.2.1 of this plan.	Schedule 3, condition 17(b) & (d)
5	Threatened species impacts resulting from clearing and vehicle strike will be minimised through the implementation of effective controls such as pre-clearing procedures and fauna strike mitigation measures.	Schedule 3, condition 17(d), (e) & (f)
6	An improvement (e.g. a reduction in weed/pest abundance or distribution) results from the implementation of a regular weed and pest control program.	Schedule 3, condition 17(d) & (i)

## 7. REFERENCES

The following documents were referenced in the preparation of this management plan and its appendices:

- Department of Environment and Climate Change (NSW) 2008. Hygiene protocol for the control of disease in frogs. Information Circular Number 6. DECC (NSW), Sydney South.
- DOE 2015. *Arrive Clean, Leave Clean*, Commonwealth of Australia 2015
- DPI 2018, Ecology and Management of Vertebrate Pests in NSW, NSW Department of Primary Industries 2018.
- DPI Fisheries 1999, DPI Policy and Guidelines: Aquatic Habitat Management and Fish Conservation, NSW Fisheries.
- DPIE 2020, Saving our Species Hygiene Guidelines, State of New South Wales and Department of Planning, Industry and Environment.
- EMM 2018, *Environmental Impact Statement: Exploratory Works for Snowy 2.0, Vol 1*, prepared for Snowy Hydro Limited.
- EMM 2018, Exploratory Works for Snowy 2.0 – Response to Submissions, v1, dated 03/10/2018
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- EMM 2020, *Revised Biodiversity Development Assessment Report (BDAR)*, v2, dated 24/02/2020.
- Mifsud G. 2016. *A field guide to poison baiting: wild dogs and foxes*. 3rd edition 2018. PestSmart Toolkit publication. The Centre for Invasive Species Solutions, Canberra, ACT.
- Menkhorst P. & Broome L. 2008. *National Recovery Plan for the Smoky Mouse Pseudomys fumeus*, Department of Sustainability and Environment, Melbourne.
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- NPWS 2001, *Approved NSW Threat Abatement Plan. Predation by the red fox (Vulpes vulpes)*, NSW National Parks and Wildlife Service, Hurstville.
- OEH 2012, Regional Pest Management Strategy 2012–17, Southern Ranges Region: a new approach for reducing impacts on native species and park neighbours, Office of Environment and Heritage [now DPIE BCD] 2012, Sydney.
- OEH 2017, Biodiversity Assessment Method (BAM), NSW Office of Environment and Heritage, Sydney.
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- OEH 2017, Broad-toothed Rat – profile, NSW Office of Environment and Heritage, Sydney.
- OEH 2017, Alpine Tree Frog – profile, NSW Office of Environment and Heritage, Sydney.
- OEH 2017, Alpine She-oak Skink – profile, NSW Office of Environment and Heritage, Sydney.



- OEH 2018, Saving our Species Monitoring, Evaluation and Reporting Guidelines for conservation projects, OEH NSW 2018.
- OEH 2018, Mauve Burr-daisy – profile, NSW Office of Environment and Heritage, Sydney.
- OEH 2018, Clover Glycine – profile, NSW Office of Environment and Heritage, Sydney.
- OEH 2018, Smoky Mouse – profile, NSW Office of Environment and Heritage, Sydney.
- Sharp, T. 2016. *Standard Operating Procedure: CAT002: Trapping of feral cats using cage traps*, The Centre for Invasive Species Solutions, Canberra, ACT.
- Sharp, T. and Saunders, G. 2016. *Standard Operating Procedure: FOX007: Baiting of foxes with paraaminopropiophenone (PAPP)*, The Centre for Invasive Species Solutions, Canberra, ACT.
- TSSC 2009, Commonwealth Listing Advice on Alpine Sphagnum Bogs and Associated Fens. Department of the Environment, Water, Heritage and the Arts, Canberra

## APPENDIX A      PROJECT BIODIVERSITY MAPPING

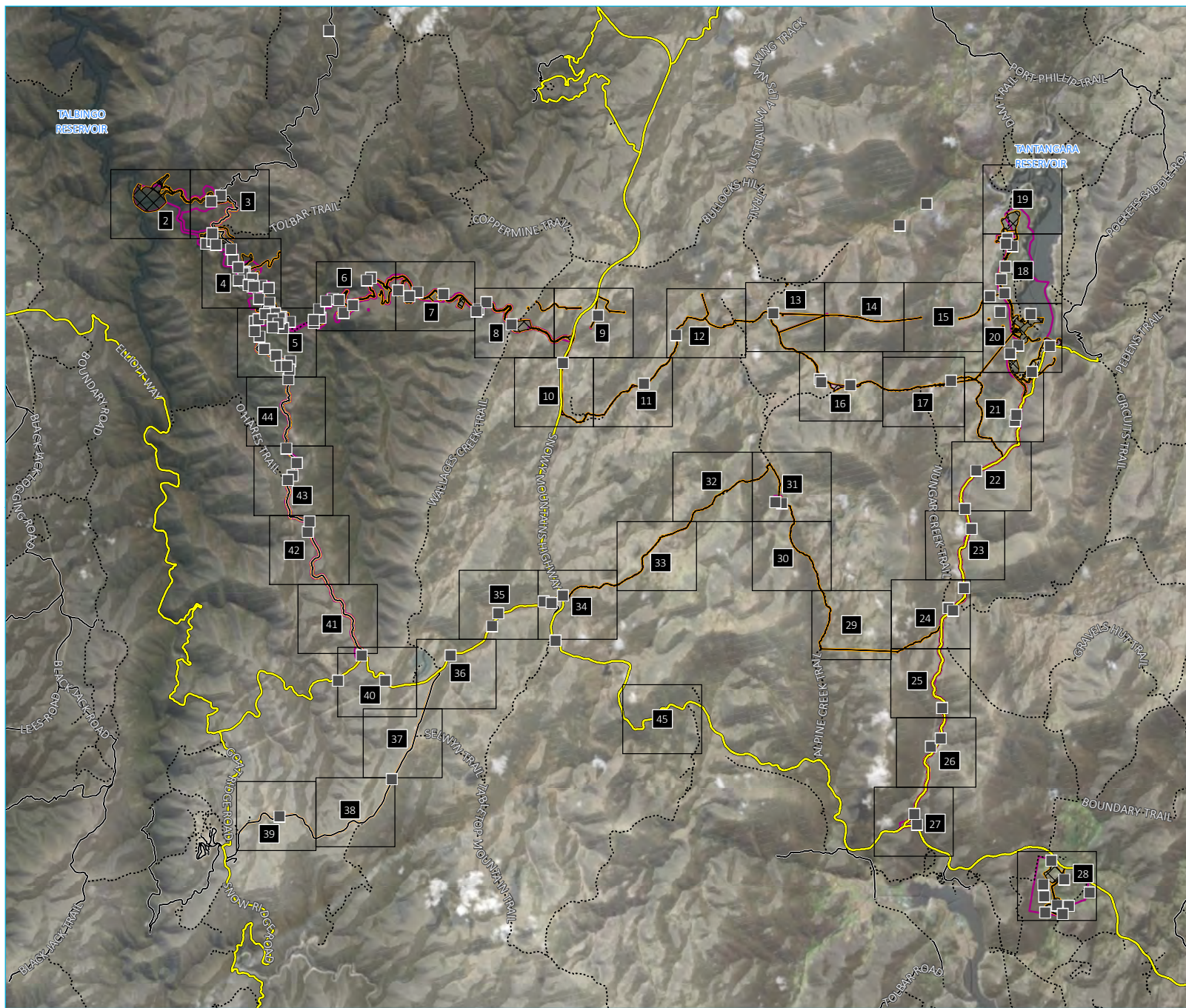
Includes:

- Appendix A1 - Plant Community Type (PCT) Mapping
- Appendix A2 - Threatened Flora Mapping
- Appendix A3 - Threatened Fauna Mapping



## Appendix A1      Plant Community Type (PCT) mapping

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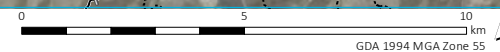


- KEY**
- Plot location
  - Main road
  - Local road
  - ..... Vehicular track
  - Page index
  - ⊗ Disturbance area
  - Indirect disturbance area
  - Construction envelope

Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations - page index

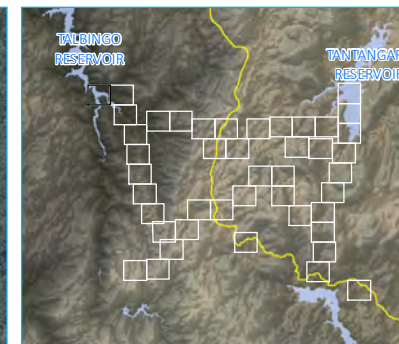
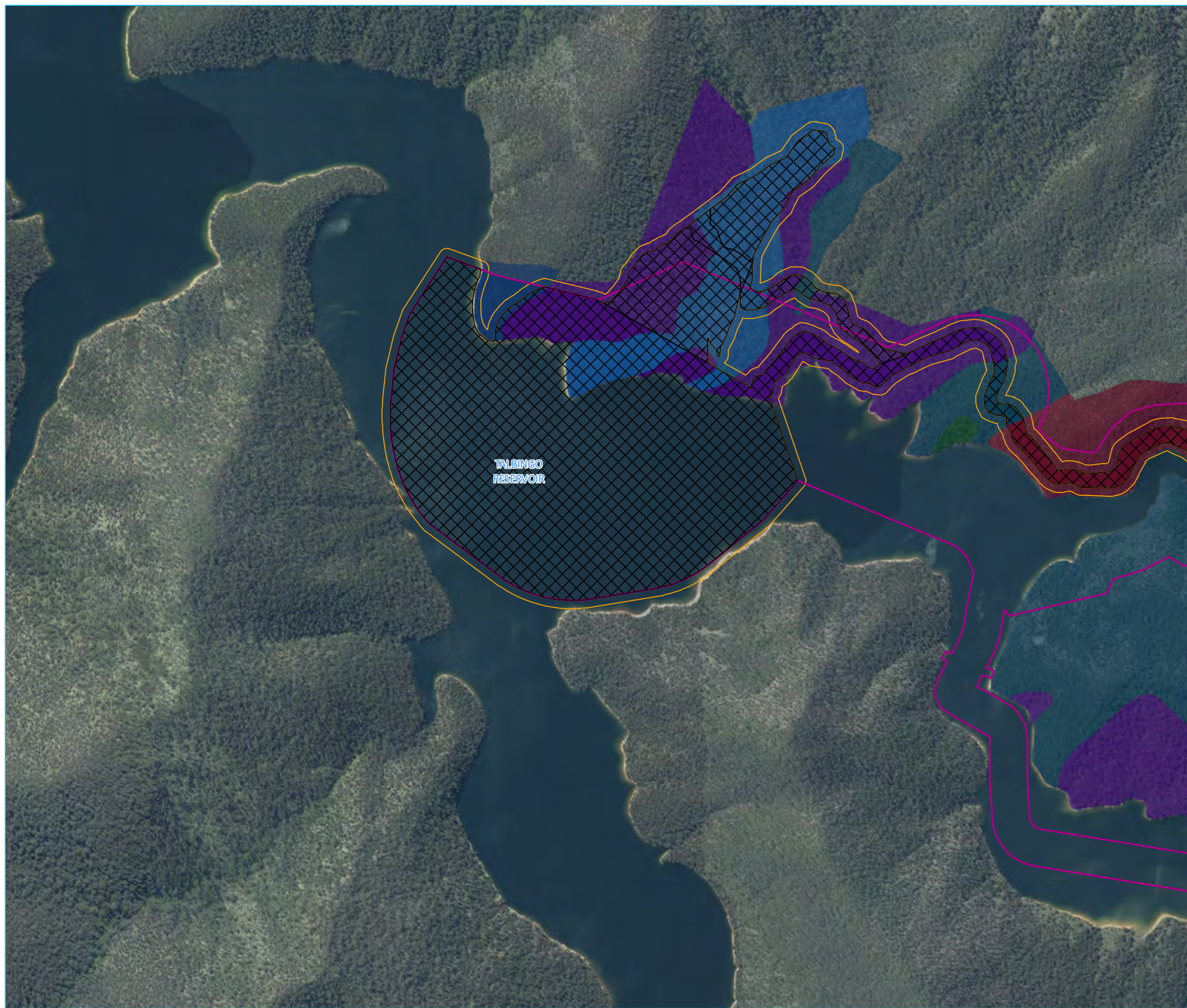
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.1

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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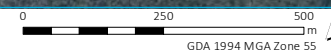
**KEY**

Disturbance area	Medium
Indirect disturbance area	PCT 300
Construction envelope	High
PCT 299	PCT 311
High	High
PCT 296	PCT 729
High	High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

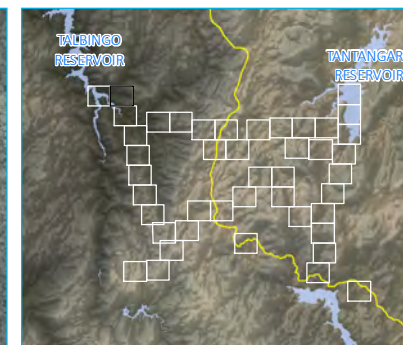
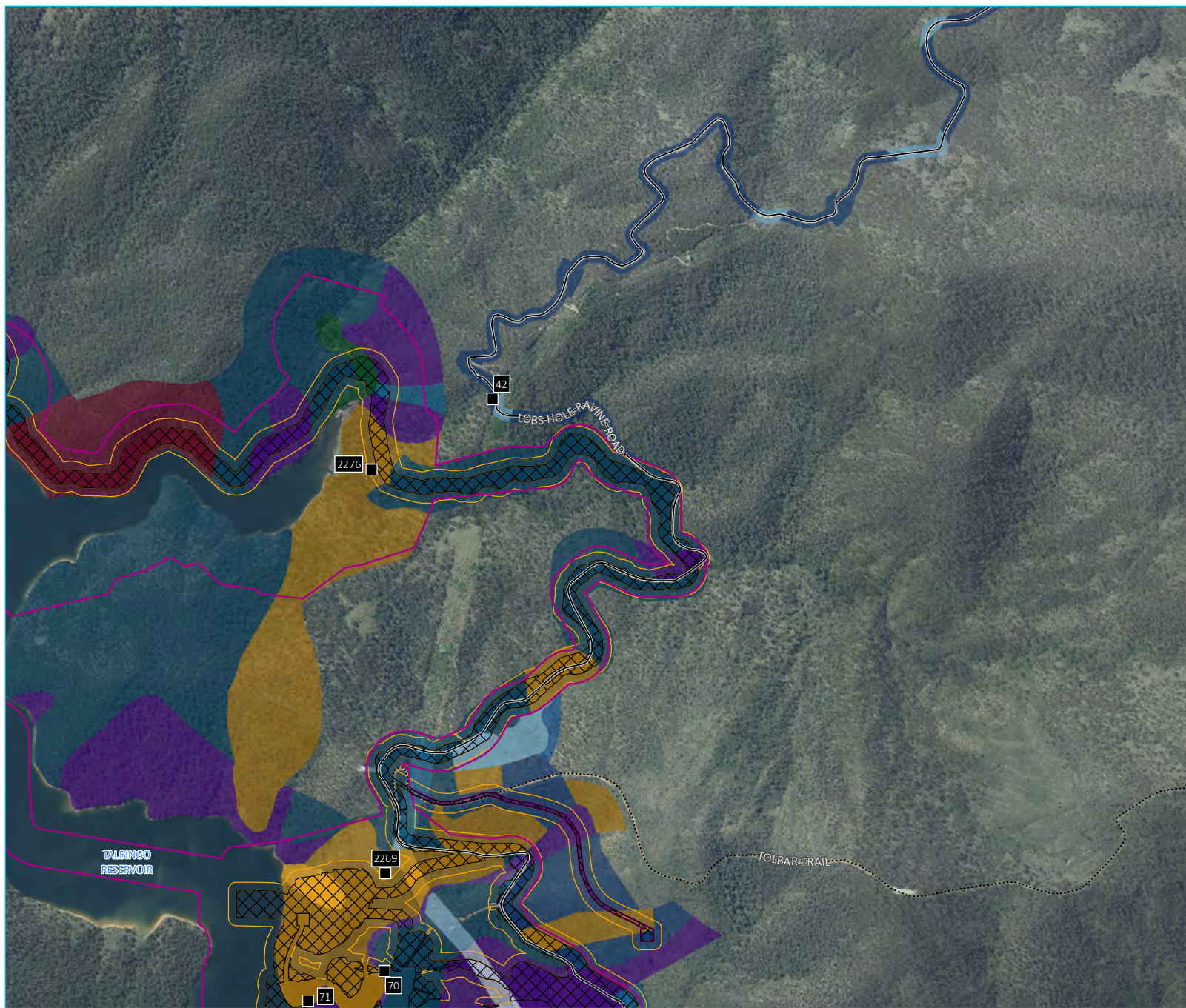
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.2

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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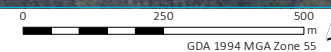
# KEY

■ Plot location	PCT 300
— Local road	High
..... Vehicular track	Medium
▨ Disturbance area	Derived grassland
▭ Indirect disturbance area	PCT 311
▭ Construction envelope	High
PCT 299	PCT 729
High	High
PCT 296	Medium
High	Derived grassland
Medium	PCT 1191
Derived grassland	High
	Derived grassland

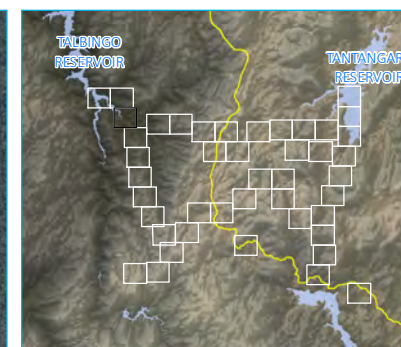
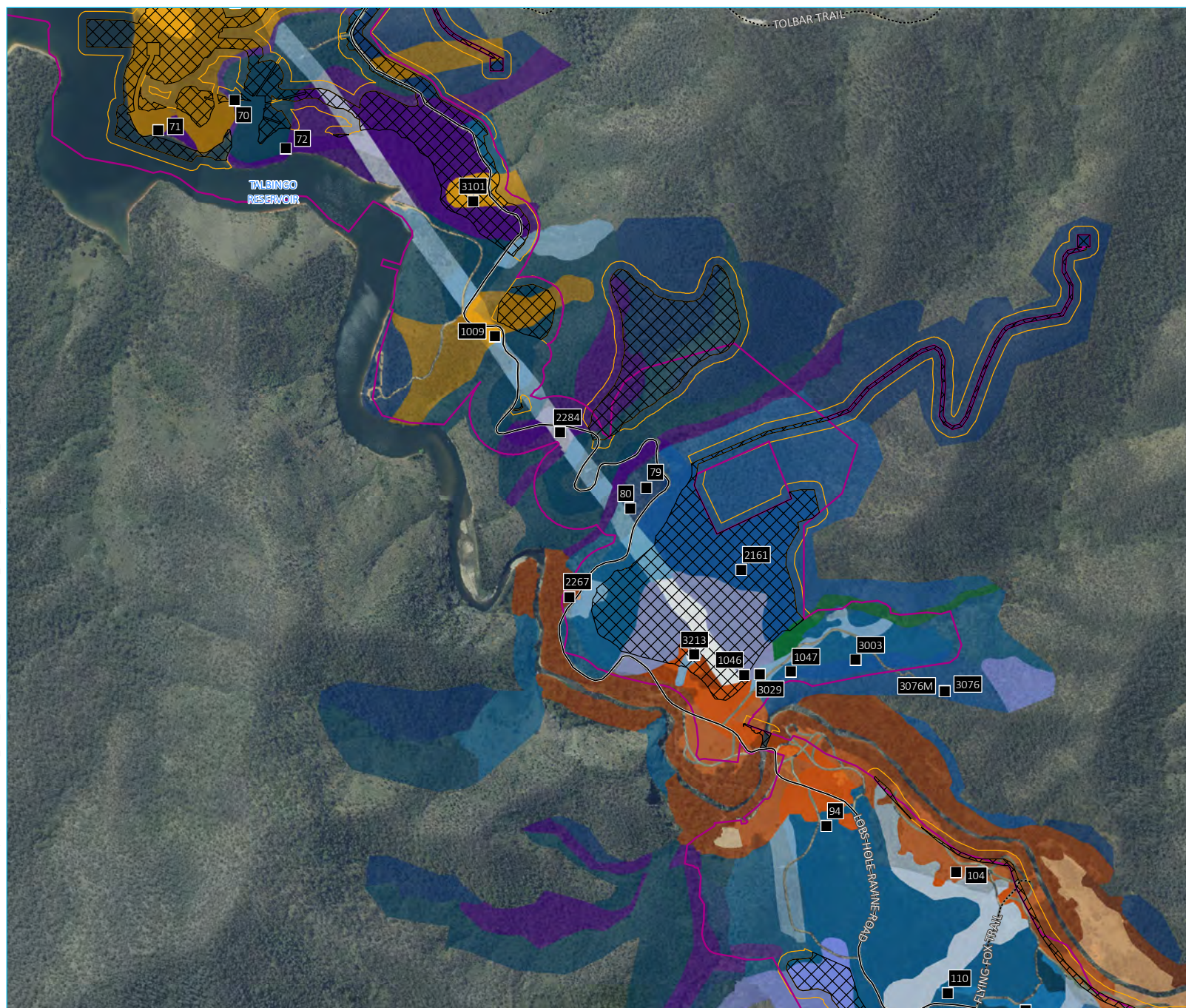
Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.3

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)







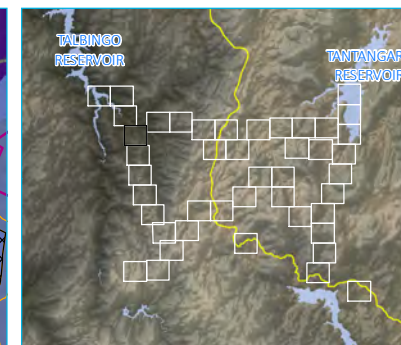
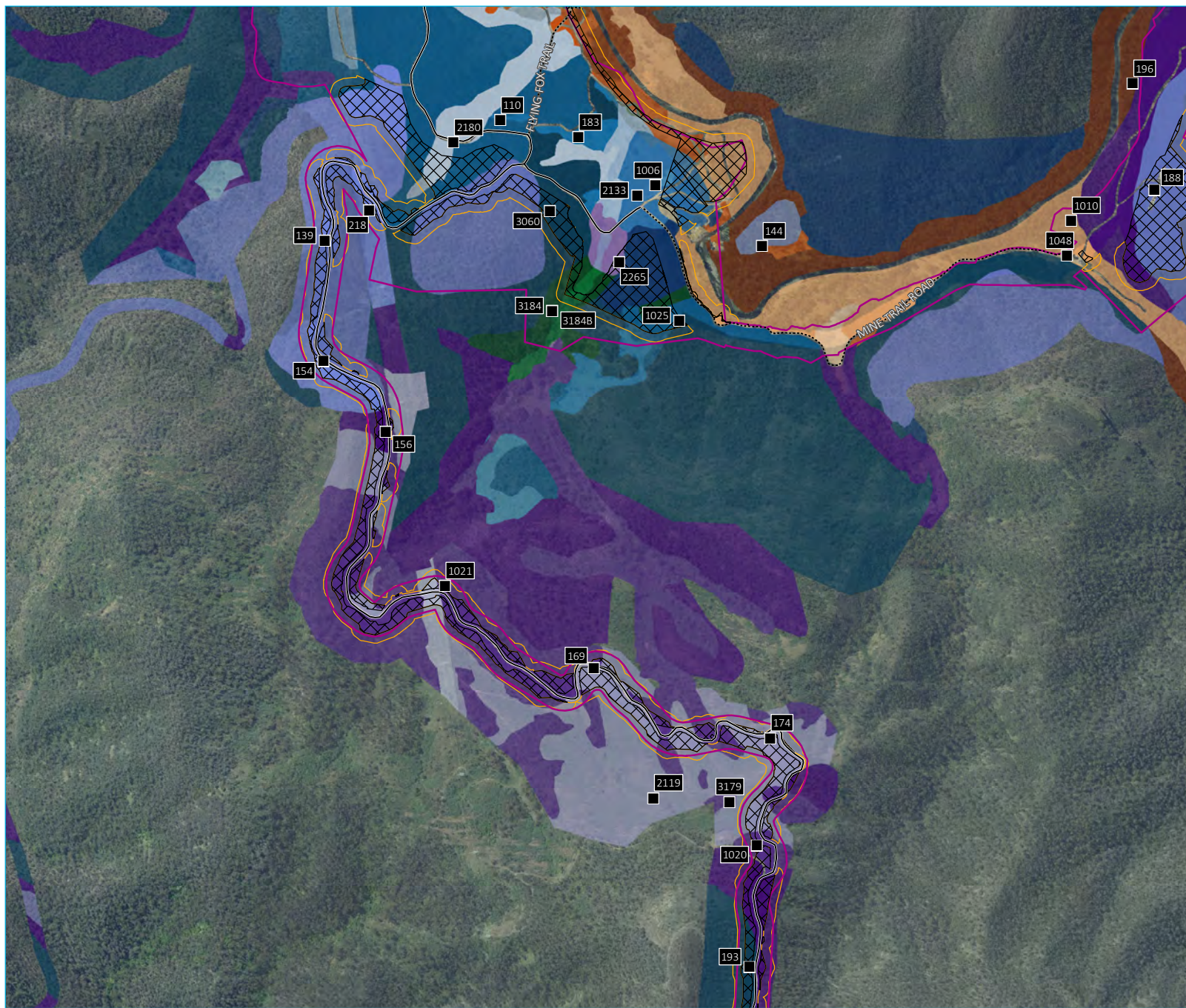
# KEY

■ Plot location	Derived grassland
— Local road	PCT 302
..... Vehicular track	High
▨ Disturbance area	Medium
▨ Indirect disturbance area	Low
▨ Construction envelope	Poor
PCT 299	Other
Medium	Derived grassland
PCT 285	PCT 729
Medium	High
Low	Medium
Poor	Low
Derived grassland	Derived grassland
PCT 296	PCT 999
High	High
Medium	Medium
Low	PCT 1191
Derived grassland	High
PCT 300	Medium
High	Derived grassland
Medium	

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.4





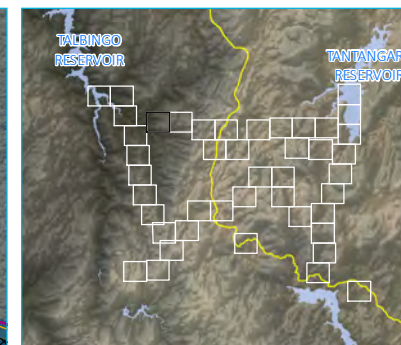
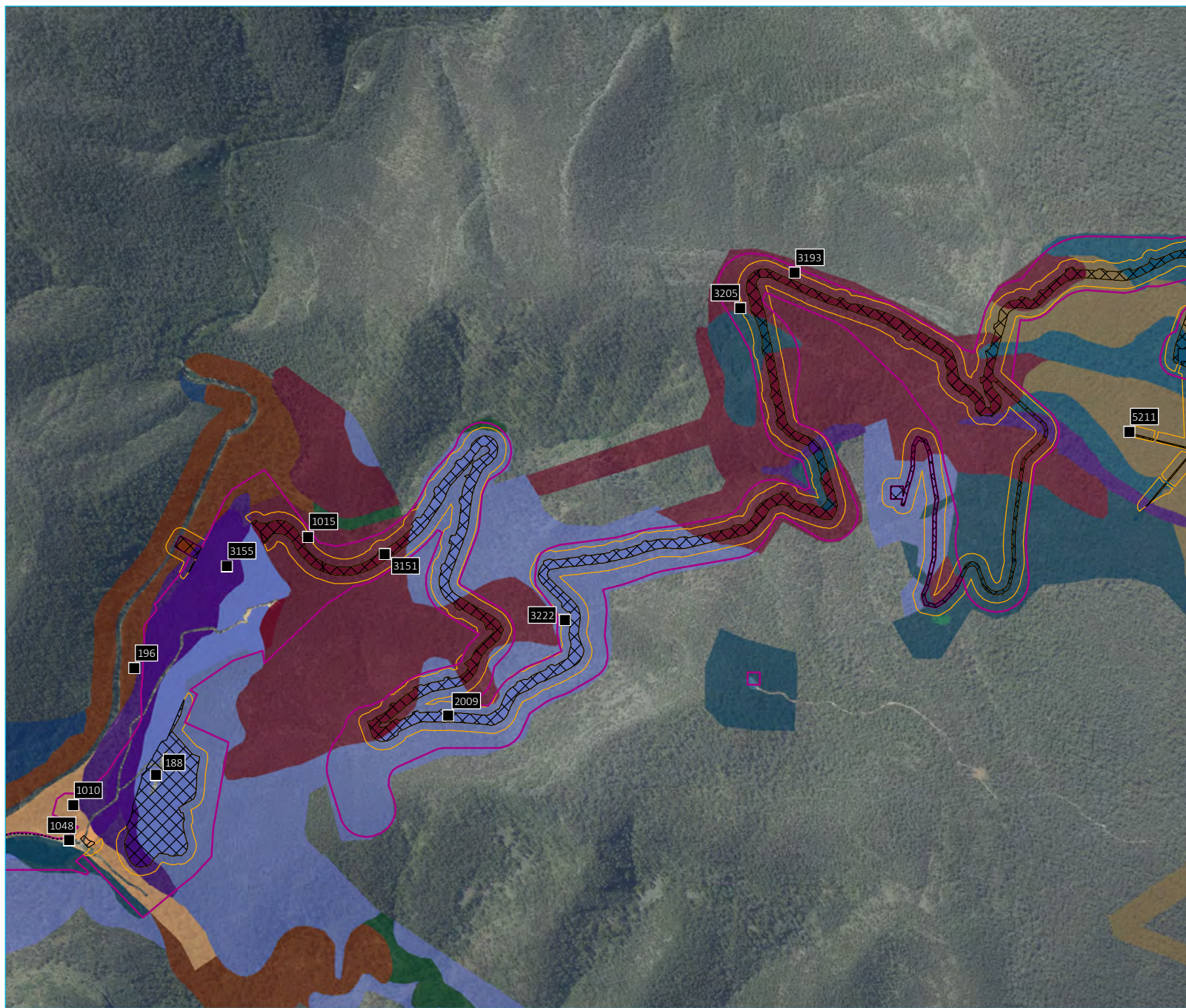
**KEY**

■ Plot location	■ Poor
— Local road	■ Other
⋯ Vehicular track	■ Derived grassland
▨ Disturbance area	PCT 302
▨ Indirect disturbance area	■ High
▨ Construction envelope	■ Medium
PCT 299	■ Low
■ High	■ Poor
■ Medium	■ Other
PCT 285	■ Derived grassland
■ High	PCT 729
■ Medium	■ High
■ Low	■ Medium
■ Poor	■ Low
PCT 296	■ Poor
■ High	■ Derived grassland
■ Medium	PCT 999
■ Low	■ High
■ Poor	■ Medium
PCT 300	PCT 1225
■ High	■ High
■ Medium	

Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.5





**KEY**

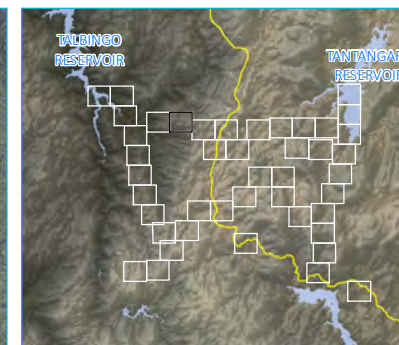
■ Plot location	PCT 311
..... Vehicular track	High
▤ Disturbance area	PCT 637
▨ Indirect disturbance area	High
▭ Construction envelope	PCT 729
PCT 299	High
PCT 296	Medium
PCT 300	High
PCT 302	High
Other	High
	PCT 953
	High
	PCT 999
	High
	PCT 1196
	High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.6



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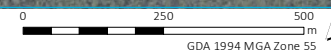


- KEY**
- |                             |          |
|-----------------------------|----------|
| ■ Plot location             | ■ Other  |
| ▨ Disturbance area          | PCT 729  |
| ▨ Indirect disturbance area | High     |
| ▨ Construction envelope     | PCT 788  |
| PCT 300                     | High     |
| ■ High                      | PCT 953  |
| PCT 311                     | High     |
| ■ High                      | PCT 1196 |
| PCT 639                     | High     |
| ■ High                      | Other    |

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

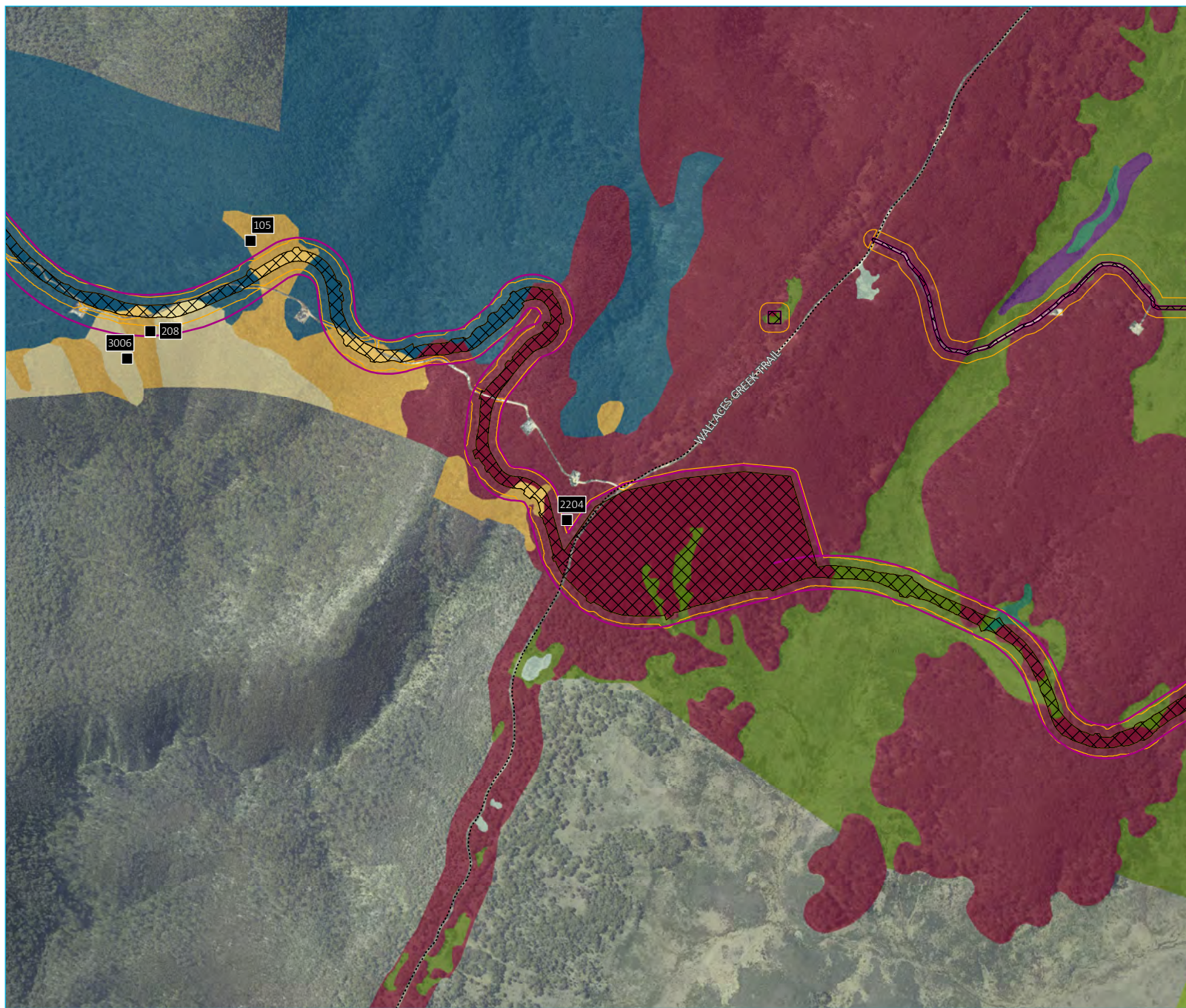
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Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.7

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

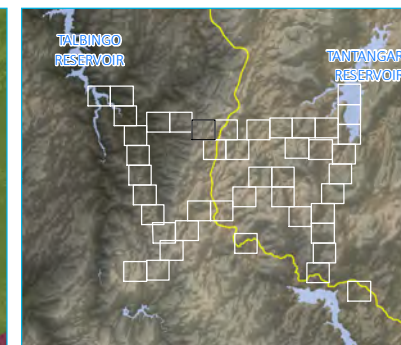




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



■ Plot location	PCT 788
..... Vehicular track	High
▨ Disturbance area	PCT 938
▨ Indirect disturbance area	High
▨ Construction envelope	PCT 1196
PCT 637	High
High	PCT 1224
PCT 639	High
High	Medium
Other	PCT 1225
PCT 644	High
High	

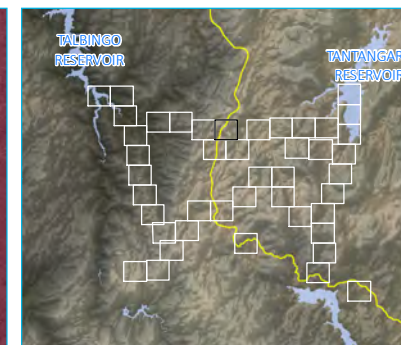
Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.8





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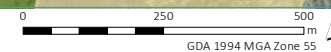
# KEY

- |                             |                   |
|-----------------------------|-------------------|
| ■ Plot location             | Medium            |
| — Main road                 | Derived grassland |
| ..... Vehicular track       | PCT 938           |
| ⊠ Disturbance area          | High              |
| ⬜ Indirect disturbance area | PCT 1196          |
| ⬜ Construction envelope     | High              |
| PCT 303                     | PCT 1224          |
| High                        | High              |
| PCT 637                     | Medium            |
| High                        | Poor              |
| PCT 639                     | PCT 1225          |
| Other                       | High              |
| PCT 644                     | Medium            |
| High                        | Poor              |

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

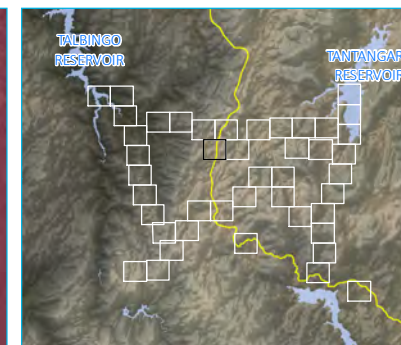
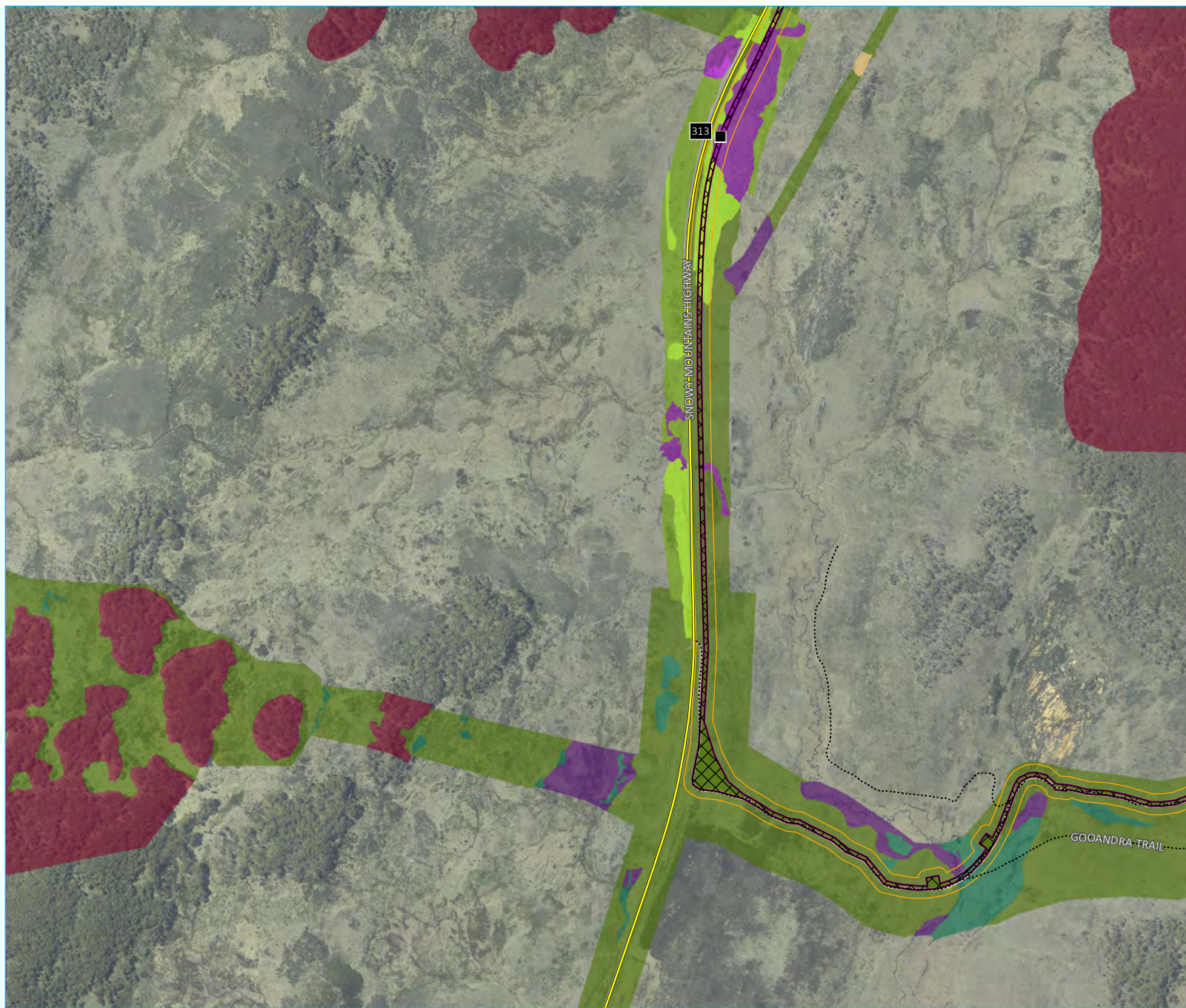
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Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.9

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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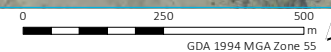


- KEY**
- Plot location
  - Main road
  - ..... Vehicular track
  - ▨ Disturbance area
  - ▨ Indirect disturbance area
  - ▨ Construction envelope
  - PCT 637
  - PCT 644
  - Derived grassland
  - PCT 1224
  - High
  - Medium
  - Poor
  - PCT 1225
  - High
  - Medium
  - Poor
  - High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

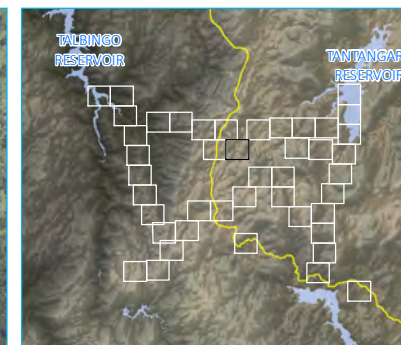
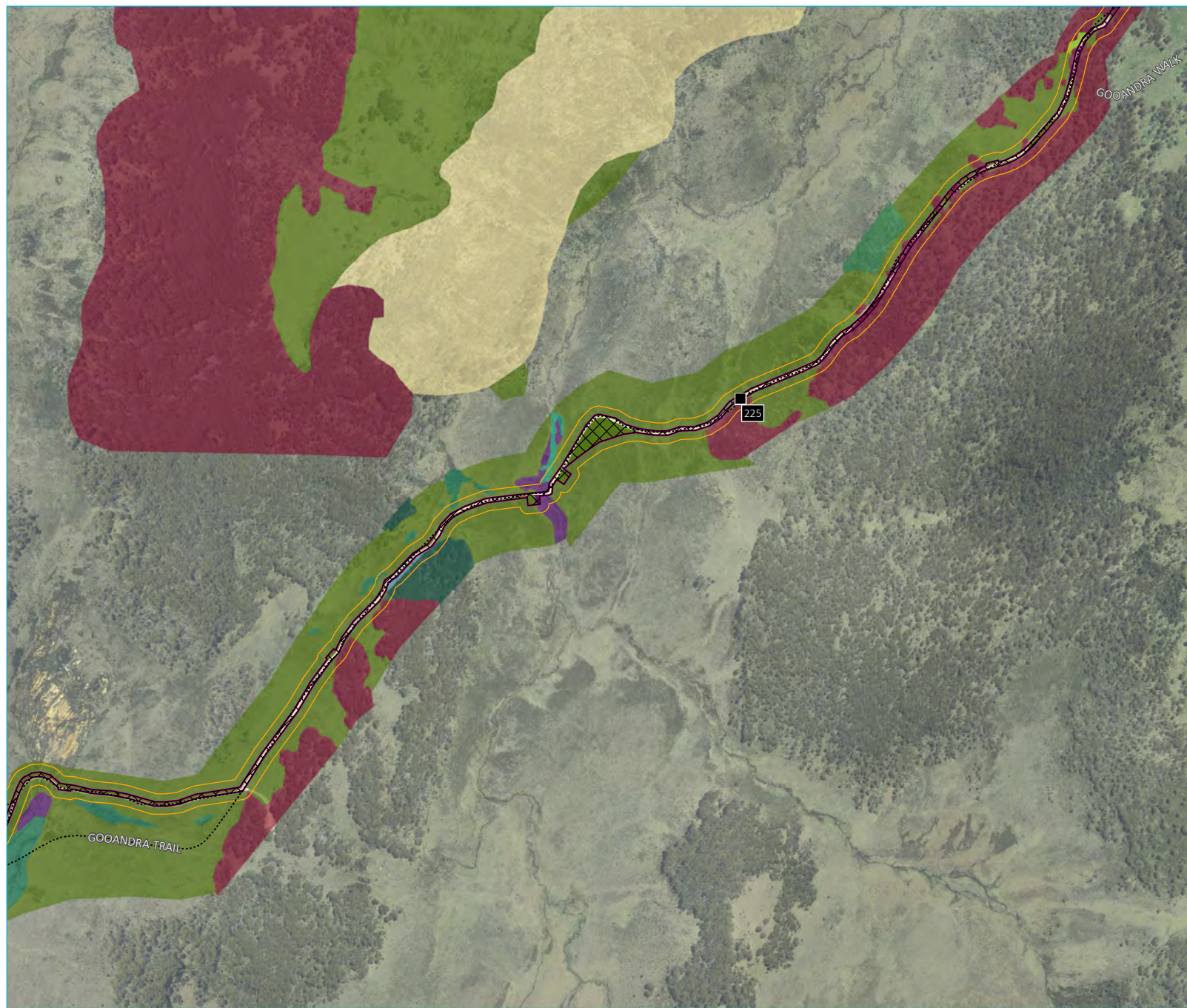
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.10

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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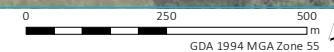
**KEY**

■ Plot location	PCT 639
..... Vehicular track	PCT 644
⊠ Disturbance area	High
□ Indirect disturbance area	PCT 679
□ Construction envelope	High
PCT 303	High
High	Other
PCT 637	PCT 1224
High	High
Medium	Low
	PCT 1225
	High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

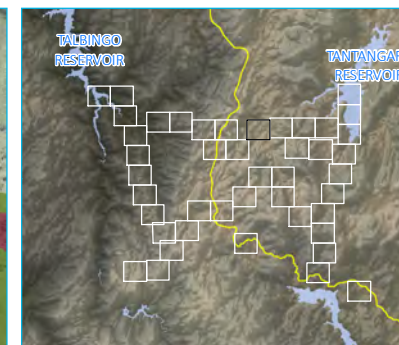
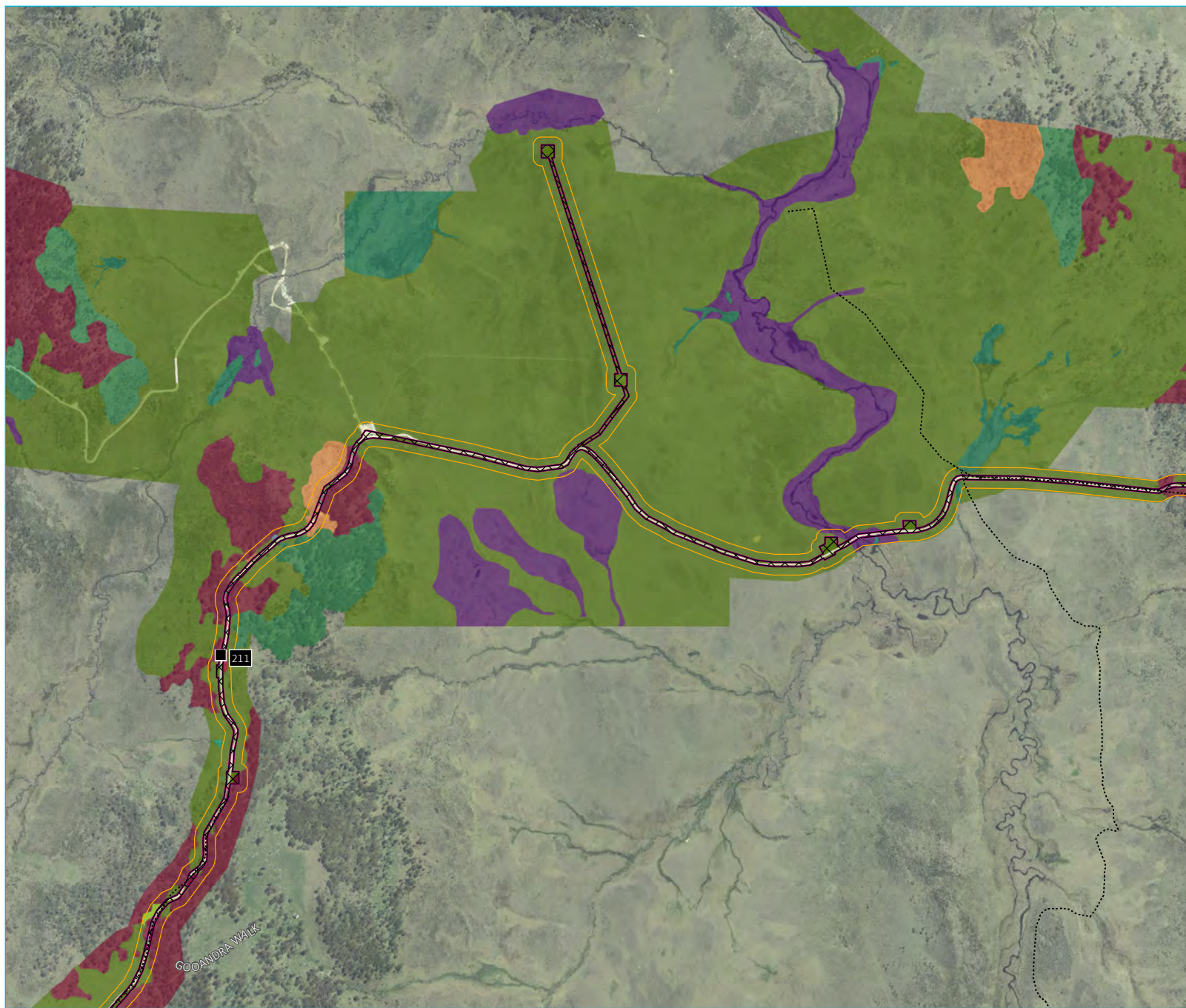
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.11

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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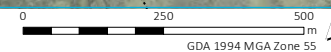
**KEY**

■ Plot location	PCT 644
..... Vehicular track	High
⊠ Disturbance area	Medium
Indirect disturbance area	Other
Construction envelope	PCT 679
PCT 303	Other
High	PCT 1224
PCT 637	High
High	Low
Medium	PCT 1225
	High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

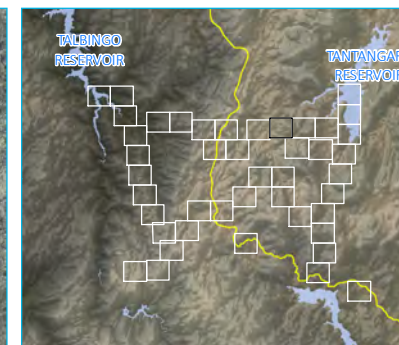
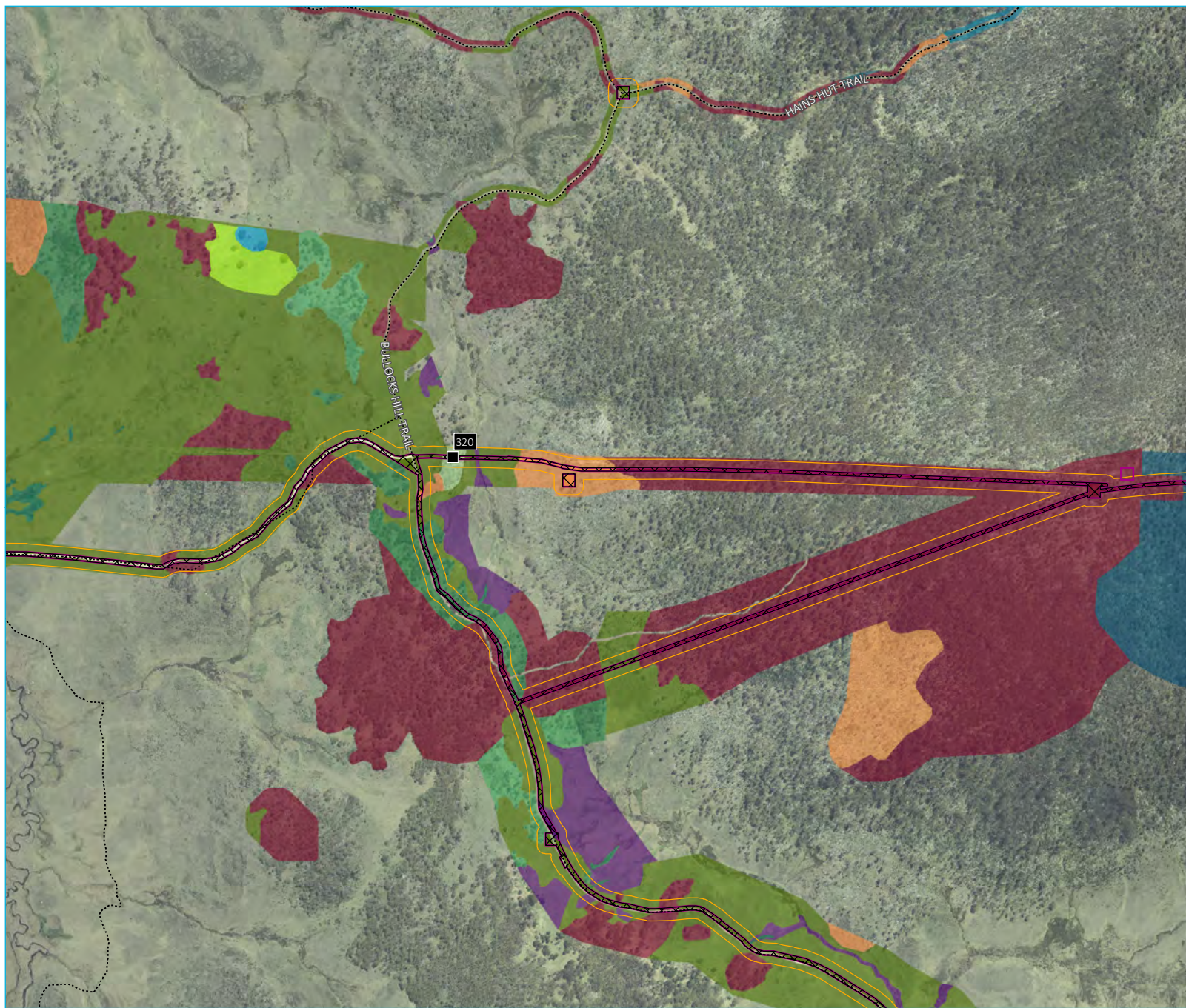
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.12

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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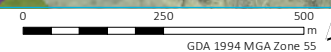
**KEY**

■ Plot location	PCT 644
..... Vehicular track	High
⊠ Disturbance area	Other
⬡ Indirect disturbance area	PCT 1196
⬢ Construction envelope	High
PCT 303	Medium
High	Poor
Medium	PCT 1224
Other	High
PCT 637	Poor
High	PCT 1225
	High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

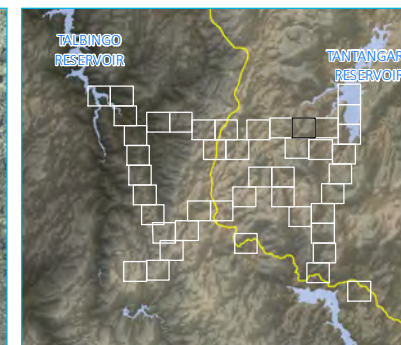
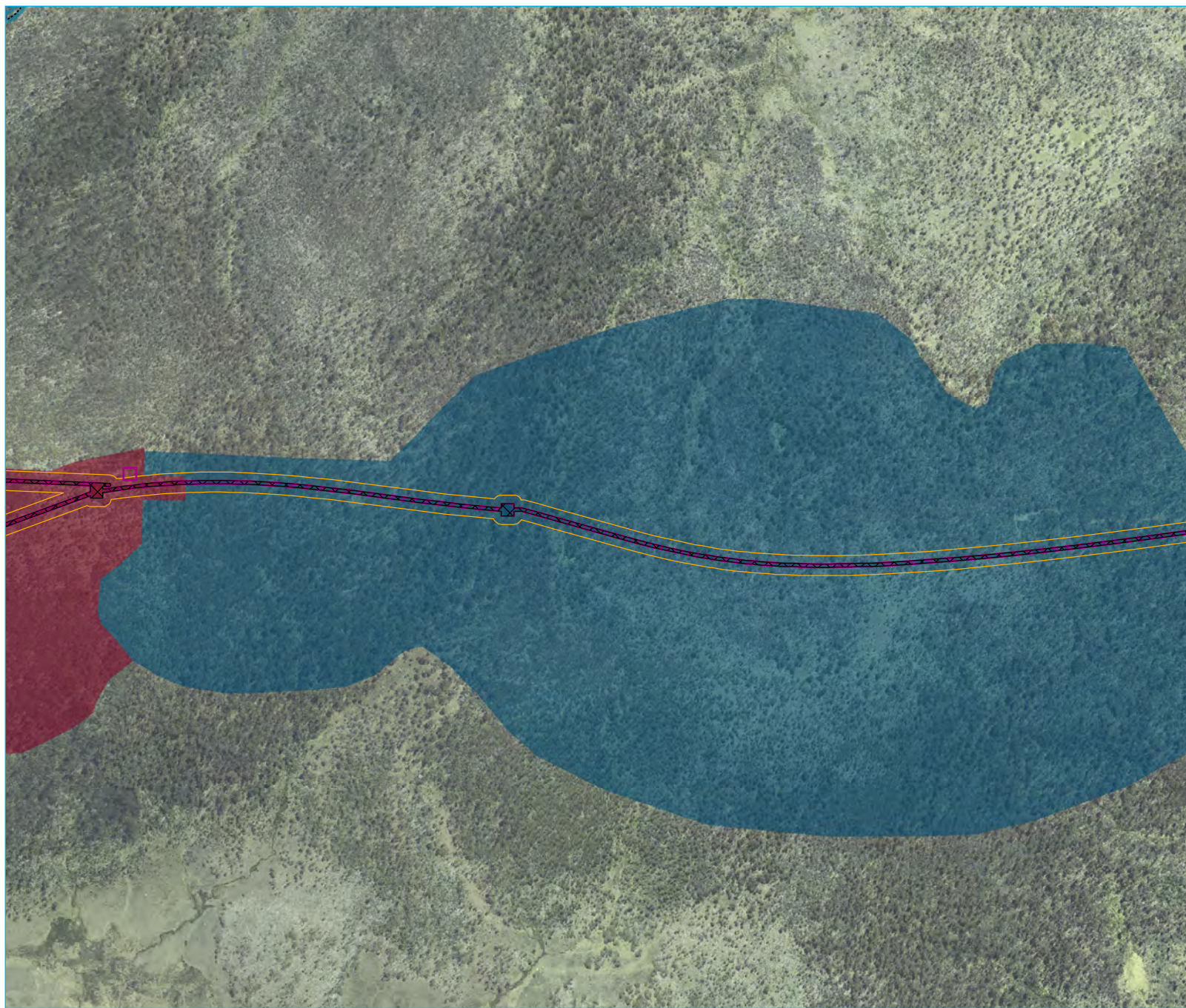
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.13

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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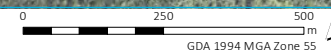


- KEY**
- ..... Vehicular track
  - ⊗ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - High
  - PCT 1196
  - High
  - Medium
  - PCT 644

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

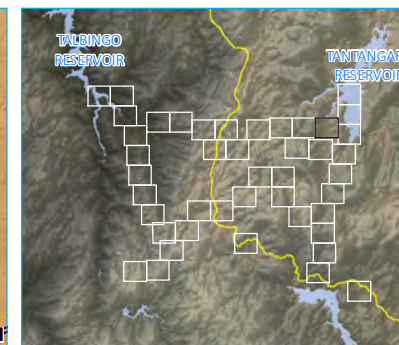
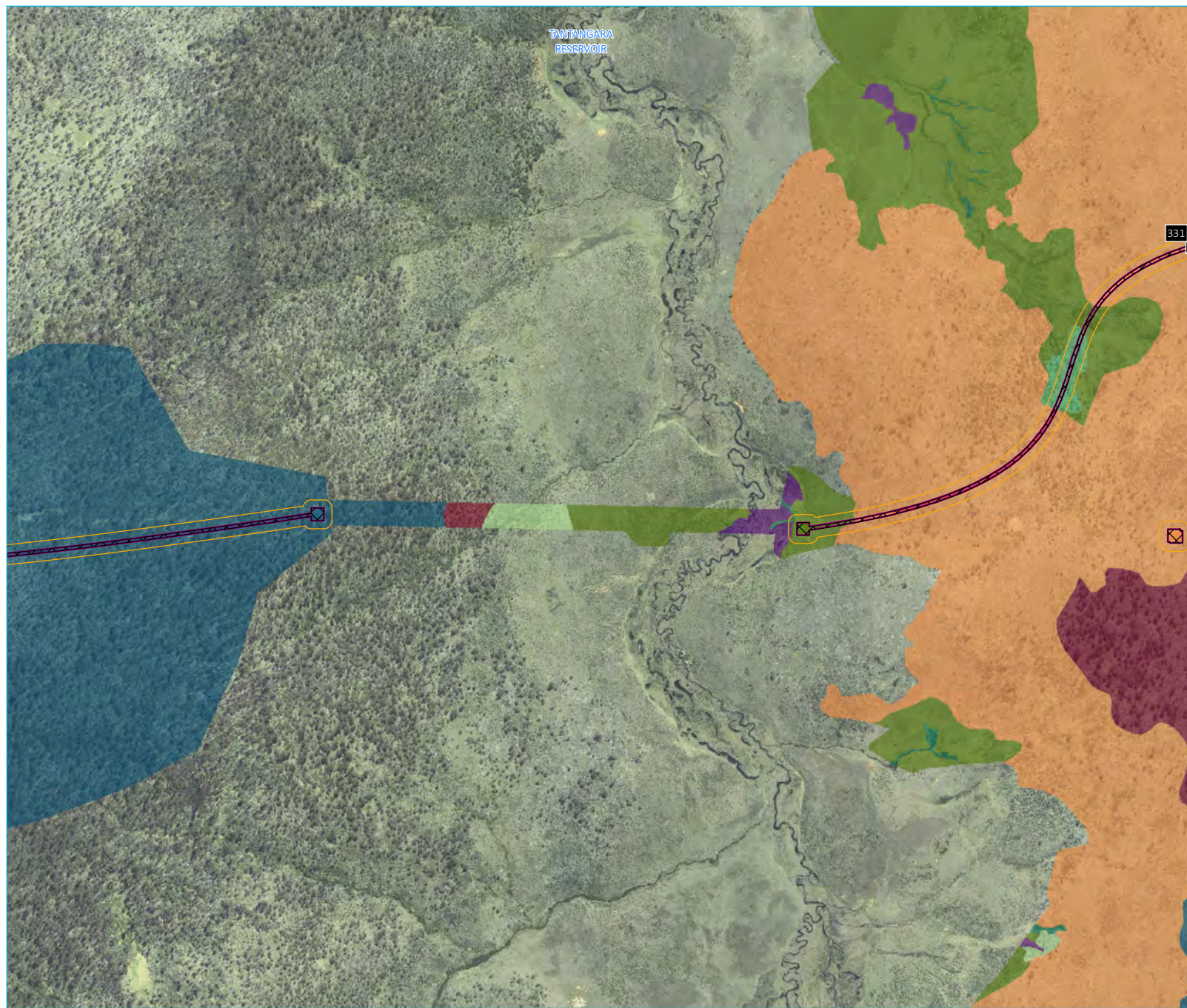
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.14

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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**KEY**

■ Plot location	PCT 644
⊠ Disturbance area	High
⬜ Indirect disturbance area	Other
⬜ Construction envelope	PCT 1196
PCT 303	High
Medium	PCT 1224
Other	High
PCT 637	PCT 1225
High	High

Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.15

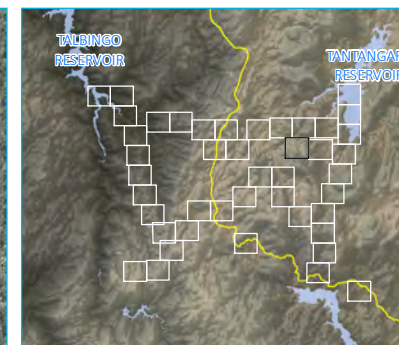
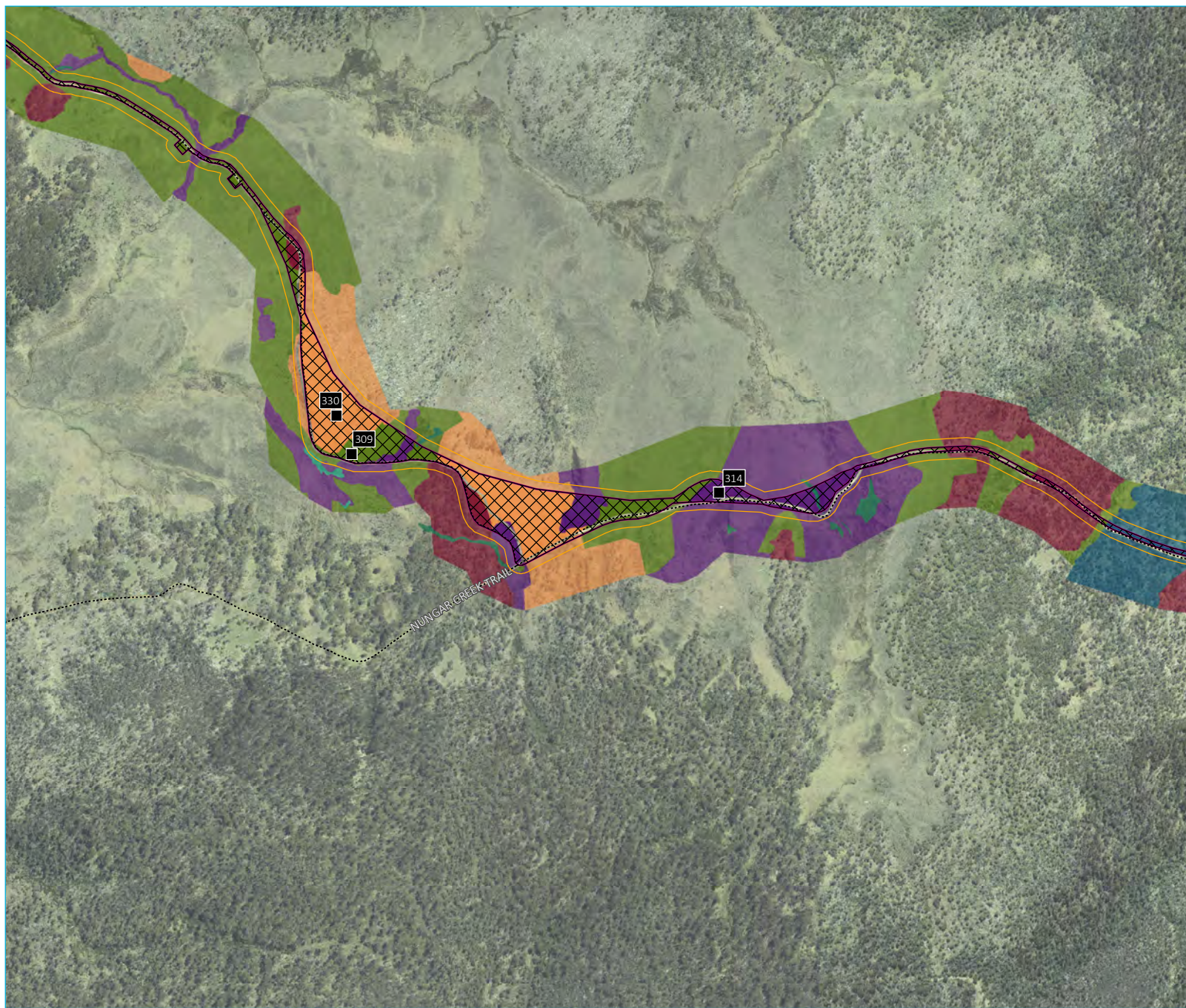
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500  
m  
GDA 1994 MGA Zone 55





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- KEY**
- Plot location
  - ..... Vehicular track
  - ▨ Disturbance area
  - ▨ Indirect disturbance area
  - ▨ Construction envelope
  - PCT 637
    - High
    - Medium
  - PCT 644
    - High
    - Other
  - PCT 1196
    - High
    - High
  - PCT 1224
    - High
  - PCT 1225
    - High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.16

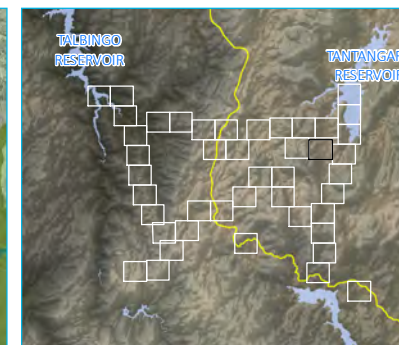
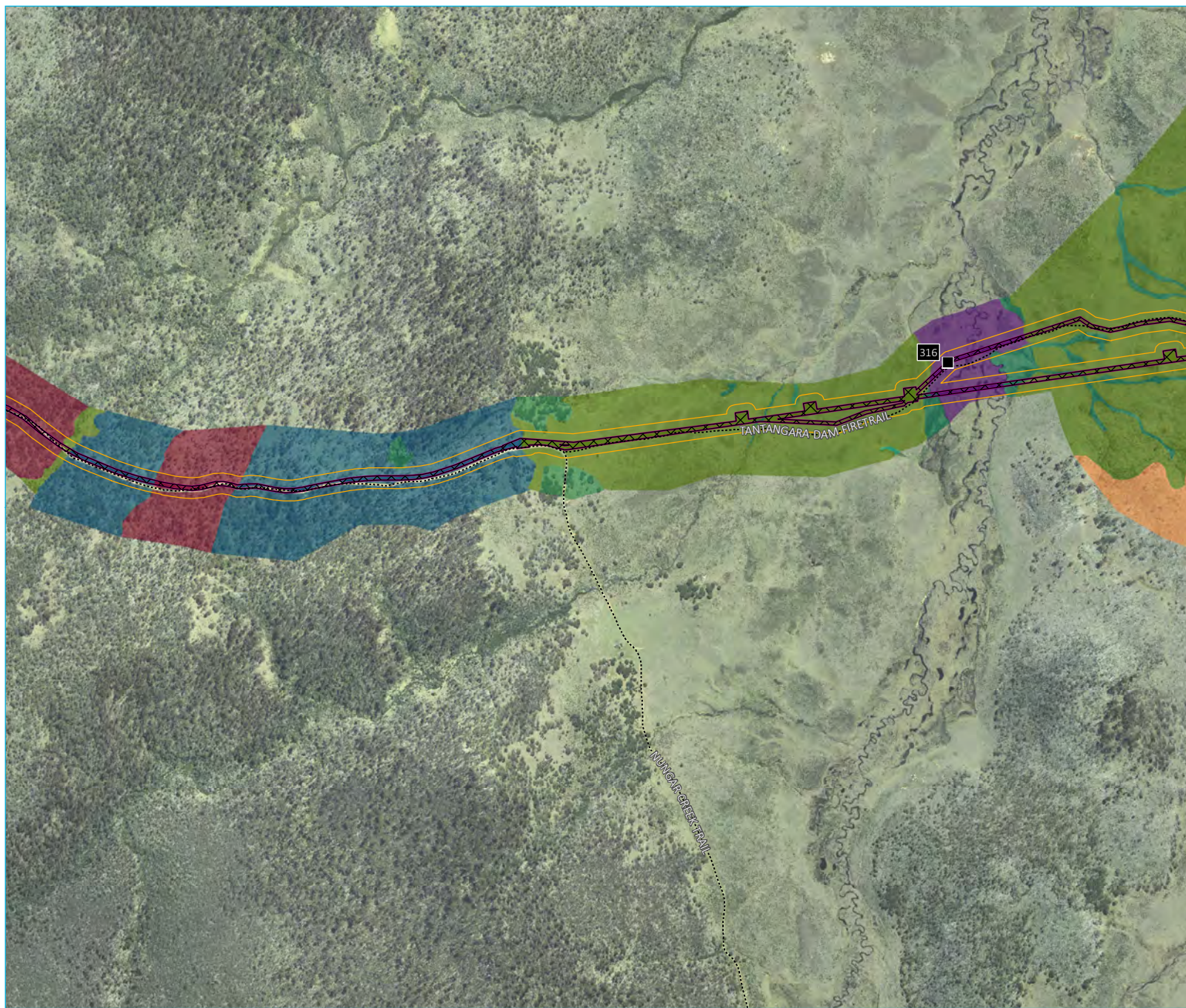
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500  
m  
GDA 1994 MGA Zone 55





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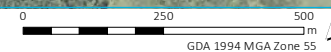


- KEY**
- Plot location
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - ▭ Construction envelope
  - PCT 303
  - PCT 637
  - Medium
  - PCT 644
  - High
  - Other
  - High
  - PCT 1196
  - High
  - PCT 1224
  - High
  - PCT 1225
  - High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

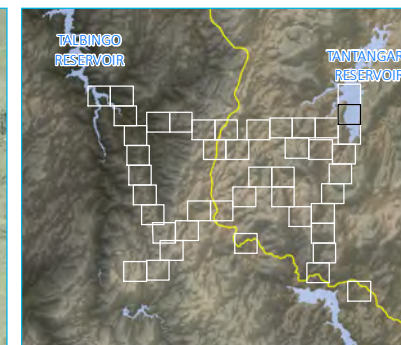
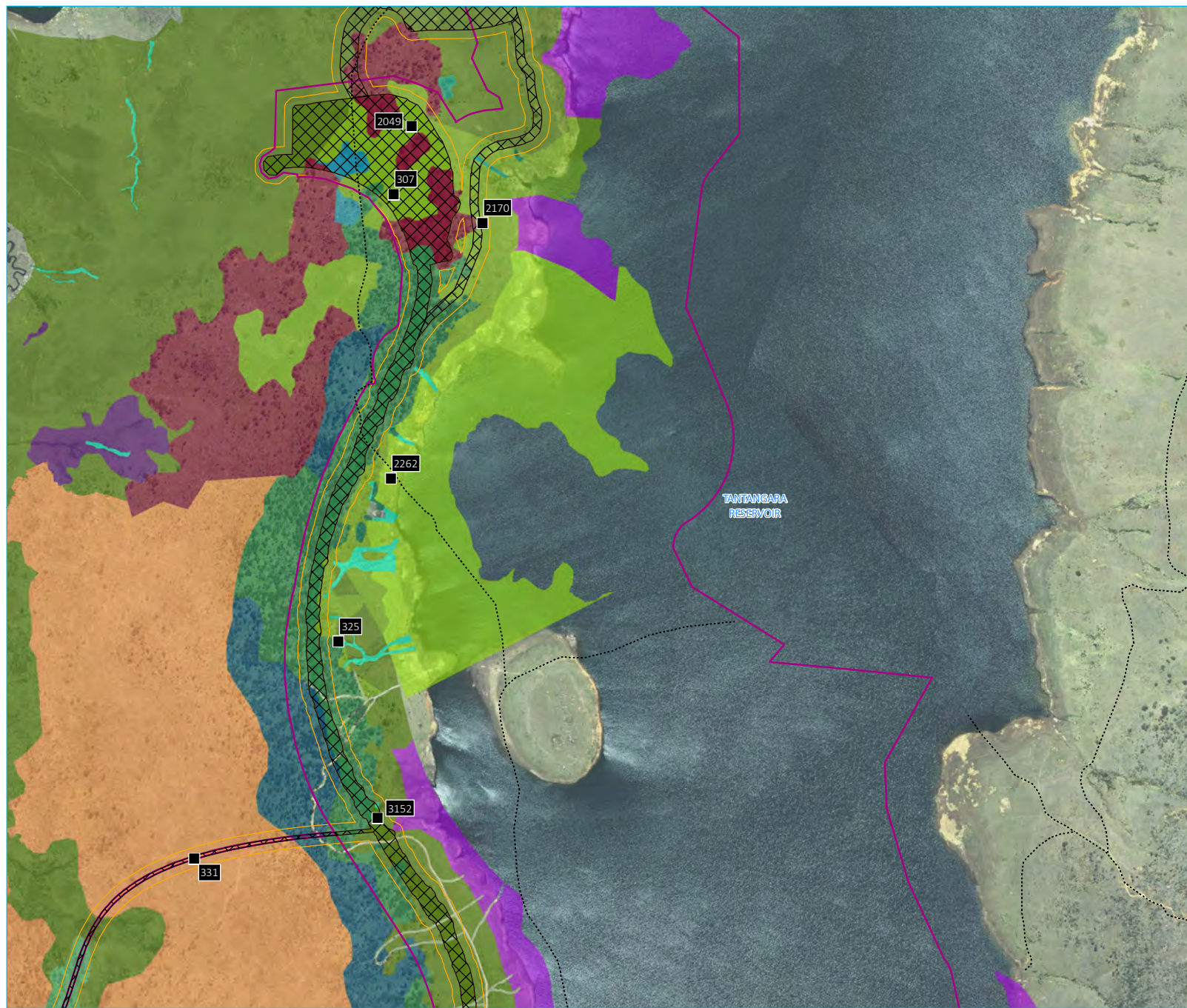
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.17

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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- KEY**
- Plot location
  - ..... Vehicular track
  - ▨ Disturbance area
  - ▨ Indirect disturbance area
  - ▨ Construction envelope
  - PCT 303
    - High
    - Medium
  - PCT 637
    - High
    - Medium
    - Poor
  - PCT 644
    - High
    - Other
  - PCT 1196
    - High
    - Medium
    - Other
  - PCT 1224
    - High
    - Medium
    - Low
  - PCT 1225
    - High
    - Low

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.18

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500  
m  
GDA 1994 MGA Zone 55

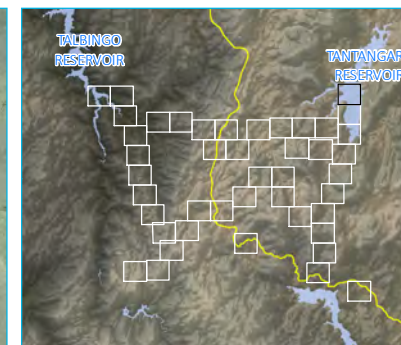




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



**KEY**

■ Plot location	PCT 644
..... Vehicular track	High
▨ Disturbance area	Other
▨ Indirect disturbance area	PCT 1224
▨ Construction envelope	High
PCT 637	Medium
High	Poor
Medium	Other
Poor	PCT 1225
	High
	Low

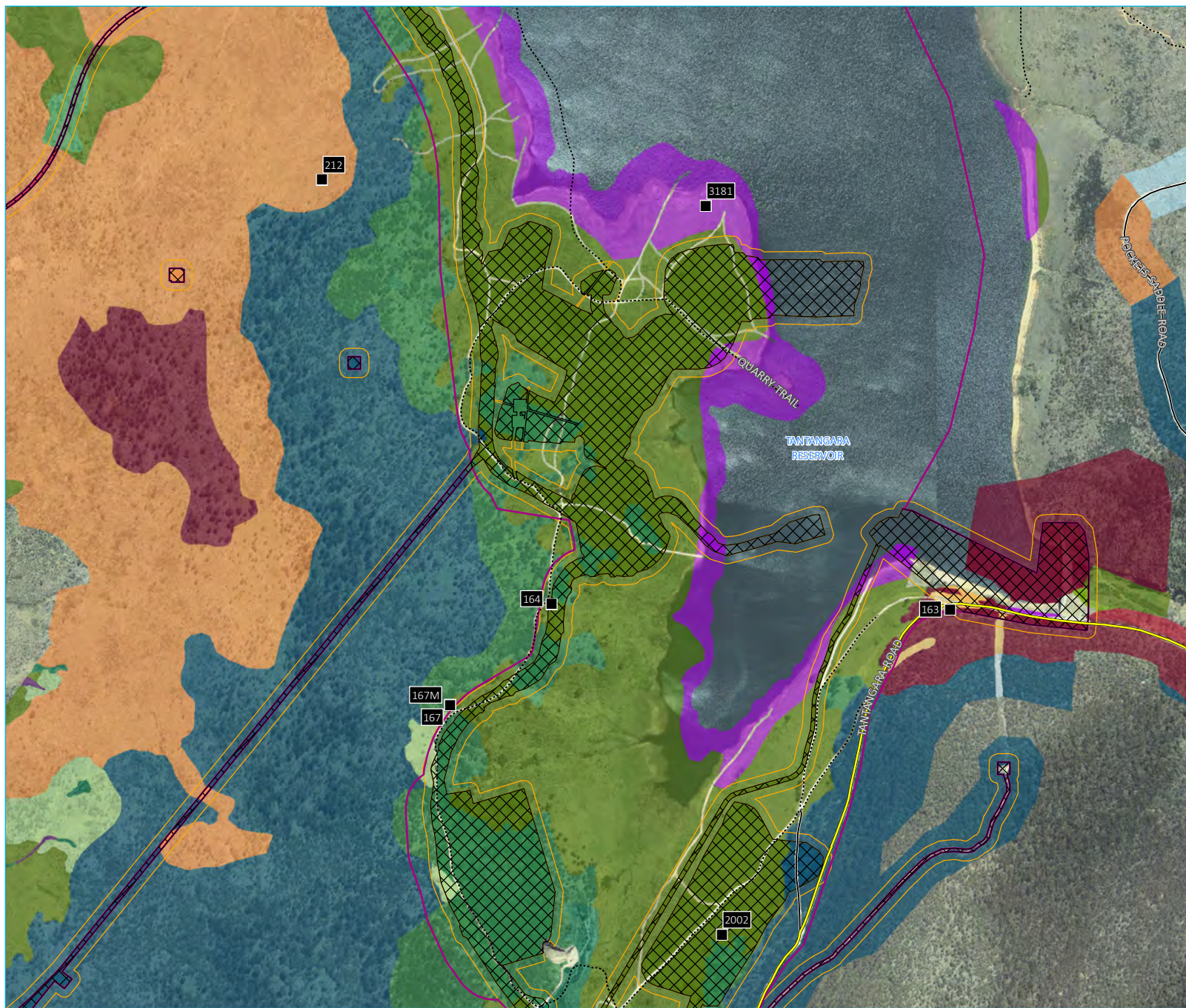
Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.19

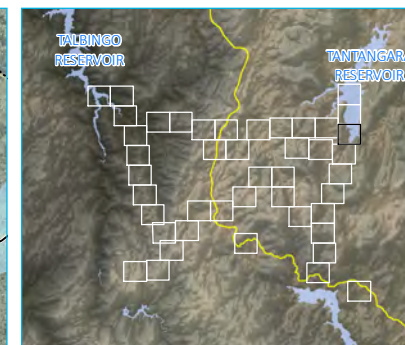




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



**KEY**

■ Plot location	PCT 644
— Main road	High
— Local road	Medium
..... Vehicular track	Other
▣ Disturbance area	Derived grassland
▤ Indirect disturbance area	PCT 1196
▥ Construction envelope	High
PCT 303	Other
High	Derived grassland
Medium	PCT 1224
Other	High
PCT 637	Medium
High	PCT 1225
	High
	Low

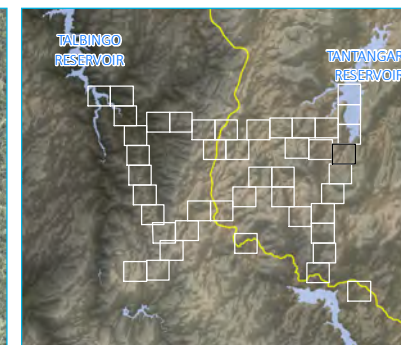
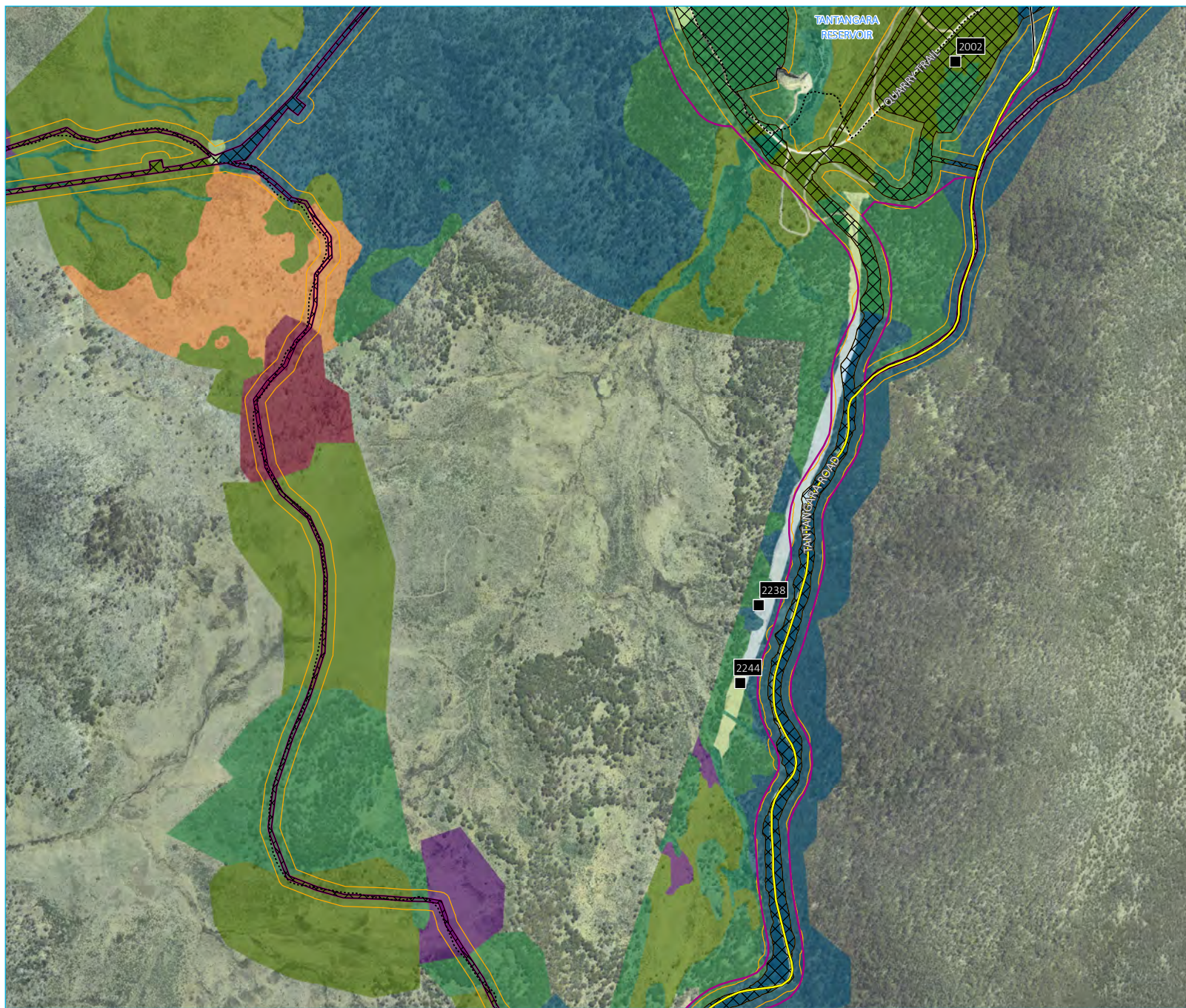
Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.20





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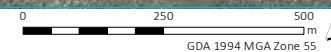
**KEY**

■ Plot location	PCT 637
— Main road	High
— Local road	PCT 644
..... Vehicular track	High
▨ Disturbance area	Other
▨ Indirect disturbance area	PCT 1196
▨ Construction envelope	High
PCT 303	Derived grassland
High	PCT 1224
Other	High
Derived grassland	PCT 1225
	High

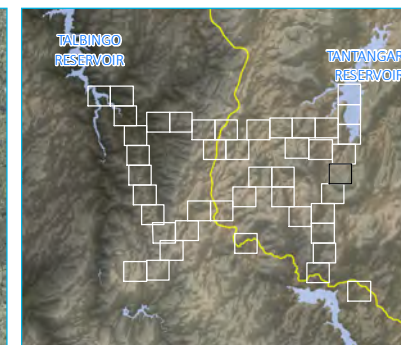
Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.21

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





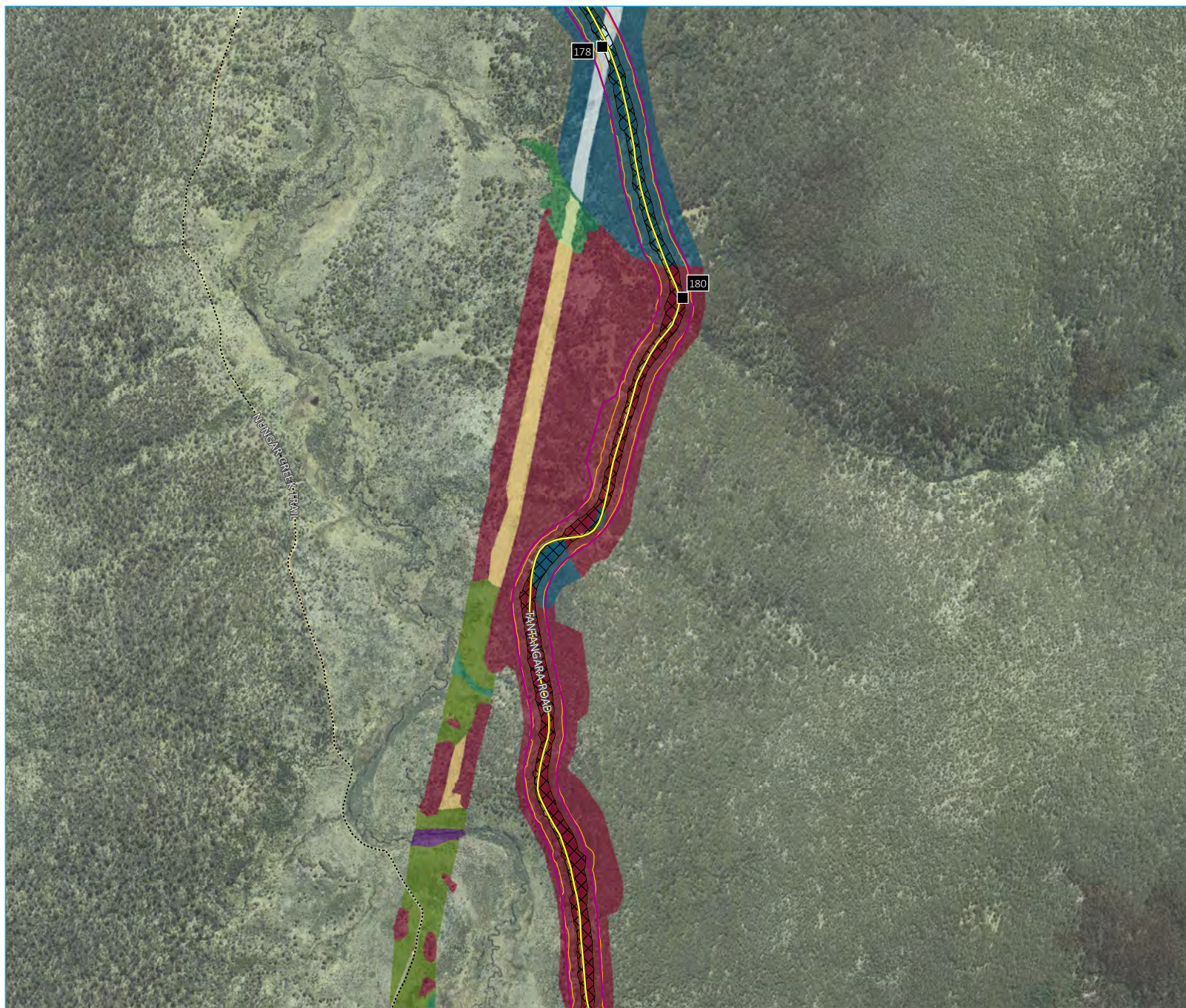


- KEY**
- Plot location
  - Main road
  - ..... Vehicular track
  - ▨ Disturbance area
  - ▨ Indirect disturbance area
  - ▨ Construction envelope
  - PCT 303
  - High
  - PCT 637
  - High
  - PCT 1196
  - High
  - Derived grassland
  - PCT 1224
  - High
  - PCT 1225
  - High

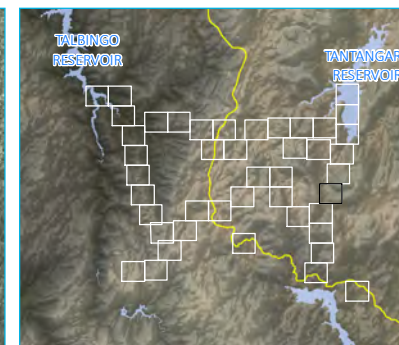
Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.22





Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

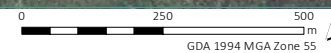


#### KEY

- |                             |                     |
|-----------------------------|---------------------|
| ■ Plot location             | PCT 644             |
| — Main road                 | ■ High              |
| ..... Vehicular track       | ■ Derived grassland |
| ▨ Disturbance area          | PCT 1196            |
| ▨ Indirect disturbance area | ■ High              |
| ▨ Construction envelope     | ■ Derived grassland |
| PCT 303                     | PCT 1224            |
| ■ High                      | ■ High              |
| ■ Derived grassland         | PCT 1225            |
| PCT 637                     | ■ High              |

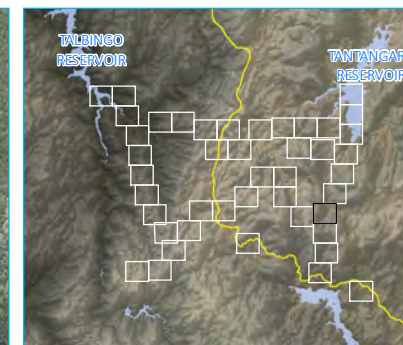
Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.23





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**KEY**

■ Plot location	PCT 643
— Main road	High
- - - Vehicular track	PCT 644
⊠ Disturbance area	High
□ Indirect disturbance area	Other
— Construction envelope	PCT 1196
PCT 303	High
High	Other
Other	Derived grassland
Derived grassland	PCT 1224
PCT 637	High
High	PCT 1225
	High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

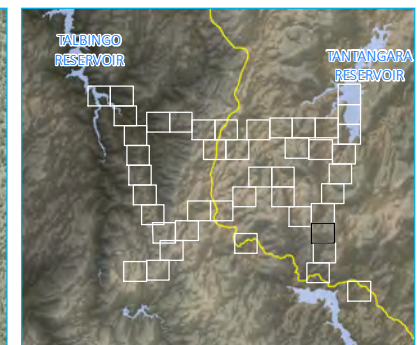
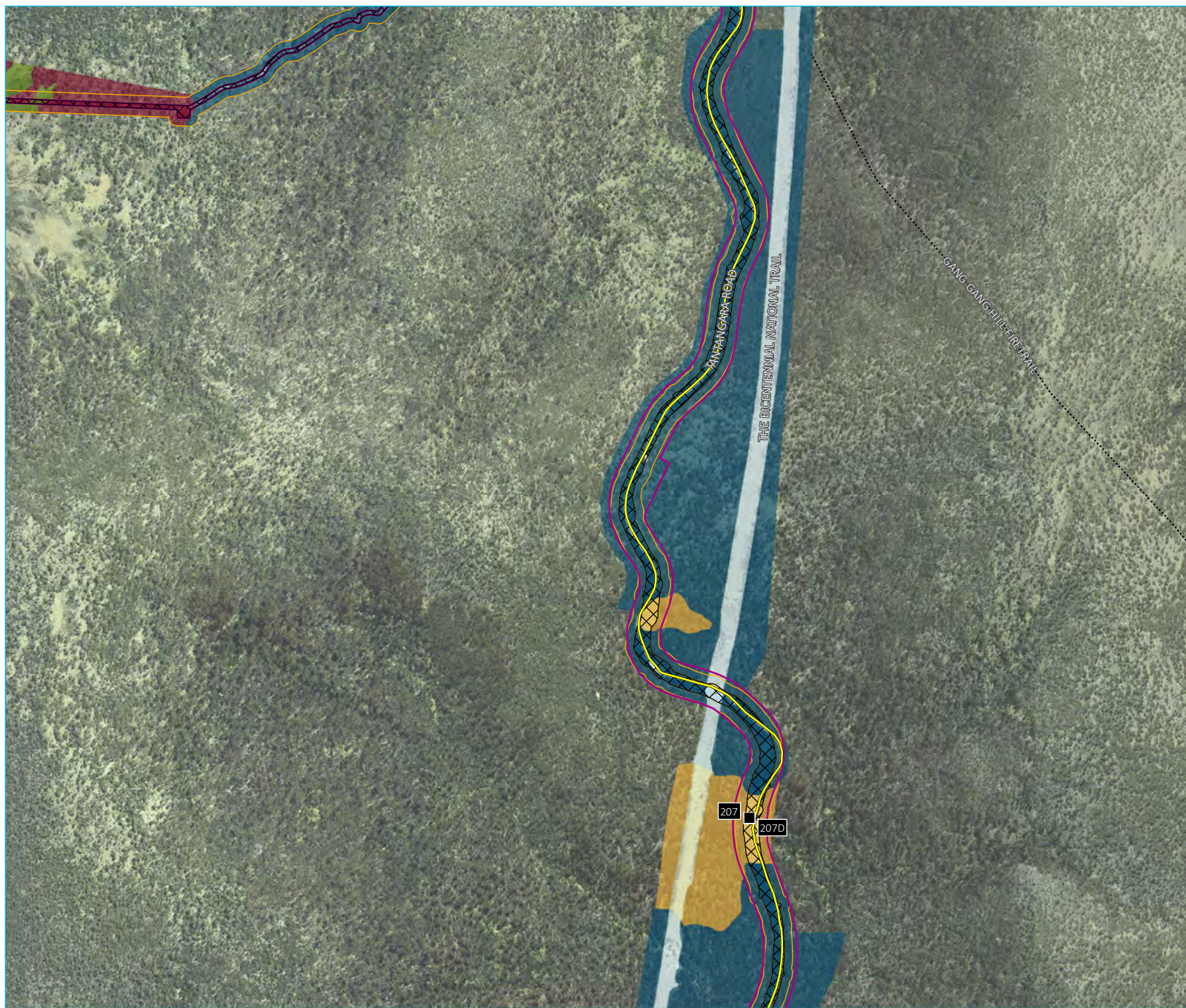
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.24

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500  
m  
GDA 1994 MGA Zone 55







#### KEY

- |                             |                   |
|-----------------------------|-------------------|
| ■ Plot location             | Derived grassland |
| — Main road                 | PCT 644           |
| ..... Vehicular track       | High              |
| ▨ Disturbance area          | PCT 1196          |
| ▨ Indirect disturbance area | High              |
| ▨ Construction envelope     | Derived grassland |
| PCT 639                     | PCT 1224          |
| High                        | High              |

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

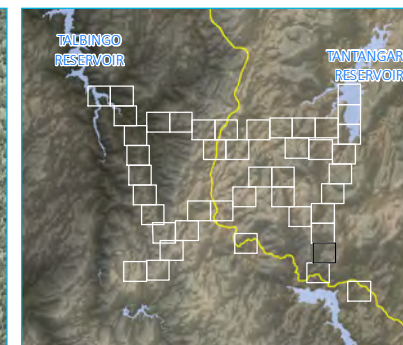
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.25

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500  
m  
GDA 1994 MGA Zone 55







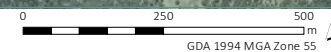
# KEY

- |                             |                   |
|-----------------------------|-------------------|
| ■ Plot location             | PCT 639           |
| — Main road                 | High              |
| ⊠ Disturbance area          | Derived grassland |
| ⊡ Indirect disturbance area | PCT 644           |
| — Construction envelope     | High              |
| PCT 303                     | PCT 1196          |
| High                        | High              |
| Derived grassland           | Derived grassland |
| PCT 637                     | PCT 1224          |
| High                        | High              |
|                             | PCT 1225          |
|                             | High              |

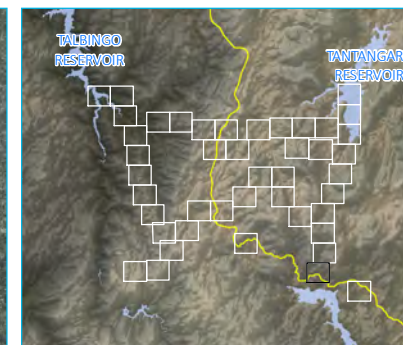
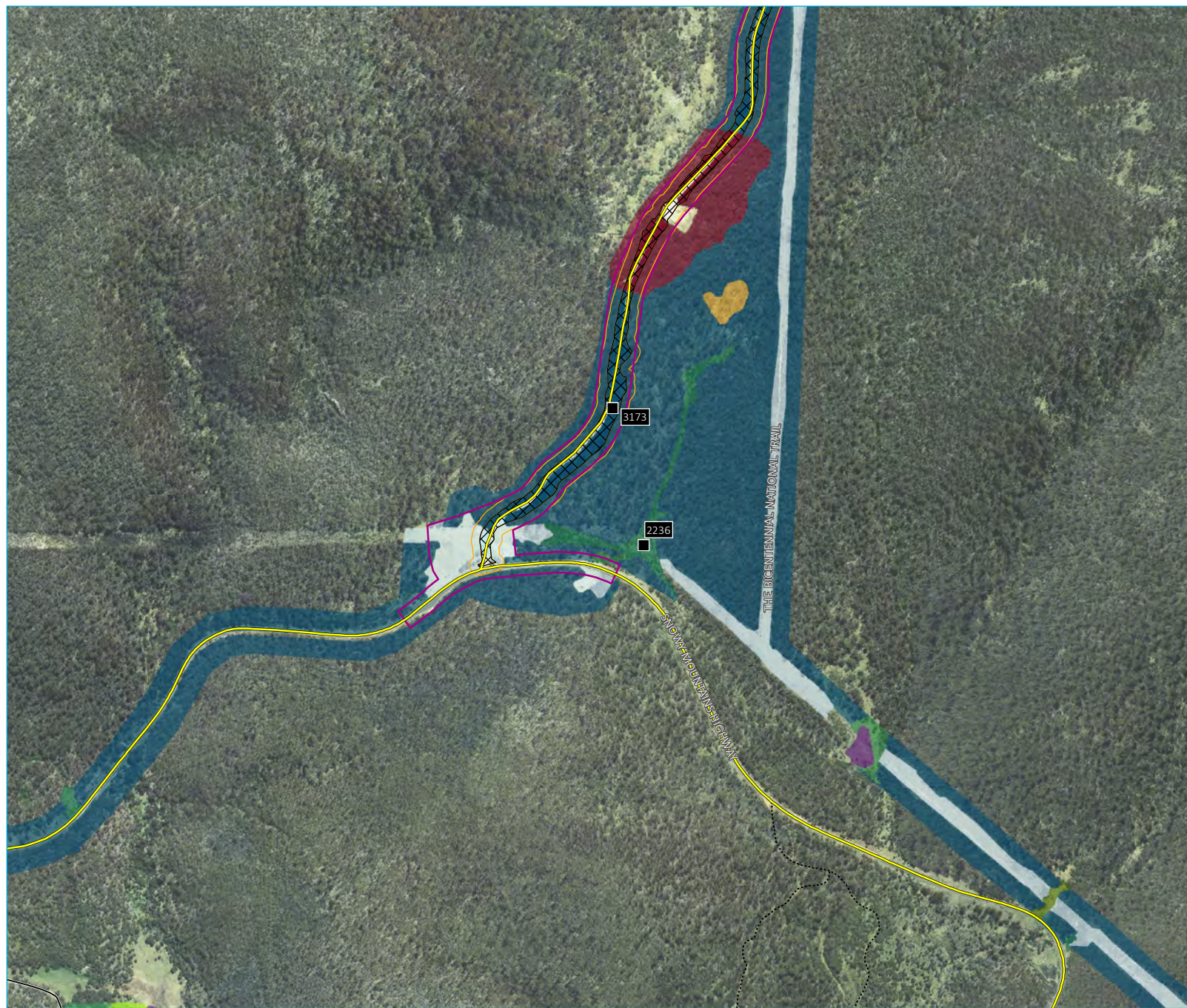
Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.26

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)







**KEY**

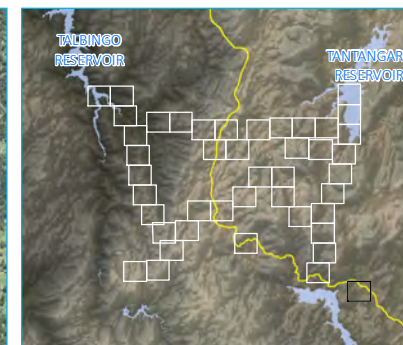
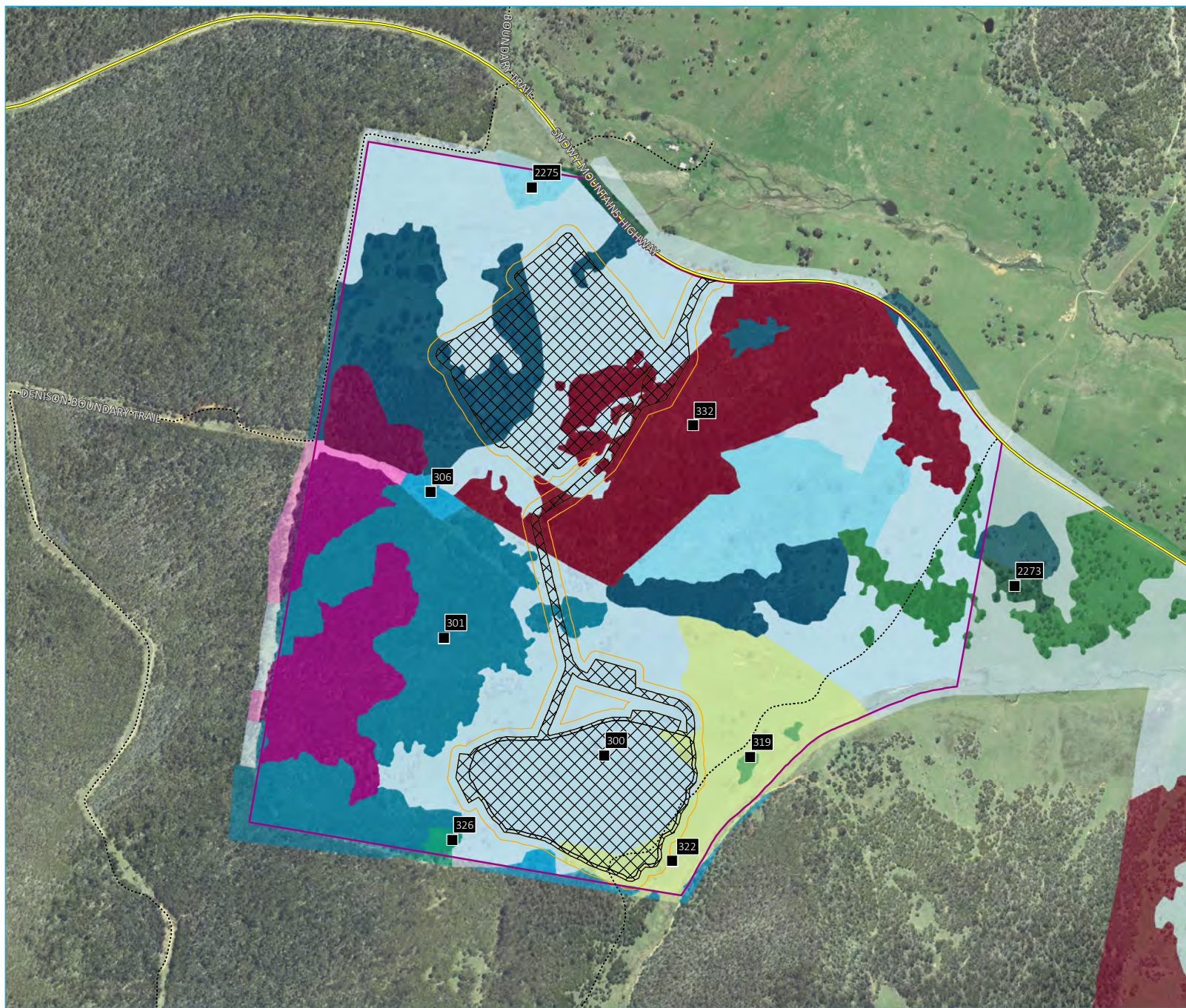
■ Plot location	PCT 639
— Main road	High
— Local road	PCT 644
..... Vehicular track	High
▨ Disturbance area	PCT 1196
▨ Indirect disturbance area	High
▨ Construction envelope	Derived grassland
PCT 303	PCT 1224
High	High
Medium	Low
PCT 637	Poor
High	PCT 1225
	High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.27



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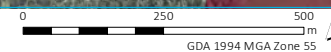
**KEY**

■ Plot location	PCT 644
— Main road	High
..... Vehicular track	PCT 679
▨ Disturbance area	High
▨ Indirect disturbance area	PCT 952
▨ Construction envelope	High
PCT 303	Medium
High	Derived grassland
Poor	PCT 1196
Derived grassland	High
PCT 637	Medium
Medium	Poor
	Other
	Derived grassland

Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations

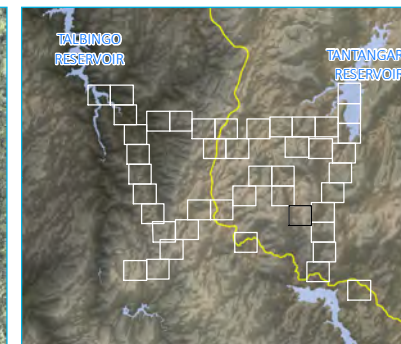
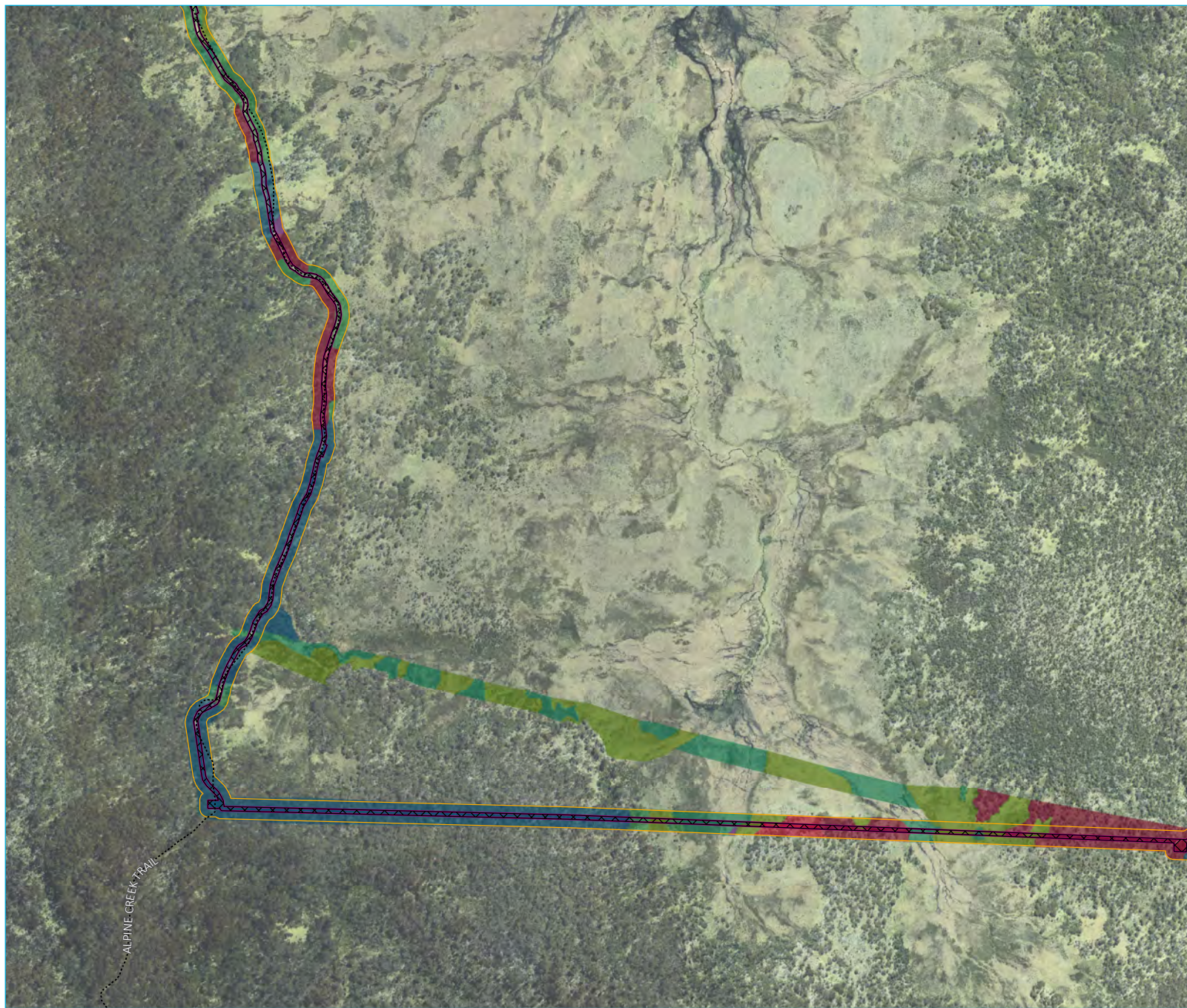
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.28

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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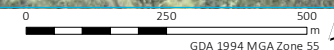
**KEY**

..... Vehicular track	PCT 644
⊗ Disturbance area	High
Indirect disturbance area	Medium
Construction envelope	PCT 1196
PCT 303	High
High	PCT 1224
PCT 637	High
High	PCT 1225
	High

Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations

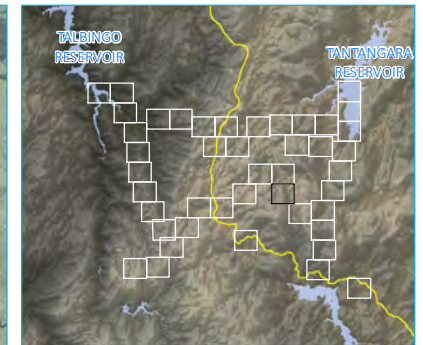
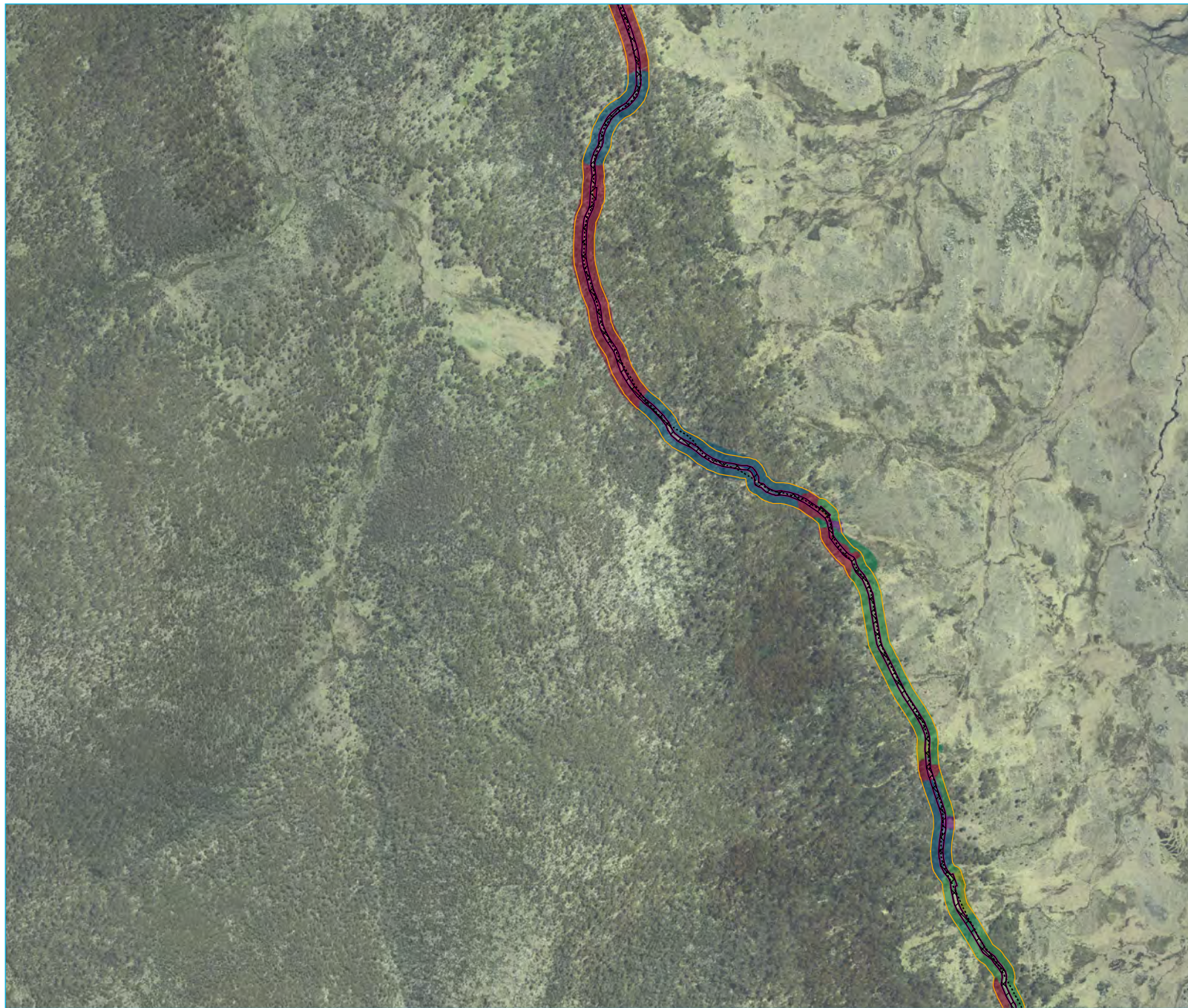
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.29

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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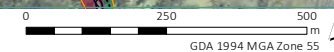
**KEY**

..... Vehicular track	PCT 644
⊗ Disturbance area	High
Indirect disturbance area	PCT 1196
Construction envelope	High
PCT 303	PCT 1224
High	High
PCT 637	PCT 1225
High	High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

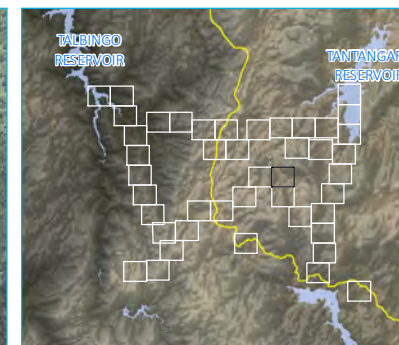
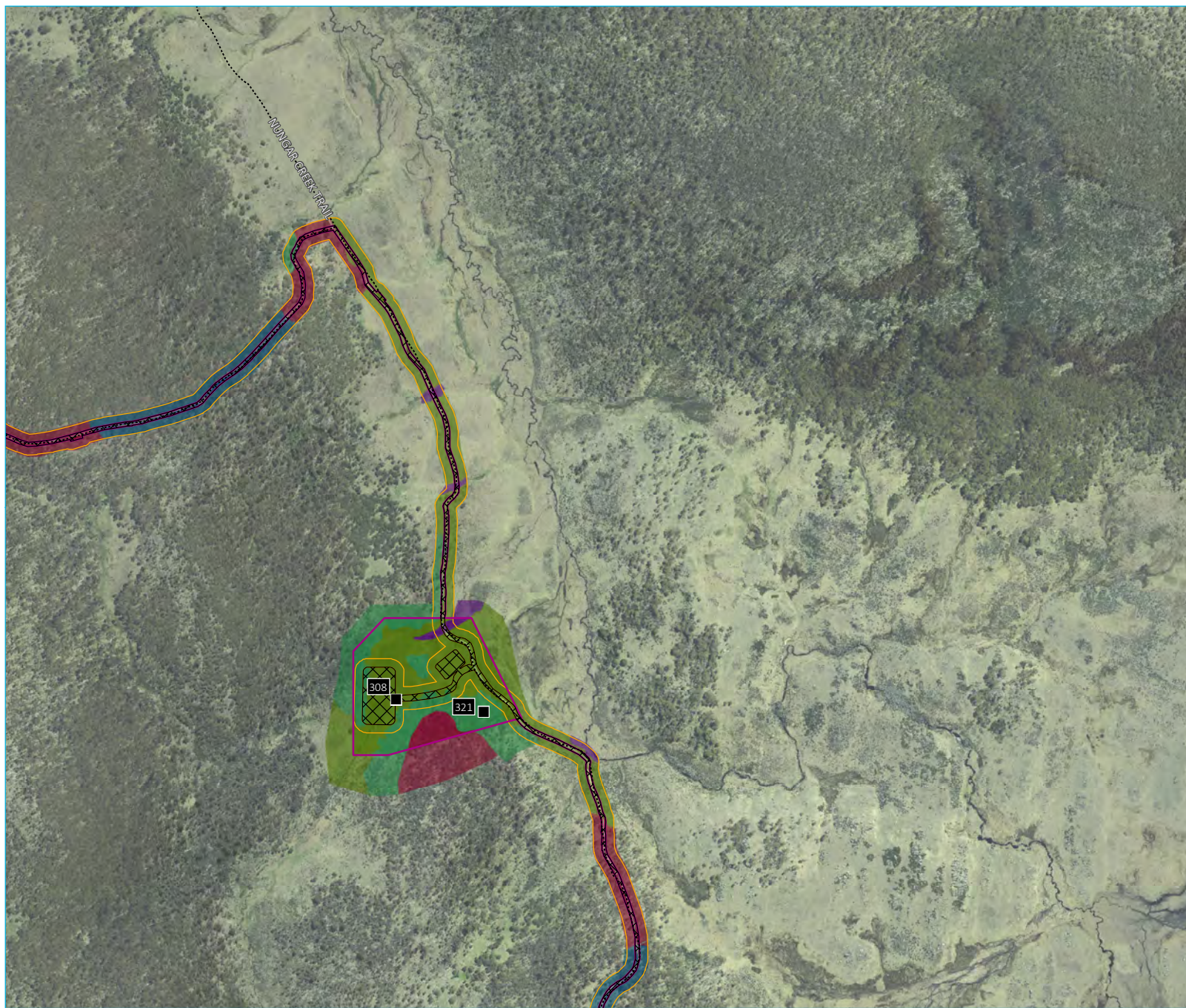
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.30

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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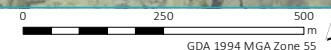
**KEY**

■ Plot location	PCT 644
..... Vehicular track	PCT 1196
⊠ Disturbance area	High
Indirect disturbance area	PCT 1224
Construction envelope	High
PCT 303	PCT 1225
High	High

Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations

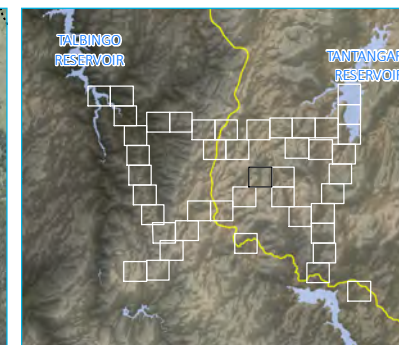
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.31

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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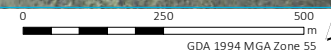


- KEY**
- ..... Vehicular track
  - ⊗ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - PCT 303 High
  - PCT 637 High
  - PCT 644 High
  - PCT 1196 High
  - PCT 1224 High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

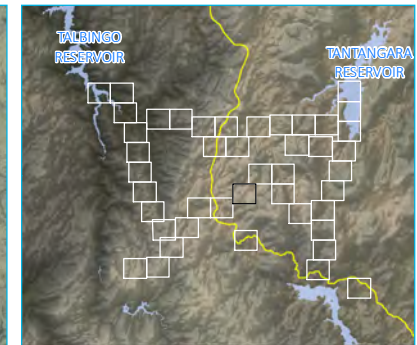
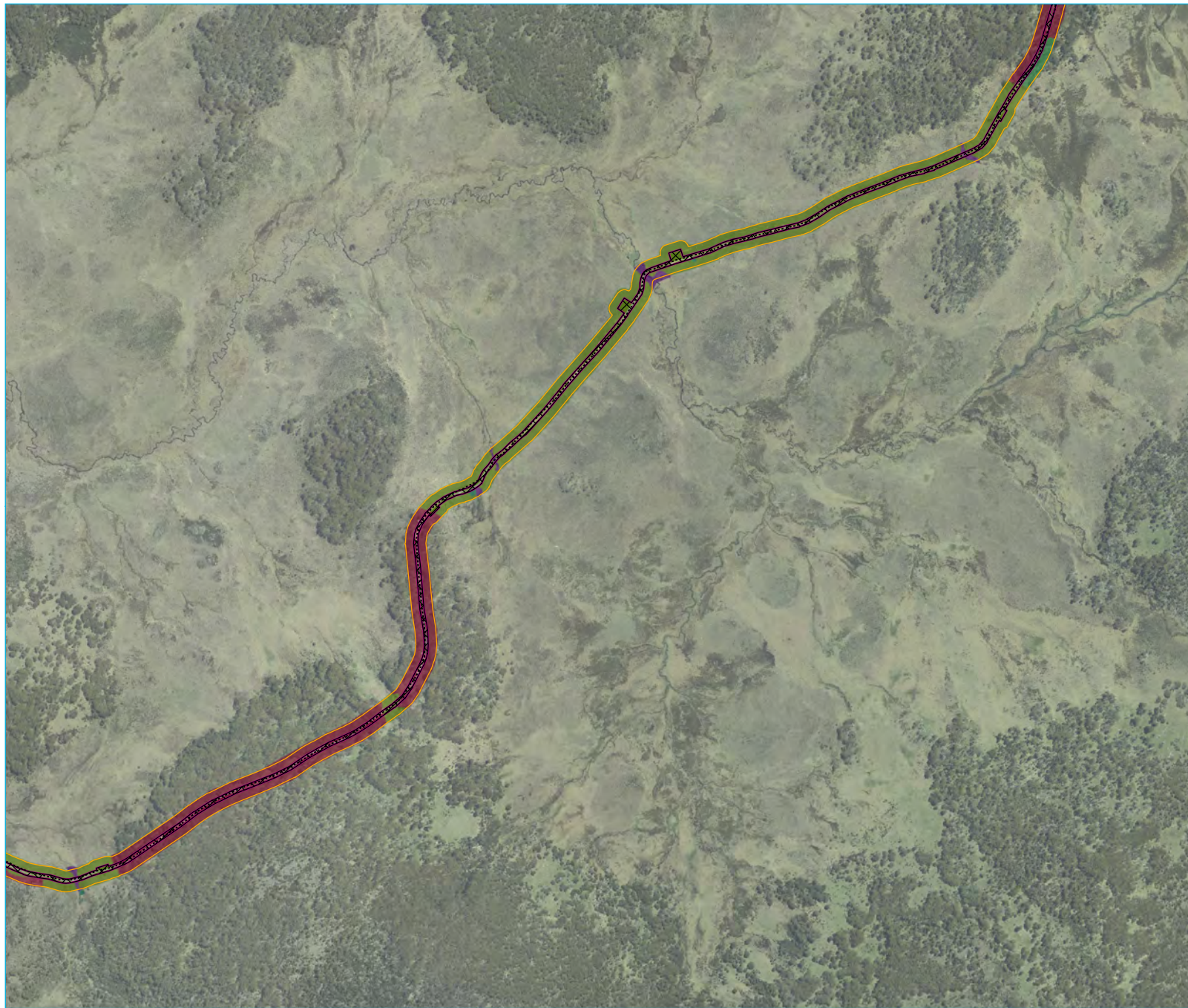
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.32

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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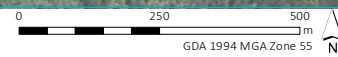


- KEY**
- ..... Vehicular track
  - ⊗ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - PCT 303 High
  - PCT 637 High
  - PCT 644 High
  - PCT 1224 High
  - PCT 1225 High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

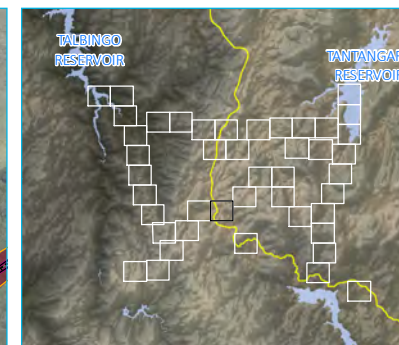
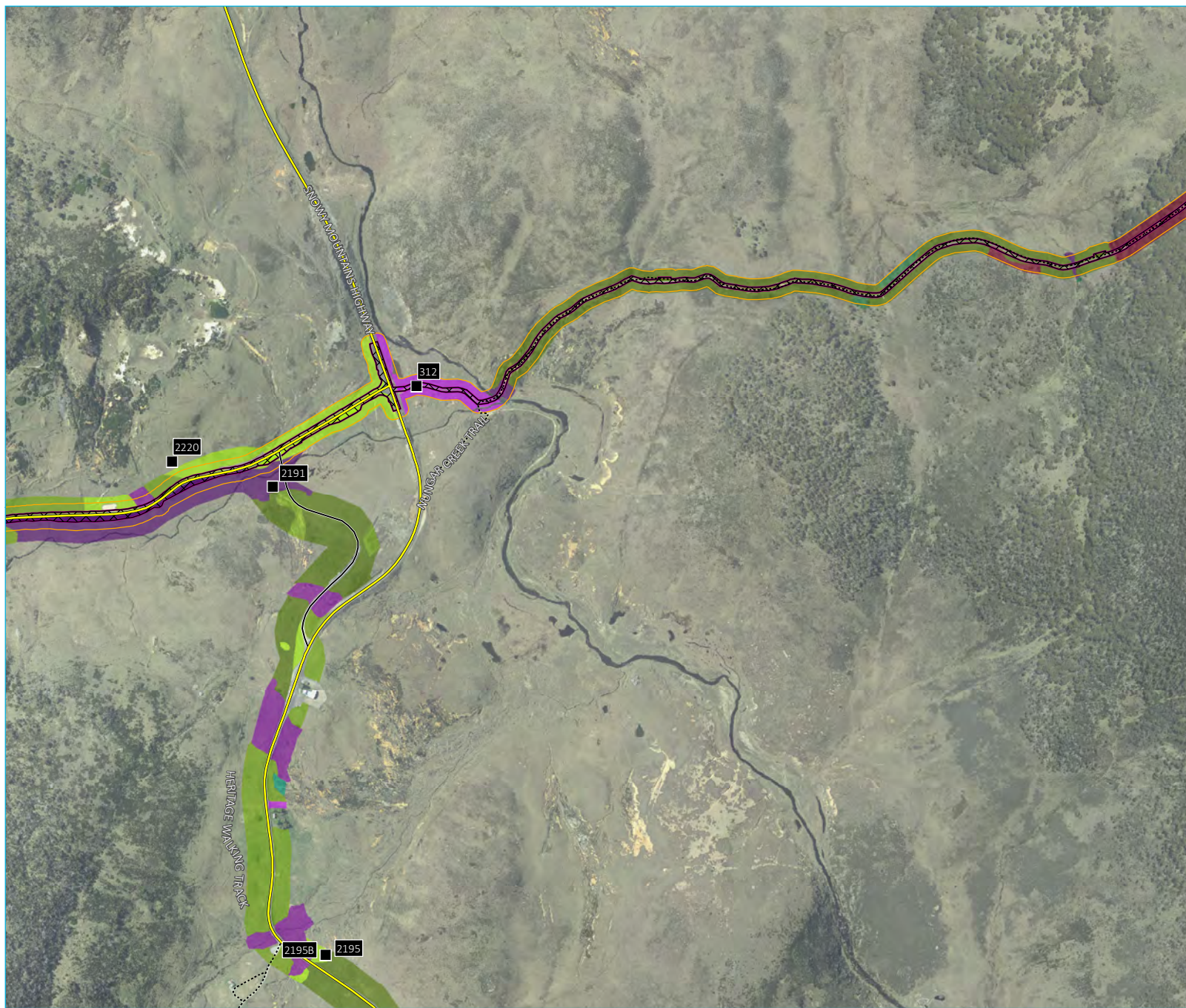
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.33

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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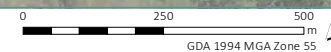
**KEY**

■ Plot location	Medium
— Main road	PCT 644
— Local road	High
..... Vehicular track	PCT 1224
⊠ Disturbance area	High
□ Indirect disturbance area	Medium
□ Construction envelope	Poor
PCT 303	PCT 1225
High	High
PCT 637	Medium
High	Poor

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

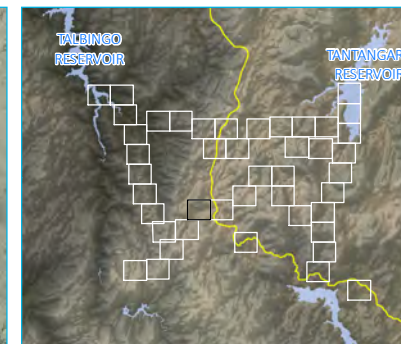
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.34

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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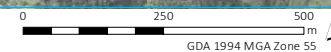
# KEY

- |                             |          |
|-----------------------------|----------|
| ■ Plot location             | PCT 644  |
| — Main road                 | ■ High   |
| ▨ Disturbance area          | PCT 1224 |
| ▨ Indirect disturbance area | ■ High   |
| ▨ Construction envelope     | ■ Medium |
| PCT 303                     | ■ Poor   |
| ■ High                      | PCT 1225 |
| PCT 637                     | ■ High   |
| ■ High                      | ■ Medium |
|                             | ■ Low    |

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

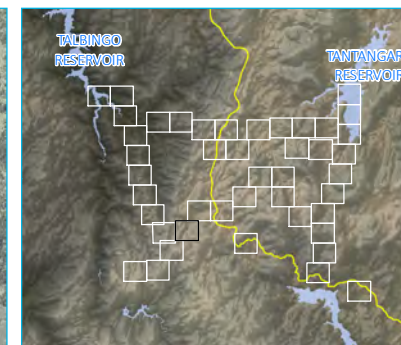
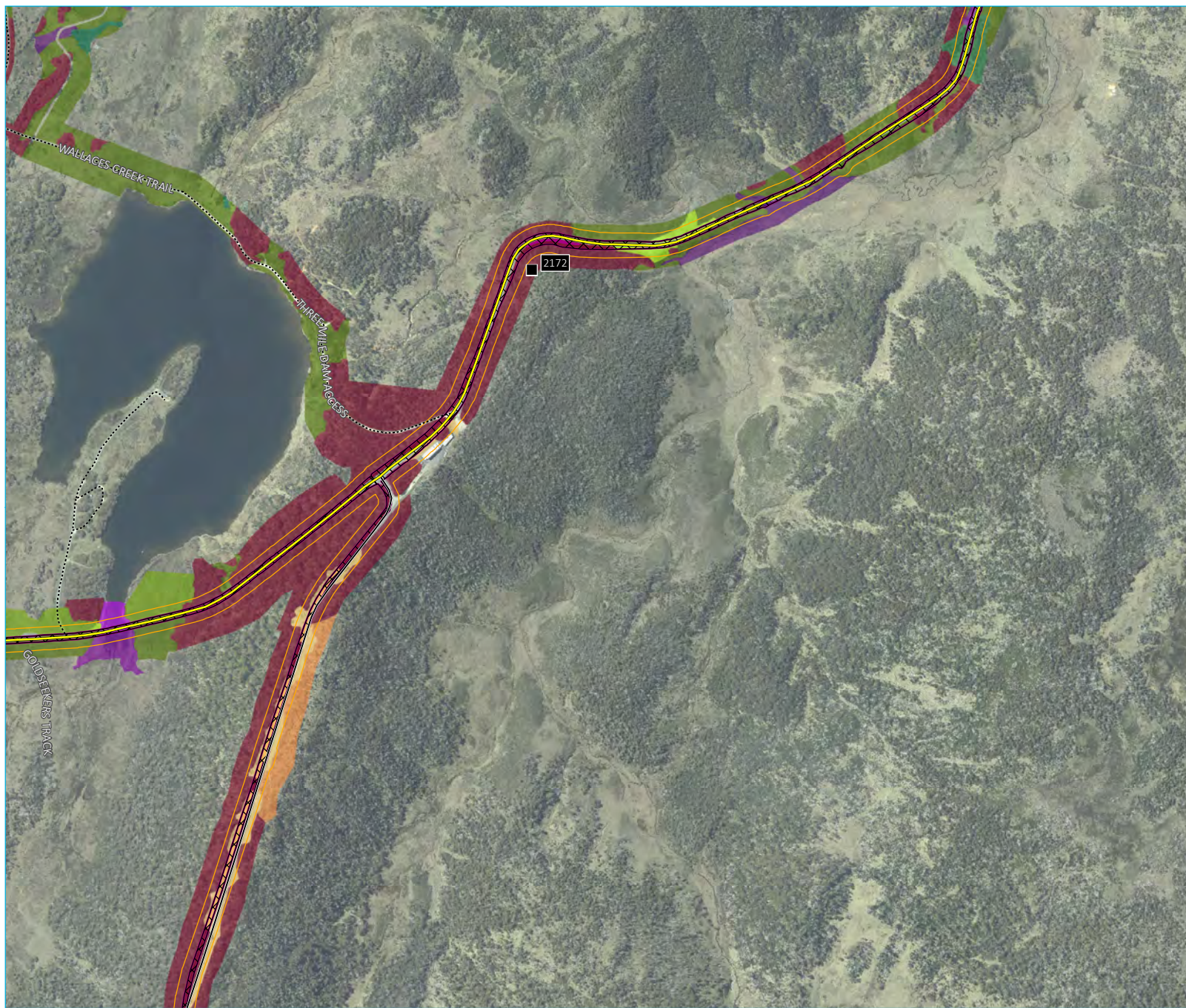
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.35

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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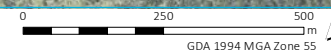
**KEY**

■ Plot location	PCT 644
— Main road	High
— Local road	Other
..... Vehicular track	Derived grassland
▨ Disturbance area	PCT 1224
▨ Indirect disturbance area	High
▨ Construction envelope	Medium
PCT 303	Poor
High	PCT 1225
PCT 637	High
High	Medium
	Poor

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

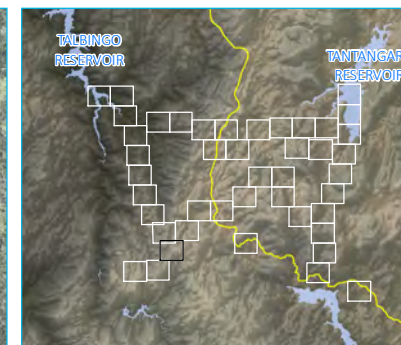
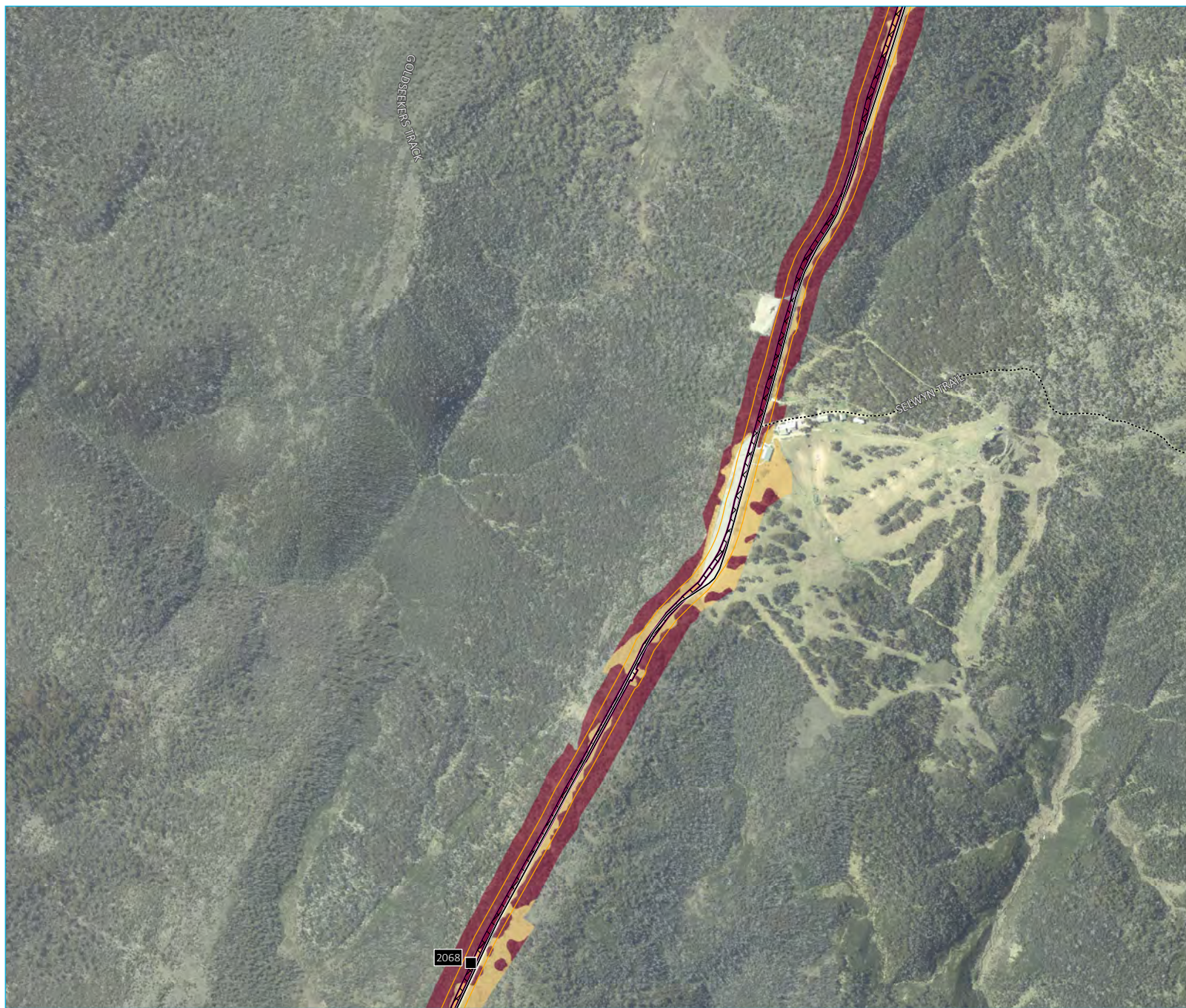
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.36

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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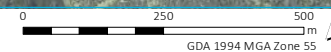


- KEY**
- Plot location
  - Local road
  - ..... Vehicular track
  - ▨ Disturbance area
  - ▭ Indirect disturbance area
  - ▭ Construction envelope
  - PCT 644
  - High
  - Derived grassland

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

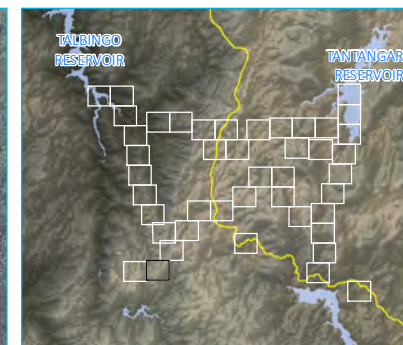
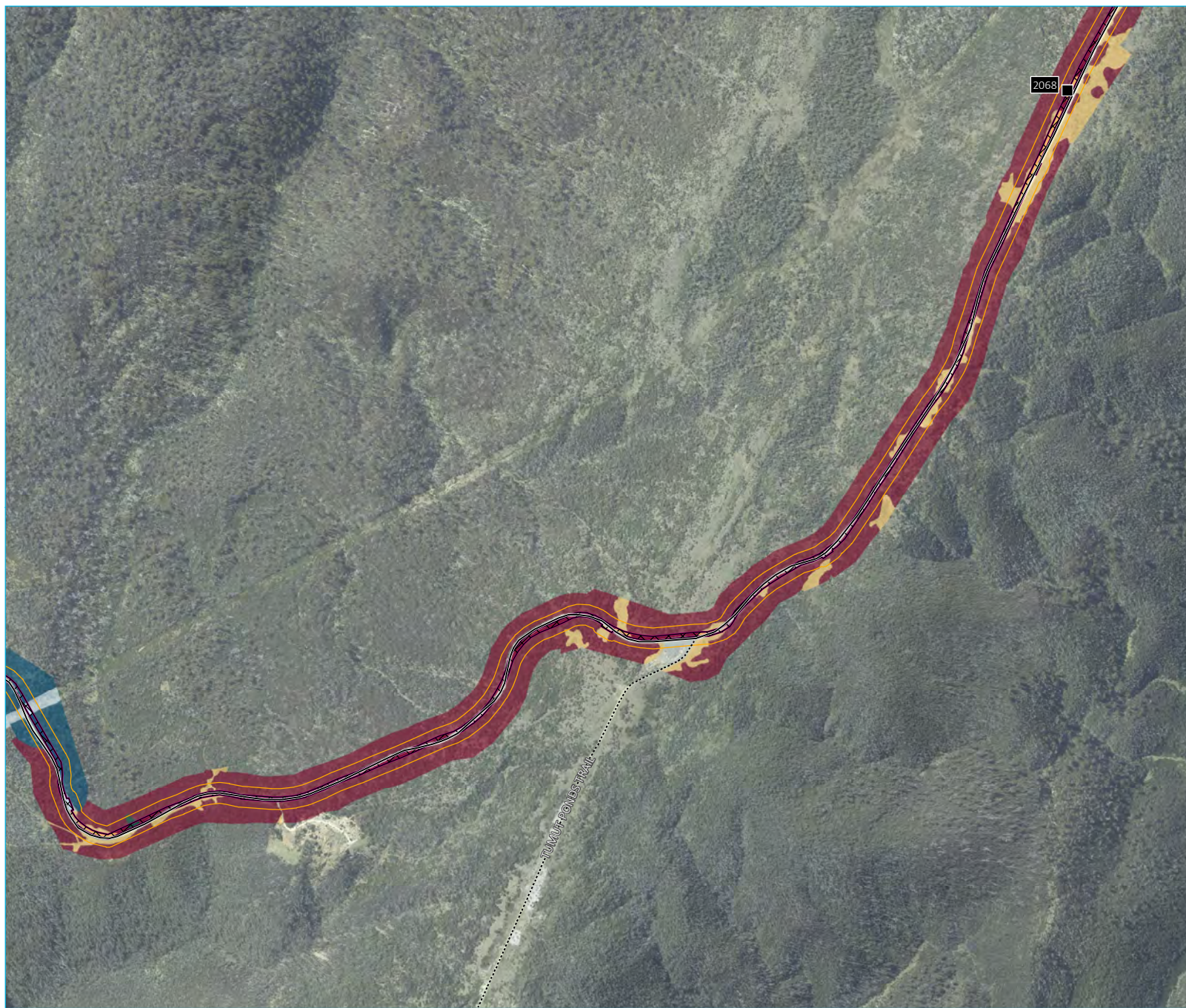
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.37

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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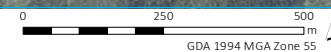
**KEY**

■ Plot location	■ High
— Local road	■ Derived grassland
⋯ Vehicular track	PCT 679
⊠ Disturbance area	■ High
■ Indirect disturbance area	PCT 1196
■ Construction envelope	■ High
PCT 644	■ Derived grassland

Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.38

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

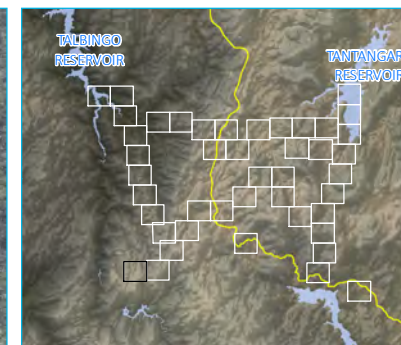




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



#### KEY

- |                             |                   |
|-----------------------------|-------------------|
| ■ Plot location             | PCT 679           |
| — Main road                 | High              |
| — Local road                | PCT 1196          |
| ..... Vehicular track       | High              |
| ⊠ Disturbance area          | Derived grassland |
| □ Indirect disturbance area | PCT 1224          |
| □ Construction envelope     | High              |
| PCT 637                     | Low               |
| High                        | Poor              |
| PCT 644                     | PCT 1225          |
| High                        | Low               |
| Derived grassland           |                   |

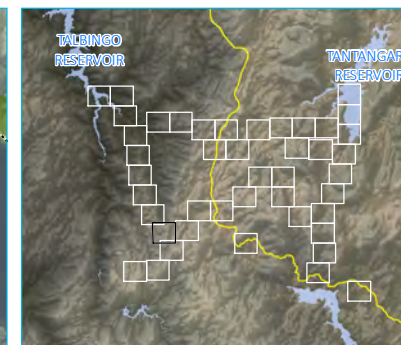
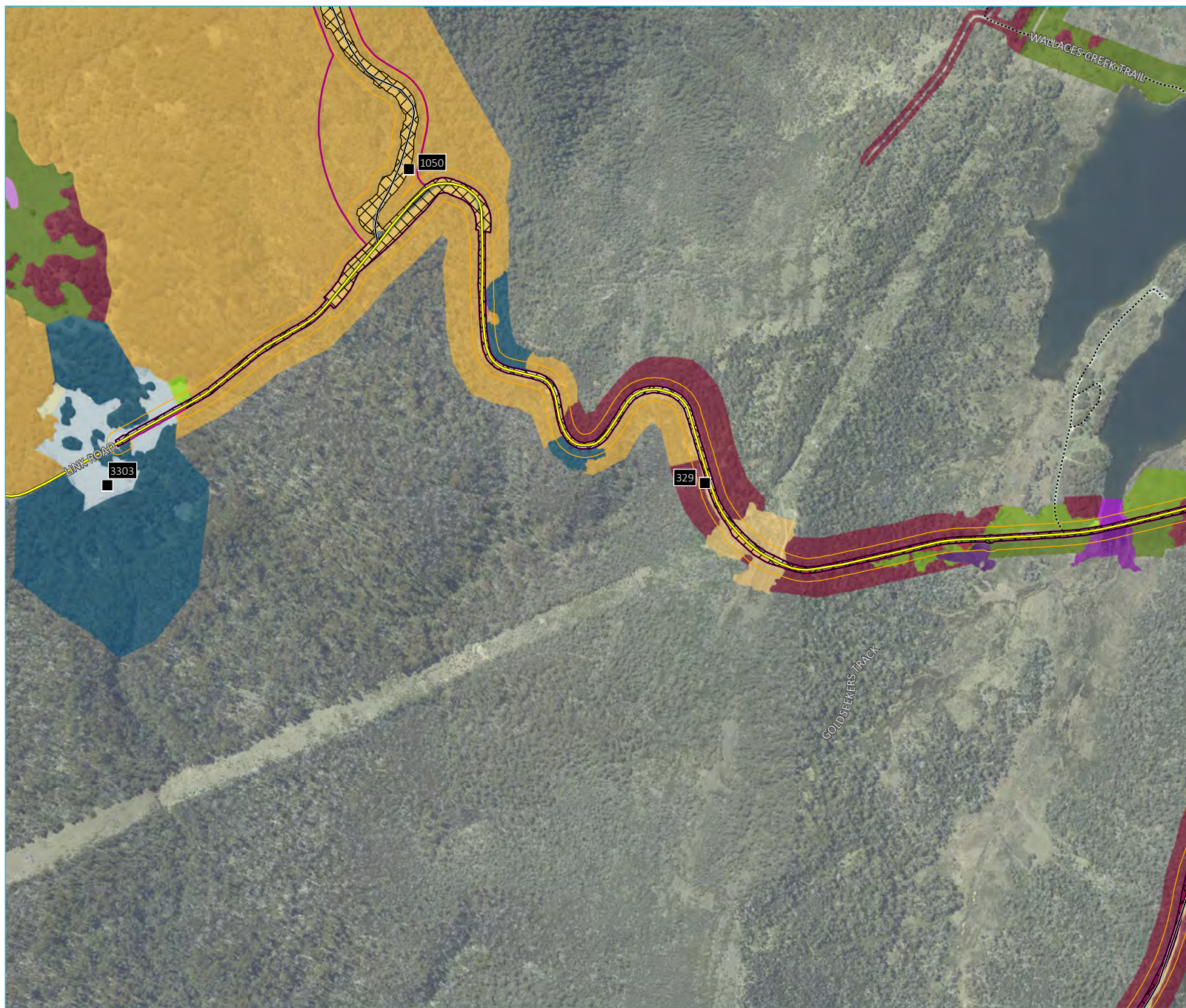
Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.39





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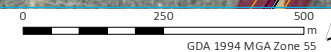
**KEY**

■ Plot location	Derived grassland
— Main road	PCT 1196
— Local road	High
..... Vehicular track	Derived grassland
⊠ Disturbance area	PCT 1224
□ Indirect disturbance area	High
□ Construction envelope	Medium
PCT 639	Poor
High	PCT 1225
Derived grassland	High
PCT 644	Medium
High	Poor
Medium	Other

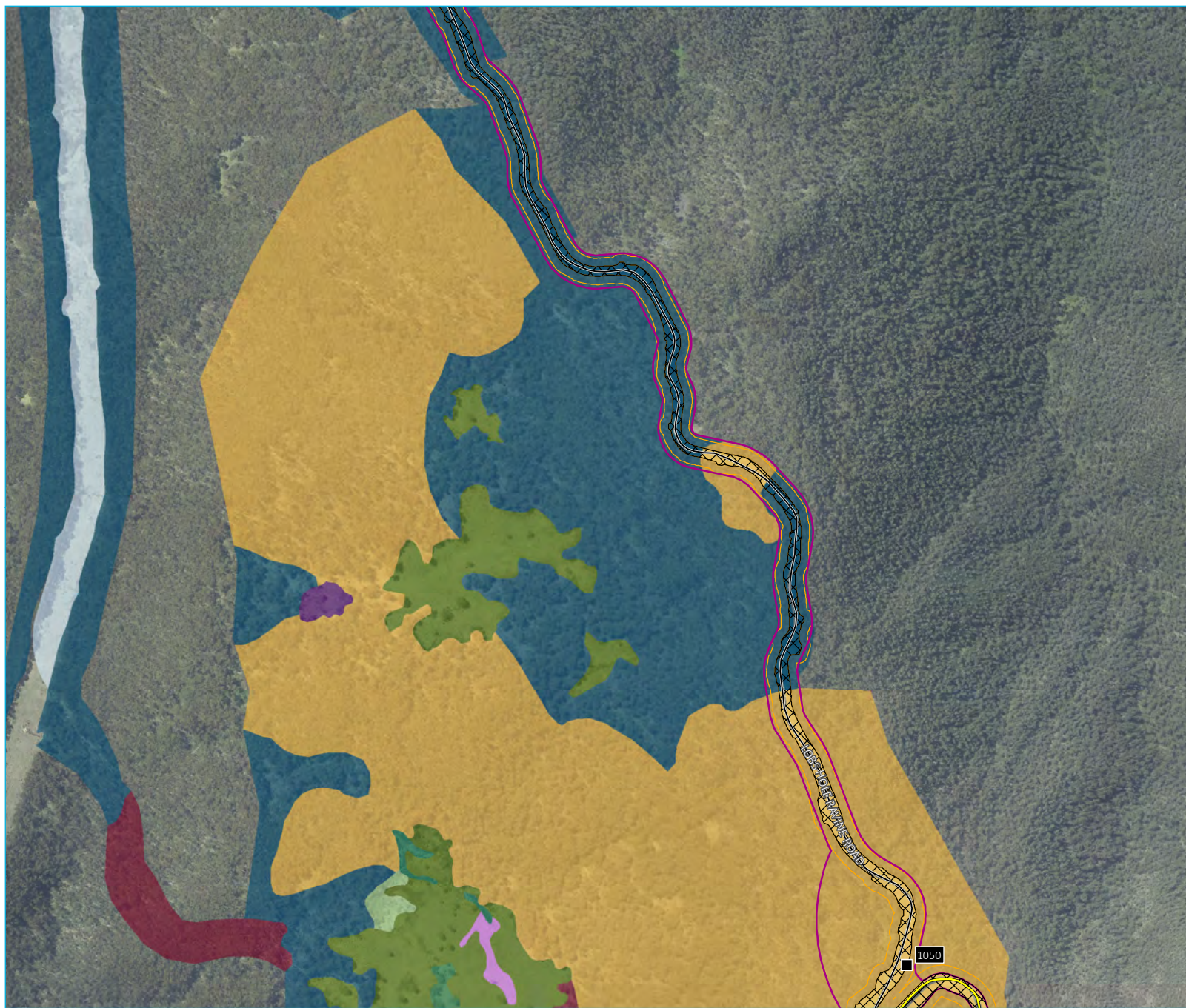
Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.40

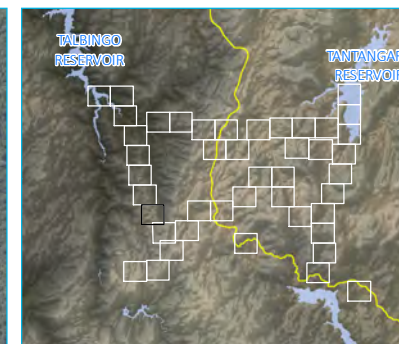
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)







Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



# KEY

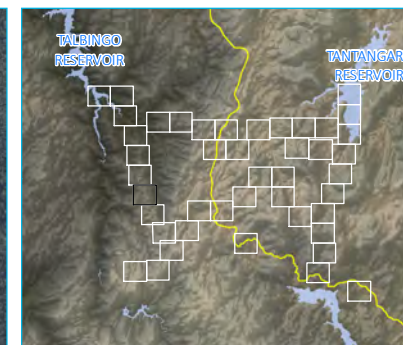
■ Plot location	PCT 639
— Main road	High
— Local road	PCT 644
⊠ Disturbance area	High
⊠ Indirect disturbance area	PCT 1196
— Construction envelope	High
PCT 303	Derived grassland
High	PCT 1224
Other	High
PCT 637	PCT 1225
High	High
	Other

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.41







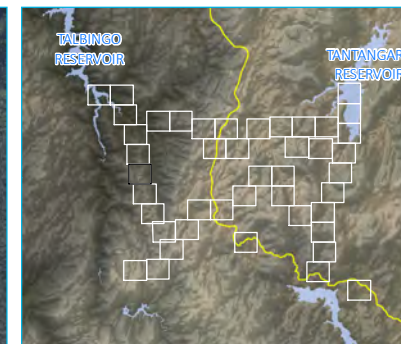
# KEY

- Plot location
- Local road
- ▨ Disturbance area
- ▨ Indirect disturbance area
- ▨ Construction envelope
- PCT 296
  - High
  - Medium
- PCT 639
  - High
- PCT 953
  - High
- PCT 1196
  - High
  - Medium
- Derived grassland

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.42





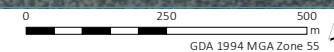
#### KEY

■ Plot location	PCT 643
— Local road	Low
..... Vehicular track	PCT 938
⊠ Disturbance area	High
□ Indirect disturbance area	PCT 953
▭ Construction envelope	High
PCT 300	Derived grassland
High	PCT 1196
PCT 303	High
High	Derived grassland

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

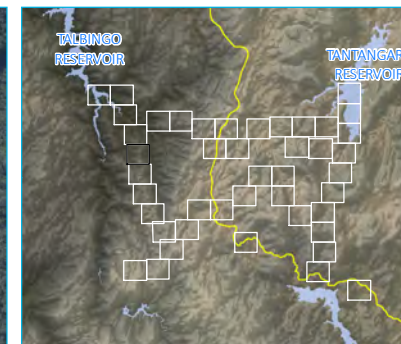
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.43

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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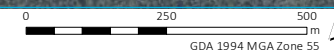


- KEY**
- Plot location
  - Local road
  - ..... Vehicular track
  - ▨ Disturbance area
  - ▨ Indirect disturbance area
  - ▨ Construction envelope
  - PCT 300
  - High
  - PCT 729
  - High

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

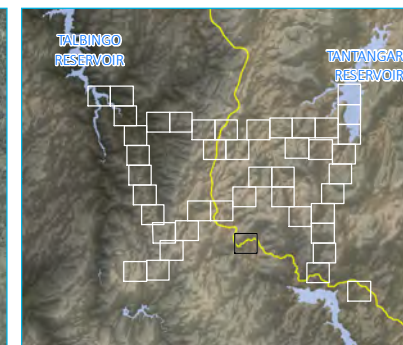
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.44

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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**KEY**

— Main road	Derived grassland
..... Vehicular track	PCT 644
⊠ Disturbance area	High
□ Indirect disturbance area	Medium
□ Construction envelope	Poor
PCT 303	Other
High	Derived grassland
Medium	PCT 679
Poor	Other
Derived grassland	Derived grassland
PCT 637	PCT 1224
High	High
Medium	PCT 1225
PCT 639	High
High	Medium
Other	

Plant Community Type and  
vegetation zone mapping within the  
Main Works disturbance footprint,  
including plots locations

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 4.1.45

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500  
m  
GDA 1994 MGA Zone 55

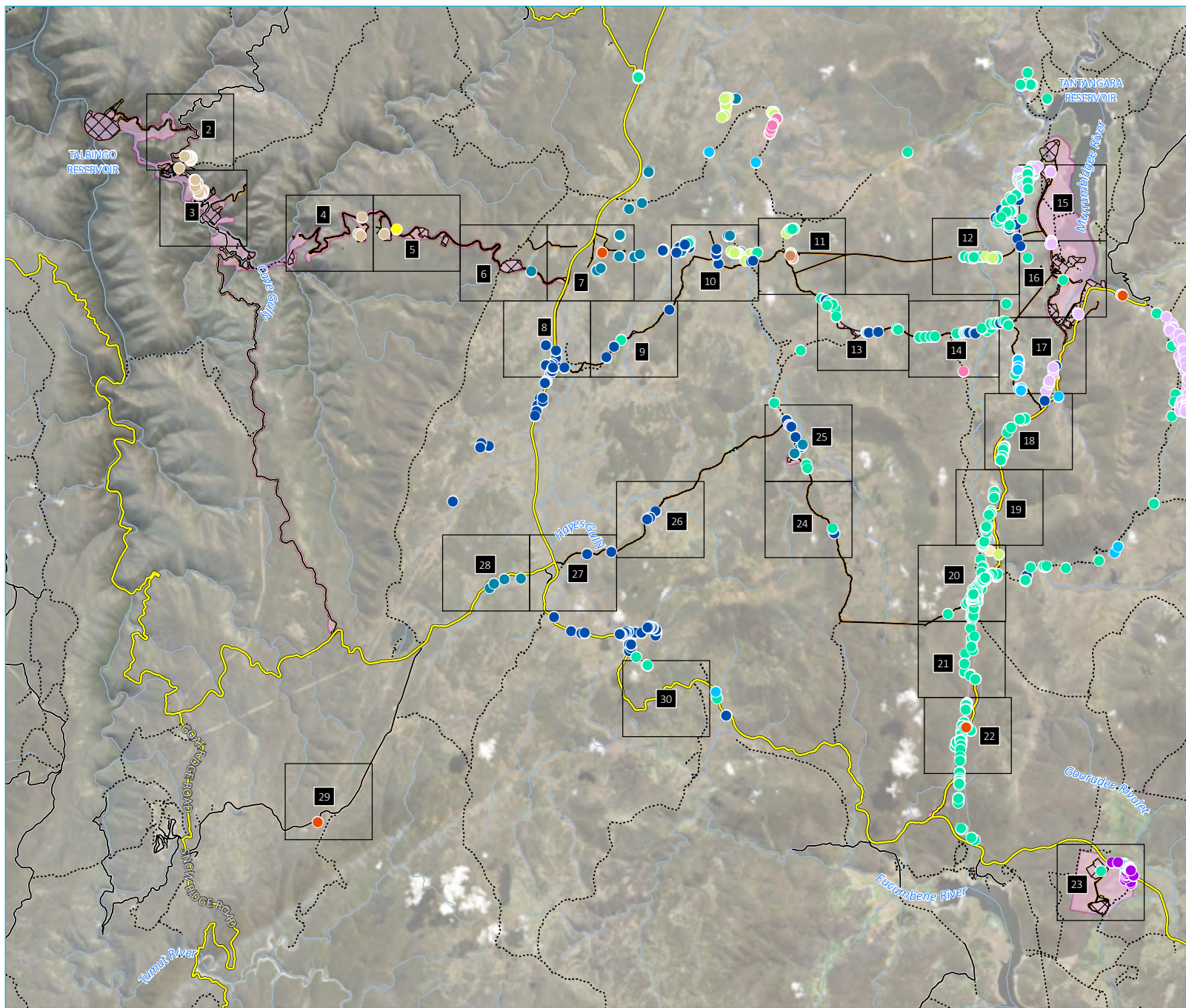






## Appendix A2      Threatened Flora mapping

\\lemmsr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02\_Maps\EIS\_MM\RS\BDAR\BDAR007\_FloraSurveyResults\_20200206\_OVERVIEW.mxd 20/02/2020



# KEY

- Watercourse
- Main road
- Local road
- ..... Vehicular track
- Page index
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope

## Threatened flora (point)

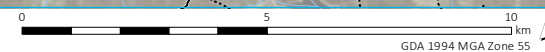
- Clover Glycine
- Hoary Sunray
- Kiandra Leek Orchid
- Leafy Anchor Plant
- Max Mueller's Burr-daisy
- Mauve Burr-daisy
- Monaro Golden Daisy
- Raleigh Sedge
- Slender Greenhood
- *Caladenia montana*
- *Pterostylis alpina*
- *Prasophyllum innubum*
- *Thelymitra alpicola*

Flora survey results - page index

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.1

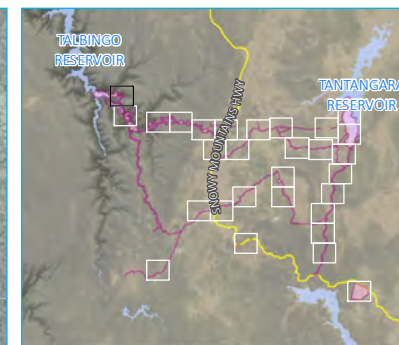
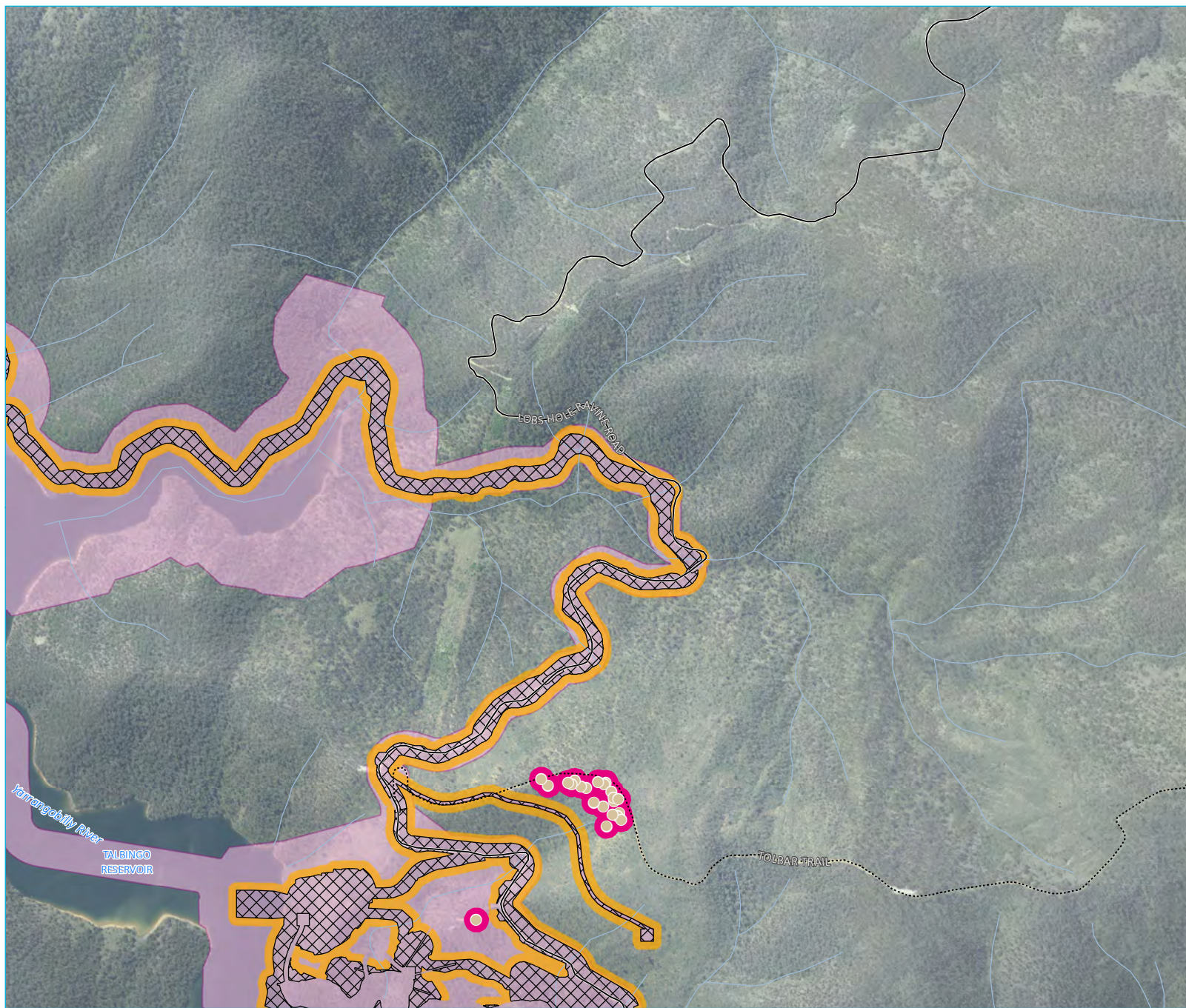


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02\_Maps\EIS\_MM\RS\BDAR\BDAR007\_FloraSurveyResults\_20200206\_DDP\_07.mxd 20/02/2020



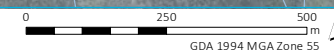
#### KEY

- Watercourse / drainage line
- Local road
- ..... Vehicular track
- ▨ Disturbance area
- Yellow Indirect disturbance area
- Pink Construction envelope
- Pink Threatened species habitat
- Threatened flora (point)
- *Caladenia montana*

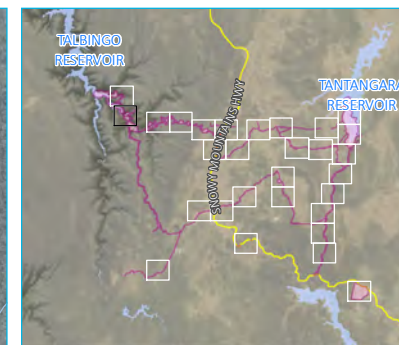
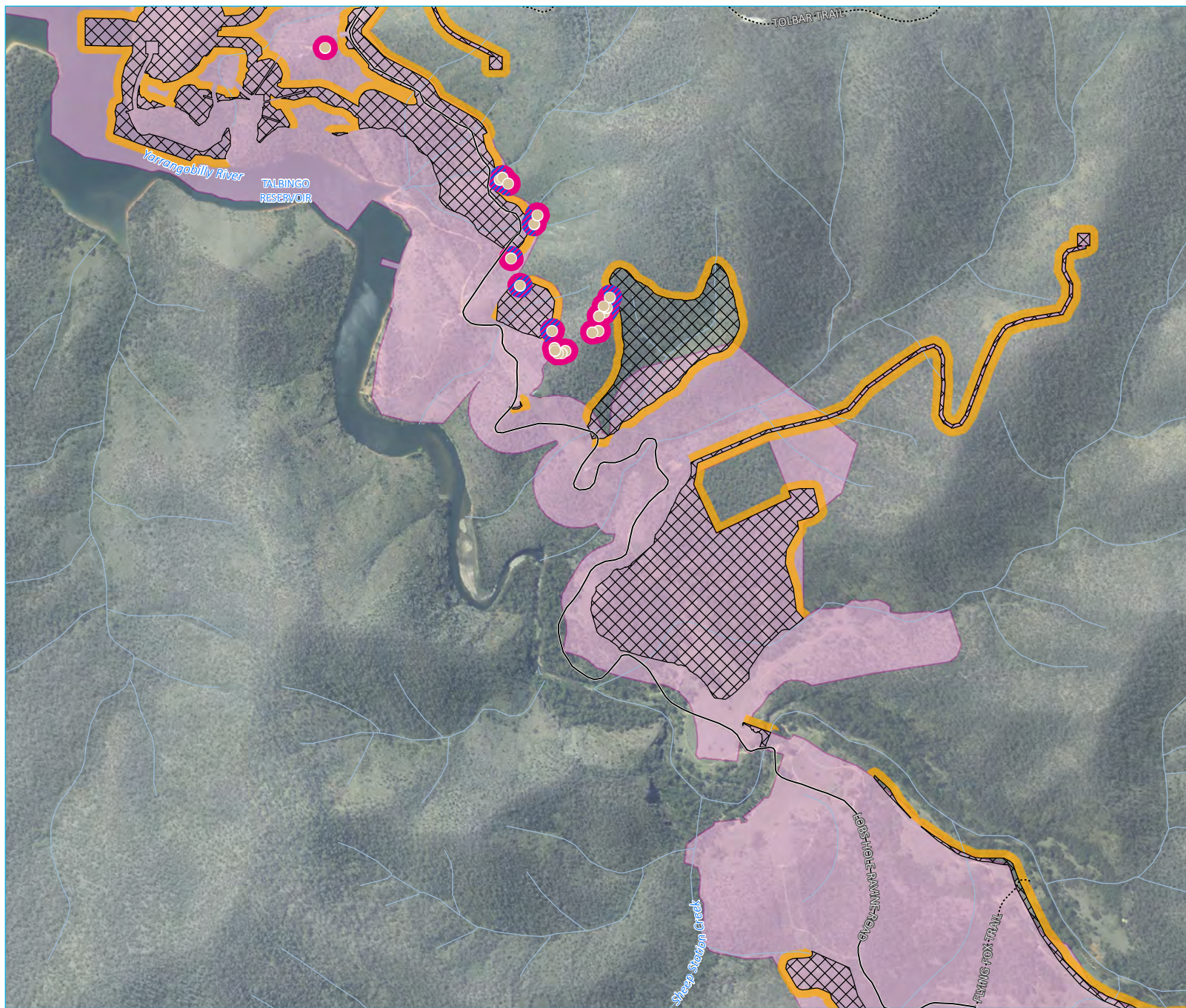
#### Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.2

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)







- KEY**
- Watercourse / drainage line
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
  - *Caladenia montana*

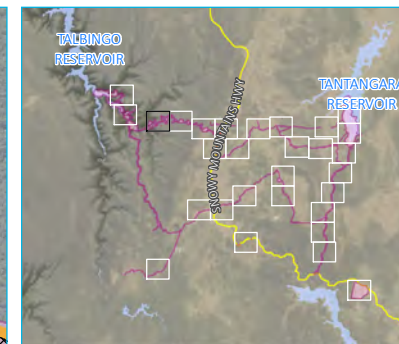
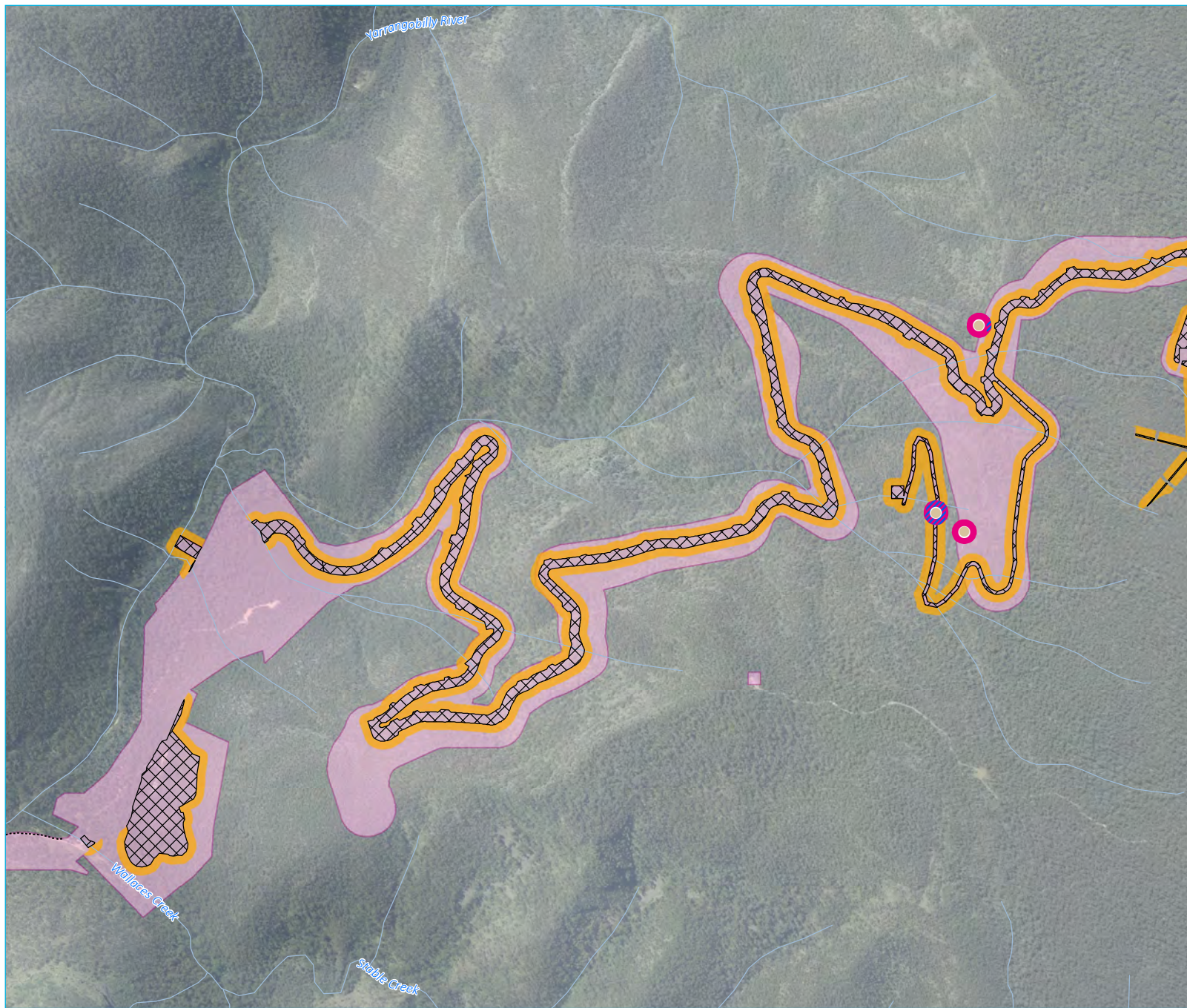
## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.3





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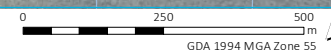
- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
  - *Caladenia montana*

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.4

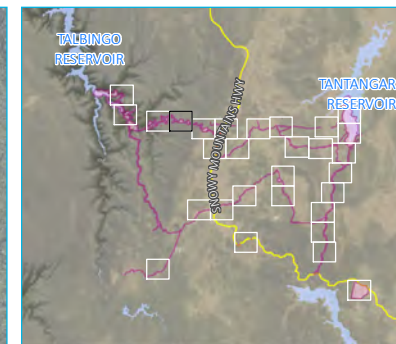


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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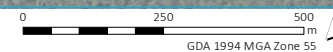


- KEY**
- Watercourse / drainage line
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
  - Slender Greenhood
  - *Caladenia montana*

Flora survey results

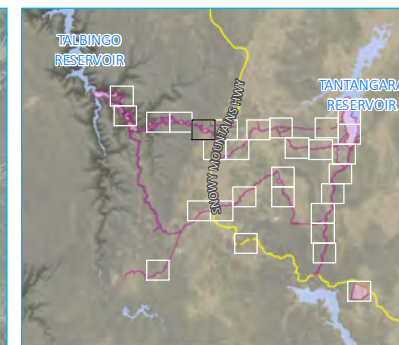
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.5

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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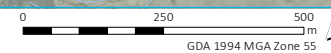
- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora (point)
  - Leafy Anchor Plant

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.6

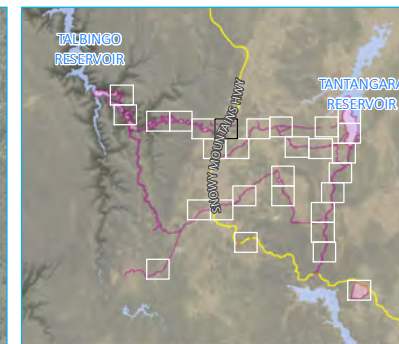
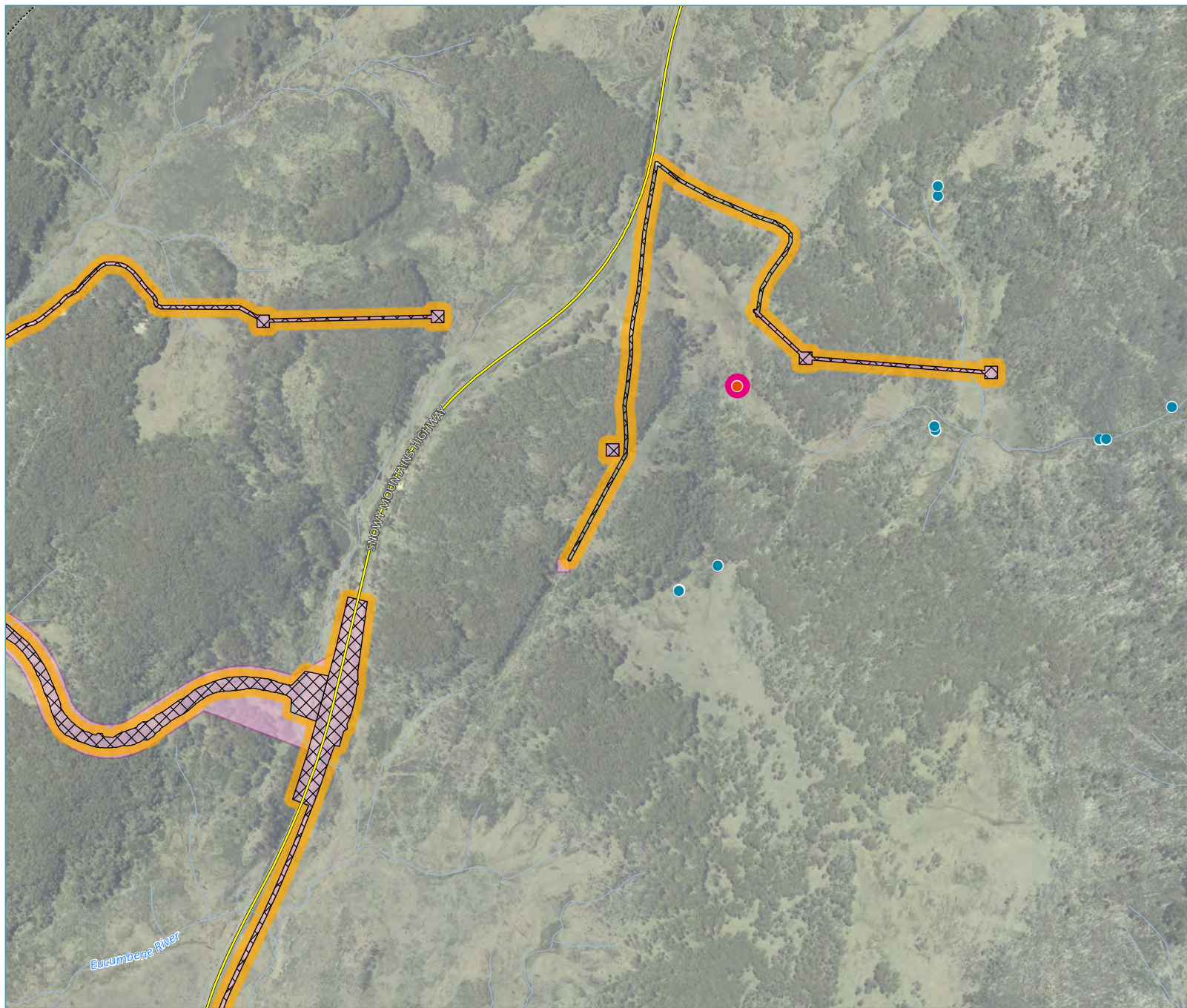


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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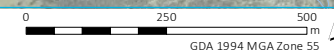
- KEY**
- Watercourse / drainage line
  - Main road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened species habitat
  - Threatened flora (point)
  - Leafy Anchor Plant
  - *Thelymitra alpicola*

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.7

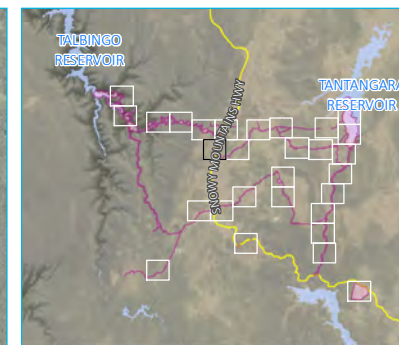
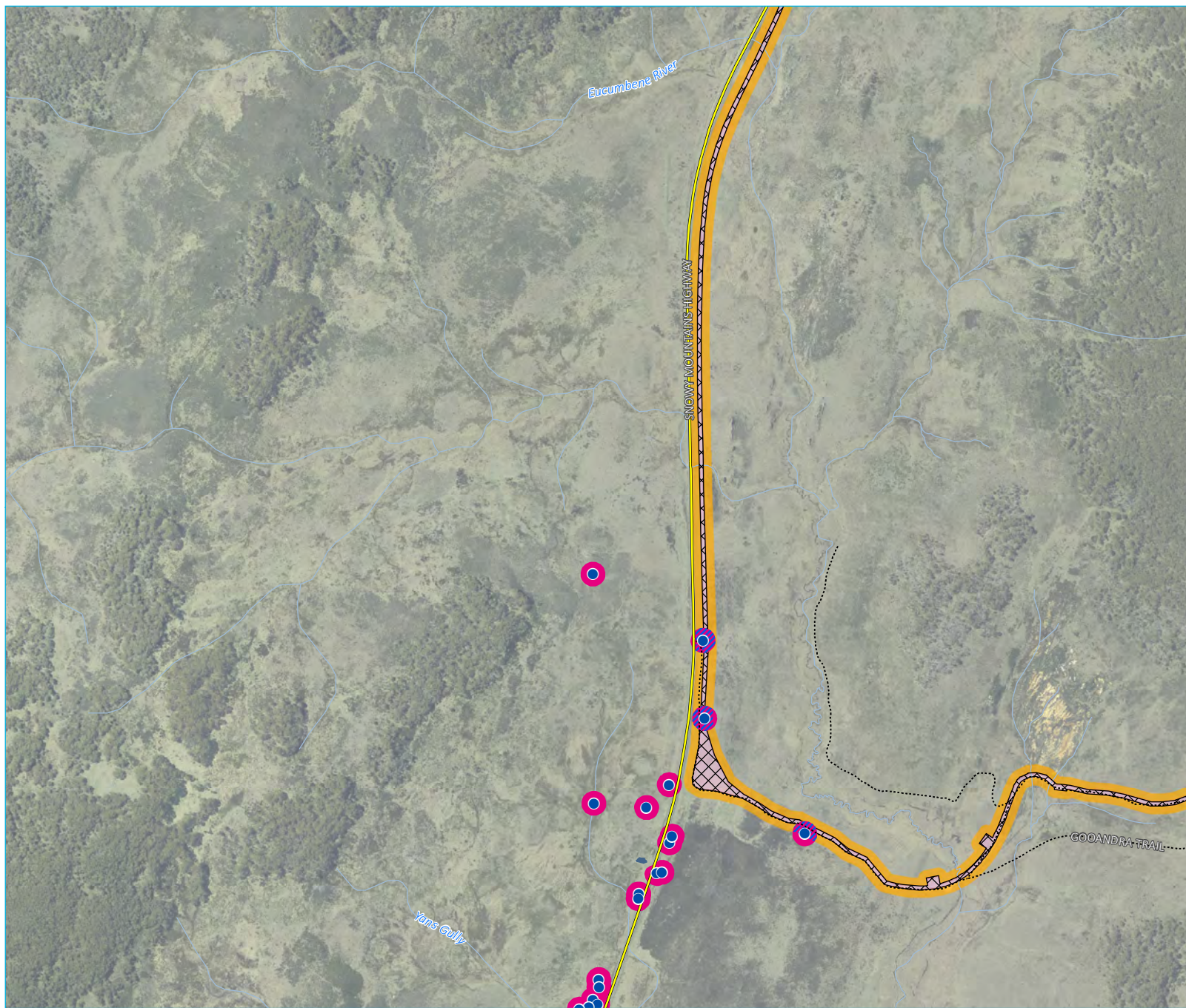


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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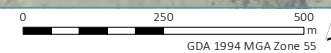
- KEY**
- Watercourse / drainage line
  - Main road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (polygon)
  - Kiandra Leek Orchid
  - Threatened flora (point)
  - Kiandra Leek Orchid

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.8

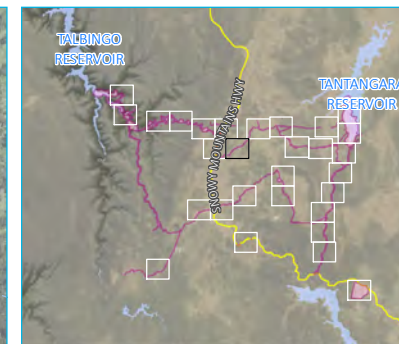
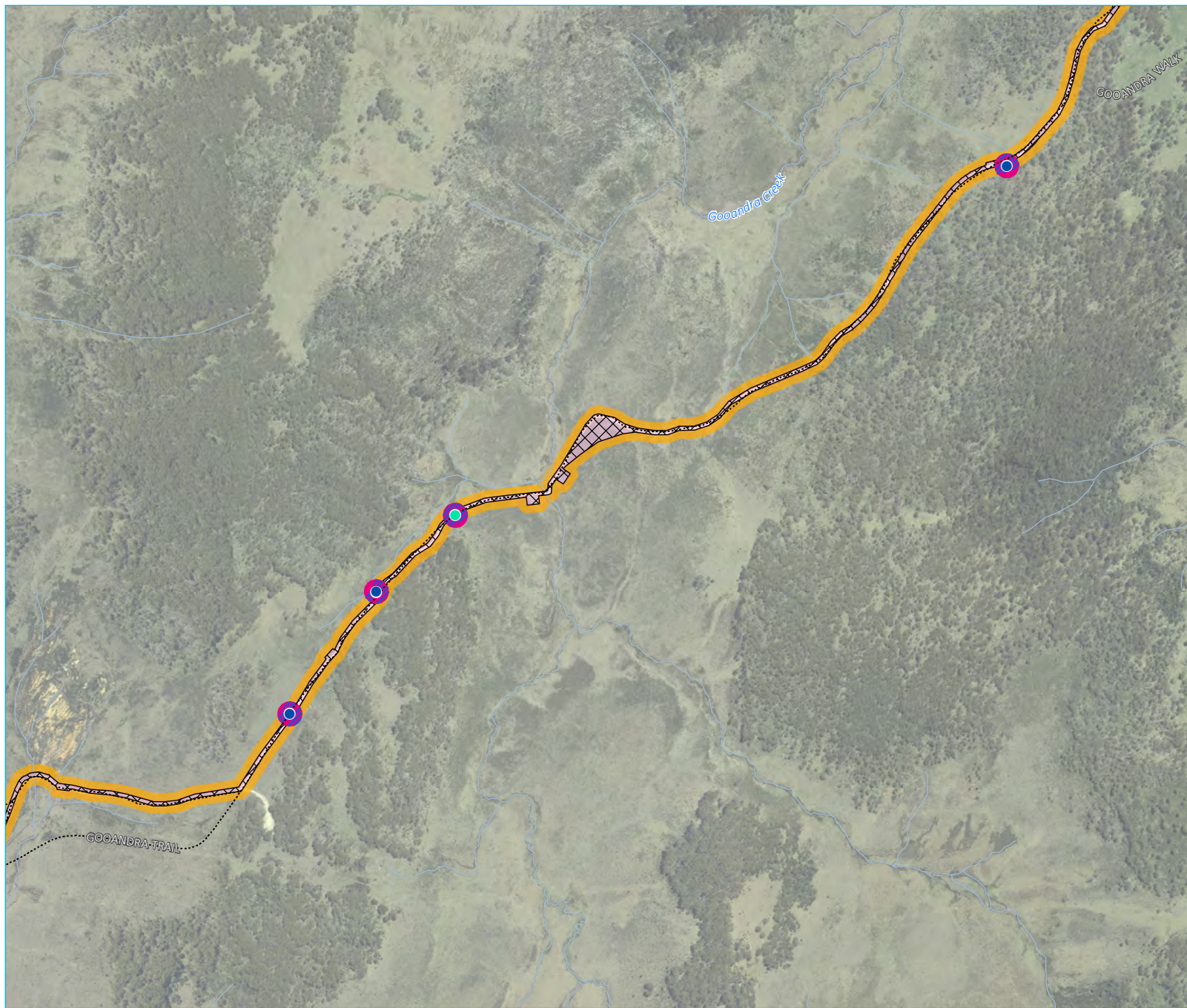


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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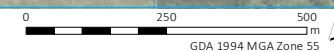


- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
    - Kiandra Leek Orchid
    - Mauve Burr-daisy

## Flora survey results

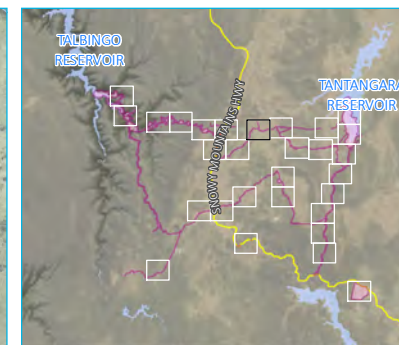
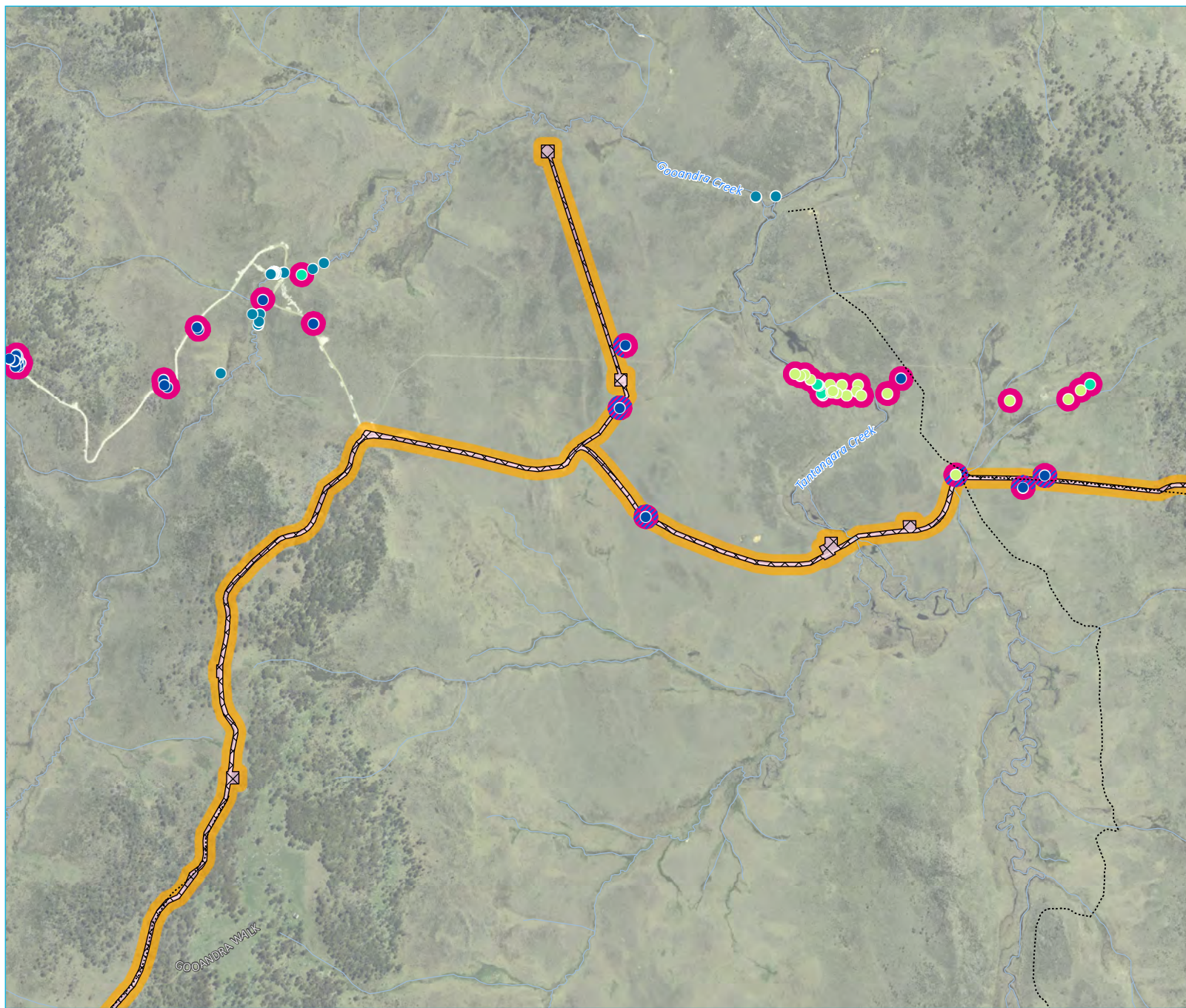
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.9

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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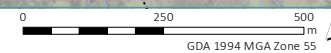
- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
    - Kiandra Leek Orchid
    - Leafy Anchor Plant
    - Mauve Burr-daisy
    - Raleigh Sedge

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.10

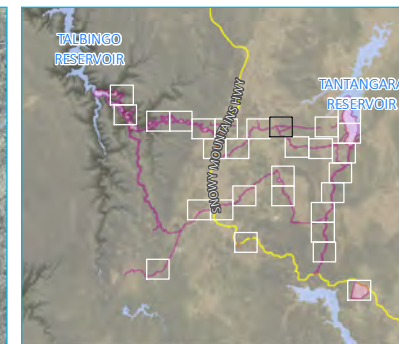
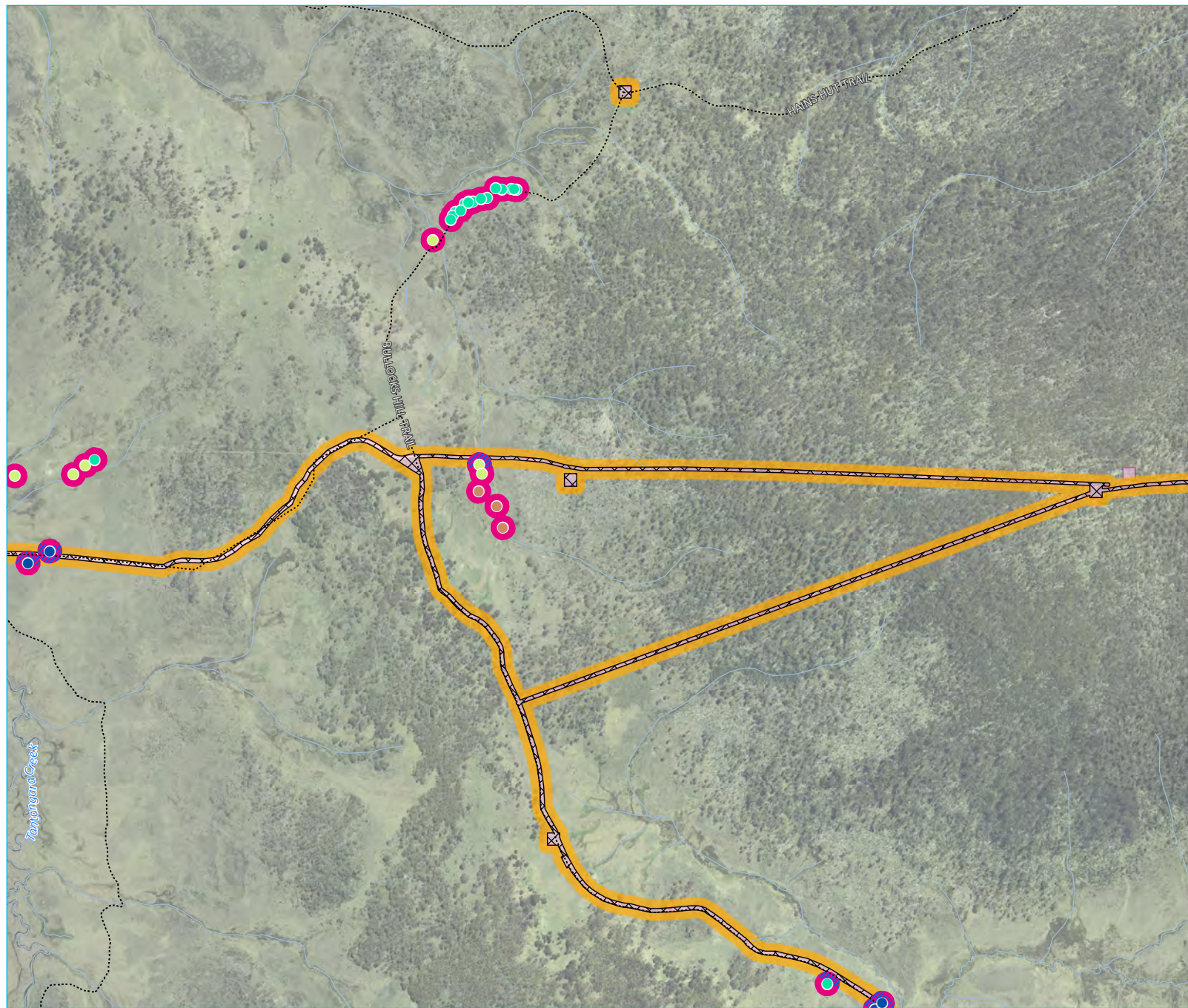


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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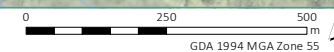


- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
    - Kiandra Leek Orchid
    - Mauve Burr-daisy
    - Raleigh Sedge
    - *Prasophyllum innubum*

## Flora survey results

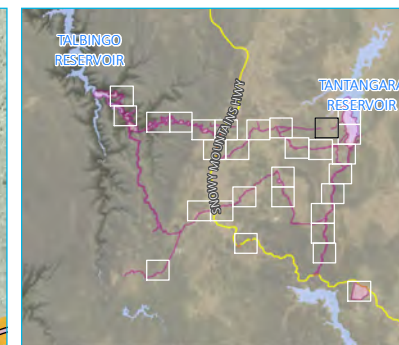
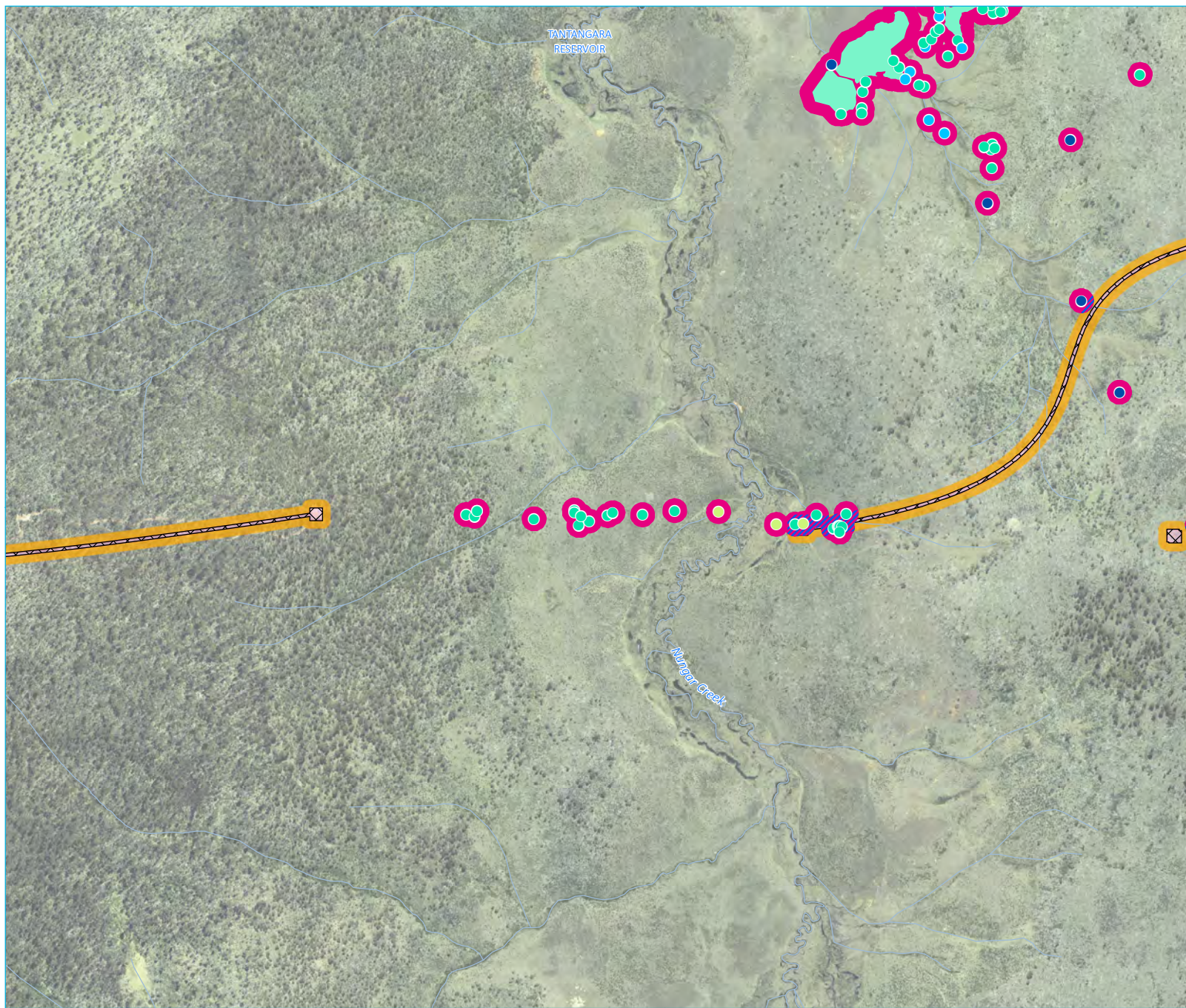
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.11

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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- KEY**
- Watercourse / drainage line
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (polygon)
  - Threatened flora (point)
  - Maive Burr-daisy
  - Kiandra Leek Orchid
  - Max Mueller's Burr-daisy
  - Maive Burr-daisy
  - Raleigh Sedge

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.12

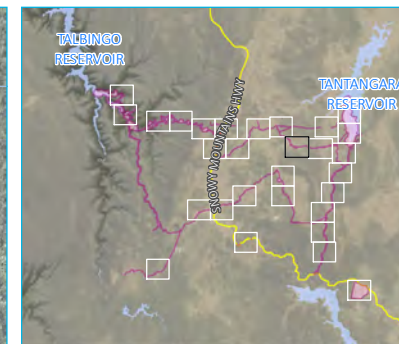


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

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GDA 1994 MGA Zone 55



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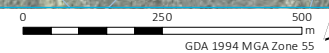
- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ▨ Disturbance area
  - ▨ Indirect disturbance area
  - ▨ Construction envelope
  - ▨ Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
  - Kiandra Leek Orchid
  - Mauve Burr-daisy

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.13

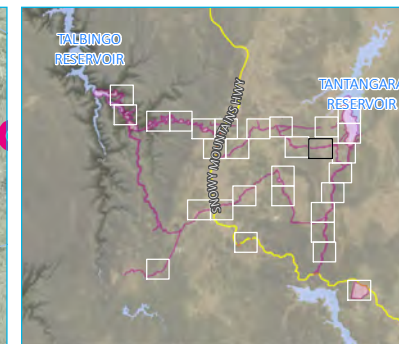


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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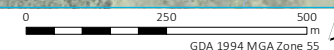


- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (polygon)
  - Mauve Burr-daisy
  - Threatened flora (point)
  - Kiandra Leek Orchid
  - Mauve Burr-daisy
  - Monaro Golden Daisy

## Flora survey results

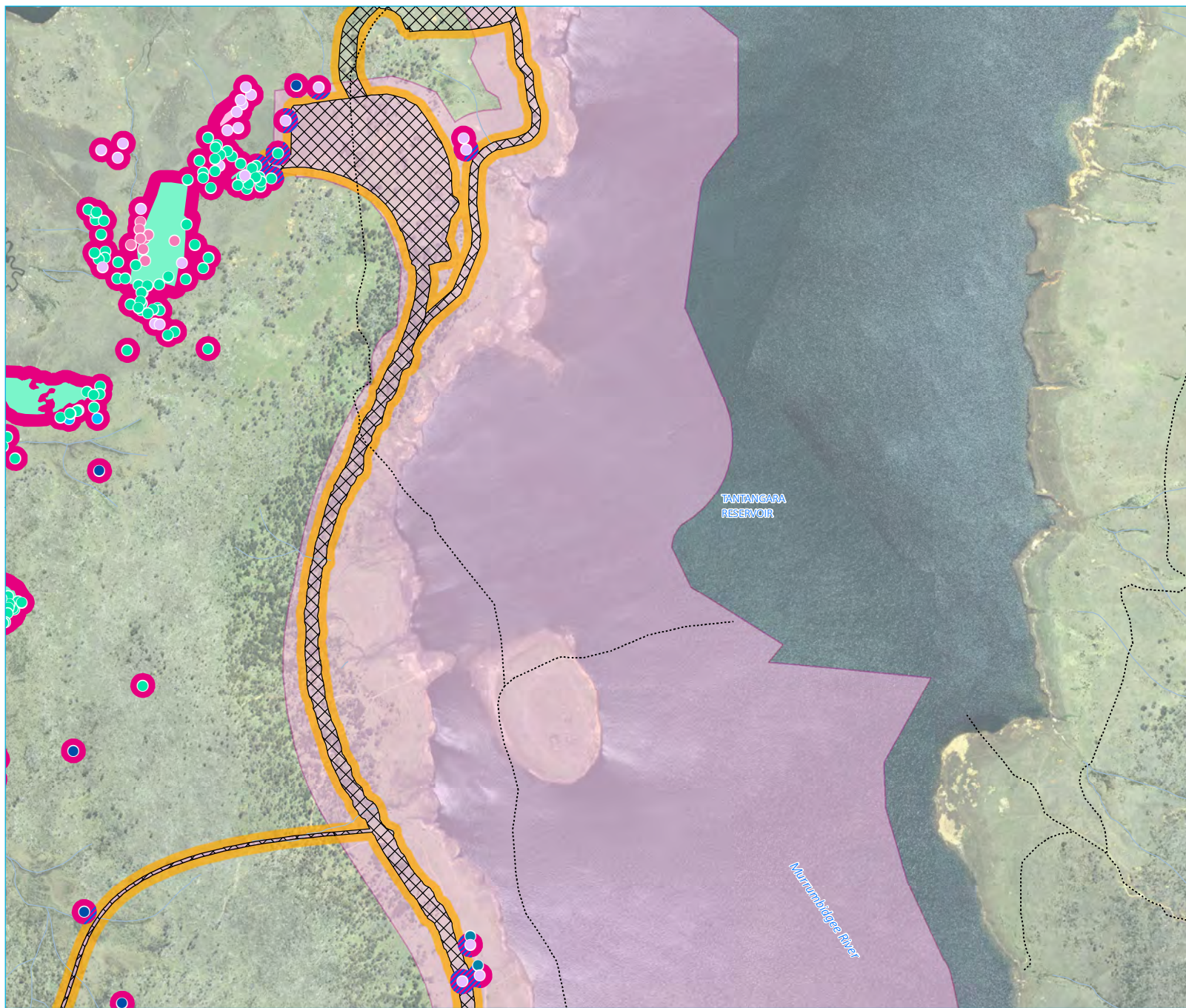
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.14

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

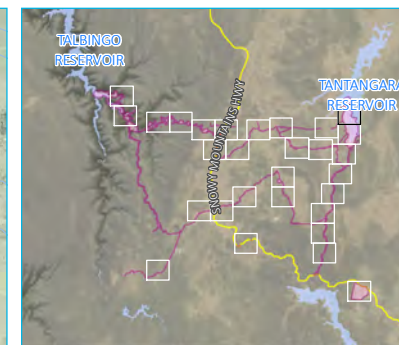




\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02\_Maps\EIS\_MM\RS\BDAR\BDAR007\_FloraSurveyResults\_20200206\_DDP\_07.mxd 20/02/2020



Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (polygon)
  - Clover Glycine
  - Mauve Burr-daisy
  - Threatened flora (point)
  - Clover Glycine
  - Kiandra Leek Orchid
  - Leafy Anchor Plant
  - Max Mueller's Burr-daisy
  - Mauve Burr-daisy
  - Monaro Golden Daisy

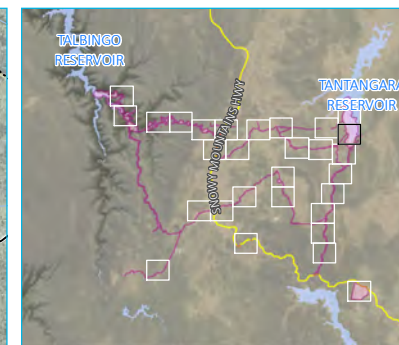
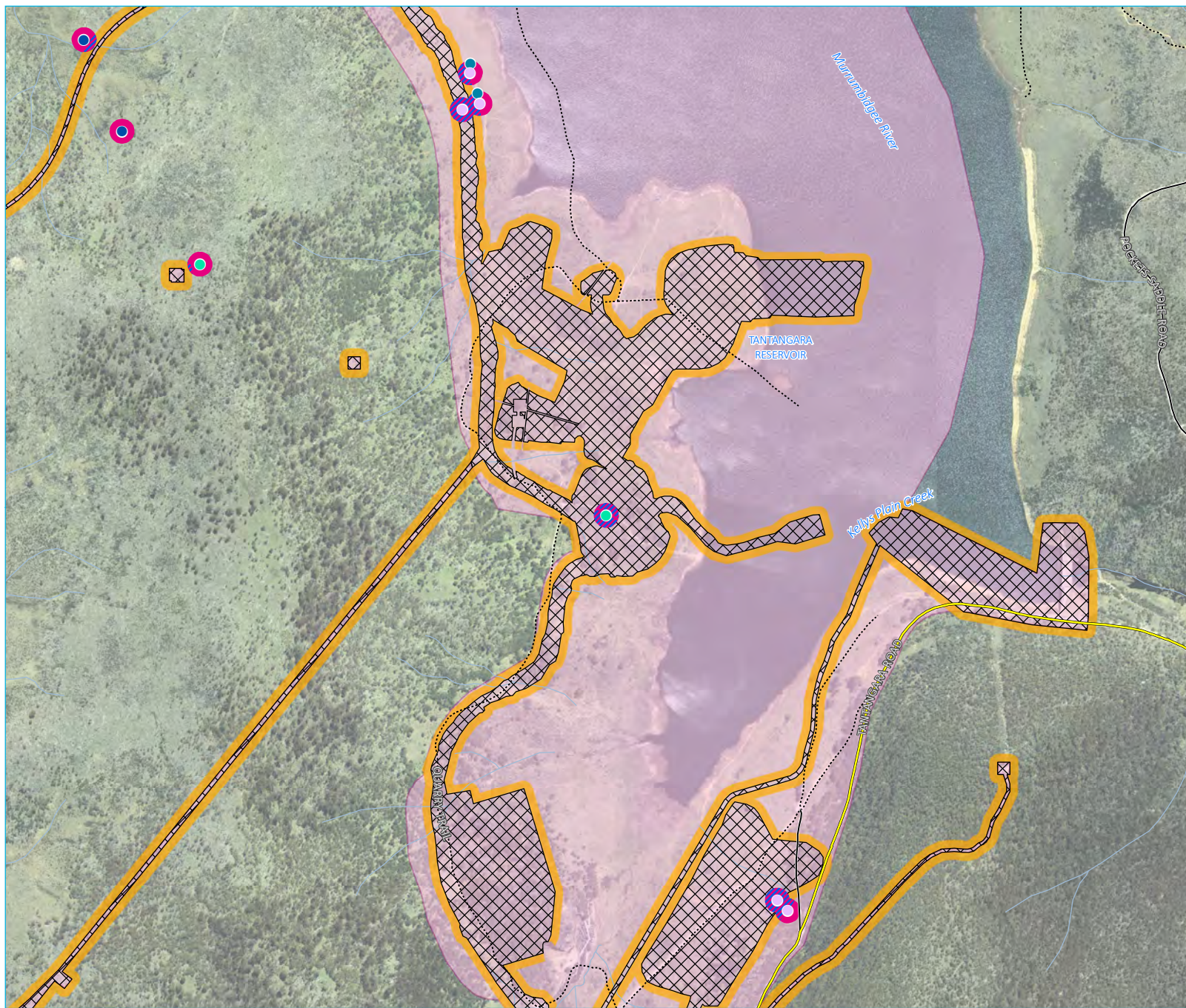
## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.15





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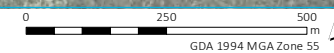
- KEY**
- Watercourse / drainage line
  - Main road
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
  - Clover Glycine
  - Kiandra Leek Orchid
  - Leafy Anchor Plant
  - Mauve Burr-daisy

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.16

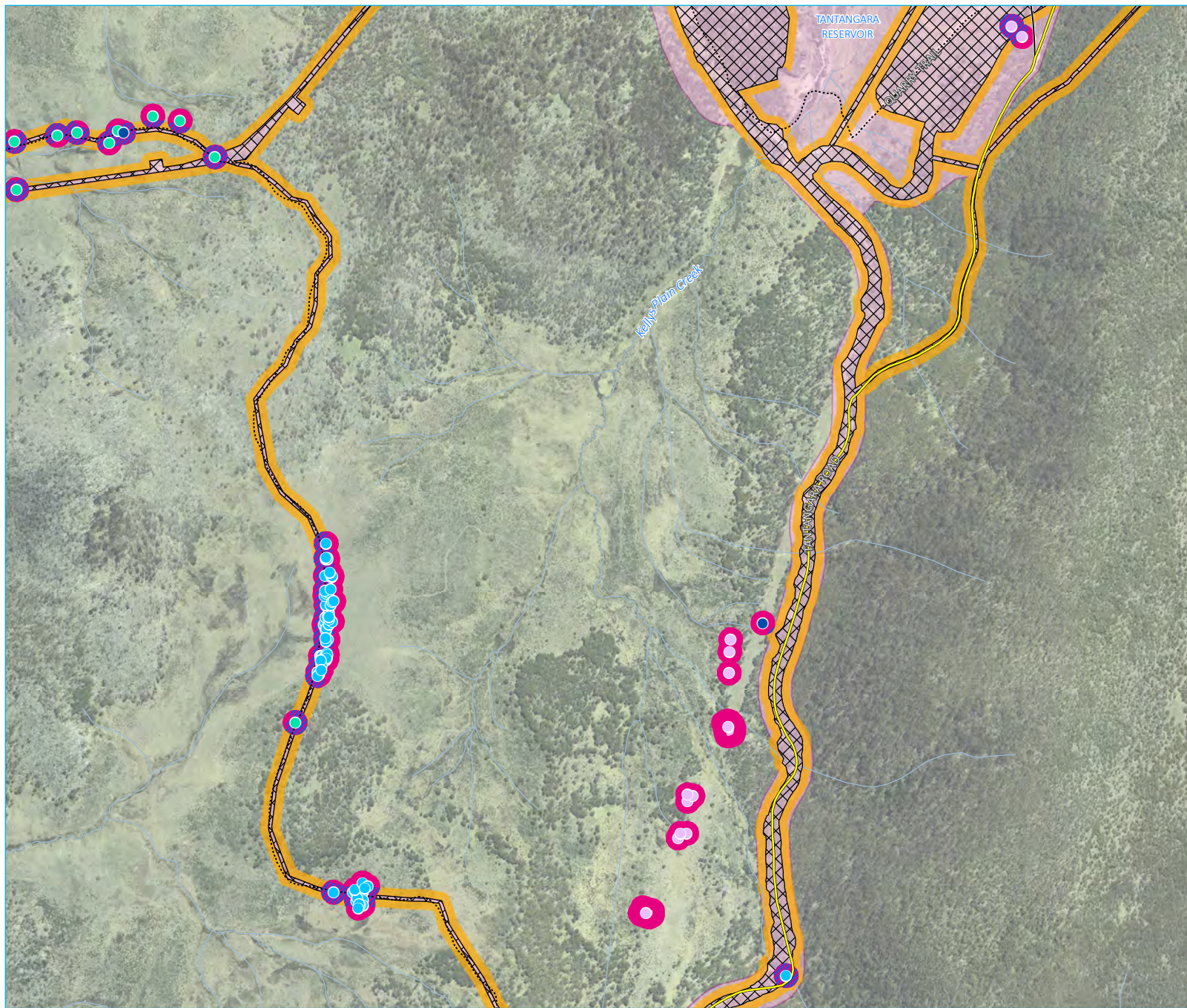


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

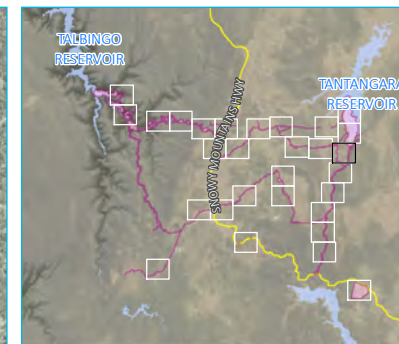




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



- KEY**
- Watercourse / drainage line
  - Main road
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (polygon)
  - Clover Glycine
  - Threatened flora (point)
  - Clover Glycine
  - Kiandra Leek Orchid
  - Max Mueller's Burr-daisy
  - Mauve Burr-daisy

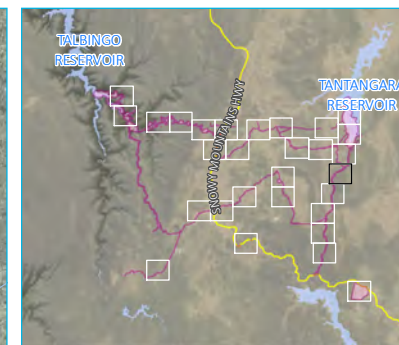
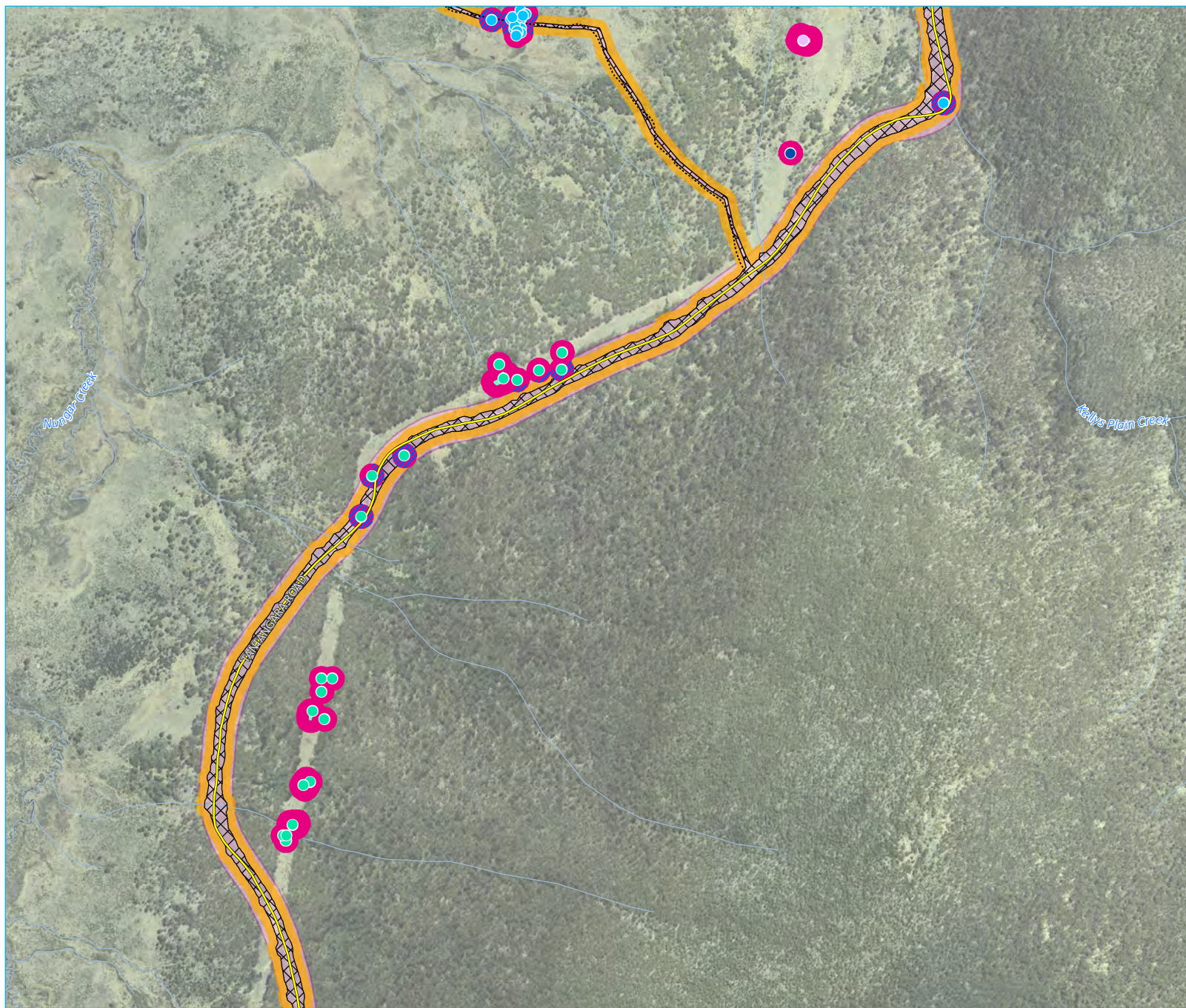
## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.17





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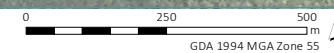
- KEY**
- Watercourse / drainage line
  - Main road
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (polygon)
  - Clover Glycine
    - Mauve Burr-daisy
  - Threatened flora (point)
  - Clover Glycine
    - Kiandra Leek Orchid
    - Max Mueller's Burr-daisy
    - Mauve Burr-daisy

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.18

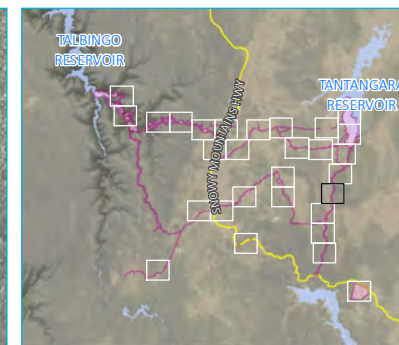


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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#### KEY

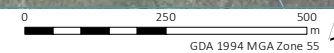
- Watercourse / drainage line
- Main road
- ..... Vehicular track
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope
- Threatened species habitat
- Threatened flora (polygon)
- Threatened flora (point)
- Mauve Burr-daisy
- *Pterostylis alpina*

#### Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.19

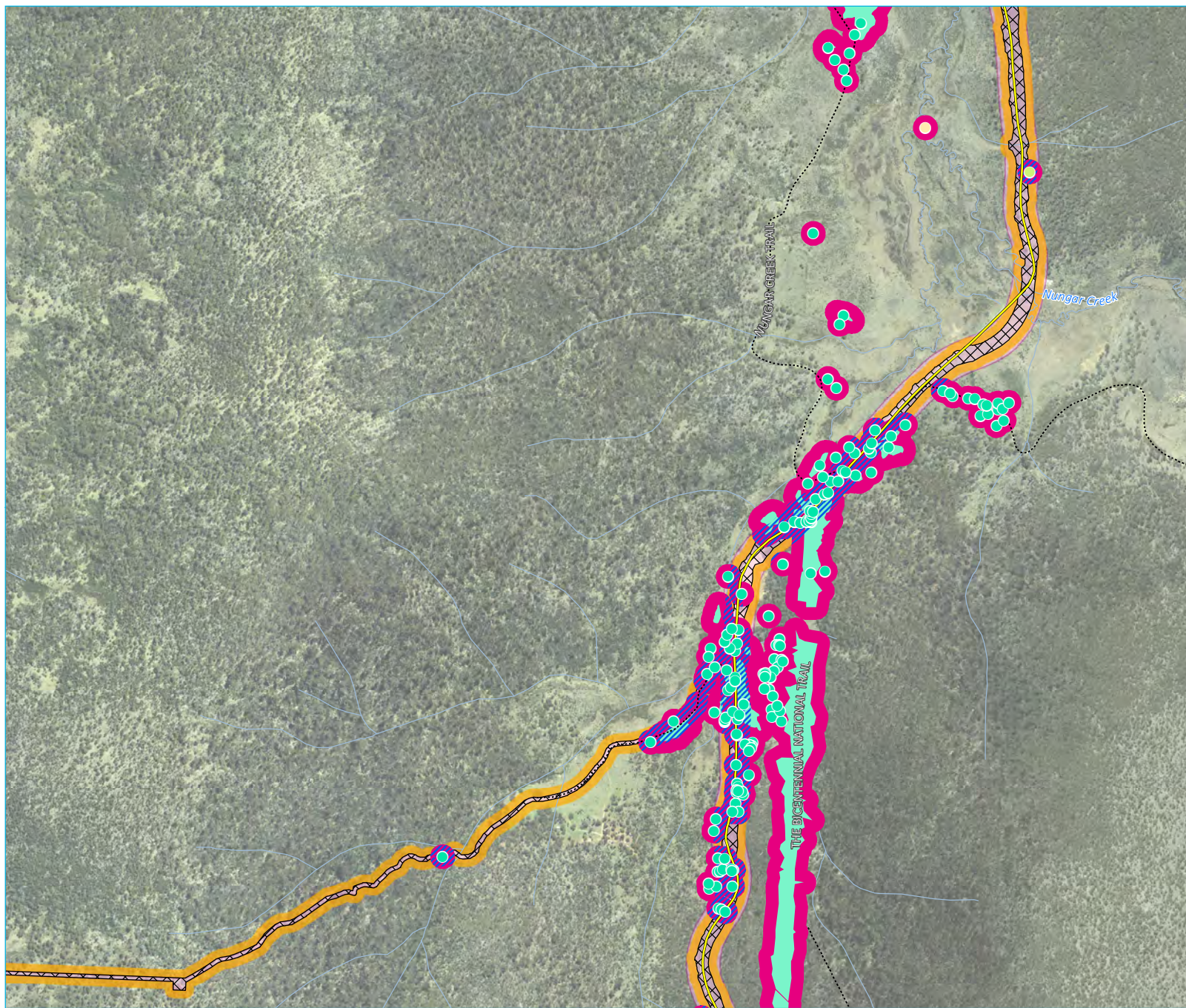


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

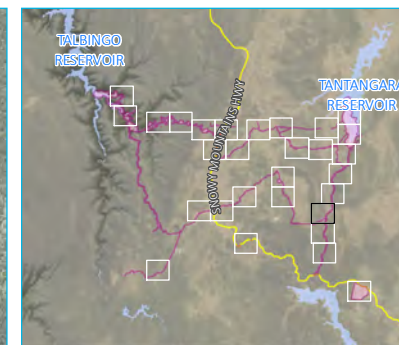




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



- KEY**
- Watercourse / drainage line
  - Main road
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (polygon)
  - Threatened flora (point)
  - Mauve Burr-daisy
  - Raleigh Sedge
  - Pterostylis alpina*

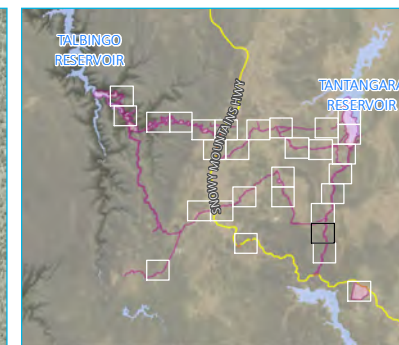
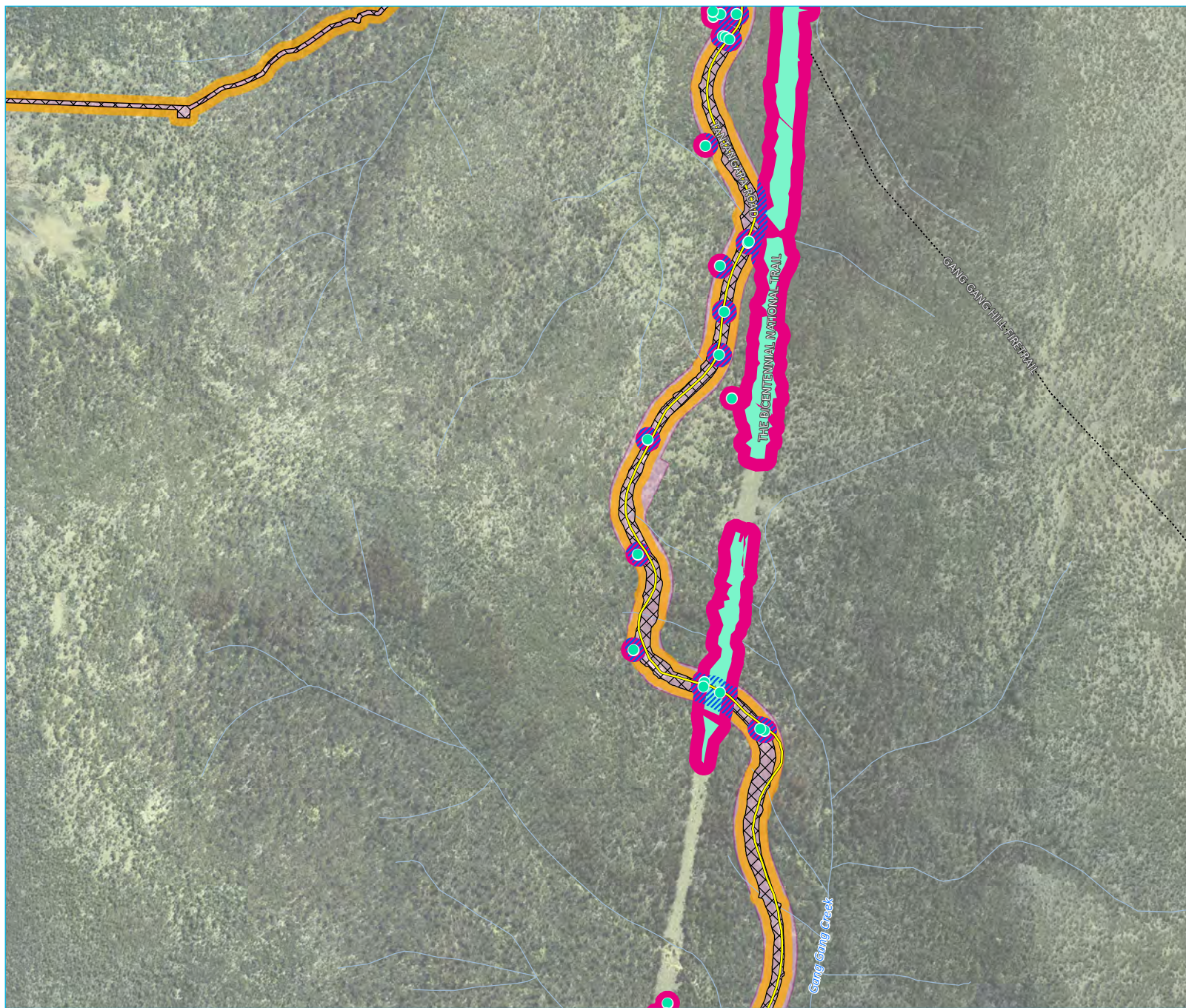
## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.20





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- KEY**
- Watercourse / drainage line
  - Main road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (polygon)
  - Mauve Burr-daisy
  - Threatened flora (point)
  - Mauve Burr-daisy

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.21

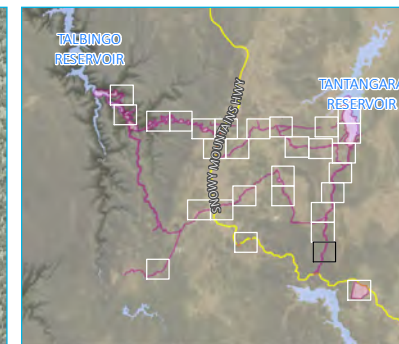


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

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GDA 1994 MGA Zone 55



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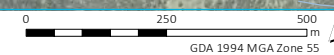
- KEY**
- Watercourse / drainage line
  - Main road
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (polygon)
  - Threatened flora (point)
  - Mauve Burr-daisy
  - *Thelymitra alpicola*

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.22

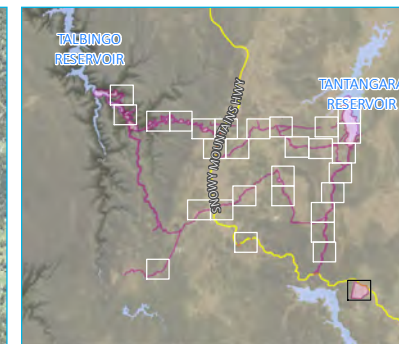
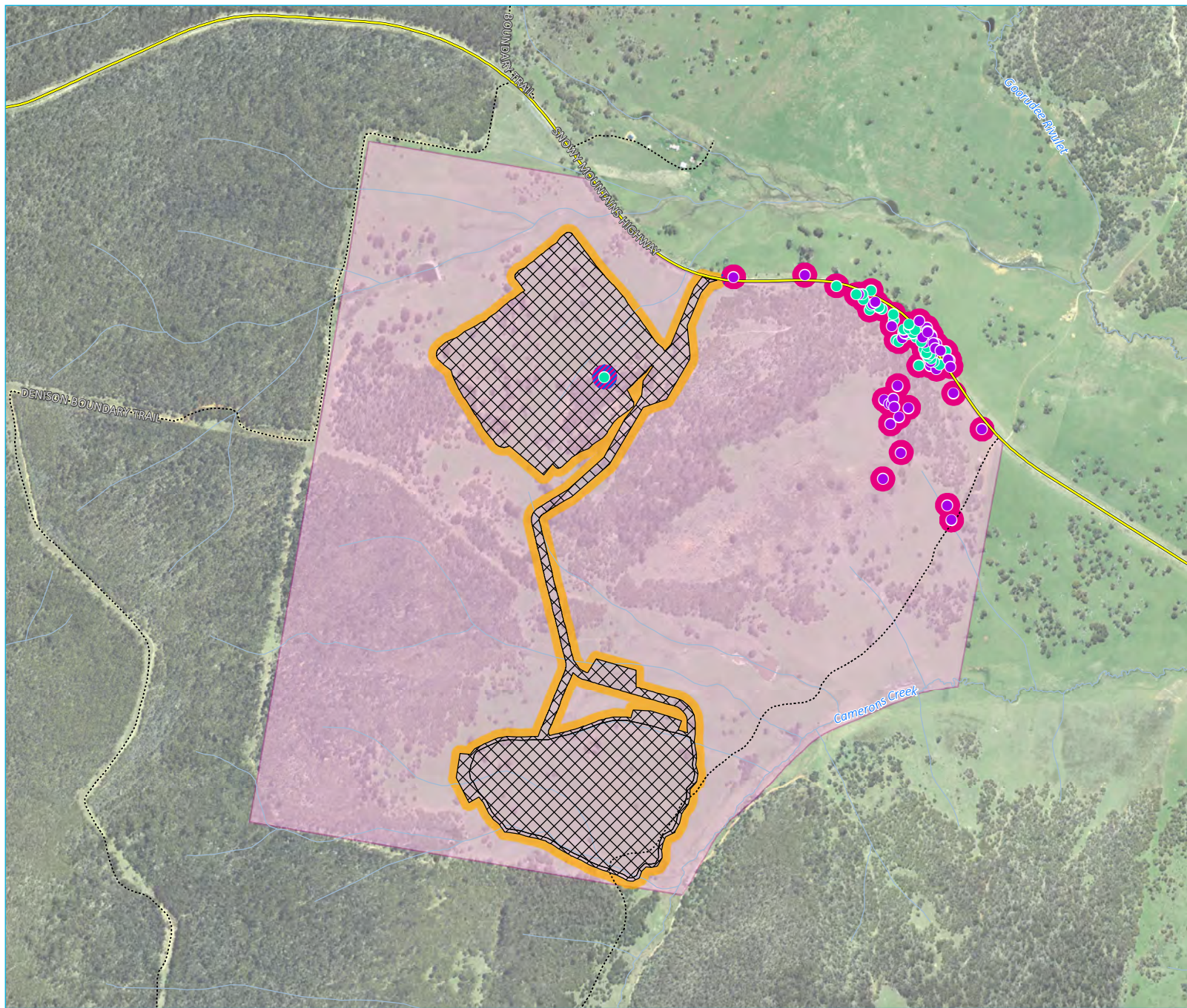


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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- KEY**
- Watercourse / drainage line
  - Main road
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
  - Hoary Sunray
  - Mauve Burr-daisy

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.23

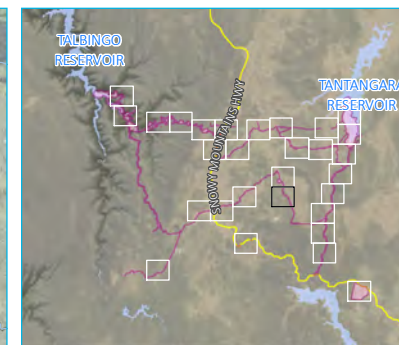
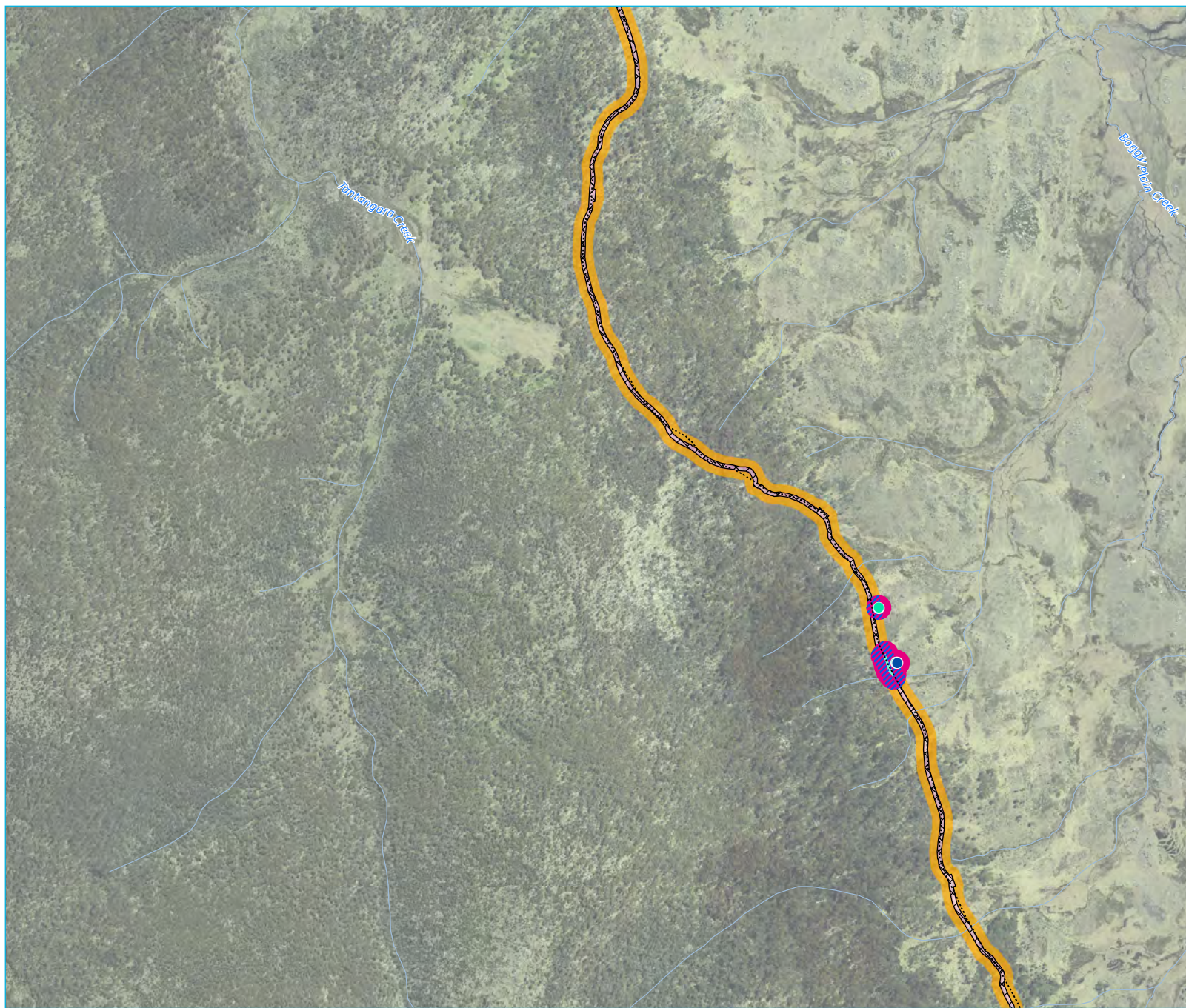


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

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GDA 1994 MGA Zone 55



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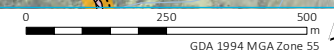


- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (polygon)
  - Mauve Burr-daisy
  - Threatened flora (point)
  - Kiandra Leek Orchid
  - Mauve Burr-daisy

## Flora survey results

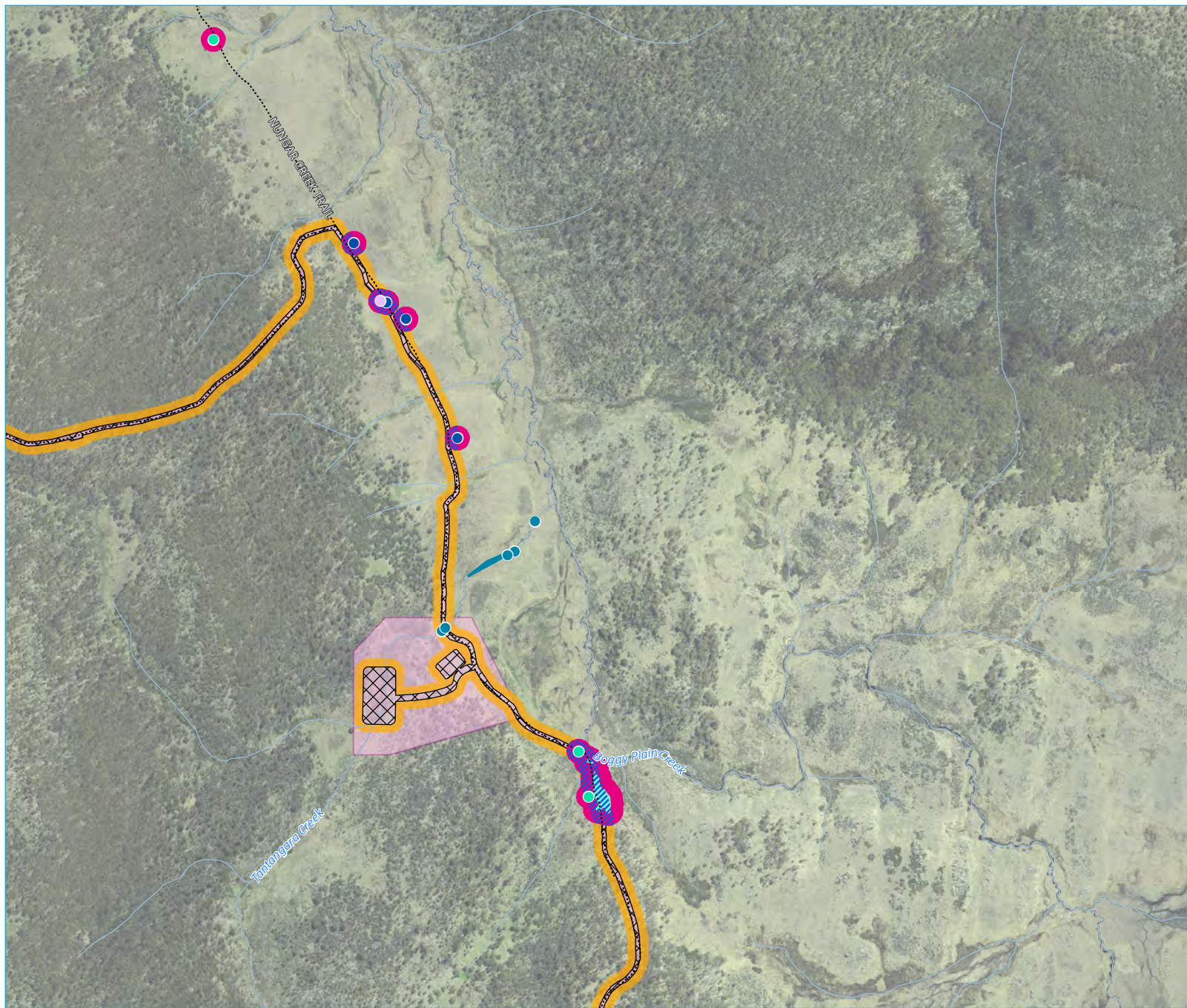
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.24

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

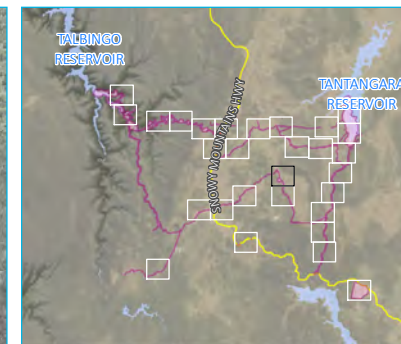




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (polygon)
  - Leafy Anchor Plant
  - Mauve Burr-daisy
  - Threatened flora (point)
  - Clover Glycine
  - Kiandra Leek Orchid
  - Leafy Anchor Plant
  - Mauve Burr-daisy

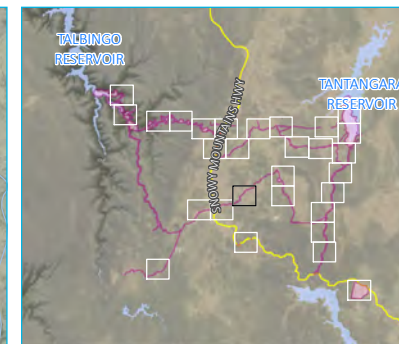
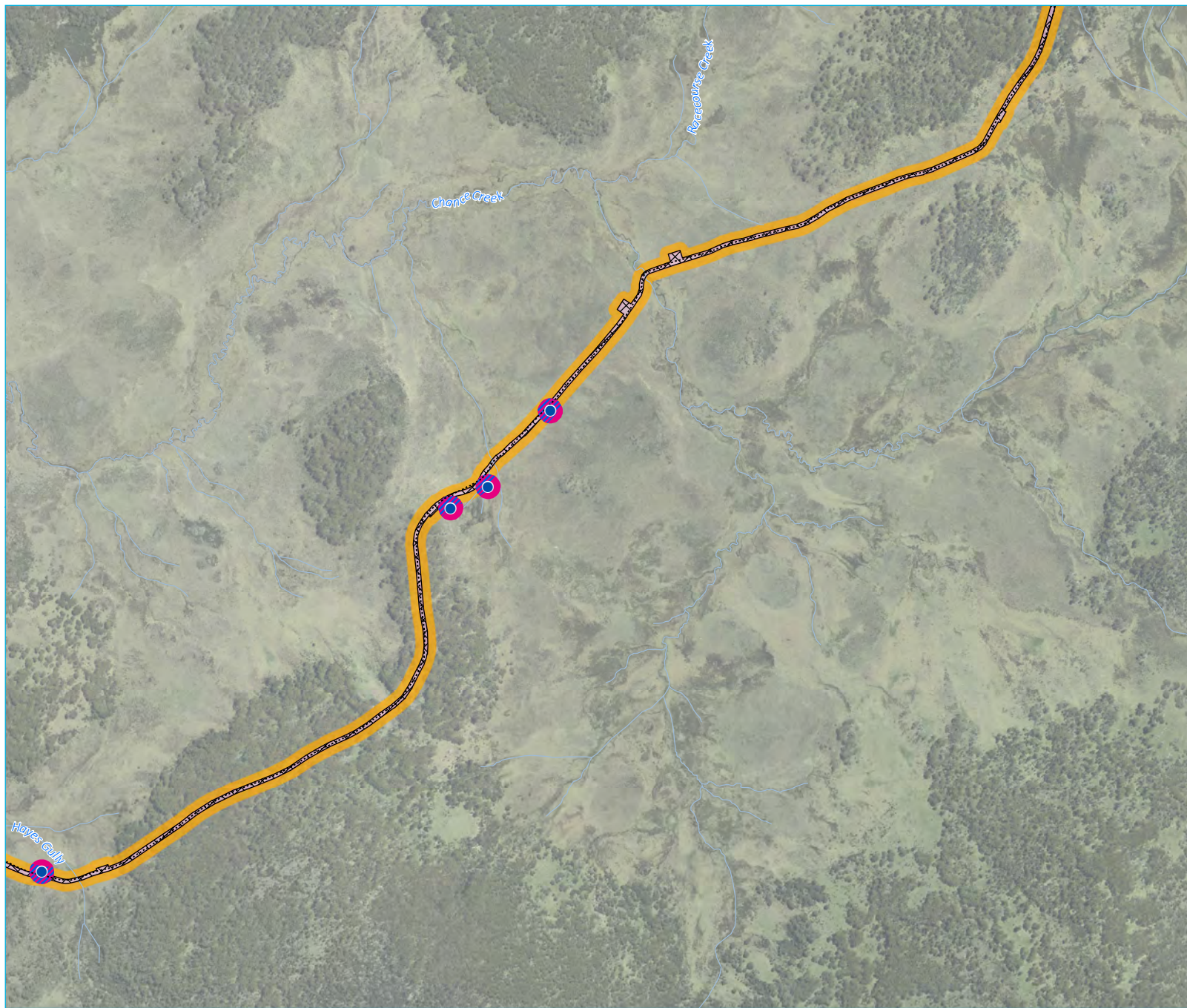
## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.25





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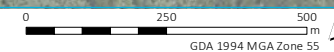


- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
  - Kiandra Leek Orchid

## Flora survey results

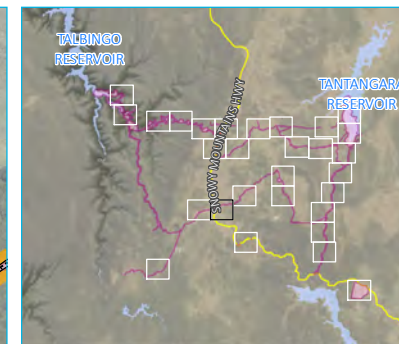
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.26

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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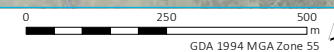


- KEY**
- Watercourse / drainage line
  - Main road
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
    - Kiandra Leek Orchid
    - Leafy Anchor Plant

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.27

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

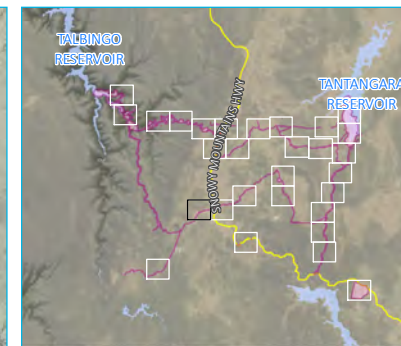
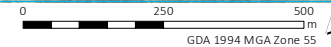




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



- KEY**
- Watercourse / drainage line
  - Main road
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora (point)
  - Leafy Anchor Plant

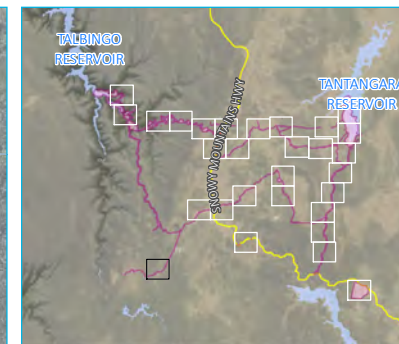
## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.28





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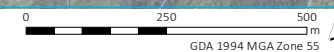


- KEY**
- Watercourse / drainage line
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened flora species polygon
  - Threatened species habitat
  - Threatened flora (point)
  - *Thelymitra alpicola*

## Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.29

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

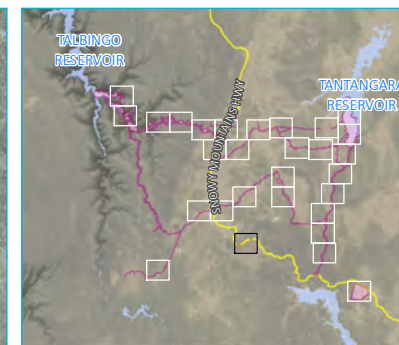




\\lemmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02\_Maps\EIS\_MM\RHS\BDAR\BDAR007\_FloraSurveyResults\_20200206\_DDP\_07.mxd 20/02/2020



Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



#### KEY

- Watercourse / drainage line
- Main road
- ..... Vehicular track
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope
- Threatened species habitat
- Threatened flora (point)
  - Max Mueller's Burr-daisy
  - Mauve Burr-daisy

#### Flora survey results

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.4.30



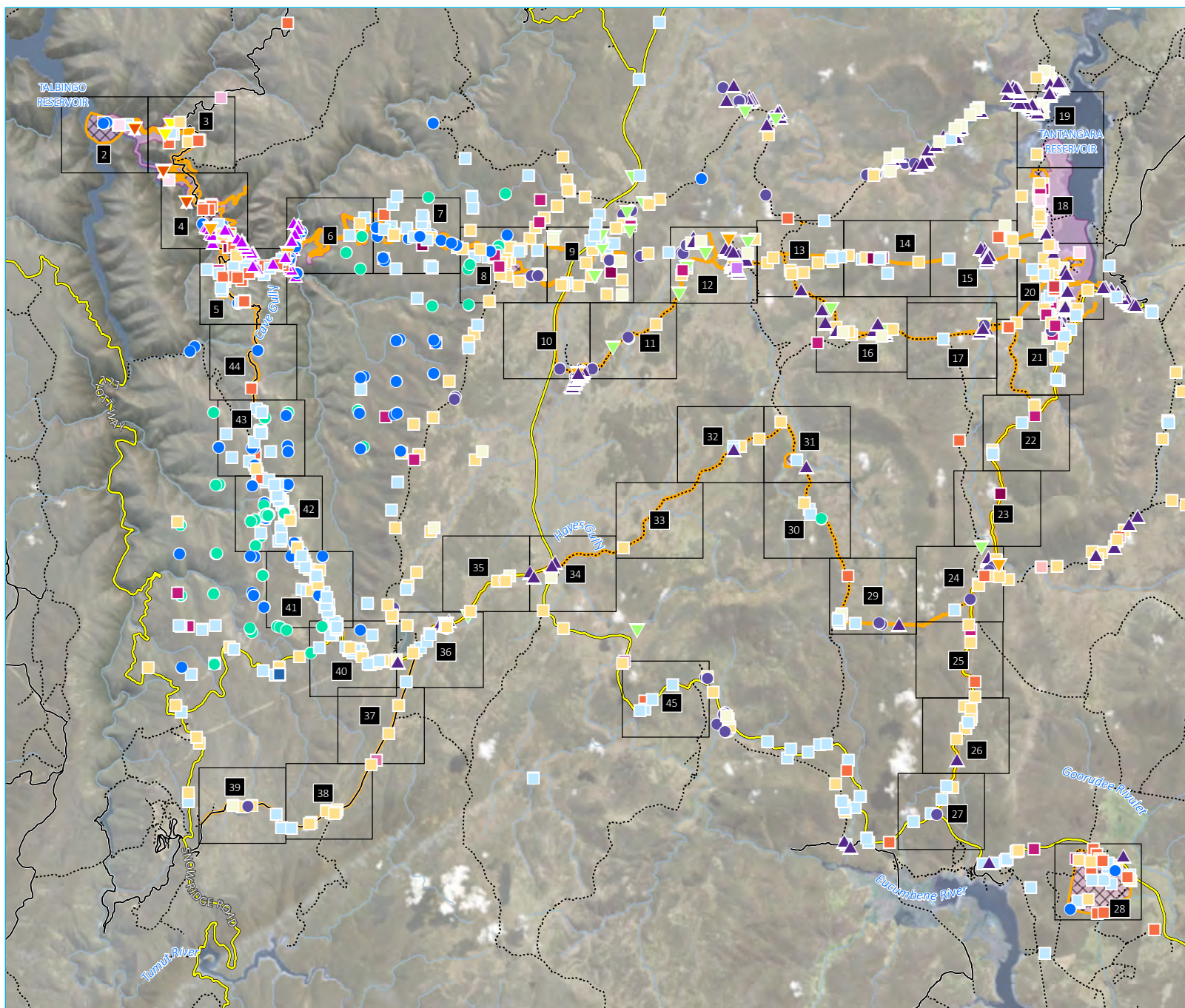




## Appendix A3      Threatened Fauna mapping



\\lemmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02\_Maps\EIS\_MM\RS\BDR\BDR008\_FaunaSurveyResults\_20200206\_OVERVIEW\_01.mxd 21/02/2020



## KEY

- Watercourse / drainage line
- Main road
- Local road
- Vehicular track
- Page index
- Disturbance area
- Indirect disturbance area
- Construction envelope

## Threatened fauna

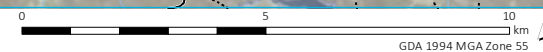
- Alpine She-oak Skink
- Murray Crayfish
- Alpine Tree Frog
- Booroolong Frog
- Broad-toothed Rat
- Eastern Pygmy-possum
- Smoky Mouse
- Spotted-tailed Quoll
- Eastern Bentwing-bat
- Eastern False Pipistrelle
- Southern Myotis
- Brown Treecreeper
- Diamond Firetail
- Dusky Woodswallow
- White-throated Needletail
- Flame Robin
- Turquoise Parrot
- Powerful Owl
- Masked Owl
- Latham's Snipe
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Olive Whistler
- Pink Robin
- Satin Flycatcher
- Scarlet Robin
- Square-tailed Kite
- Varied Sittella
- White-bellied Sea-Eagle
- Little Eagle
- White-fronted Chat

Threatened fauna overview  
- page index

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.1

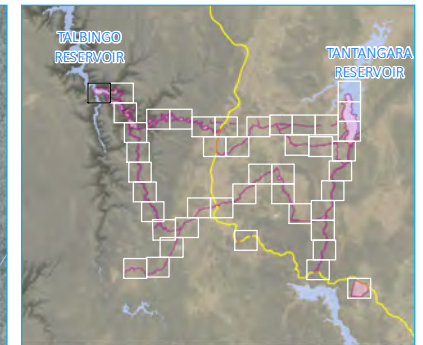
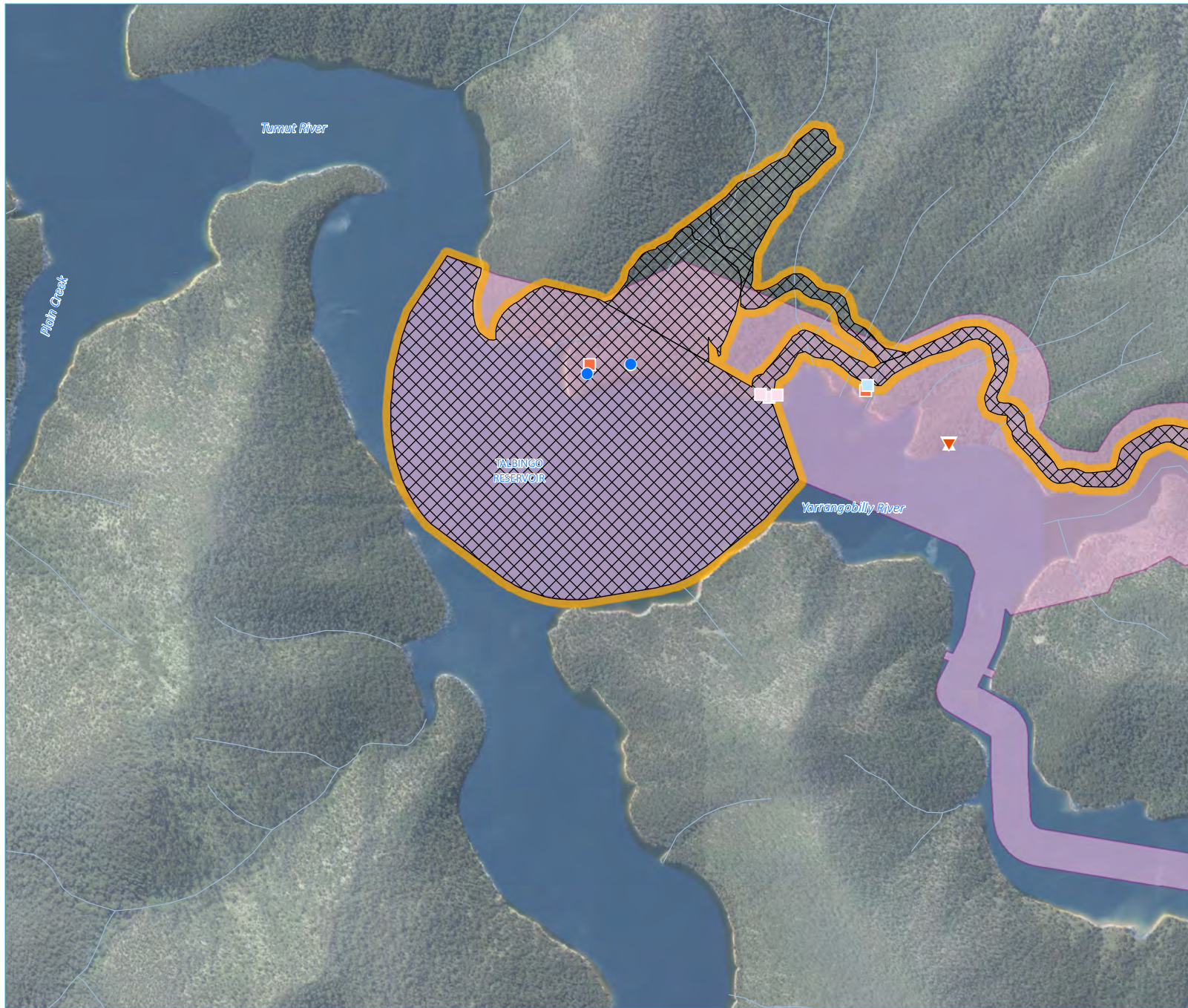


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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- KEY**
- Watercourse / drainage line
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Eastern Pygmy-possum
  - ▲ Eastern Bentwing-bat
  - ▲ Eastern False Pipistrelle
  - ▲ Southern Myotis
  - Dusky Woodswallow
  - Gang-gang Cockatoo
  - White-bellied Sea-Eagle

## Threatened fauna overview

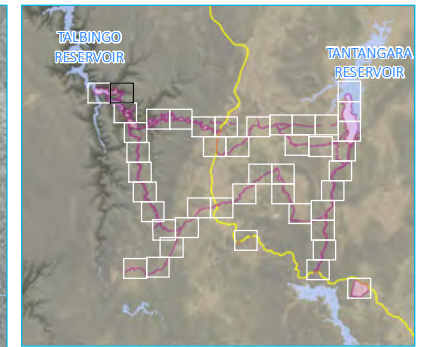
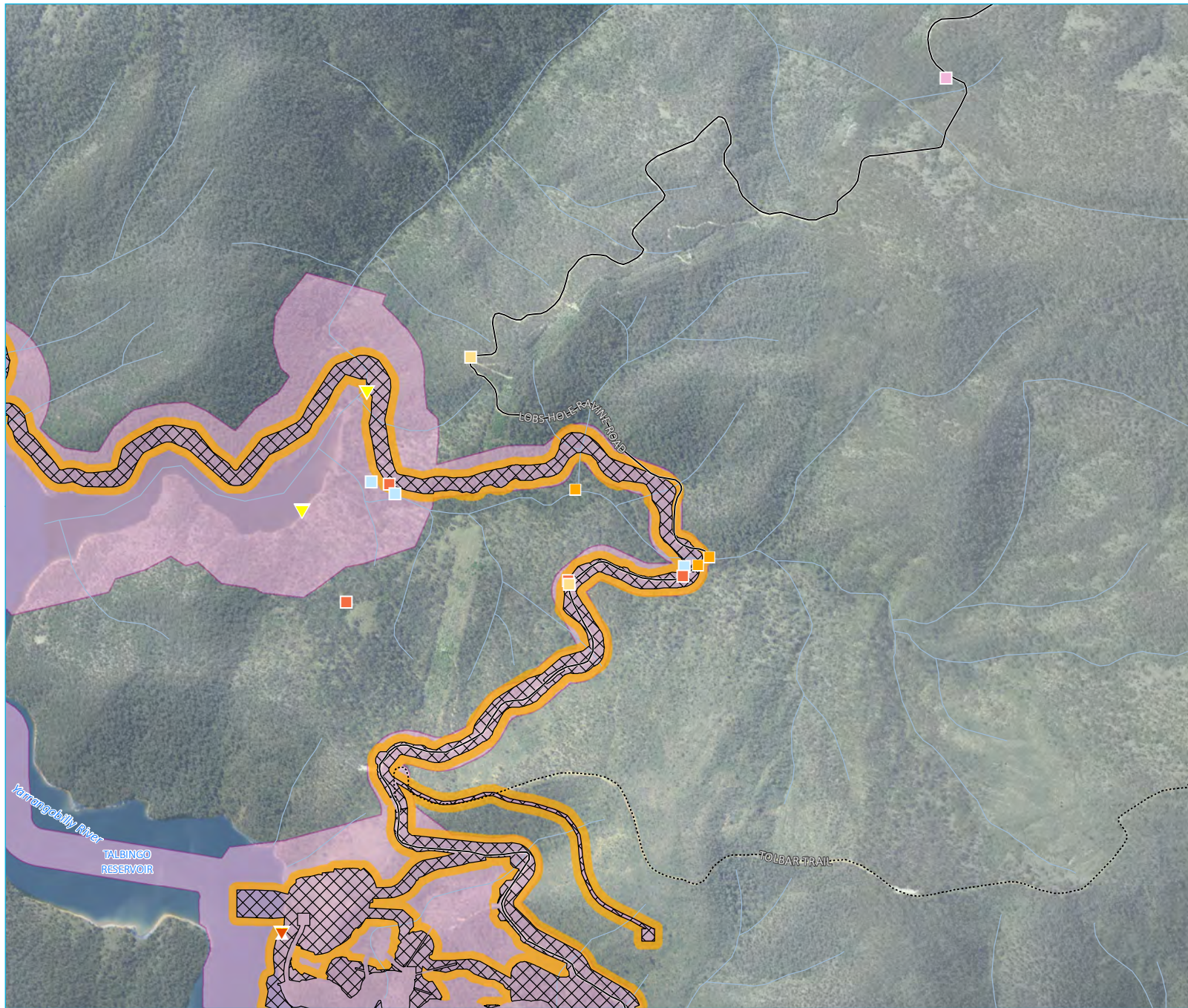
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.2



Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

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#### KEY

- Watercourse / drainage line
- Local road
- ..... Vehicular track
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope

#### Threatened fauna

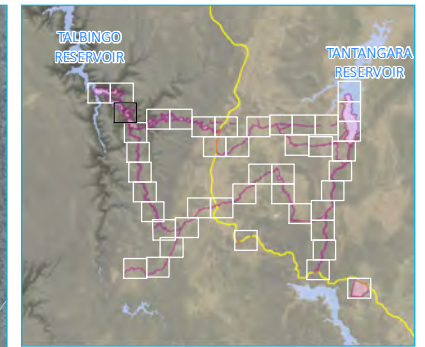
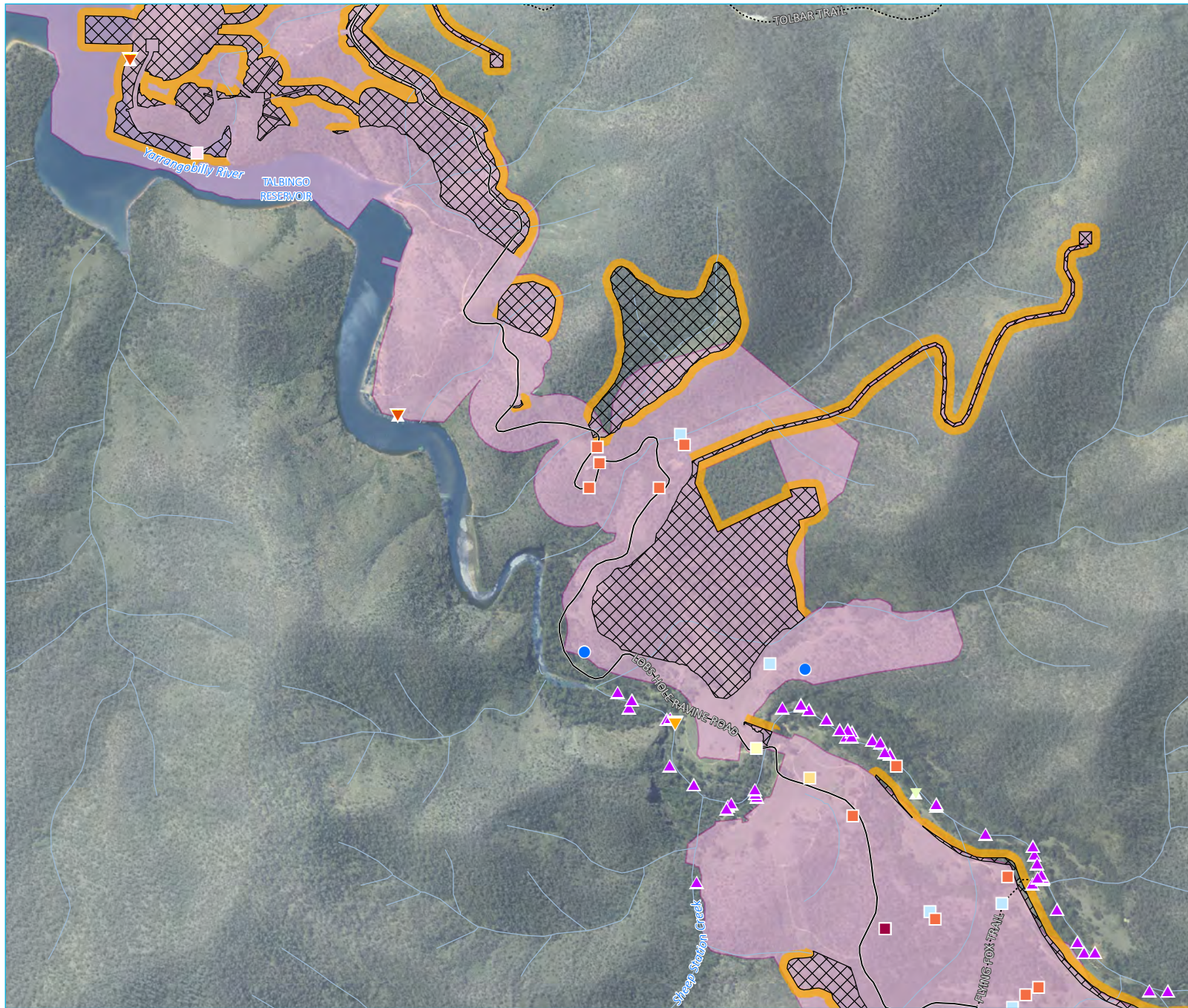
- ▼ Eastern Bentwing-bat
- ▼ Eastern False Pipistrelle
- ▼ Southern Myotis
- Dusky Woodswallow
- Flame Robin
- Turquoise Parrot
- Gang-gang Cockatoo
- Varied Sittella

#### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.3







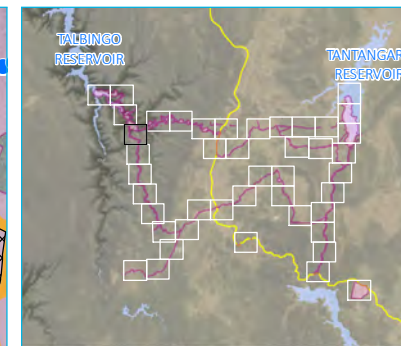
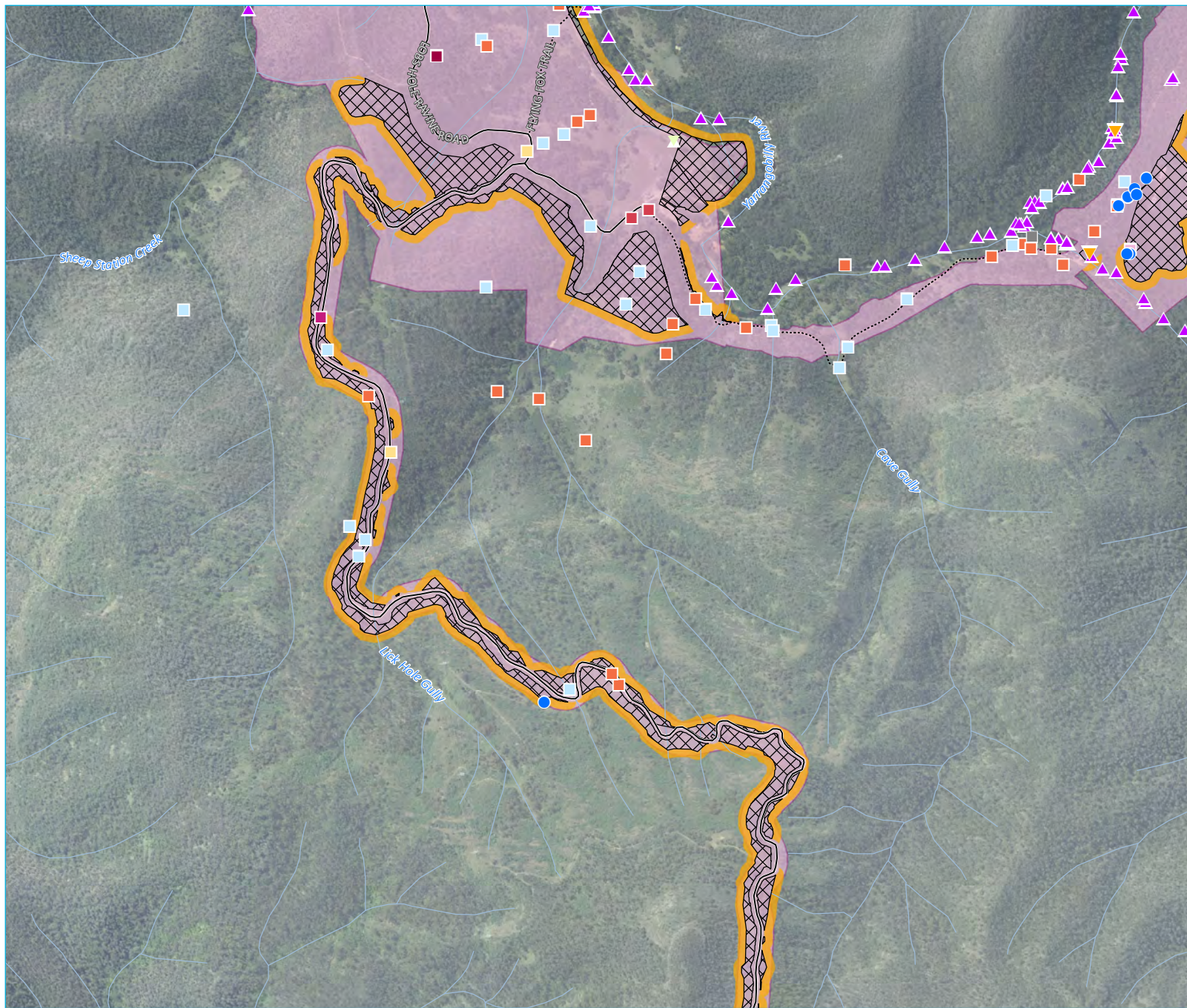
- KEY**
- Watercourse / drainage line
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- ▲ Murray Crayfish
  - ▲ Booroolong Frog
  - Eastern Pygmy-possum
  - ▲ Eastern Bentwing-bat
  - ▲ Eastern False Pipistrelle
  - ▲ Southern Myotis
  - Brown Treecreeper
  - Dusky Woodswallow
  - Flame Robin
  - Masked Owl
  - Gang-gang Cockatoo
  - White-bellied Sea-Eagle

### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.4







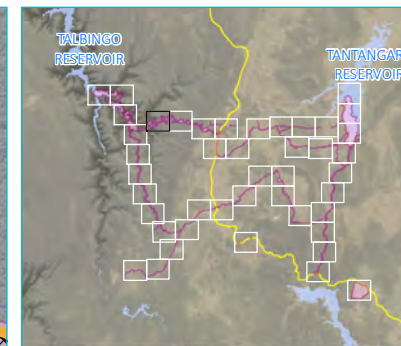
- KEY**
- Watercourse / drainage line
  - Local road
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- ▲ Murray Crayfish
  - ▲ Booroolong Frog
  - Eastern Pygmy-possum
  - ▲ Eastern Bentwing-bat
  - ▲ Eastern False Pipistrelle
  - Brown Treecreeper
  - Diamond Firetail
  - Dusky Woodswallow
  - Flame Robin
  - Powerful Owl
  - Gang-gang Cockatoo
  - Scarlet Robin
  - Varied Sittella

## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.5



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#### KEY

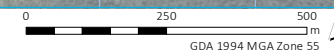
- Watercourse / drainage line
- ..... Vehicular track
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope
- Threatened fauna**
  - ▲ Murray Crayfish
  - ▲ Booroolong Frog
  - Eastern Pygmy-possum
  - Smoky Mouse
  - ▼ Eastern Bentwing-bat
  - ▼ Eastern False Pipistrelle
  - Dusky Woodswallow
  - Flame Robin
  - Powerful Owl
  - Gang-gang Cockatoo
  - Varied Sittella

#### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.6

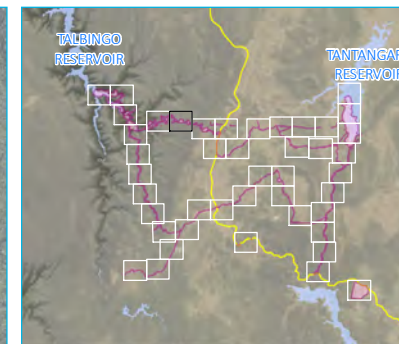
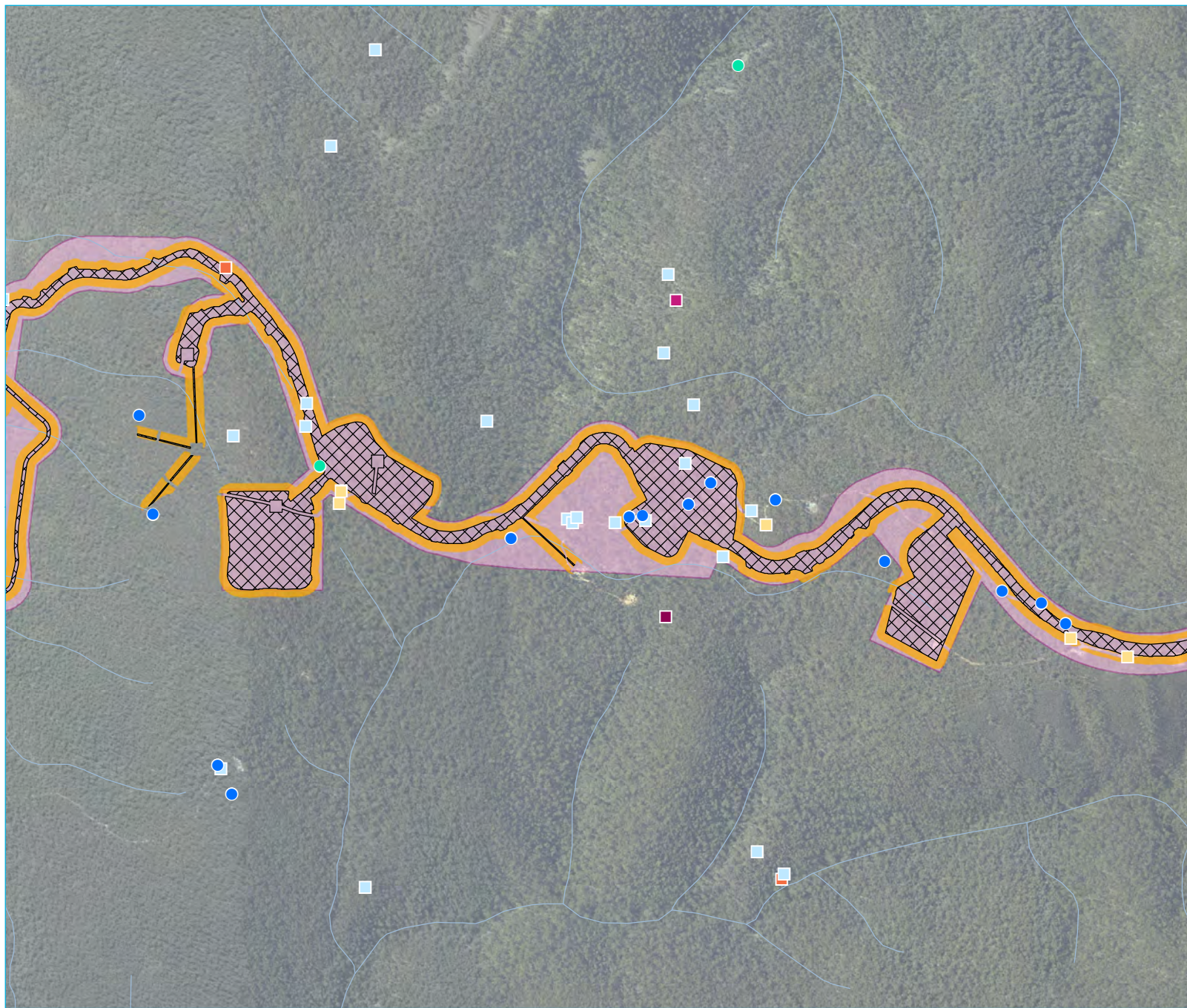


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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#### KEY

- Watercourse / drainage line
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope

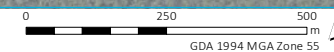
#### Threatened fauna

- Eastern Pygmy-possum
- Smoky Mouse
- Dusky Woodswallow
- Flame Robin
- Gang-gang Cockatoo
- Satin Flycatcher
- Scarlet Robin

#### Threatened fauna overview

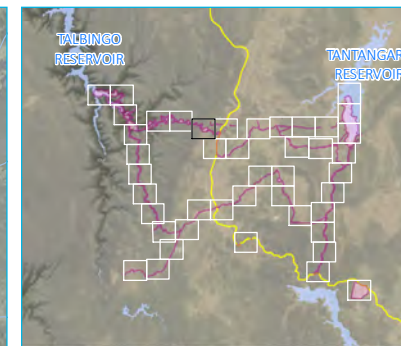
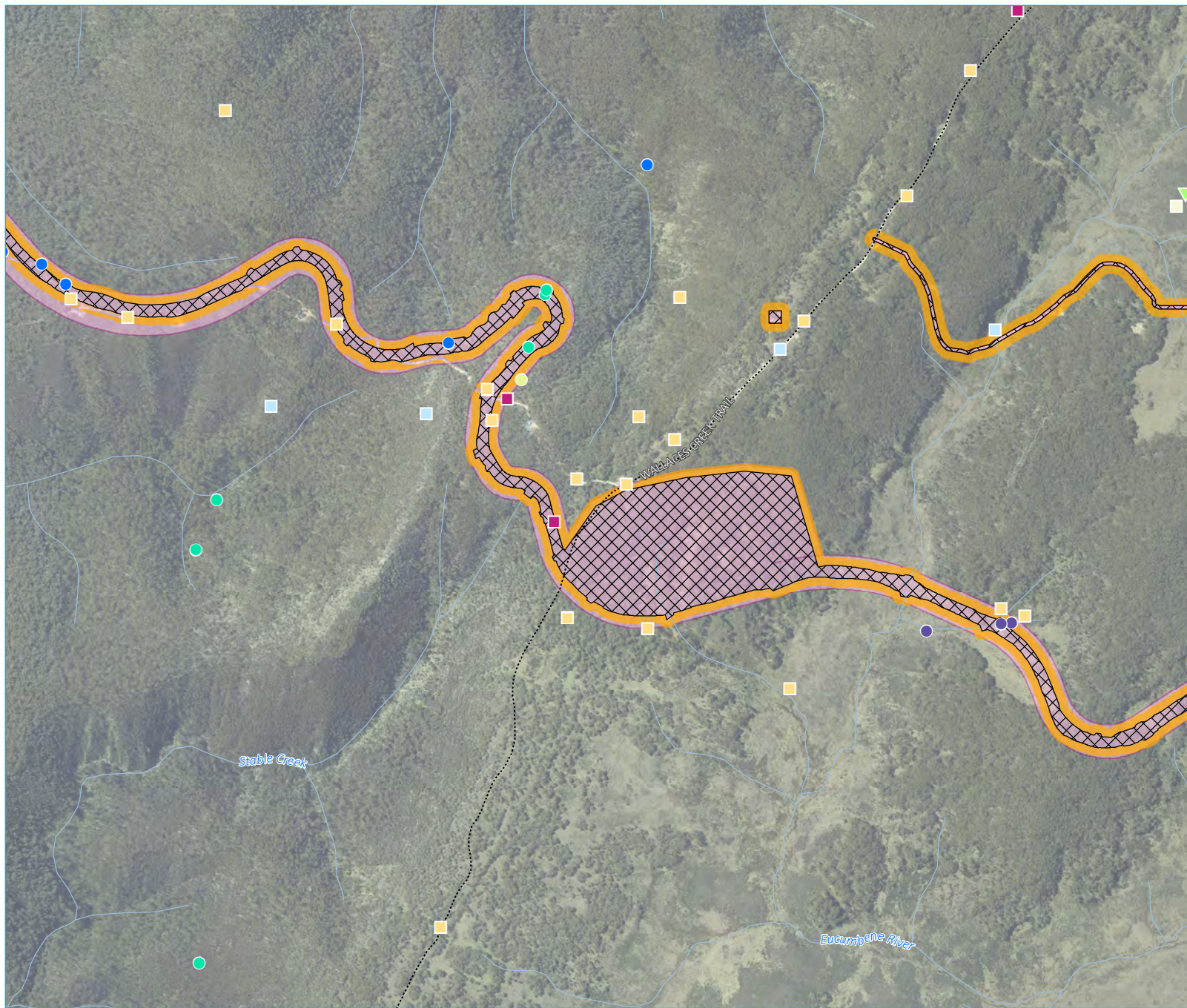
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.7

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- ▲ Alpine She-oak Skink
  - Broad-toothed Rat
  - Eastern Pygmy-possum
  - Smoky Mouse
  - Spotted-tailed Quoll
  - Flame Robin
  - Latham's Snipe
  - Gang-gang Cockatoo
  - Scarlet Robin

## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.8

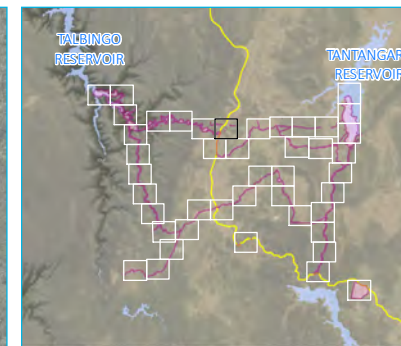
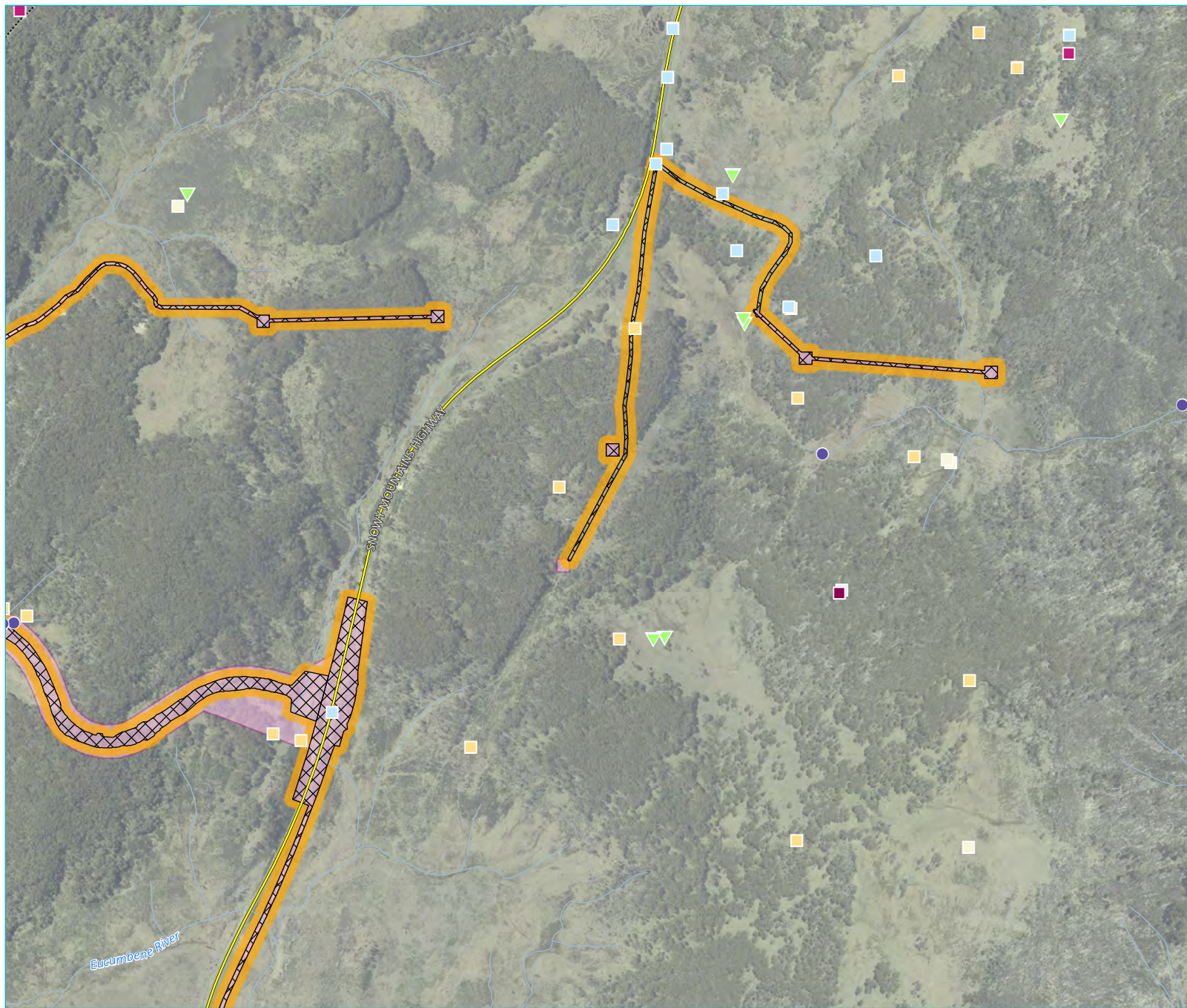


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

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GDA 1994 MGA Zone 55



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#### KEY

- Watercourse / drainage line
- Main road
- ..... Vehicular track
- ⊗ Disturbance area
- Indirect disturbance area
- Construction envelope

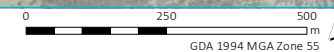
#### Threatened fauna

- Alpine She-oak Skink
- Broad-toothed Rat
- Flame Robin
- Latham's Snipe
- Gang-gang Cockatoo
- Satin Flycatcher
- Scarlet Robin

#### Threatened fauna overview

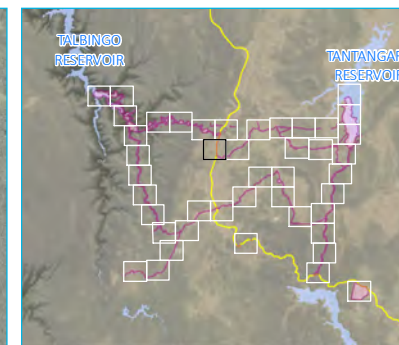
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.9

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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GDA 1994 MGA Zone 55



- Watercourse / drainage line
- Main road
- ..... Vehicular track
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope

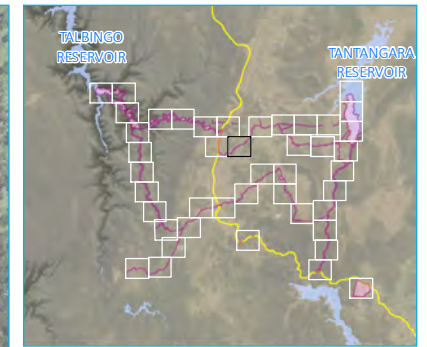
- Threatened fauna
- ▲ Alpine Tree Frog
  - Broad-toothed Rat
  - ▼ Eastern False Pipistrelle
  - Latham's Snipe

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.10





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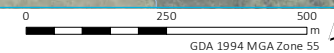


- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened fauna**
  - ▲ Alpine She-oak Skink
  - ▲ Alpine Tree Frog
  - Broad-toothed Rat
  - Flame Robin

## Threatened fauna overview

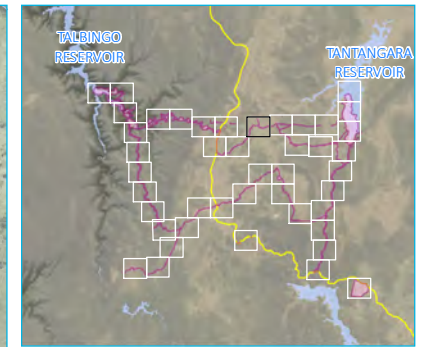
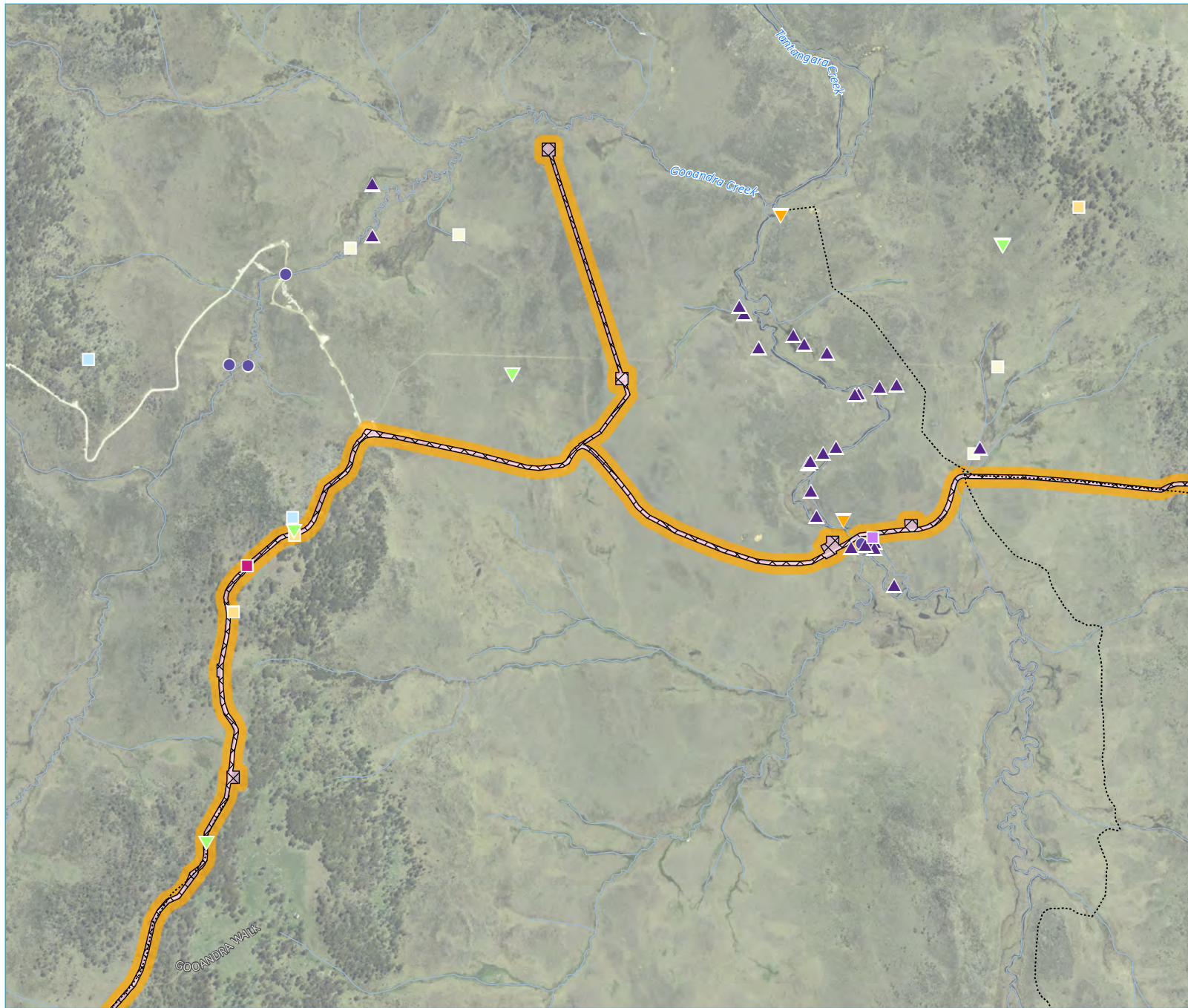
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.11

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Alpine She-oak Skink
  - Alpine Tree Frog
  - Broad-toothed Rat
  - Eastern Bentwing-bat
  - Eastern False Pipistrelle
  - Flame Robin
  - Latham's Snipe
  - Gang-gang Cockatoo
  - Scarlet Robin
  - Little Eagle

## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.12

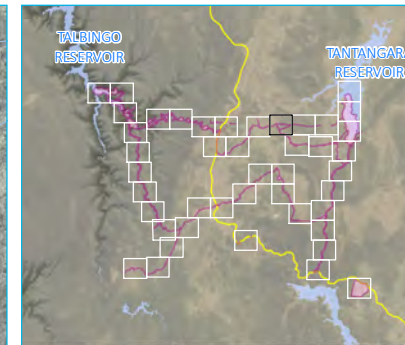
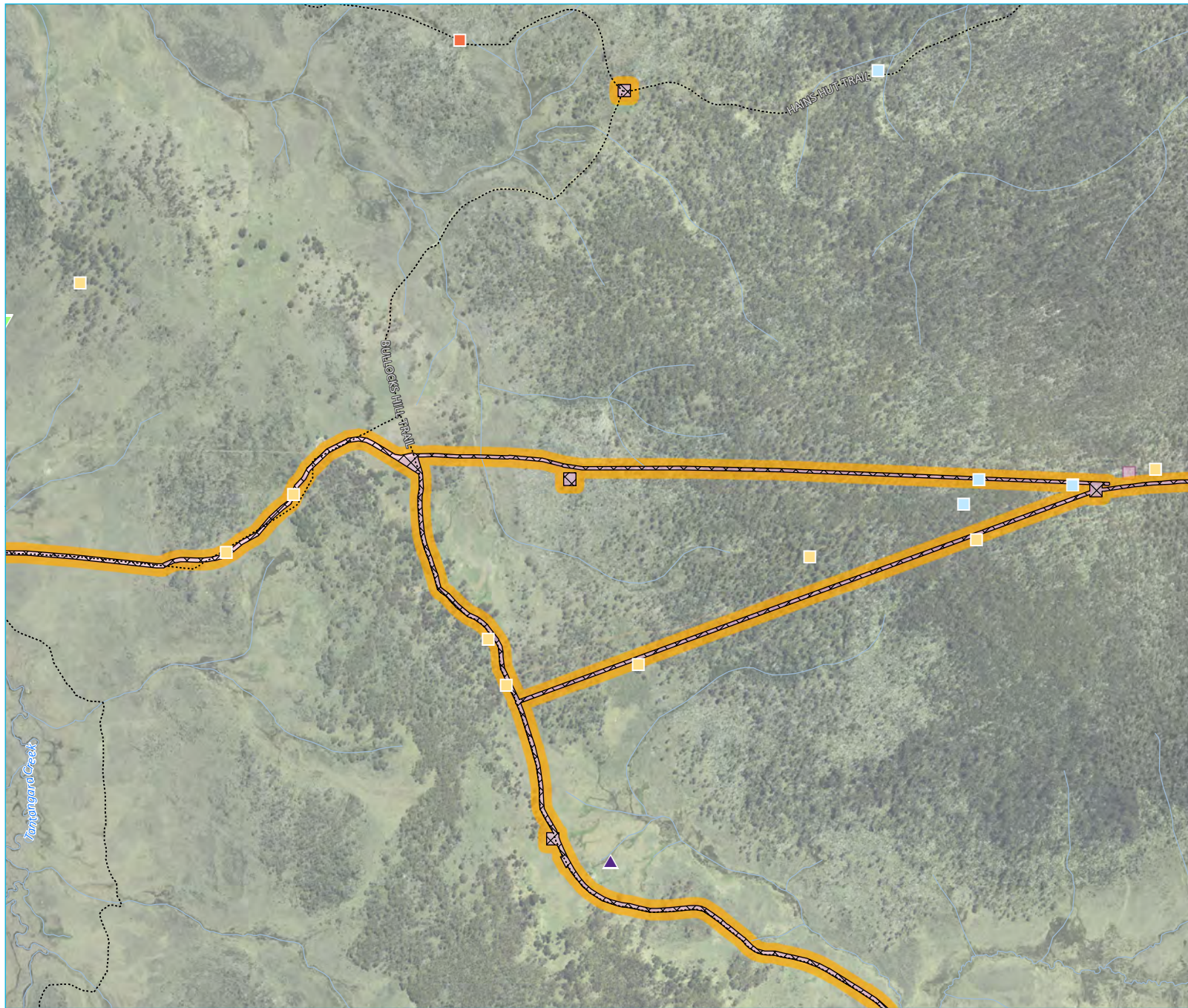
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

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GDA 1994 MGA Zone 55





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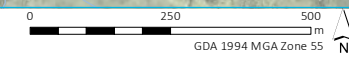


- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Alpine She-oak Skink
  - Alpine Tree Frog
  - Dusky Woodswallow
  - Flame Robin
  - Latham's Snipe
  - Gang-gang Cockatoo

Threatened fauna overview

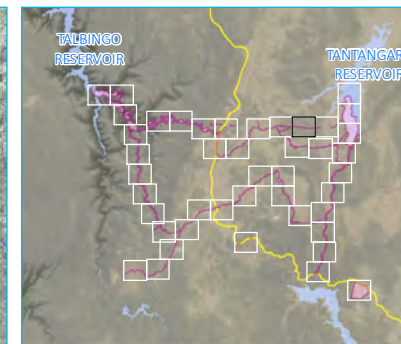
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.13

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened fauna**
  - Flame Robin
  - Gang-gang Cockatoo
  - Satin Flycatcher

Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.14

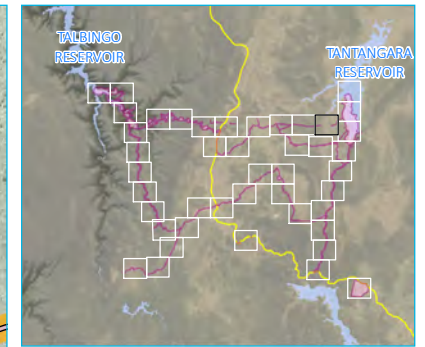
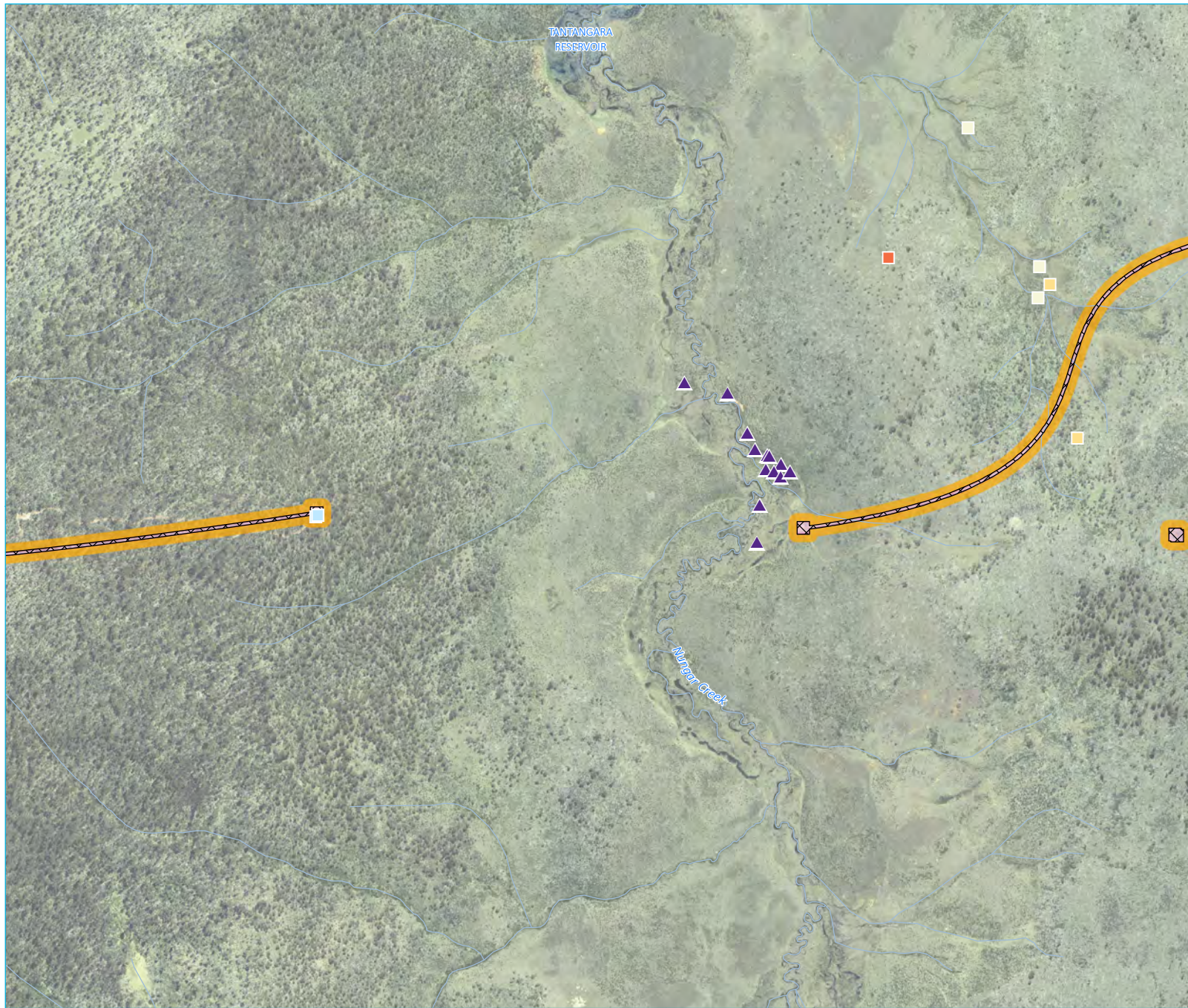
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

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GDA 1994 MGA Zone 55





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- KEY**
- Watercourse / drainage line
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- ▲ Alpine Tree Frog
  - Dusky Woodswallow
  - Flame Robin
  - Latham's Snipe
  - Gang-gang Cockatoo

## Threatened fauna overview

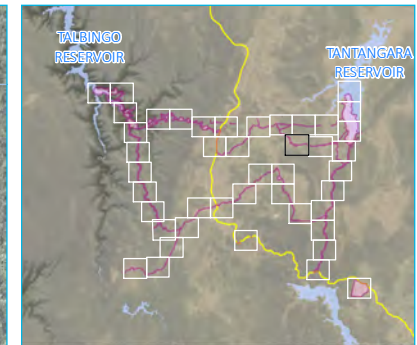
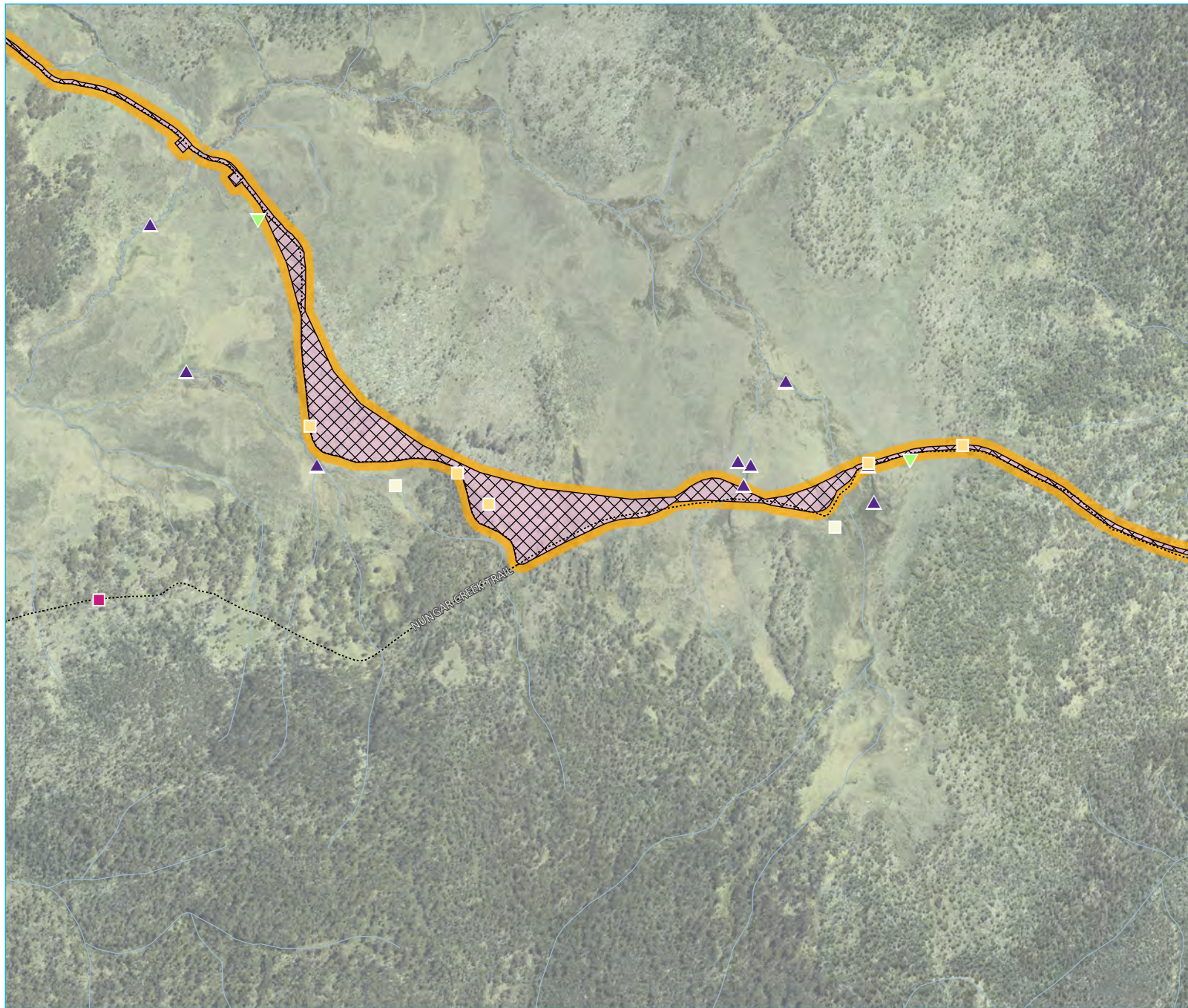
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.15



Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



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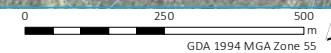


- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Alpine She-oak Skink
  - Alpine Tree Frog
  - Flame Robin
  - Latham's Snipe
  - Scarlet Robin

Threatened fauna overview

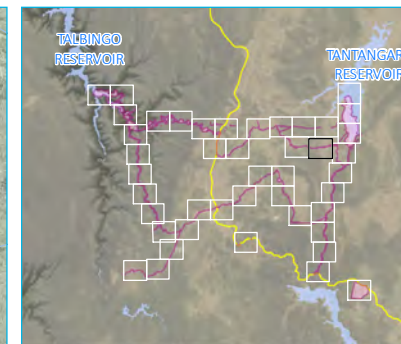
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.16

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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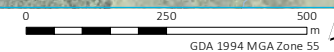
#### KEY

- Watercourse / drainage line
- ..... Vehicular track
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope
- Threatened fauna
- ▲ Alpine Tree Frog
- Broad-toothed Rat
- ▼ Eastern Bentwing-bat
- Gang-gang Cockatoo

#### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.17

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

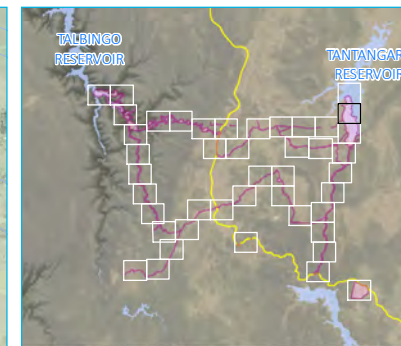
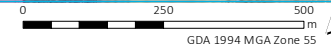




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



#### KEY

- Watercourse / drainage line
- ..... Vehicular track
- ▨ Disturbance area
- ▭ Indirect disturbance area
- ▭ Construction envelope
- Threatened fauna
- ▲ Alpine Tree Frog
- Flame Robin
- Latham's Snipe
- Gang-gang Cockatoo
- Scarlet Robin
- White-bellied Sea-Eagle

#### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.18

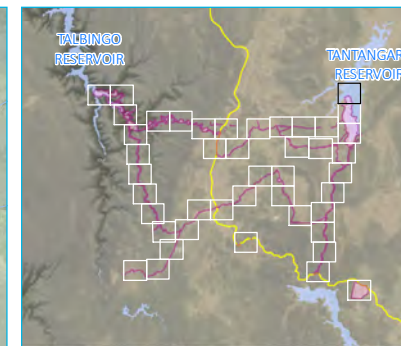




\\lemmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02\_Maps\EIS\_MM\GIS\BDAR\BDAR008\_FaunaSurveyResults\_20200206\_DDP\_01.mxd 21/02/2020



Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



#### KEY

- Watercourse / drainage line
- ..... Vehicular track
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope
- Threatened fauna
  - ▲ Alpine Tree Frog
  - Flame Robin
  - Latham's Snipe

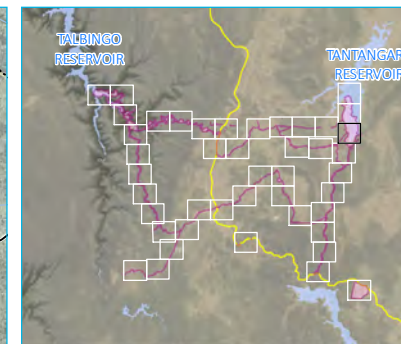
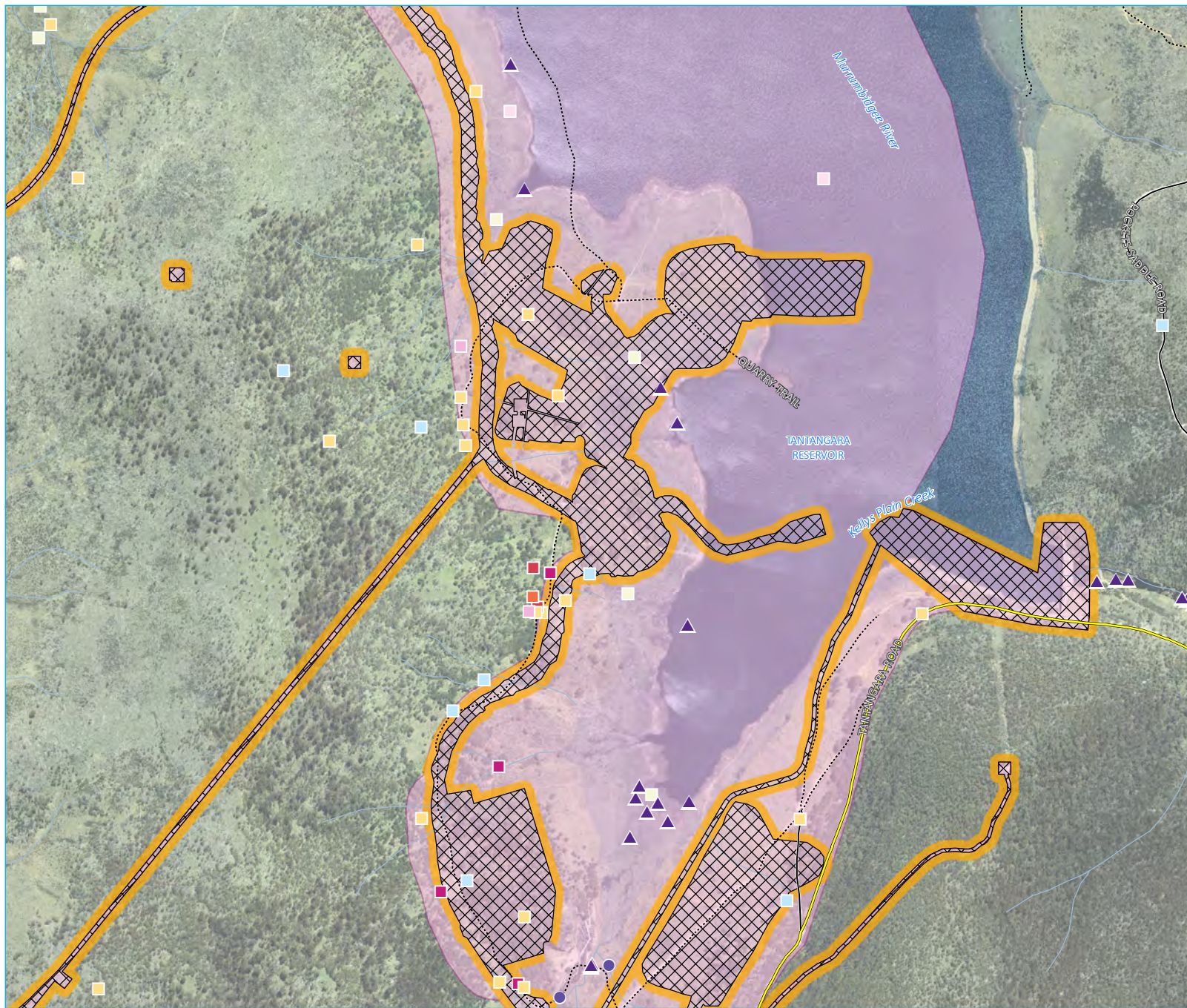
#### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.19





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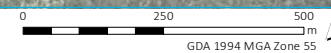
- KEY**
- Watercourse / drainage line
  - Main road
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- ▲ Alpine Tree Frog
  - Broad-toothed Rat
  - Diamond Firetail
  - Dusky Woodswallow
  - Flame Robin
  - Latham's Snipe
  - Gang-gang Cockatoo
  - Scarlet Robin
  - Varied Sittella
  - White-bellied Sea-Eagle

## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.20

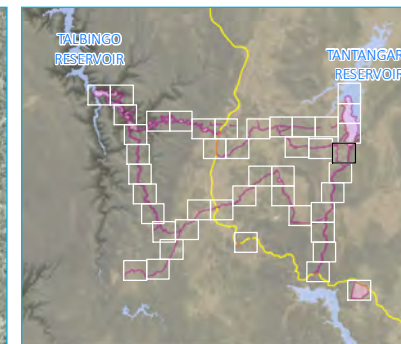


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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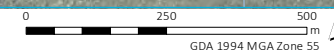


- KEY**
- Watercourse / drainage line
  - Main road
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- ▲ Alpine Tree Frog
  - Broad-toothed Rat
  - Dusky Woodswallow
  - Flame Robin
  - Latham's Snipe
  - Gang-gang Cockatoo
  - Scarlet Robin

## Threatened fauna overview

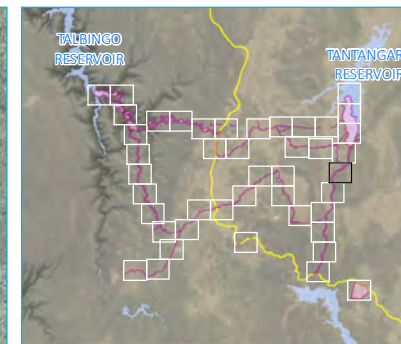
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.21

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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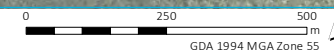
- KEY**
- Watercourse / drainage line
  - Main road
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Flame Robin
  - Gang-gang Cockatoo
  - Scarlet Robin

Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.22



Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

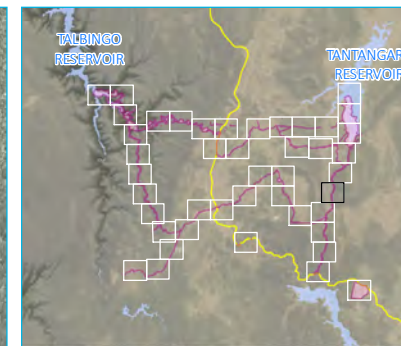




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



#### KEY

- Watercourse / drainage line
- Main road
- ..... Vehicular track
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope
- Threatened fauna
- ▲ Alpine She-oak Skink
- Satin Flycatcher

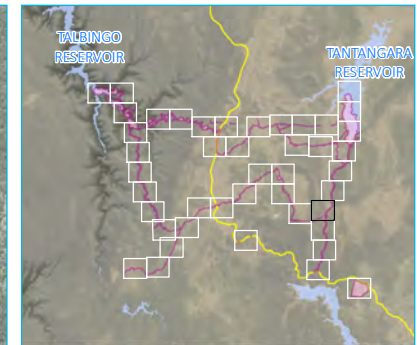
#### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.23





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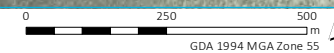


- KEY**
- Watercourse / drainage line
  - Main road
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- ▲ Alpine She-oak Skink
  - ▲ Alpine Tree Frog
  - Broad-toothed Rat
  - ▼ Eastern Bentwing-bat
  - ▼ Eastern False Pipistrelle
  - Dusky Woodswallow
  - Flame Robin
  - Gang-gang Cockatoo

### Threatened fauna overview

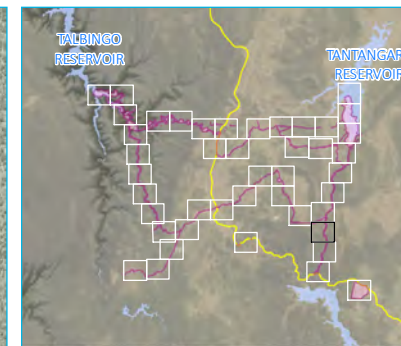
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.24

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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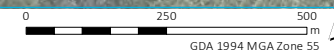


- KEY**
- Watercourse / drainage line
  - Main road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Dusky Woodswallow
  - Flame Robin
  - Scarlet Robin

## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.25

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

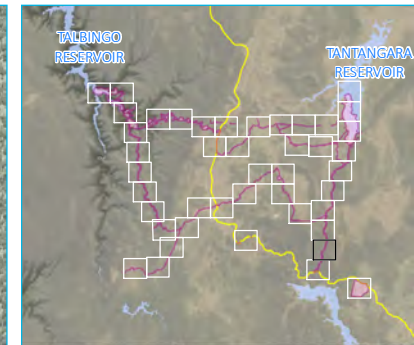




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



- KEY**
- Watercourse / drainage line
  - Main road
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- ▲ Alpine Tree Frog
  - Dusky Woodswallow
  - Flame Robin
  - Gang-gang Cockatoo
  - Scarlet Robin

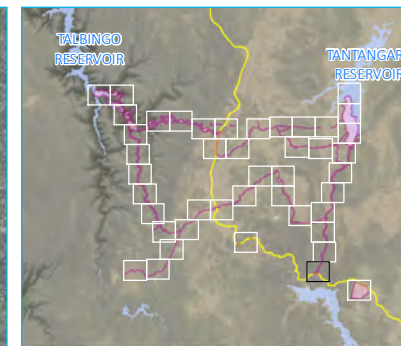
## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.26





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- KEY**
- Watercourse / drainage line
  - Main road
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Broad-toothed Rat
  - Dusky Woodswallow
  - Flame Robin
  - Gang-gang Cockatoo

## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.27

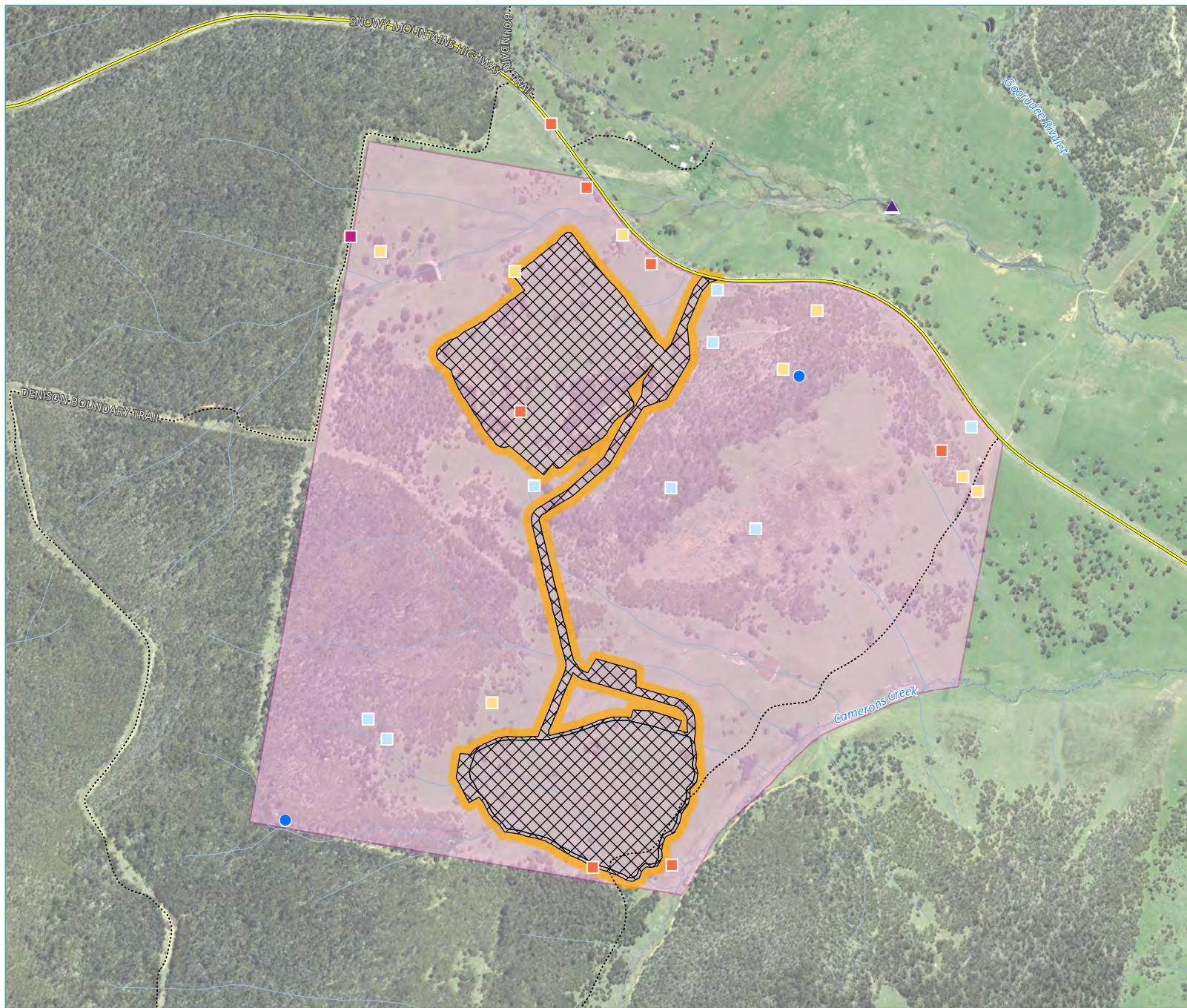
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

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GDA 1994 MGA Zone 55

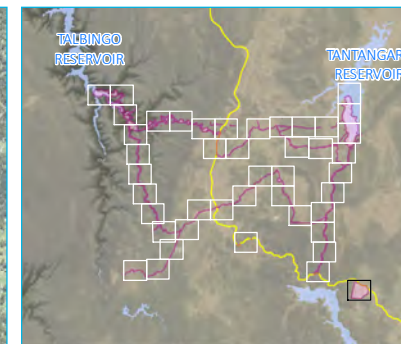




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



- KEY**
- Watercourse / drainage line
  - Main road
  - ..... Vehicular track
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- ▲ Alpine Tree Frog
  - Eastern Pygmy-possum
  - Dusky Woodswallow
  - Flame Robin
  - Gang-gang Cockatoo
  - Scarlet Robin

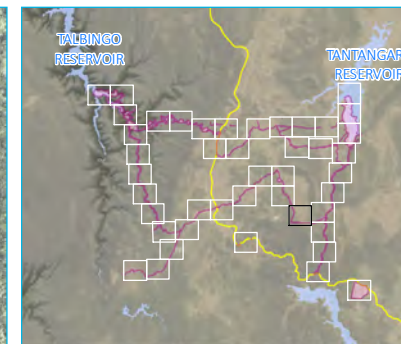
## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.28





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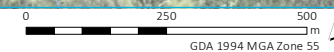
#### KEY

- Watercourse / drainage line
- ..... Vehicular track
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope
- Threatened fauna
- ▲ Alpine Tree Frog
- Broad-toothed Rat
- Dusky Woodswallow
- Flame Robin
- Latham's Snipe
- Gang-gang Cockatoo

#### Threatened fauna overview

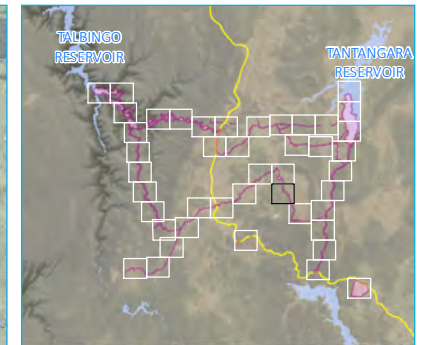
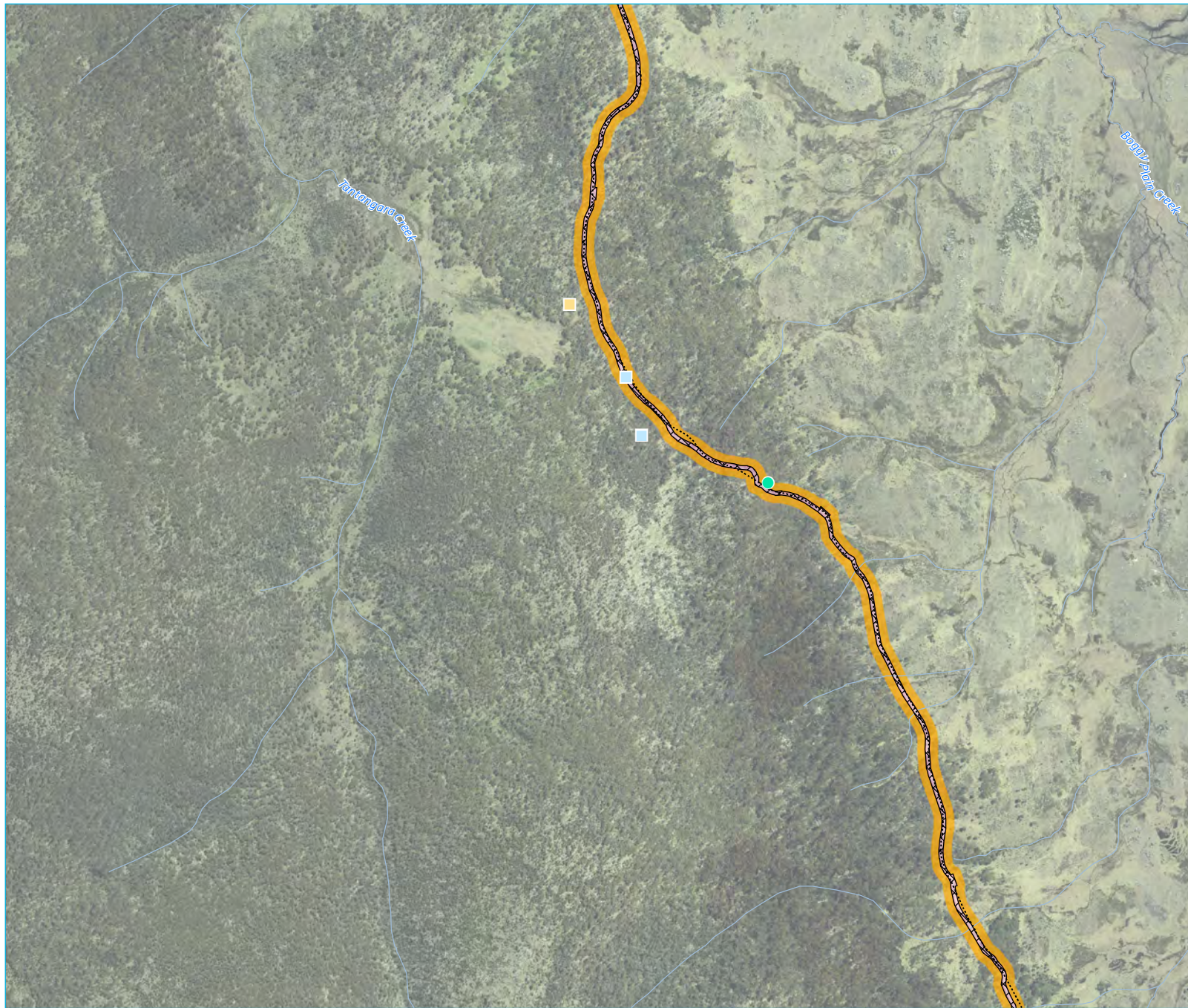
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.29

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened fauna**
  - Smoky Mouse
  - Flame Robin
  - Gang-gang Cockatoo

## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.30

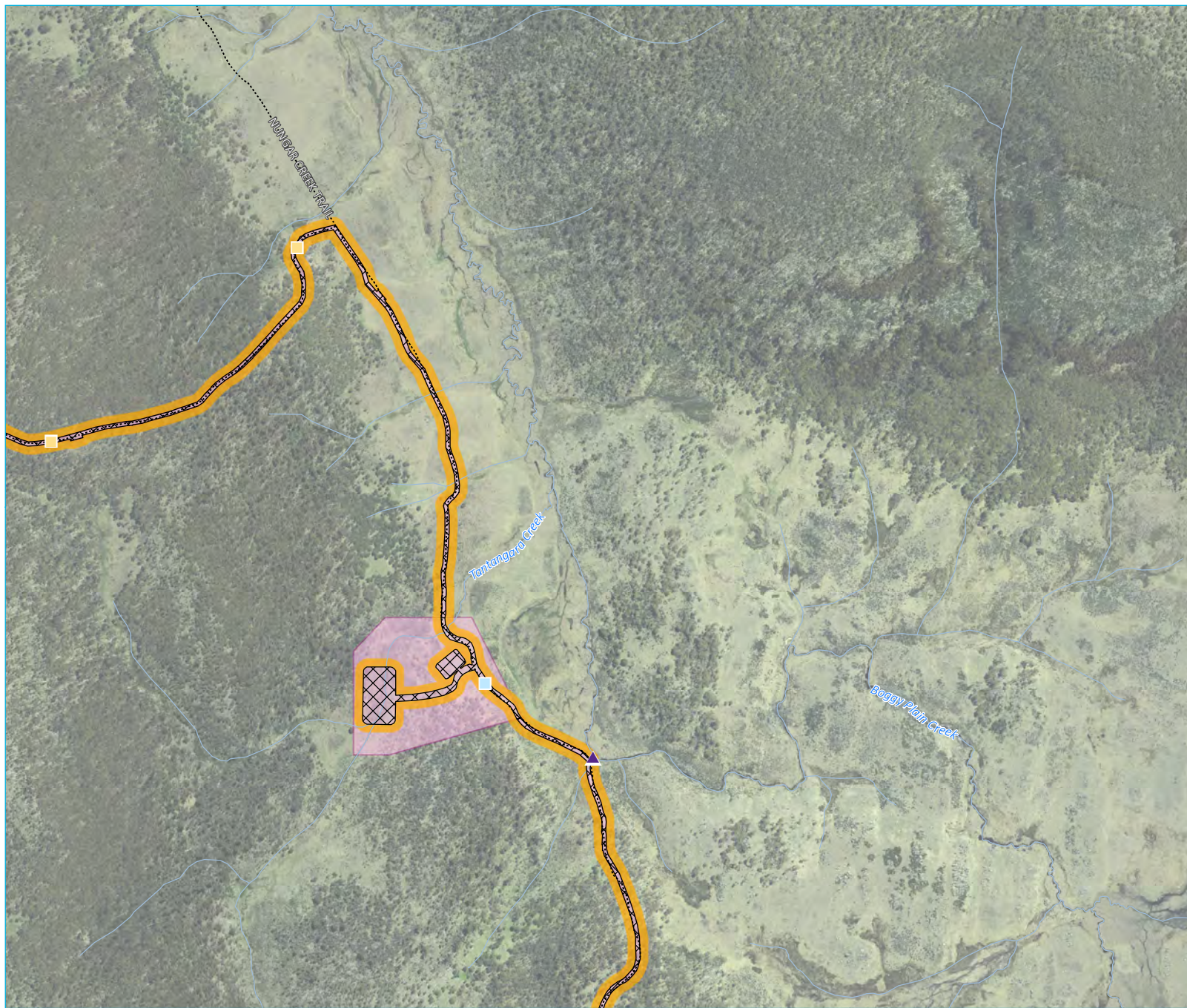


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

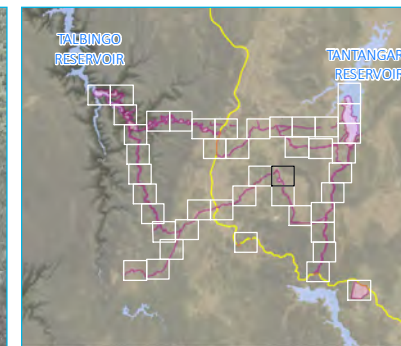
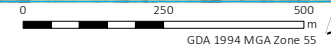
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GDA 1994 MGA Zone 55



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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



#### KEY

- Watercourse / drainage line
- ..... Vehicular track
- ▣ Disturbance area
- Indirect disturbance area
- Construction envelope
- Threatened fauna
- ▲ Alpine Tree Frog
- Flame Robin
- Gang-gang Cockatoo

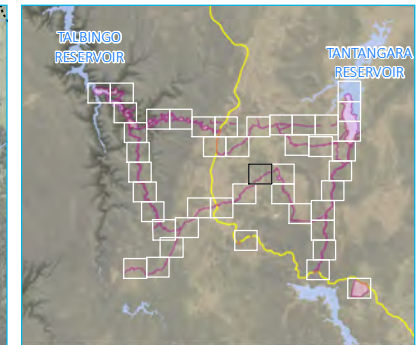
#### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.31





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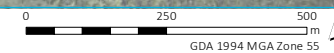


- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- ▲ Alpine Tree Frog
  - Flame Robin
  - Gang-gang Cockatoo

### Threatened fauna overview

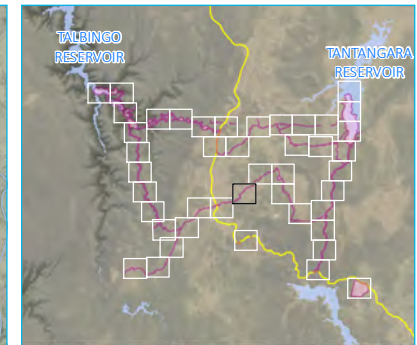
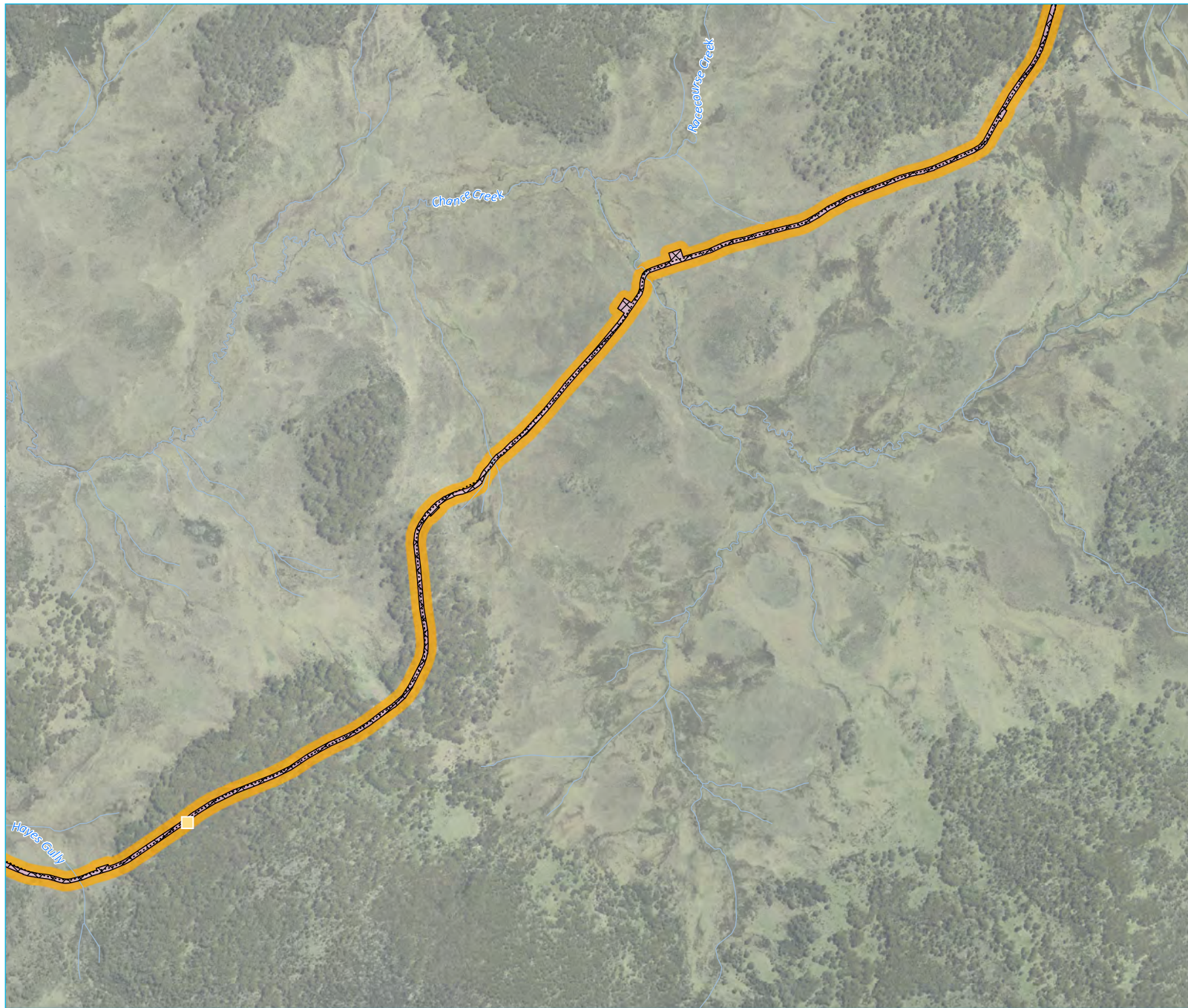
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.32

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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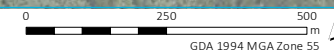


- KEY**
- Watercourse / drainage line
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened fauna**
  - Flame Robin

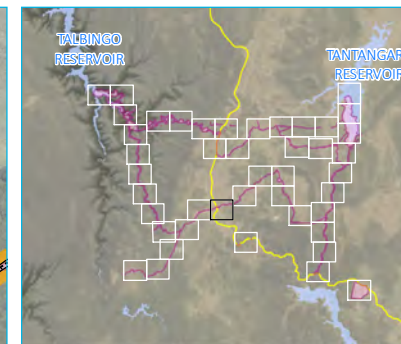
Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.33

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)







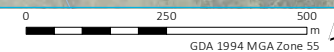
#### KEY

- Watercourse / drainage line
- Main road
- Local road
- ..... Vehicular track
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope
- Threatened fauna
- ▲ Alpine She-oak Skink
- ▲ Alpine Tree Frog
- Flame Robin
- Latham's Snipe

#### Threatened fauna overview

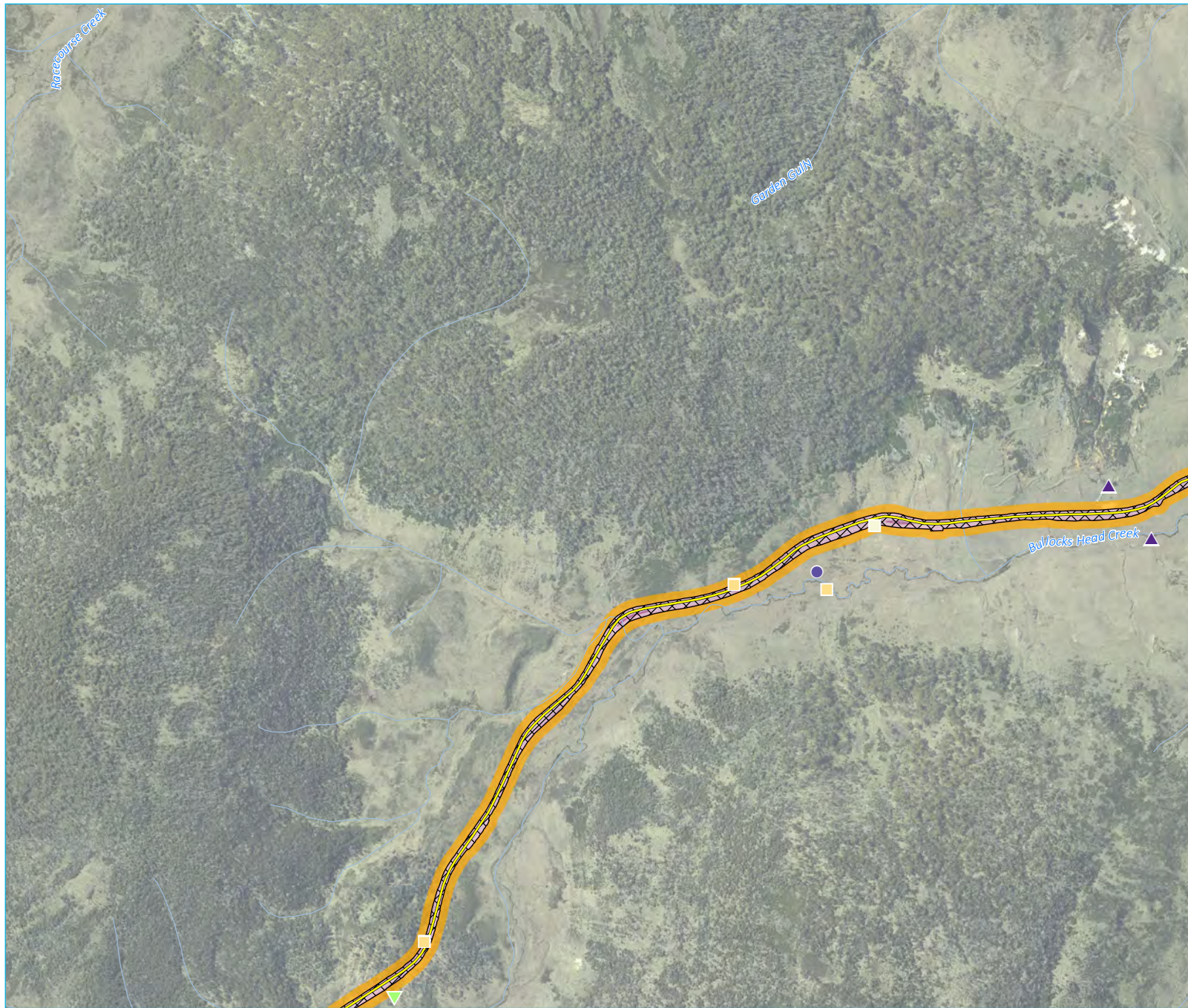
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Main Works  
Figure 5.5.34

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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#### KEY

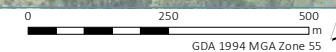
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- Main road
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope
- Threatened fauna
  - ▲ Alpine She-oak Skink
  - ▲ Alpine Tree Frog
  - Broad-toothed Rat
  - Flame Robin
  - Latham's Snipe

#### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.35

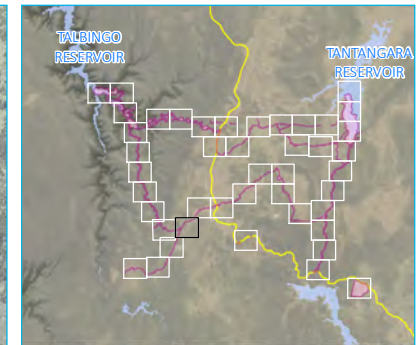


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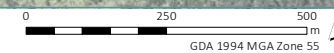
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  - Local road
  - ..... Vehicular track
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  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Alpine She-oak Skink
  - Alpine Tree Frog
  - Broad-toothed Rat
  - Eastern Bentwing-bat
  - Eastern False Pipistrelle
  - Flame Robin
  - Latham's Snipe
  - Gang-gang Cockatoo
  - Scarlet Robin

## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.36

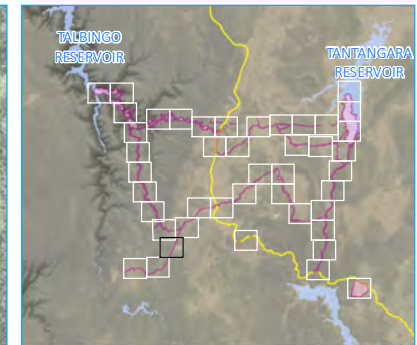


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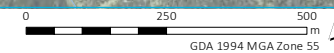


- KEY**
- Watercourse / drainage line
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Flame Robin
  - Gang-gang Cockatoo
  - Square-tailed Kite

## Threatened fauna overview

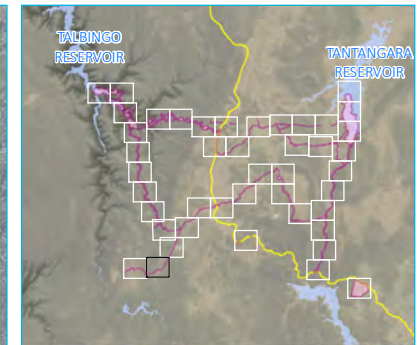
Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.37

Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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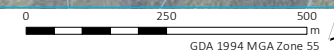


- KEY**
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  - ..... Vehicular track
  - ⊠ Disturbance area
  - Yellow box Indirect disturbance area
  - Pink box Construction envelope
- Threatened fauna**
- Yellow square Flame Robin
  - Blue square Gang-gang Cockatoo
  - Pink square Square-tailed Kite

Threatened fauna overview

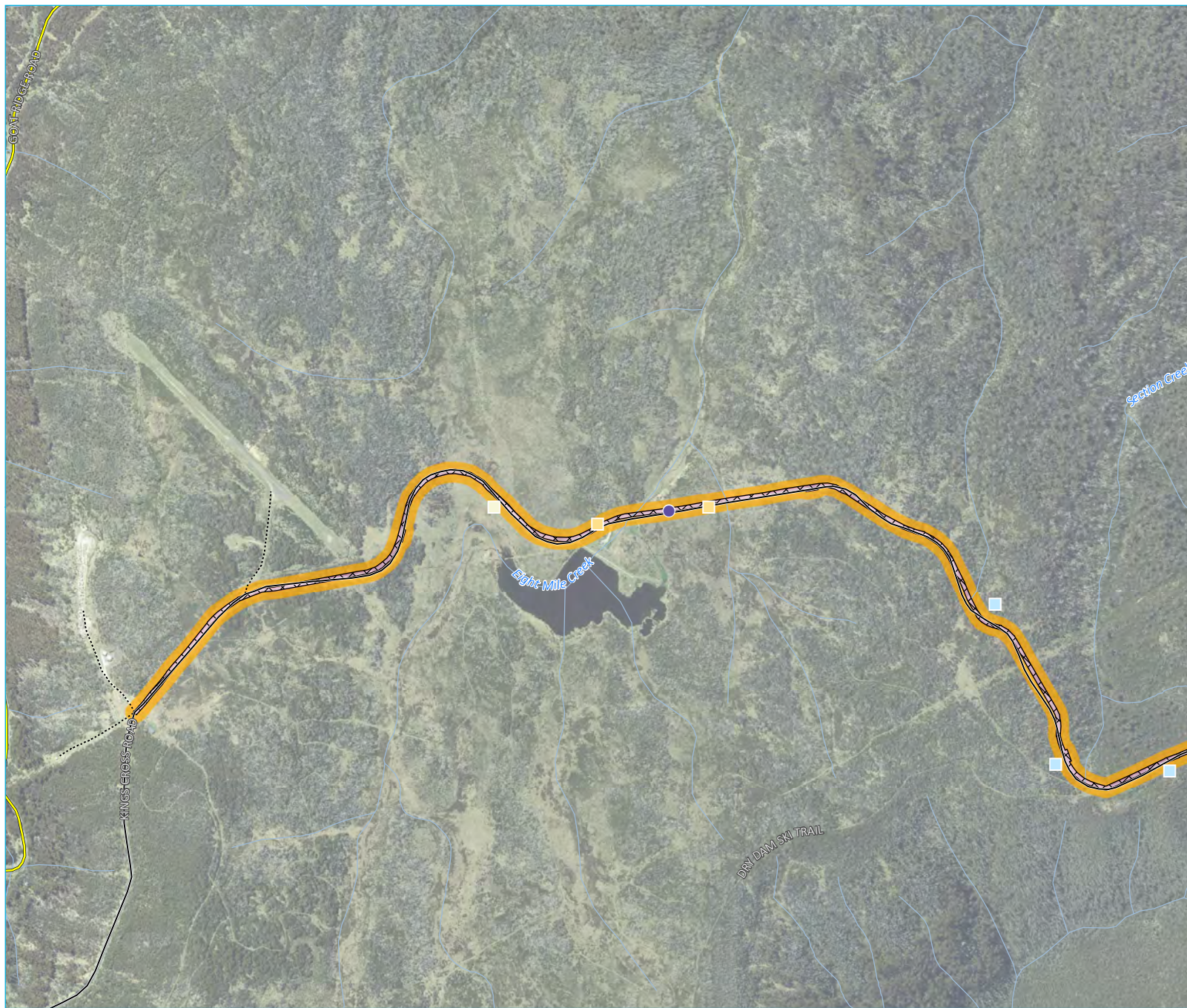
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Biodiversity Development Assessment Report  
Main Works  
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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

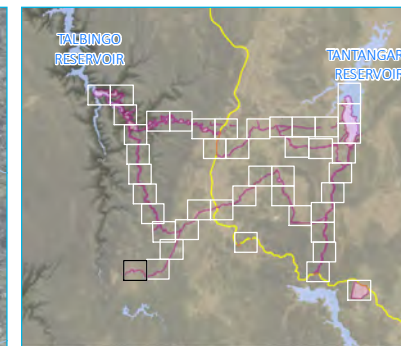




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



- KEY**
- Watercourse / drainage line
  - Main road
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Broad-toothed Rat
  - Flame Robin
  - Latham's Snipe
  - Gang-gang Cockatoo

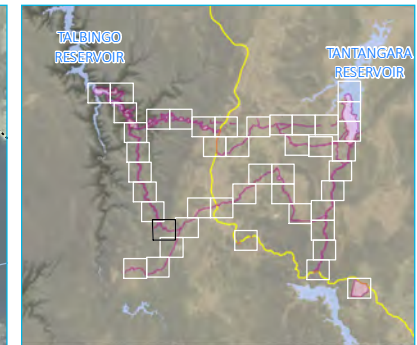
Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.39





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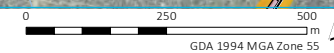
- KEY**
- Watercourse / drainage line
  - Main road
  - Local road
  - ..... Vehicular track
  - ⊠ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- ▲ Alpine Tree Frog
  - Eastern Pygmy-possum
  - Smoky Mouse
  - Flame Robin
  - Masked Owl
  - Latham's Snipe
  - Gang-gang Cockatoo

### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.40

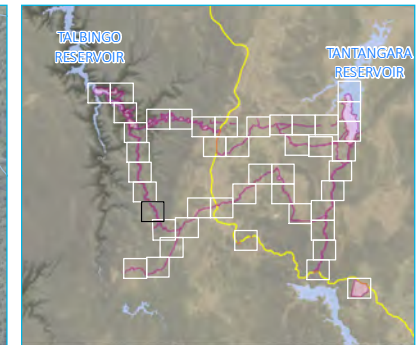
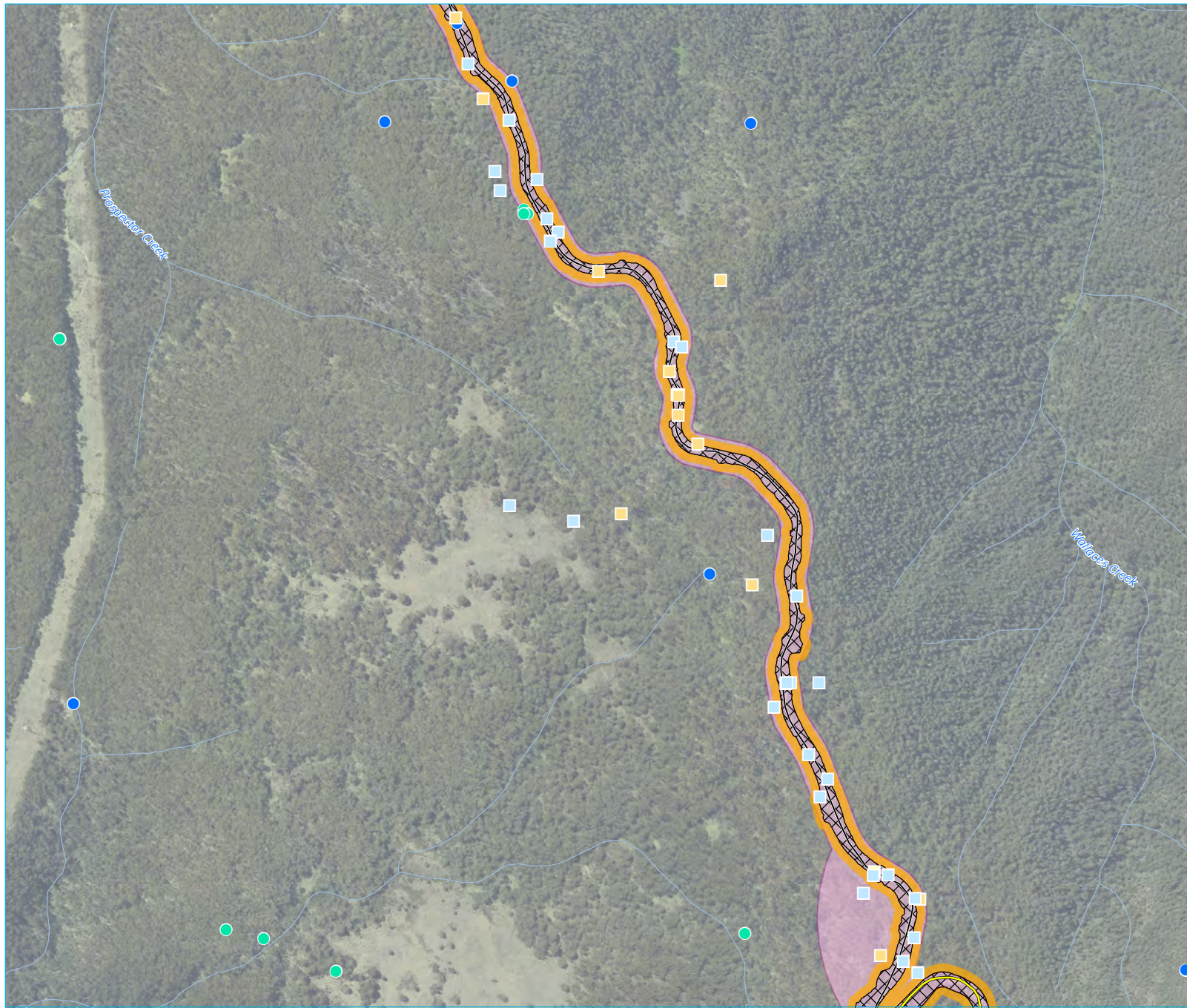


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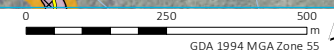
- KEY**
- Watercourse / drainage line
  - Main road
  - Local road
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Eastern Pygmy-possum
  - Smoky Mouse
  - Flame Robin
  - Masked Owl
  - Gang-gang Cockatoo

### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.41

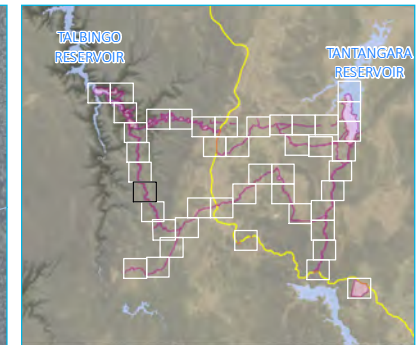
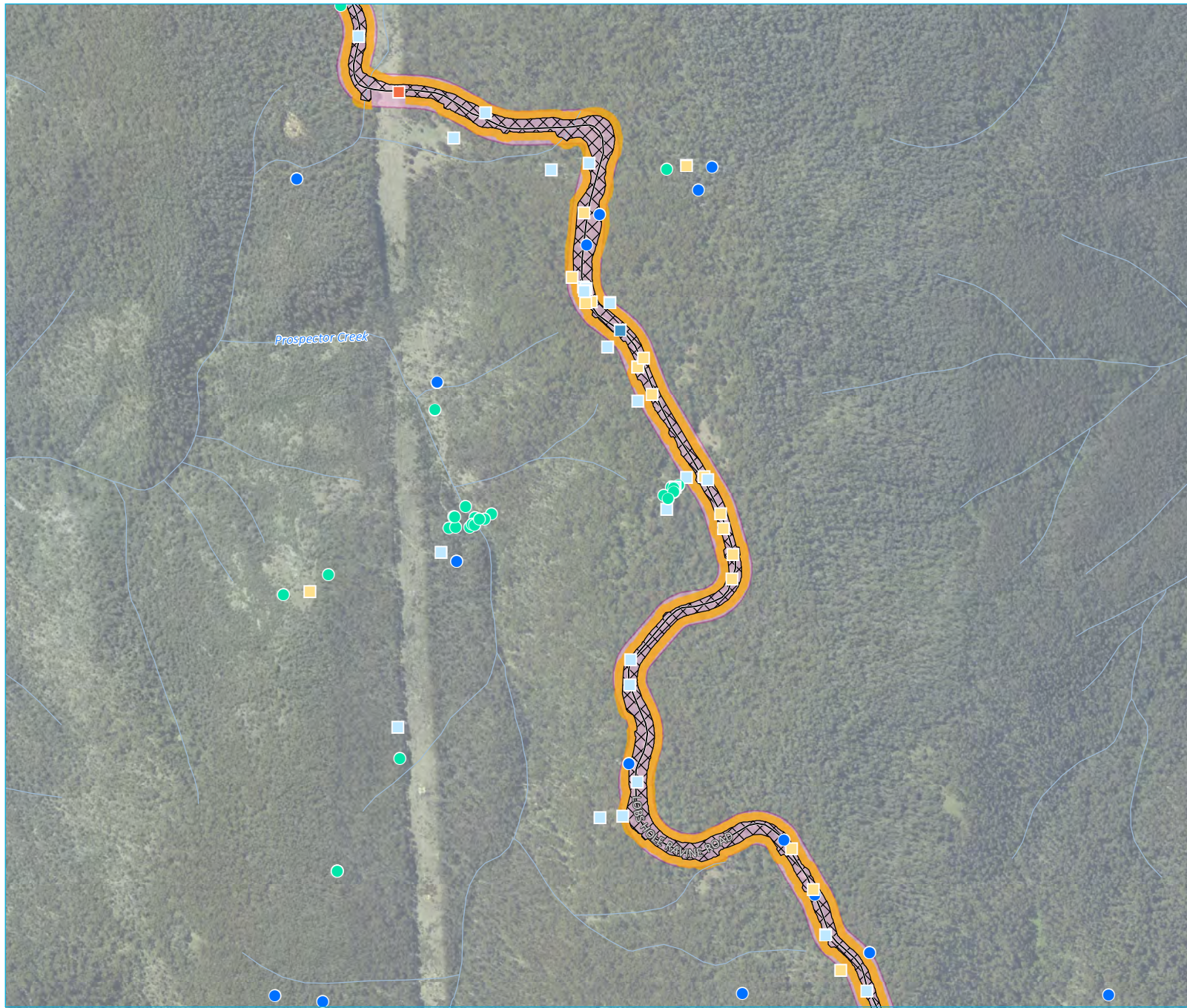


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





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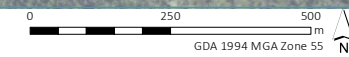
- KEY**
- Watercourse / drainage line
  - Local road
  - ▨ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened fauna**
  - Eastern Pygmy-possum
  - Smoky Mouse
  - Dusky Woodswallow
  - Flame Robin
  - Gang-gang Cockatoo
  - Olive Whistler

Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.42

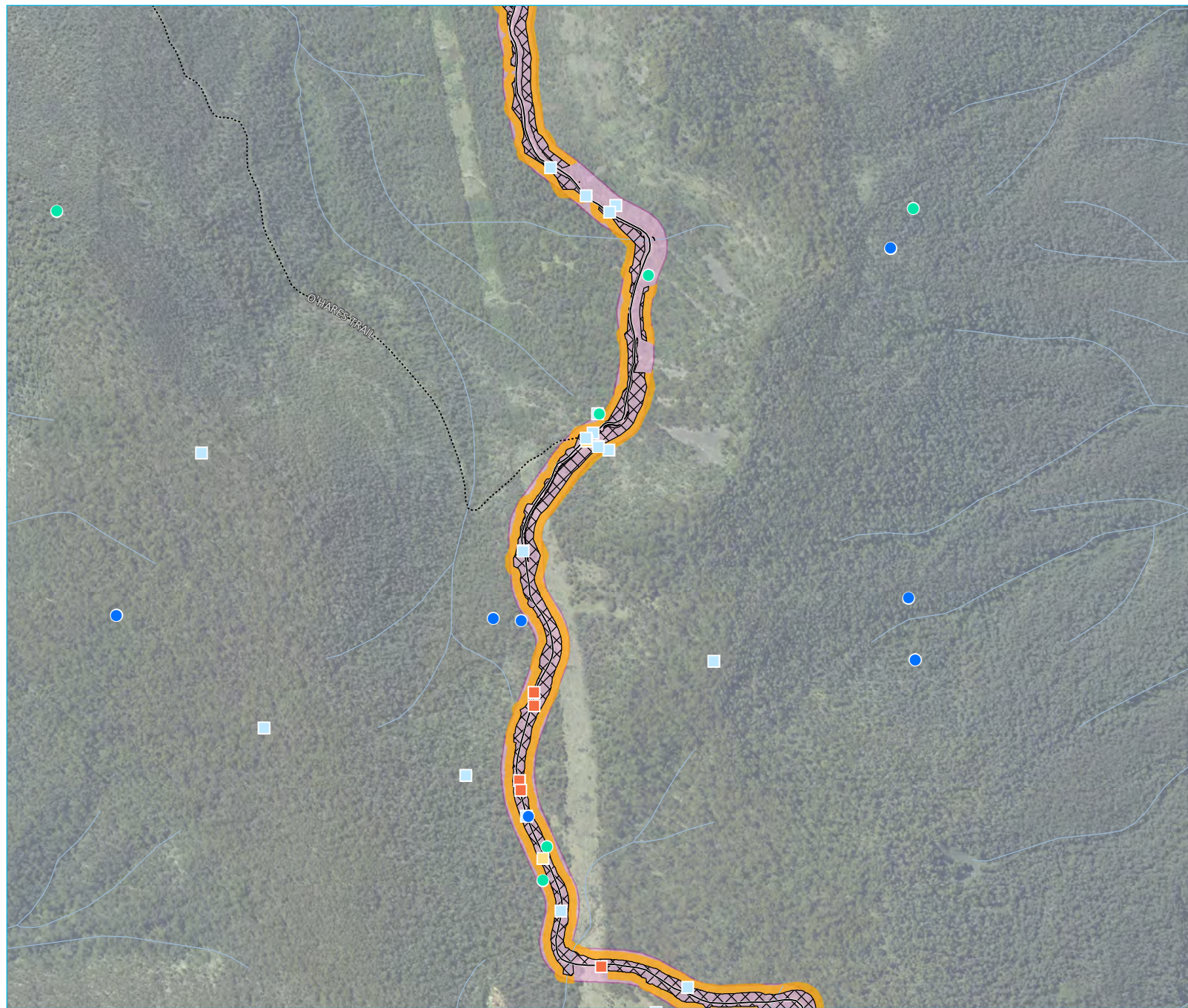


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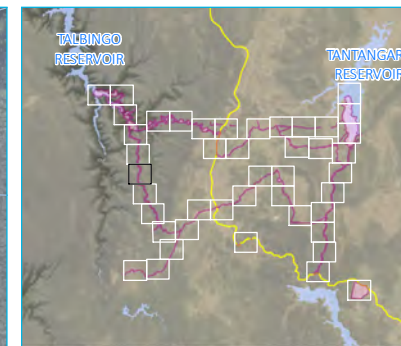




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



#### KEY

- Watercourse / drainage line
- Local road
- ..... Vehicular track
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope
- Threatened fauna
- Eastern Pygmy-possum
- Smoky Mouse
- Dusky Woodswallow
- Flame Robin
- Gang-gang Cockatoo

#### Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.43

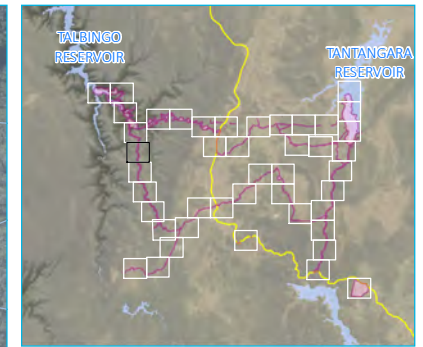
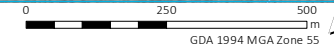




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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



- KEY**
- Watercourse / drainage line
  - Local road
  - ..... Vehicular track
  - ▣ Disturbance area
  - Indirect disturbance area
  - Construction envelope
  - Threatened fauna**
  - Eastern Pygmy-possum
  - Dusky Woodswallow

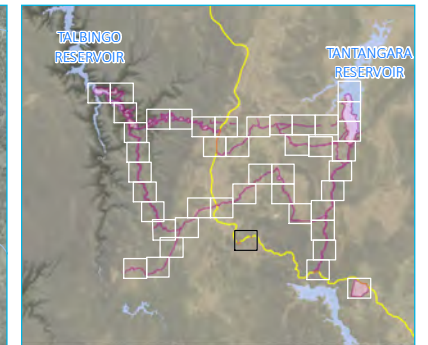
## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.44





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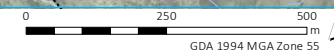
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  - Main road
  - Vehicular track
  - Disturbance area
  - Indirect disturbance area
  - Construction envelope
- Threatened fauna**
- Broad-toothed Rat
  - Dusky Woodswallow
  - Flame Robin
  - Gang-gang Cockatoo
  - Scarlet Robin

## Threatened fauna overview

Snowy 2.0  
Biodiversity Development Assessment Report  
Main Works  
Figure 5.5.45



Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

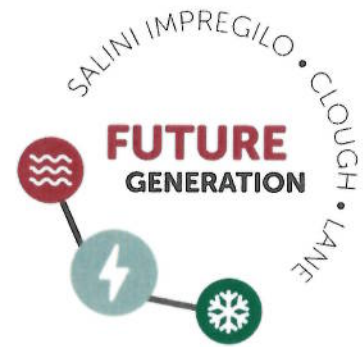








## APPENDIX B      BIODIVERSITY MONITORING PROGRAM





S2-FGJV-ENV-PLN-0106

## SNOWY 2.0 MAIN WORKS – BIODIVERSITY MANAGEMENT PLAN – APPENDIX B BIODIVERSITY MONITORING PROGRAM

Approval Record			
Document preparation, review and approval		Name in print	Signature
Prepared by	Lead Ecologist Snowy 2.0	N. Garvey	
Verified by	Environmental Compliance Lead Snowy 2.0	C. Buscall	

Document Revision Table		
Rev.	Date	Description of modifications / revisions
A	29.11.2019	Initial draft for Snowy Hydro review
B	02.06.2020	Updated for Main Works approval
C	09.06.2020	Updated to address Snowy Hydro comments
D	17.06.2020	Updated monitoring requirements
E	23.07.2020	Updated to address BCD comments and review
F	07.10.2020	Updated to address DPIE comments



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## ABBREVIATIONS AND DEFINITIONS

Acronym	Definition
BAM	Biodiversity Assessment Method
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BCD	Biodiversity and Conservation Division (formerly Office of Environment and Heritage (OEH))
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BOS	Biodiversity Offset Scheme
Construction envelope	The envelope within which the disturbance area of the development may be located
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DEC	NSW Department of Environment and Conservation (now BCD)
DECC	Department of Environment and Climate Change (now BCD)
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
DoEE	Commonwealth Department of the Environment and Energy (now DAWE)
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
EMS	Environmental Management Strategy
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDEs	Groundwater Dependent Ecosystems
LHRR	Lobs Hole Ravine Road
KNP	Kosciuszko National Park
Main Works EIS	<i>Snowy 2.0 Main Works - Environmental Impact Statement</i>
MNES	Matters of national environmental significance
NPW Act	NSW <i>National Parks and Wildlife Act 1995</i>
NPW Regulation	NSW <i>National Parks and Wildlife Regulation 2009</i>
NPWS	NSW National Parks and Wildlife Service
PCTs	Plant community types
Program	This Biodiversity Monitoring Program
REMM	Revised environment management measures
RTS	Response to Submissions
Submissions Report or Rts	<i>Response to Submissions Main Works for Snowy 2.0</i>
Project, the	Snowy 2.0 Main Works



## 1. INTRODUCTION

### 1.1. Context

This Biodiversity Monitoring Program (Program) forms an appendix to the Biodiversity Management Plan (BMP) which forms part of the Environmental Management Strategy (EMS) for Snowy 2.0 – Main Works (the project). This program addresses the requirements of Schedule 3, Condition 18(d) of the infrastructure approval (SSI 9687) and several Revised Environmental Management Measures (REMM) as detailed in the Biodiversity Management Plan (BMP).

### 1.2. Purpose of this program

The purpose of this program is to detail the biodiversity monitoring requirements which are to be implemented during construction of the project. Specifically, this program details the monitoring activities that shall be undertaken to track the indirect impact of project construction activities. This monitoring will provide feedback on the efficacy of the implemented environmental management measures at mitigating the indirect biodiversity impacts of construction.

This program provides a key input which facilitates adaptive management of construction activities such that the project remains consistent with the predicted biodiversity impacts detailed in the Main Works EIS and RTS.

One of the key adaptive management measures, developed during implementation of the biodiversity monitoring program for the Snowy 2.0 Exploratory Works, was to create a strong nexus between monitoring and timely management, particularly where construction related activities result in impacts that can be effectively and readily managed in a timely manner. This nexus means that monitoring will be used to inform ready management, rather than monitoring changes over time. This is particularly relevant to impacts such as increased levels of feral animals and weeds.

### 1.3. Objectives

The primary objective of this program is to monitor the effectiveness of the impact avoidance, minimisation and mitigation measures outlined in the EIS/RTS.

As such, the key objectives of the program are to:

- identify the entities that require monitoring during construction;
- specify the existing condition, distribution and presence of the monitored entities;
- detail the monitoring parameters for each entity including:
  - survey method, frequency and location;
  - data collection and analysis approach;
  - reporting requirements;
- provide threshold triggers for implementation of adaptive management procedures;
- provide adaptive management procedures; and
- facilitate compliance with relevant conditions of approval.

### 1.4. Consultation

The Infrastructure Approval requires that the monitoring plan be prepared in consultation with National Parks and Wildlife Service (NPWS), Biodiversity Conservation Division (BCD) of the Department of Planning Industry and Environment (DPIE) and the Department of Agriculture, Water



and The Environment (DAWE). The project team has undertaken consultation with these agencies throughout the development of this plan, seeking input on the proposed monitoring framework. An overview of key consultation is provided in Table 1-1.

**Table 1-1: Key consultation undertaken through the development of this plan**

Date	Activity
3 April 2020	Presentation to BCD and NPWS on the status of the project and the structure of the draft BMP.
8 May 2020	Initial presentation to BCD and NPWS on the proposed fauna-strike mitigation strategy that Future Generation propose to implement during construction.
15 June 2020	Rev. D of the BMP issued to NPWS and BCD for review and comment.
26 June 2020	Revision E of the BMP issued to DAWE for review and comment
26 June 2020	Phone meeting with NPWS, Snowy Hydro and Future Generation to discuss key issues from NPWS' review of Revision D
3 July 2020	Meeting with BCD to discuss monitoring framework and initials comments
3 July 2020	Notes on meeting outcomes received from BCD
9 July 2020	Meeting with BCD and NPWS to discuss updates to proposed monitoring framework
9 July 2020	Notes on meeting outcomes received from BCD
14 July 2020	Meeting with BCD and NPWS, including species expert, to discuss updated proposed monitoring framework
14 July 2020	Notes on meeting outcomes received from BCD
15 July 2020	Meeting with DAWE and discussion of draft plan
16 July 2020	Notes on meeting outcomes received from BCD
17 July 2020	Correspondence from NPWS on Broad-toothed Rat monitoring
24 July 2020	Revised plan sent to BCD, NPWS for review
24 July 2020	Comments received from DAWE on draft plan

## 1.5. Personnel

The personnel responsible for implementing the report will be SHL Environmental Lead.



## 2. MONITORING SCOPE

### 2.1. Monitoring and managing indirect impacts of construction

As detailed in Section 4 of the BMP, the project will have direct and indirect impacts (including prescribed and uncertain impacts) on threatened flora and fauna, on native plant community types (PCTs) within and adjacent to the project's disturbance area and on Groundwater Dependent Ecosystems (GDE). Direct impacts include clearing of native vegetation, removal of habitat and relocation of species from the disturbance area. Indirect impacts to biodiversity from the project may include:

- the introduction and/or exacerbation of weeds and pathogens;
- introduced herbivores and predators (feral animals);
- changes in behaviour to increased activity (including noise, dust and lighting);
- decreased connectivity;
- changes in water quality;
- fauna-vehicle strike; and
- groundwater drawdown.

While the direct impacts are easily quantified and controlled by managing the extent of clearing within the disturbance area, the indirect impacts are subject to the efficacy of the implemented environmental controls. As such, direct impacts are defined during project design, whereas indirect impacts are mitigated through the effective environmental management of construction. It is for this reason that this program is primarily focussed on monitoring those entities which have been predicted to experience indirect impacts during construction.

Section 2.2 summarises the threatened species and communities that occur within the project area and section 2.3 identifies the entities from this broader list which have potential to experience indirect impacts. It is impacts to these entities that will be monitored throughout the construction program.

### 2.2. Threatened species and communities present within the project area

Section 3 of the BMP details the biodiversity values present within the project as assessed in the Main Works EIS and RtS.

One threatened ecological community listed under NSW and Commonwealth legislation has been confirmed within the disturbance area (1.03 ha):

- PCT 637 – Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions, listed as:
- Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions endangered ecological community under the NSW Biodiversity Conservation Act 2016 (BC Act); and
- Alpine Sphagnum Bogs and Associated Fens endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Two plant community types were identified as being entirely/obligate GDEs:

- 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.

The threatened species that were recorded across the project are listed in Table 2-1 and Table 2-2 for flora and fauna respectively.

**Table 2-1: Threatened flora species recorded within and adjacent to the construction envelope**

Species name	Common name	Threatened status		Location recorded					
		EPBC Act1	BC Act2	Talbingo	Lobs Hole	Marica	Plateau	Tantangara	Rock Forest
<i>Caladenia montana</i>	-		V		✓	✓			
<i>Calotis glandulosa</i>	Mauve Burr-daisy	VU	V				✓	✓	✓
<i>Calotis pubescens</i>	Max Mueller's Burr Daisy		E1				✓	✓	
<i>Carex raleighii</i>	Raleigh Sedge		E1				✓	✓	
<i>Discaria nitida</i>	Leafy Anchor Plant		V			✓	✓	✓	
<i>Glycine latrobeana</i>	Clover Glycine	VU	E4A				✓	✓	
<i>Leucochrysum albicans</i> var. <i>tricolor</i>	Hoary Sunray	EN							✓
<i>Prasophyllum innubum</i> *	Brandy Marys Leek-orchid	CE	E4A				✓		
<i>Prasophyllum retroflexum</i>	Kiandra Leek Orchid		V				✓	✓	
<i>Pterostylis alpina</i> *	Alpine Leek Orchid		V				✓	✓	
<i>Pterostylis foliata</i>	Slender Greenhood		V			✓			
<i>Rutidosia leiocarpis</i> *	Monaro Golden Daisy	VU	V				✓	✓	
<i>Thelymitra alpicola</i>	Alpine Sun Orchid		V				✓		

<sup>1</sup> EPBC Act categories: VU- Vulnerable; EN- Endangered, CR- Critically Endangered

<sup>2</sup> BC Act categories: V- Vulnerable; E1- Endangered; E4A- Critically endangered

\* these species were recorded outside of but adjacent to the construction envelope and will not be impacted by the Project



**Table 2-2: Fauna species recorded within and adjacent to the disturbance footprint**

Species name	Common name	Threatened status		Location recorded					
		EPBC Act <sup>1</sup>	BC Act <sup>2</sup>	Talbingo	Lobs Hole	Marica	Plateau	Tantangara	Rock Forest
EPBC Act Migratory species									
<i>Gallinago hardwickii</i>	Latham's Snipe	M				✓	✓	✓	
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M				✓	✓		
<i>Hirundapus caudacutus</i>	White-throated Needletail	M, VU						✓	
BC Act Ecosystem credit species									
<i>Artamus cyanopterus</i>	Dusky Woodswallow		V	✓	✓	✓	✓	✓	✓
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper		V		✓				
<i>Daphoenositta chrysoptera</i>	Varied Sittella		V		✓	✓		✓	
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	EN	V			✓			
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V		✓	✓	✓	✓	
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle*		V	✓	✓			✓	
<i>Hieraaetus morphnoides</i>	Little Eagle*		V				✓		
<i>Lophoictinia isura</i>	Square-tailed Kite*		V				✓		
<i>Miniopterus schreibersii oceanensis</i>	Large Bent-winged Bat*		V	✓	✓	✓	✓	✓	
<i>Neophema pulchella</i>	Turquoise Parrot		V		✓				
<i>Ninox strenua</i>	Powerful Owl*		V		✓				
<i>Pachycephala olivacea</i>	Olive Whistler		V		✓				
<i>Petroica boodang</i>	Scarlet Robin		V		✓	✓	✓	✓	✓
<i>Petroica phoenicea</i>	Flame Robin		V		✓	✓	✓	✓	✓
<i>Stagonopleura guttata</i>	Diamond Firetail		V		✓				
<i>Tyto novahollandiae</i>	Masked Owl*		V		✓				
BC Act Species credit species									
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo		V	✓	✓	✓	✓	✓	✓
<i>Cercartetus nanus</i>	Eastern Pygmy-possum		V		✓	✓			
<i>Cyclodomorphus praealtus</i>	Alpine She-oak Skink	EN	E1			✓	✓	✓	
<i>Litoria booroolongensis</i>	Booroolong Frog	EN	E1		✓	✓			
<i>Litoria verreauxii alpina</i>	Alpine Tree Frog	VU	E1				✓	✓	



Species name	Common name	Threatened status		Location recorded					
		EPBC Act <sup>1</sup>	BC Act <sup>2</sup>	Talbingo	Lobs Hole	Marica	Plateau	Tantangara	Rock Forest
<i>Mastacomys fuscus</i>	Broad-toothed Rat	VU	V			✓	✓	✓	
<i>Myotis macropus</i>	Southern Myotis		V		✓				
<i>Petroica rodinogaster</i>	Pink Robin		V	Recorded outside Project footprint					
<i>Pseudomys fumeus</i>	Smoky Mouse	EN	E4A		✓	✓			
<sup>1</sup> EPBC Act categories: VU- Vulnerable; EN- Endangered, M- Migratory <sup>2</sup> BC Act categories: V- Vulnerable; E1- Endangered; E4A- Critically endangered * Breeding habitat (e.g. nests and hollows) for this ecosystem-credit species is considered a species-credit and would require individual offsetting if present									

## 2.3. Entities to be monitored

The following targeted entities to be monitored throughout construction are derived from those detailed in section 2.2 above.

### 2.3.1. Threatened flora

Of the threatened flora listed in Table 2-1 the species that have been targeted for ongoing monitoring are those which have potential to be adversely effected by indirect impacts or because of their proximity to the final disturbance area. Indirect impacts were predicted to occur within a 20m buffer of the disturbance area Main Works EIS and RtS. Some flora species listed in Table 2-1 have been excluded for monitoring as there are no retained individuals are situated within the 20m buffer from the disturbance area or the predicted indirect impact is expected to have negligible effects on the individuals/population.

The installation of the communications cable will be undertaken within the existing track surface, while passing bays will be micrositied to avoid threatened species. Further, the communications cable is expected to be installed over a short timeframe, with construction of approximately 250 m per day (dependent on conditions). Based on the degree of impact and short timeframe for construction it is expected that the installation of the communications cable will result in negligible impacts to adjacent areas of vegetation and threatened species habitat. For this reason, no monitoring of threatened species along the communications route is proposed in the Biodiversity Monitoring Plan. This includes all locations for Mueller's Burr-daisy (*Calotis pubescens*) with no records of this species within 50 m of any other areas of the disturbance footprint. If detailed design indicates that impacts cannot be retained within the existing track surface, the monitoring plan will be revised to include additional monitoring.

Table 2-3 provides an overview of the species outlined in Table 2-1 and a determination as to whether monitoring is required.



**Table 2-3: Justification of threatened flora to be monitored**

Species Name	Common Name	Monitoring to be conducted (Y/N)	Justification
<i>Caladenia montana</i>	-	To be confirmed	<p>Targeted surveys undertaken for <i>Caladenia montana</i> were undertaken in October 2019. These surveys identified the species. Further targeted surveys undertaken in November and December 2019 recorded <i>Caladenia</i> sp. that had gone to seed and could not be reliably identified. For the purposes of the biodiversity assessment all records of <i>Caladenia</i> sp. were deemed <i>Caladenia montana</i>.</p> <p>Targeted surveys will be conducted in early November 2020 to confirm if records of <i>Caladenia</i> sp. are <i>Caladenia montana</i>. If this species is confirmed within 50 m of the disturbance footprint monitoring will be included for this species.</p>
<i>Calotis glandulosa</i>	Mauve Burr-daisy	N	<p>Mauve Burr-daisy was recorded within 50 m of the disturbance footprint. However, Mauve Burr-daisy is known to occur within disturbed sites and along road and track edges, as well as broadly throughout the KNP.</p> <p>Therefore, the predicted indirect impact is expected to have negligible effects on the population. Given this, the species will not be monitored.</p>
<i>Calotis pubescens</i>	Max Mueller's Burr-daisy	N	<p>Max Mueller's Burr-daisy was recorded along Tantangara Dam Firetrail within 50 m of the disturbance area, with five plants recorded along the upper reaches of Kellys Plain Creek on Tantangara Road within the disturbance footprint.</p> <p>Impacts along communications cable route will be limited to within the existing disturbance area for the firetrails traversed by the communication cable, except for where passing bays and laydown areas will occur. These will be microsituated to avoid impacts to individuals.</p> <p>Given the limited impacts arising from the project this species will not be monitored.</p>
<i>Carex raleighii</i>	Raleigh Sedge	N	<p>Raleigh Sedge was recorded at four locations within 50 m of the disturbance area. The Project has the potential to result in indirect impacts on the species such as spread of weeds and/or impacts to ground-water dependant ecosystems as a result of drawdown. However, where the species was recorded it was recorded in high numbers (often &gt;100).</p> <p>Consultation with the Australian Herbarium and National Herbarium of NSW during biodiversity surveys for Snowy 2.0 indicates that Raleigh Sedge is difficult to differentiate from <i>Carex hebes</i> with the two species sharing a number of features. This consultation concluded that further study is required to differentiate the two species. Based on this, it is not possible to undertake monitoring for this species.</p> <p>Given indirect impacts to the population of this species recorded in KNP will be minimal (3% of the population impacted) monitoring will not be undertaken.</p>
<i>Discaria nitida</i>	Leafy Anchor Plant	N	<p>Two records of the Leafy Anchor Plant are situated within the 50 m buffer from the disturbance area. Indirect impacts including weed invasion, dust, noise etc. are unlikely to result in any impact to the Leafy Anchor Plant with only woody weeds, fire and grazing by feral Horses highlighted as key threats.</p>



Species Name	Common Name	Monitoring to be conducted (Y/N)	Justification
			Based on the low risk of indirect impacts and lack of monitoring locations the Biodiversity Monitoring Plan does not propose any monitoring of this species.
<i>Glycine latrobeana</i>	Clover Glycine	Y	Clover Glycine has been recorded adjacent to Tantangara Dam and has the potential to be indirectly impacted by the Project. Impacts along communications cable route will be limited to within the existing disturbance area for the firetrails traversed by the communication cable, except for where passing bays and laydown areas will occur. These will be micrositied to avoid impacts to individuals. Individuals within the 50 m buffer from the disturbance area for project elements will be monitored.
<i>Prasophyllum retroflexum</i>	Kiandra Leek Orchid	Y	Kiandra Leek Orchid has been recorded across the Plateau including along Gooandra Firetrail, Bullocks Hill Firetrail and Alpine Creek Firetrail. Impacts along communications cable route will be limited to within the existing disturbance area for the firetrails traversed by the communication cable, except for where passing bays and laydown areas will occur. These will be micrositied to avoid impacts to individuals. Individuals within the 50 m buffer from the disturbance area for project elements will be monitored.
<i>Pterostylis foliata</i>	Slender Greenhood	N	No retained individuals are situated within the 30 m buffer from the disturbance area.
<i>Thelymitra alpicola</i>	-	N	No retained individuals are situated within the 30 m buffer from the disturbance area.

Indirect impacts on flora species and their habitats may include competition from introduced weeds, attack by introduced pathogens or pests, and sediment and nutrient runoff. Threatened flora located more than 20m from the disturbance area are unlikely to be indirectly impacted by construction; however, monitoring to 50m has been included based on feedback from BCD.

In line with REMM BM05, the clearing of native vegetation shall be minimised where possible with the objective of reducing impacts to any threatened species or TECs. The current design indicates that the communications cable can be installed within the existing disturbance area for the firetrails traversed, except for areas where passing bays and laydown areas will occur and impacts to individual threatened species have been avoided and minimised. If this was to change during detailed design this will be picked up through the design process. If this process indicates that the communications cable cannot avoid impacts to threatened flora species a review will be undertaken, and additional monitoring may be triggered.

Based on the table above the threatened flora species targeted for monitoring include:

- Clover Glycine; and
- Kiandra Leek Orchid.

### 2.3.2. Threatened fauna

The threatened fauna species listed in Table 2-2 include migratory species, ecosystem-credit species, and species-credit species. Migratory species are defined under the Commonwealth EPBC Act. Species-credit and ecosystem-credit species are defined under the NSW Biodiversity Assessment Methodology (BAM) in accordance with the NSW BC Act.



While the listed migratory species have potential to occur in the project area, the indirect impacts of the project have been assessed as having negligible impact on these species. As such, the migratory species will not be targeted for monitoring.

Ecosystem-credit species are threatened species where the likelihood of occurrence of a species or elements of its habitat can be predicted by vegetation surrogates and landscape features, or species for which targeted survey has a low probability of detection. Under the BAM, targeted survey is not required for these species for assessment purposes. Likewise, the ecosystem-credit species listed in Table 2-2 have been excluded from this monitoring program.

From the list of species-credit species in Table 2-2 some species have been excluded from monitoring because they either have ubiquitous habitat across the locality and/or have negligible breeding habitat with the disturbance area. These species will experience negligible indirect impacts from the construction activities.

Table 2-4 provides an overview of the species outlined in Table 2-2 and a determination as to whether monitoring is required.

**Table 2-4: Justification of threatened fauna to be monitored**

Species Name	Common Name	Monitoring to be conducted (Y/N)	Justification
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	N	There are four retained breeding hollows for the Gang-gang Cockatoo within a 100 m buffer from the disturbance area. Surveys for this species will be undertaken as a part of the pre-clearing process. Where pairs are recorded breeding adjacent to the disturbance footprint a review of the monitoring requirements will be undertaken in line with Section 2.4.
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Y	Retained Eastern-pygmy Possum habitat occurs adjacent to the disturbance area. The Project has the potential to indirectly impact the species and therefore will be included in small terrestrial mammal monitoring.
<i>Cyclodomorphus praealtus</i>	Alpine She-oak Skink	Y	Retained Alpine She-oak Skink habitat occurs adjacent to the disturbance area, although the number of records adjacent to the disturbance footprint is limited to area adjacent to the communications cable. The Project has the potential to indirect impact habitat for the species and therefore will be monitored.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	N	One breeding tree for the White-bellied Sea-eagle was recorded during targeted surveys (EMM, 2020). The tree is situated within the disturbance area and will be removed. Therefore, no monitoring will be required.
<i>Litoria booroolongensis</i>	Booroolong Frog	Y	The Booroolong Frog was recorded along the Yarrangobilly River and Wallaces Creek. The Project has the potential to result in indirect impacts to these areas. Therefore, the species will be included in frog monitoring.
<i>Litoria verreauxii alpina</i>	Alpine Tree Frog	Y	The Alpine Tree Frog was recorded along a number of major waterways. The Project has the potential to result in indirect impacts to the Alpine Tree Frog population across the Plateau and Tantangara. Therefore, the species will be included in frog monitoring.
<i>Mastacomys fuscus</i>	Broad-toothed Rat	Y	Retained Broad-toothed Rat habitat occurs adjacent to the disturbance area.



Species Name	Common Name	Monitoring to be conducted (Y/N)	Justification
			The Project has the potential to indirectly impact the species and therefore will be included in small terrestrial mammal monitoring.
<i>Myotis macropus</i>	Southern Myotis	N	<p>The Southern Myotis was recorded at three locations across the project area, adjacent to major waterbodies. Extensive areas of Southern Myotis habitat will be retained adjacent to Talbingo Reservoir.</p> <p>The Project is not considered to indirectly impact the species and therefore will not be monitored.</p>
<i>Pseudomys fumeus</i>	Smoky Mouse	Y	<p>The Smoky Mouse was recorded along upper sections of Lobs Hole Ravine Road, in the Marica area and extensively throughout similar habitat across an estimated 6000-8000 ha. Smoky Mouse habitat occurs adjacent to the disturbance area.</p> <p>The Project has the potential to indirectly impact the species and therefore will be included in small terrestrial mammal monitoring.</p>

In line with REMM BM05, the clearing of native vegetation shall be minimised where possible with the objective of reducing impacts to any threatened species or TECs. The current design indicates that the communications cable can be installed within the existing disturbance area for the firetrails traversed, except for areas where passing bays and laydown areas will occur and impacts to individual threatened species and habitats have been avoided and minimised. If this was to change during detailed design this will be picked up through the design process. If this process indicates that the communications cable cannot avoid impacts to threatened fauna species habitat a review will be undertaken, and additional monitoring may be triggered.

The fauna species that will be targeted for ongoing monitoring during construction include:

- Eastern Pygmy-possum;
- Broad-toothed Rat;
- Smoky Mouse;
- Alpine Tree Frog;
- Booroolong Frog; and
- Alpine She-oak Skink.

These species will be monitored in a combined program of Small Terrestrial Mammal Monitoring (section 5), Frog Monitoring (section 6) and Alpine She-oak Skink Monitoring (section 7).

In addition to habitat impacts to the above threatened species, predation by feral cats and foxes, and fauna vehicle strike are two other impacts that are predicted to affect fauna more generally across the project. These impacts will be tracked through:

- Feral animal monitoring (section 6.3); and
- Fauna Strike Mitigation Strategy (Appendix G of the BMP).

### 2.3.3. Native vegetation

As detailed in section 3 of the BMP, 20 Plant Community Types (PCT) were mapped in the project area. Native vegetation was assessed as experiencing both direct and indirect impacts. Direct impacts consist of land-clearing and indirect impacts primarily involve PCT degradation resulting from weed and pest invasion along disturbed edges.



PCTs will not be directly targeted for monitoring but indirect impacts on PCTs will be tracked through Weed and Pathogen monitoring within a 50m buffer of the disturbance area (section 8.3).

#### **2.3.4. Groundwater dependant ecosystems**

Two PCTs were identified in the BDAR as obligate GDEs (PCT 637 and PCT 1225). Direct impacts to these GDEs will result from clearing of vegetation on the Plateau and Tantangara work fronts and will be addressed as typical native vegetation (see section 2.3.3 above).

However, tunnelling for the project has potential to result in drawdown of groundwater and an associated adverse impact on GDEs. Monitoring of groundwater levels will be carried out in accordance with the Groundwater Monitoring Program (Water Management Plan). If the shallow groundwater regime in GDE patches shows a drawdown in exceedance of the 80th percentile and this drawdown is subsequently found to be attributable to the project, then a non-negligible impact to the shallow groundwater system will be confirmed.

No additional biometric monitoring, such as floristics or vegetation condition, is proposed to assess the impact on ecosystem function as a result of drawdown. This is because, functional impacts can take a substantial amount of time to present and be detected. Instead, shallow groundwater levels will be used as a proxy for ecosystem function in the GDE patches. Where there is a confirmed change to the shallow groundwater regime (as determined by the Groundwater Monitoring Program), an adverse impact will be assumed and offsets for the affected patches will be paid directly.

Confirmed groundwater drawdown in GDE patches will trigger potential ameliorative actions where practicable, otherwise a loss of ecological function will be assumed, and offsets will be sought. This approach, of assuming an ecological impact based on groundwater levels alone, provides offset funds for conservation measures in a timely fashion without requiring extensive and prolonged ecosystem monitoring. Offsets will be secured in accordance with Schedule 3, Condition 16 of the Infrastructure Approval (SSI 9687). Further detail on the proposed offsetting arrangement is included in section 5.3.1 of the BMP.

Figure 2-1 provides an outline of the GDE monitoring process as addressed in the Groundwater Monitoring Program and in the BMP.



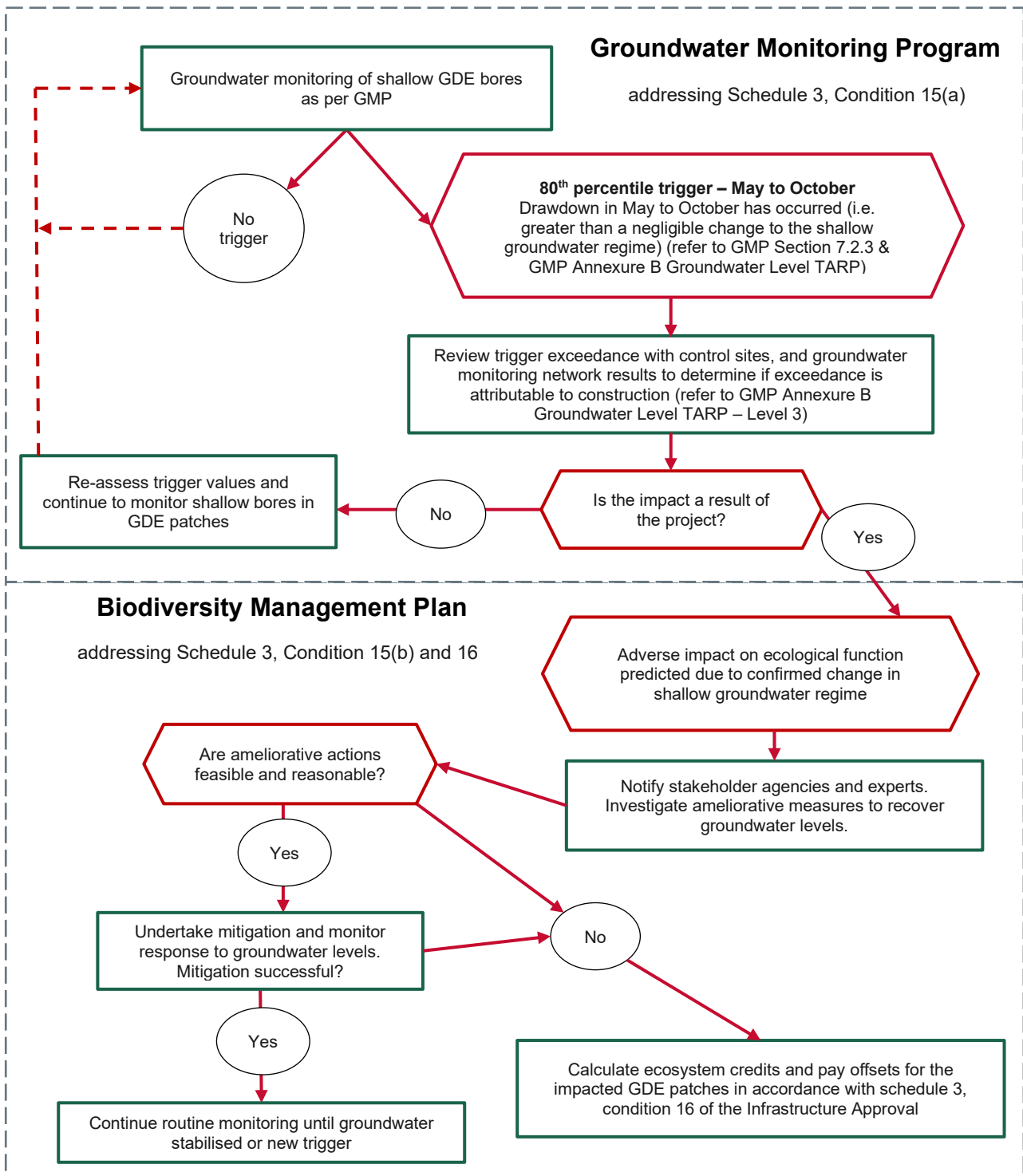


Figure 2-1: Outline of GDE monitoring process and division of responsibility across GMP and BMP

## 2.4. Process for reviewing the monitoring program

As outlined in the BMP, the detailed design for the project is being undertaken and Section 5.2 of the BMP outlines a process for reviewing impacts arising from this design process.



Where this design process identifies additional threatened species locations within 50 m of the revised disturbance footprint, or where pre-clearing surveys identify a new record of a threatened species within 50 m of the revised disturbance footprint, a review of the monitoring program will be undertaken to determine whether additional monitoring is required. This decision will be made based on the rationale outlined above.

### 3. PROGRAM STRUCTURE

#### 3.1. Monitoring activities

The monitoring activities which comprise this overarching Biodiversity Monitoring Program include:

- Threatened flora monitoring for:
  - *Glycine latrobeana* (Clover Glycine); and
  - *Prasophyllum retroflexum* (Kiandra Leek Orchid).
- Small terrestrial mammal presence/absence monitoring for:
  - Smoky Mouse (*Pseudomys fumeus*);
  - Broad-toothed Rat (*Mastacomys fuscus*); and
  - Eastern Pygmy-possum (*Cercartetus nanus*).
- Amphibian occupancy monitoring for:
  - Alpine Tree Frog (*Litoria verreauxii alpina*); and
  - Booroolong Frog (*Litoria booroolongensis*).
- Alpine She-oak Skink Monitoring.
- Feral animal monitoring.
- Weed and pathogen monitoring.

Further detail on each of the above-listed monitoring activities is provided from section 1 onwards.

The following monitoring will be addressed in other plans:

- Fauna vehicle strike monitoring (Appendix G of the BMP); and
- Groundwater dependant ecosystem monitoring (Groundwater Management Plan).

#### 3.2. Monitoring schedule

The timing and frequency of monitoring activities is summarised in Table 3-1 below. Further detail is provided in the following sections of this program.

**Table 3-1: Monitoring schedule**

Activity	Timing/duration	Detailed in
Threatened Flora Monitoring	Conducted bi-annually between December and January.	Section 1
Small Mammal Presence/Absence Monitoring	Four monitoring events per year, with each monitoring event defined as a 30-day deployment of remote cameras and a single faecal pellet monitoring event.	Section 5
Small Mammal Habitat Characteristics Monitoring	One monitoring event per year.	Section 5



Activity	Timing/duration	Detailed in
Frog Occupancy Monitoring	One monitoring event per year, comprising two surveys of each transect.	Section 1
Frog Habitat Characteristics Monitoring	One monitoring event per year.	Section 1
Alpine She-oak Skink Monitoring	Monthly checks of tile grids between October and March.	Section 7
Feral Animal Occupancy Monitoring	Four monitoring events per year, with each monitoring event defined as a 30-day deployment of remote cameras and a single faecal pellet monitoring event.	Section 8
Feral Animal Presence/Absence Monitoring	Four monitoring events per year, comprising one night of survey per site.	Section 8
Weed Monitoring	One monitoring event per year in early Summer.	Section 9
Pathogen Monitoring	Annual Phytophthora soil tests.	Section 9
GDE Monitoring	Groundwater drawdown monitored as detailed in the Groundwater Management Plan.	Addressed in Groundwater Management Plan



## 4. THREATENED FLORA MONITORING

### 4.1. Known distribution of target species

#### **Clover Glycine**

Clover Glycine is a low growing herb endemic to south-eastern Australia with a wide distribution from Port Pirie in South Australia through Victoria to near Hobart in Tasmania. Recently discovered in Kosciuszko National Park, it grows up to elevations of ~1,300 m in Subalpine Woodlands and Temperate Montane Grasslands. The species grows in a variety of soils including alluvial, sandstone, mudstone, granite and basalt derived soils.

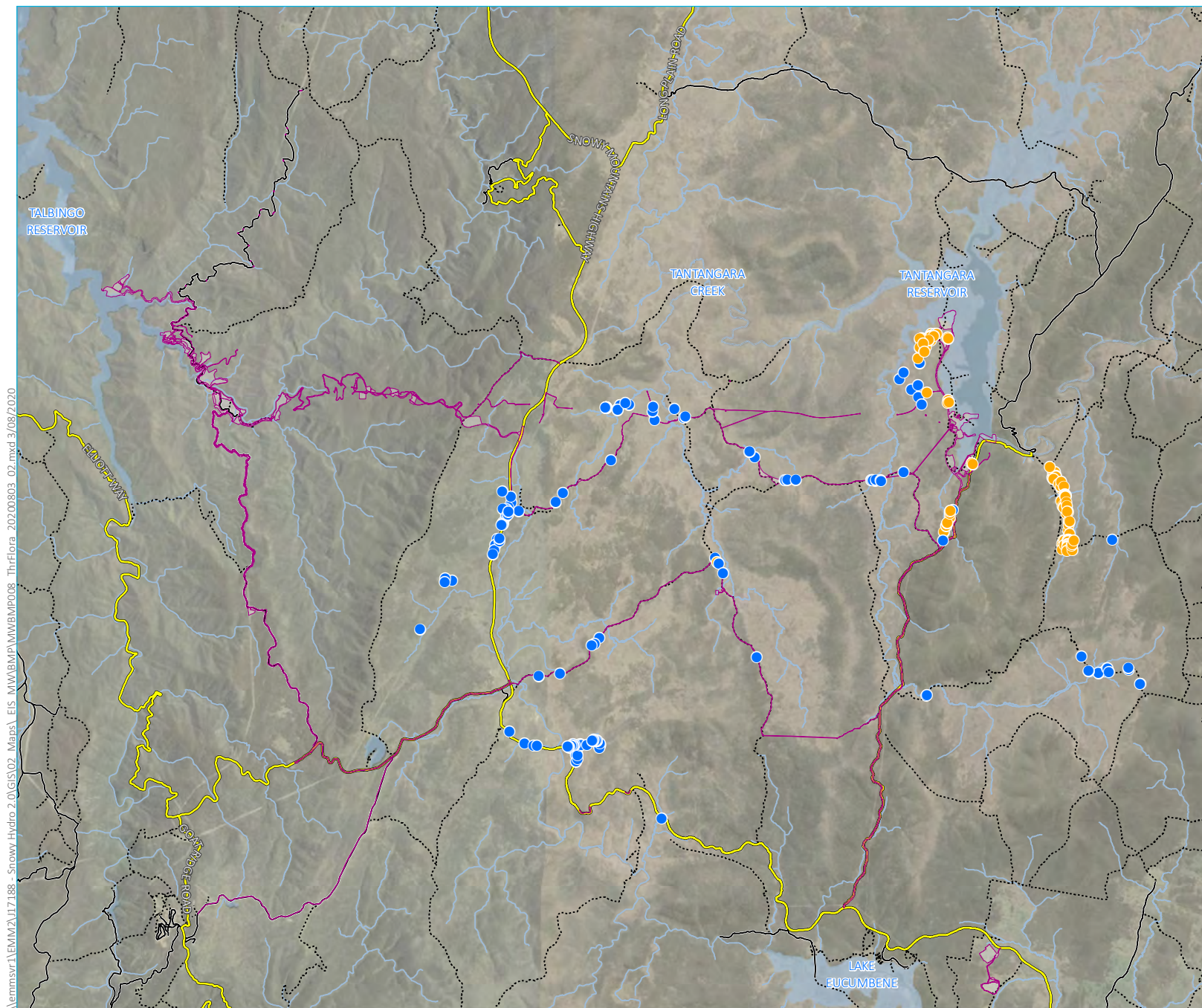
Almost 1000 individual records of the Clover Glycine (*Glycine latrobeana*) were recorded during the Main Works assessment. Several sub-populations were identified, including a large population of over 600 plants on Gulf Plain, in areas not impacted by Ox-eye Daisy (*Leucanthemum vulgare*) (Figure 4-1).

#### **Kiandra Leek Orchid**

Kiandra Leek-orchid is a terrestrial orchid restricted to the Long Plain, Kiandra and Tantangara areas of KNP. Found growing in Subalpine meadows, Subalpine grasslands and Snow Gum *Eucalyptus pauciflora* subsp. *pauciflora* woodlands in Temperate Montane Grasslands. This species is cryptic and most visible when flowering between October and December.

Almost 1500 individual records of the Kiandra Leek Orchid (*Prasophyllum retroflexum*) were recorded in and around the project area during the BDAR surveys. The species was recorded over large areas of KNP (Figure 4-1).





# KEY

Threatened flora location

● *Glycine latrobeana*

● Kiandra Leek Orchid

Existing environment

— Main road

— Local road

..... Vehicular track

— Watercourse / drainage line

Waterbody

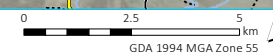
Main Works disturbance footprint

Threatened flora locations

Snowy 2.0  
Biodiversity monitoring program report  
Main Works  
Figure 4.1



Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





## 4.2. Threatened Flora Monitoring

Threatened flora monitoring will be undertaken by a suitably qualified ecologist(s) as detailed in Table 4-1.

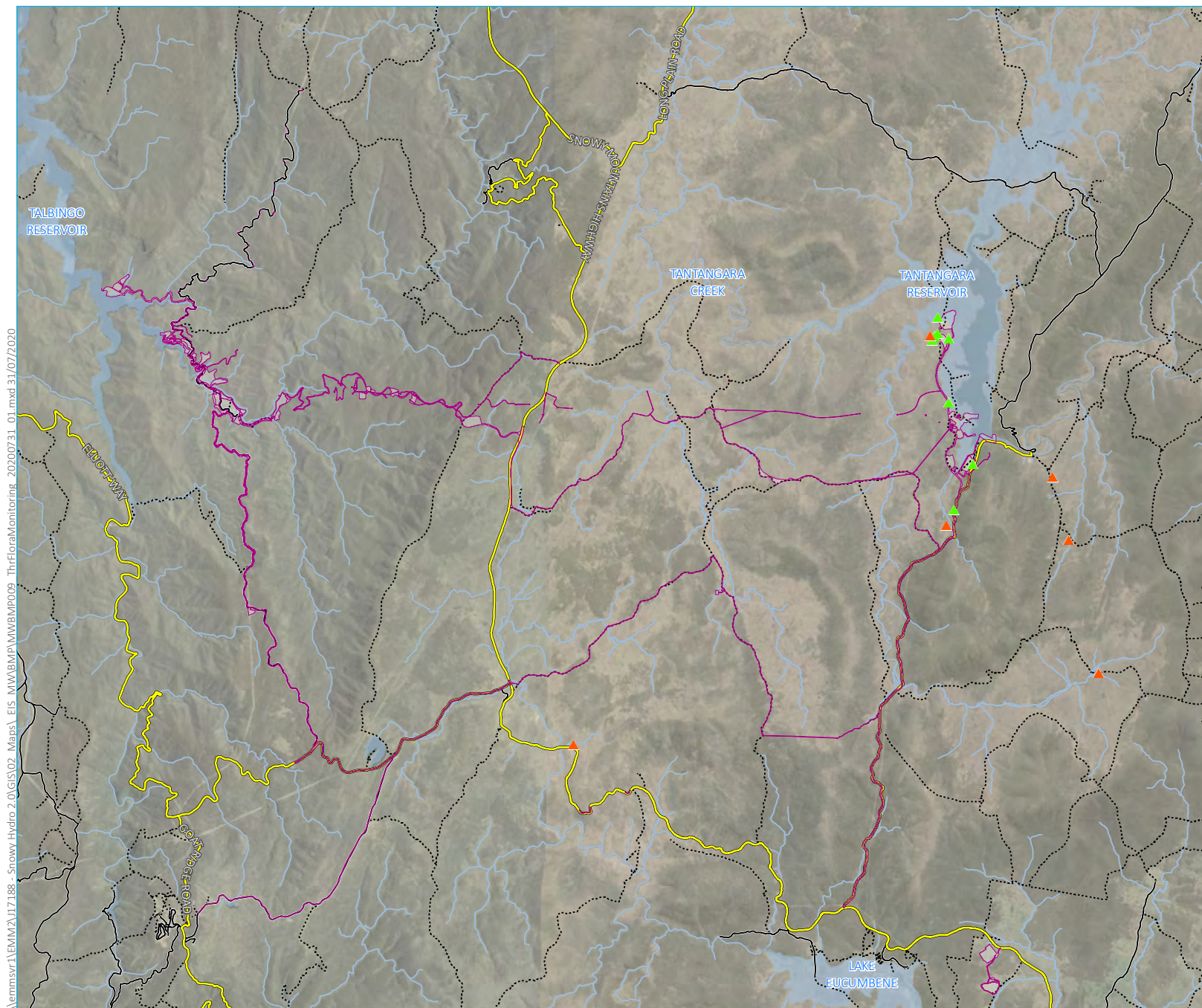
**Table 4-1: Threatened flora monitoring**

Threatened flora monitoring	
<b>Objective</b>	To determine the health of threatened flora populations located adjacent to the disturbance area in order to implement additional controls if necessary.
<b>Target species</b>	<ul style="list-style-type: none"> <li>• Clover Glycine</li> <li>• Kiandra Leek-Orchid</li> </ul>
<b>Sampling units</b>	Monitoring plots
<b>Method</b>	<ul style="list-style-type: none"> <li>• Monitoring plots (e.g. 20m x 50m, 50m x 50m or 100m x 50m, to fit location) will be established at key locations adjacent to the Main Works disturbance area in all locations where Clover Glycine and/or Kiandra Leek Orchid are known to occur.               <ul style="list-style-type: none"> <li>○ Plots will be established and permanently marked using a metal stake at all corners and tagged. Plots will run parallel with infrastructure where possible.</li> <li>○ At the commencement of each monitoring event a photo will be taken from a pre-established photo monitoring point.</li> <li>○ Transects, spaced at 5m intervals will be traversed within the monitoring plot. The number of plants within each monitoring plot will be counted during each monitoring event, with individual plants flagged and marked using a marker flag and a GPS. A plant should only be counted/marked where the individual can be observed during the monitoring event.</li> <li>○ The number of plants per monitoring plot will be the total observed per annum (i.e. plants will not be double counted).</li> <li>○ Monitoring will be undertaken twice per annum between December and January to encompass the flowering period for the two species. Reference sites will be used to determine flowering.</li> </ul> </li> <li>• Monitoring of control sites, located outside of the disturbance area and construction envelope, will be incorporated into the threatened flora monitoring to ensure any observed changes are not a result of bioclimatic factors unrelated to construction.</li> </ul>
<b>Location</b>	<ul style="list-style-type: none"> <li>• All locations where the species were identified during the BDAR assessment, including:               <ul style="list-style-type: none"> <li>○ eight impact monitoring sites (Figure 4-2) located at the:                   <ul style="list-style-type: none"> <li>○ Peninsula emplacement area (subject to surveys);</li> <li>○ Ancillary facilities area in northern Tantangara (three sites);</li> <li>○ Tantangara access road (two sites);</li> <li>○ Tantangara laydown area;</li> <li>○ Tantangara Road;</li> </ul> </li> <li>○ six control sites, located outside of the disturbance area and construction envelope (Figure 4-2).</li> </ul> </li> </ul>
<b>Timing, effort and frequency</b>	<ul style="list-style-type: none"> <li>• Threatened flora monitoring will be conducted bi-annually between December and January (dependent on flowering).</li> <li>• Where possible monitoring will be undertaken prior to construction activities occurring, during construction and for a period of two years following construction.</li> </ul>
<b>Data analysis</b>	



Threatened flora monitoring
<ul style="list-style-type: none"> <li>Population counts in each monitoring plot will be compared across survey periods.</li> </ul>
Triggers for adaptive management
<ul style="list-style-type: none"> <li>Percentage decline in the number of plants observed within a single monitoring plot, observed over two consecutive monitoring periods and outside of the standard deviation observed at control sites.</li> <li>Decline must be observed in conjunction with a primary impact (e.g. increase in weed cover).</li> </ul>
Adaptive management
<ul style="list-style-type: none"> <li>Initial investigation to document potential causation between decline and project related impacts.</li> <li>Development of a mitigation plan, in consultation with DPIE and DAWE, addressing causes of decline as determined in initial investigation.</li> <li>If this is ineffective, undertake seed collection and propagation from in-situ populations and try to re-establish local populations. This will be accompanied by additional monitoring.</li> <li>If this is ineffective, additional offsets may be required.</li> </ul>





# KEY

Monitoring location

▲ Threatened flora - control site

▲ Threatened flora - impact site

Existing environment

— Main road

— Local road

..... Vehicular track

— Watercourse / drainage line

Waterbody

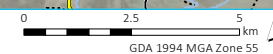
Main Works disturbance footprint

Threatened flora monitoring  
locations

Snowy 2.0  
Biodiversity monitoring program report  
Main Works  
Figure 4.2



Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





## 5. SMALL TERRESTRIAL MAMMAL MONITORING

### 5.1. Known distribution

The three target species – Broad-toothed Rat, Eastern Pygmy-possum and Smoky Mouse – were recorded within or adjacent to the disturbance footprint at several locations during the biodiversity assessment for the Project (EMM, 2020). Locations of species records are mapped in Figure 5-1.

The Broad-toothed Rat was recorded within or adjacent to the disturbance footprint along Link Road, west of the Snowy Mountain Highway and adjacent to Tantangara Reservoir. The Eastern Pygmy-possum was recorded within the upper reaches of Lobs Hole Ravine Road to Lobs Hole and spanning across to Marica. The Smoky Mouse was recorded at 61 locations within and adjacent to the disturbance area. Smoky Mouse is predominantly associated with tall forests dominated by Mountain Gum and Snow Gum, with a moderate to dense shrubby mid-storey, and dense groundcover with abundant subshrubs. Its habitat is located above 1,100m altitude along the upper reaches of Lobs Hole Ravine Road and in the Marica area.

Table 5-1 shows the plant community type where each species was recorded during the BDAR surveys. There is a partial overlap in distribution between Smoky Mouse and Eastern Pygmy Possum, however, Broad-toothed Rat appears to occur separately from the other targeted mammals. This distribution variation across species is also apparent in Figure 5-1.

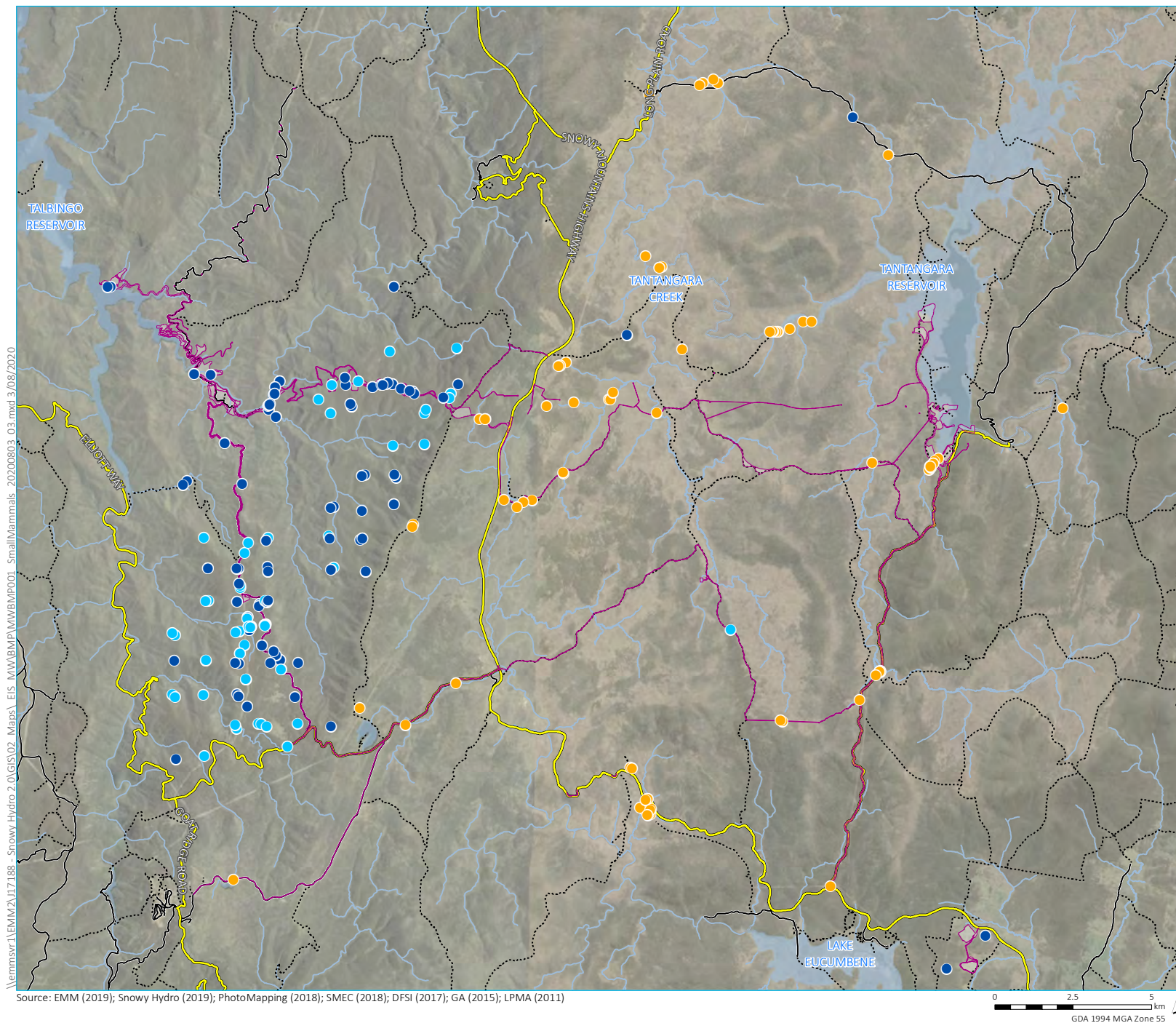
**Table 5-1: Occurrence of small mammal across PCT as surveyed by EMM, 2020**

Plant Community	Smoky Mouse	Eastern Pygmy Possum	Broad-toothed Rat
296 - Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion		X	
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	X	X	
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		X	
311 – Red Stringybark - Broad-leaved Peppermint - Nortons Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion		P	
637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion			X
639 - Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	X	X	
643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion	X		
644 - Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	X		
729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	X	X	



Plant Community	Smoky Mouse	Eastern Pygmy Possum	Broad-toothed Rat
953 - Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion;	X	X	
999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion		X	
1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	X	X	
1224 - Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion			X
1225 - Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion			X
<i>X = species recorded within the PCT</i> <i>P = species predicted to occur (EMM 2020)</i>			





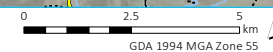
- KEY**
- Records**
- Broad-toothed Rat
  - Eastern Pygmy-possum
  - Smoky Mouse
- Existing environment**
- Main road
  - Local road
  - ..... Vehicular track
  - Watercourse / drainage line
  - Waterbody
  - Main Works disturbance footprint

Small terrestrial mammal records

Snowy 2.0  
Biodiversity monitoring program report  
Main Works  
Figure 5.1



Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





## 5.2. Presence/absence monitoring

Small terrestrial mammal presence/absence monitoring will be undertaken by a suitably qualified person(s) as detailed in Table 5-2. Installation or removal of cameras may be undertaken by appropriately trained environmental personnel under the guidance of the ecologist.

**Table 5-2: Small terrestrial mammal presence/absence monitoring**

Small Terrestrial Mammal presence/absence Monitoring	
<b>Objective</b>	
To determine the small terrestrial mammal occupancy (presence/absence) at known habitat sites within proximity to the Project and document any changes attributable to the Project.	
<b>Target Species</b>	
<ul style="list-style-type: none"> <li>• Smoky mouse</li> <li>• Eastern Pygmy-possum</li> <li>• Broad-toothed Rat</li> </ul>	
<b>Sampling units</b>	
Remote camera monitoring (all species) and faecal pellet monitoring (Broad-toothed Rat only)	
<b>Method</b>	
<p><i>Remote camera monitoring site</i></p> <ul style="list-style-type: none"> <li>• Remote Camera Monitoring Sites (RCMS) will be established adjacent to key infrastructure areas, such as key access roads, construction areas, camps etc. Monitoring locations will be focussed on sections of higher quality habitat or at sites of previous records of the target species. Subsequent monitoring events should return to the same site for consistency.</li> <li>• At each survey site, a pair of cameras will be placed out, with one camera placed approximately 20 m from the road verge and one placed approximately 120 m from the road verge (see Figure 5-2 <b>Error! Reference source not found.</b>).</li> <li>• White flash cameras will be attached to a tree or stake and positioned approximately 25 cm above ground with bait stations placed 1.5 m away.</li> <li>• Bait station to be baited with walnuts or universal mammal bait as required.</li> <li>• The remote cameras should be positioned to face suitable small mammal habitat (e.g. logs, coarse woody debris, leaf litter, dense understorey cover and key flora feed species).</li> <li>• Trimming of vegetation with hand-held shearers directly between the camera and bait station may be required to avoid vegetation from obscuring the view of an animal investigating the bait or that might cause the camera to false trigger.</li> <li>• Cameras are to be deployed for 30 days per survey and will be set to trigger over the entire 24-hour cycle for the duration.</li> <li>• Coordinates to be recorded at each camera location, such that the same sites can be setup for subsequent monitoring events.</li> <li>• Monitoring of control sites, located outside of the disturbance area and construction envelope, will be incorporated into the small terrestrial mammal monitoring to ensure any observed changes are not a result of bioclimatic factors unrelated to construction.</li> </ul> <p><i>Faecal pellet monitoring (Broad-toothed Rat)</i></p> <ul style="list-style-type: none"> <li>• Surveys will be undertaken at select RCMS within suitable Broad-toothed Rat habitat.</li> <li>• A timed 10-minute search will be conducted at each site in an approximately 10 m radius to search for Broad-toothed Rat scats.</li> <li>• The observer will record:             <ul style="list-style-type: none"> <li>○ an estimate of abundance will be recorded after the 10-minute search (Abundant &gt;200 scats, Common = 100-200 scats, Uncommon = 50-100 scats, Rare &lt;50 scats and Not Present = no scats recorded);</li> <li>○ scat age (1. Old – completely dry, 2. Fresh – Bright Olive Green, 3. Intermediate); and</li> <li>○ feral animal impacts.</li> </ul> </li> </ul>	



Small Terrestrial Mammal presence/absence Monitoring
<ul style="list-style-type: none"> <li>Monitoring of control sites, located outside of the disturbance area and construction envelope, will be incorporated into the faecal pellet monitoring to ensure any observed changes are not a result of bioclimatic factors unrelated to construction.</li> </ul>
Location
<p>Within patches of associated PCT or at sites of previous records of target species along the three main access roads and adjacent to key infrastructure, including:</p> <ul style="list-style-type: none"> <li>twenty-one impact sites (Figure 5-3), including:               <ul style="list-style-type: none"> <li>Lobs Hole Ravine Road between Link Road and Lobs Hole (Eastern Pygmy-possum and Smoky Mouse);</li> <li>Lobs Hole construction areas (Eastern Pygmy-possum);</li> <li>Marica Trail between MAT portal and Snowy Mountains Highway (Eastern Pygmy-possum and Smoky Mouse);</li> <li>Tantangara Road between Snowy Mountains Highway and Tantangara Reservoir (Broad-toothed Rat); and</li> <li>Tantangara construction area at Kellys Plain (Broad-toothed Rat).</li> </ul> </li> <li>eighteen control sites (Figure 5-3), to be established outside of the construction envelope.</li> </ul>
Timing, effort and frequency
<ul style="list-style-type: none"> <li>Small terrestrial mammal presence/absence monitoring will comprise four monitoring events per year during construction (one per season). A monitoring event is defined as:               <ul style="list-style-type: none"> <li>minimum 30-day deployment of all camera traps as per the layout explained in methods; and</li> <li>one faecal search per event.</li> </ul> </li> <li>Where possible monitoring will be undertaken prior to construction activities occurring, during construction and for a period of two years following construction.</li> </ul>
Data analysis
<ul style="list-style-type: none"> <li>Animals captured on digital images are to be identified with reference to appropriate field guides and by consultation with external experts, if required;</li> <li>Data to be kept in a spreadsheet to determine presence/absence between monitoring periods; and</li> <li>Data trends to be analysed by a suitably qualified person, in order to detect changes in presence/absence.</li> </ul>
Triggers for adaptive management
<ul style="list-style-type: none"> <li>Absence of target species from a site during construction and operational monitoring, where the species was recorded during pre-construction / baseline surveys;</li> <li>No changes in presence / absence at control sites;</li> <li>Absence recorded for greater than one year; and</li> <li>Absence is combined with an observed increase or new occurrence of a primary impact (decline in habitat complexity, weeds, pathogens, or feral herbivores / predators).</li> </ul>
Adaptive management
<ul style="list-style-type: none"> <li>Initial investigation to document potential causation between decline and project related impacts (e.g. if initial investigation determines that habitat is unlikely to be suitable for Smoky Mouse, then the historic record would be deemed transient).</li> <li>Development of a mitigation plan, in consultation with DPIE and DAWE, addressing causes of decline as determined in initial investigation. This may include targeted weed control, increased monitoring, feral animal control or additional construction related mitigation measures.</li> <li>If this is ineffective, additional offsets may be required.</li> </ul>

### 5.3. Habitat characteristic monitoring

The monitoring of Smoky Mouse habitat characteristics will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 5-3.



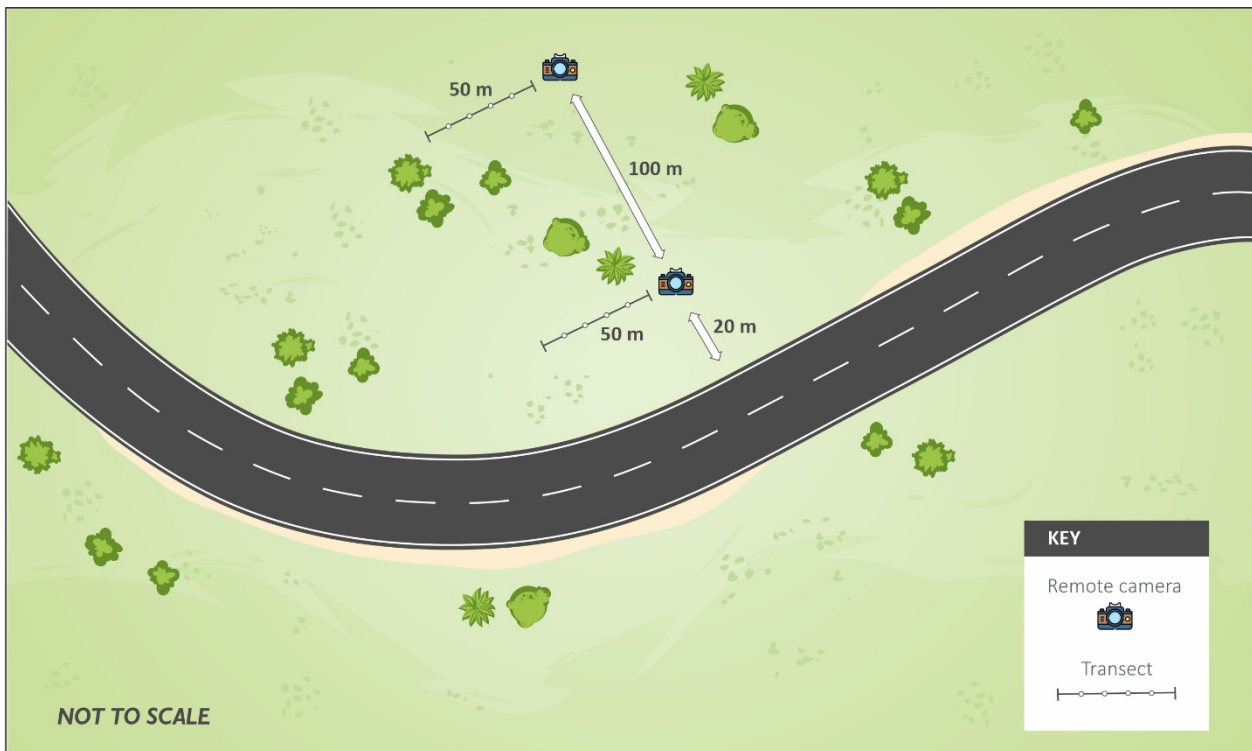
**Table 5-3: Small terrestrial mammal habitat characteristic monitoring**

<b>Small Terrestrial Mammal Habitat Characteristic Monitoring</b>	
<b>Objective</b>	To determine the habitat characteristics of occupied Smoky Mouse habitat, within proximity to the project, and document any changes to the habitat arising from the project.
<b>Target Species</b>	<ul style="list-style-type: none"> <li>• Smoky Mouse</li> <li>• Eastern Pygmy-possum</li> <li>• Broad-toothed Rat</li> </ul>
<b>Sampling units</b>	Habitat complexity at ground level (1.5 m and below) and weed cover.
<b>Method</b>	<p><i>Transects</i></p> <p>Transects are undertaken at each site to monitor changes in habitat characteristics and encompasses the following:</p> <ul style="list-style-type: none"> <li>• A pair of transects to be placed at sites as per the presence/absence monitoring.</li> <li>• Each transect to be 50 m and will be placed parallel to the disturbance footprint at a distance of 20 m and 120 m (Figure 5-2).</li> <li>• The line-point intercept method will be used at 1 m intervals along each 50 m transect.</li> <li>• At each 1m interval (starting from 1m) any native or exotic flora species, or other habitat structures (deep (&gt;5 cm) leaf litter, logs or coarse woody debris), intersecting the interval is scored to gain an estimate of habitat complexity below 1.5 m, at intervals of &lt;0.5 m, 0.5 m – 1 m, 1 – 1.5 m.               <ul style="list-style-type: none"> <li>○ Each interval is scored separately; and</li> <li>○ Native flora species, other habitat structures and exotic flora species should be scored separately.</li> </ul> </li> <li>• As data is collected for a total of 50 intervals along each transect, the cover (%) of native vegetation, exotic vegetation or habitat structure within each interval is calculated by multiplying the score by two, with a maximum of 100% cover possible for any single element (native flora, habitat structures or exotic flora).               <ul style="list-style-type: none"> <li>○ Habitat complexity = cover native flora (&lt;0.5 m, 0.5 m – 1 m, 1 – 1.5 m) + other habitat structures (&lt;0.5 m, 0.5 m – 1 m, 1 – 1.5 m); and</li> <li>○ Weed cover = sum of weed cover along 50 m transect.</li> </ul> </li> </ul>
<b>Location</b>	<ul style="list-style-type: none"> <li>• As per presence/absence monitoring. Sites will be co-located and will be targeted.</li> </ul>
<b>Timing, effort and frequency</b>	<ul style="list-style-type: none"> <li>• Small terrestrial mammal habitat characteristic monitoring will comprise one monitoring event per year (spring).</li> <li>• Where possible monitoring will be undertaken prior to construction activities occurring, during construction and for a period of two years following construction.</li> </ul>
<b>Data analysis</b>	<ul style="list-style-type: none"> <li>• Transect data to be kept in a spreadsheet to determine any changes in the cover (%) at each transect location between monitoring periods.</li> </ul>
<b>Triggers for adaptive management</b>	<ul style="list-style-type: none"> <li>• Observed degradation in vegetation structure and habitat characteristics of occupied habitat; and</li> <li>• Observed degradation is combined with an observed increase in weed cover or other project related impacts.</li> </ul>
<b>Adaptive management</b>	



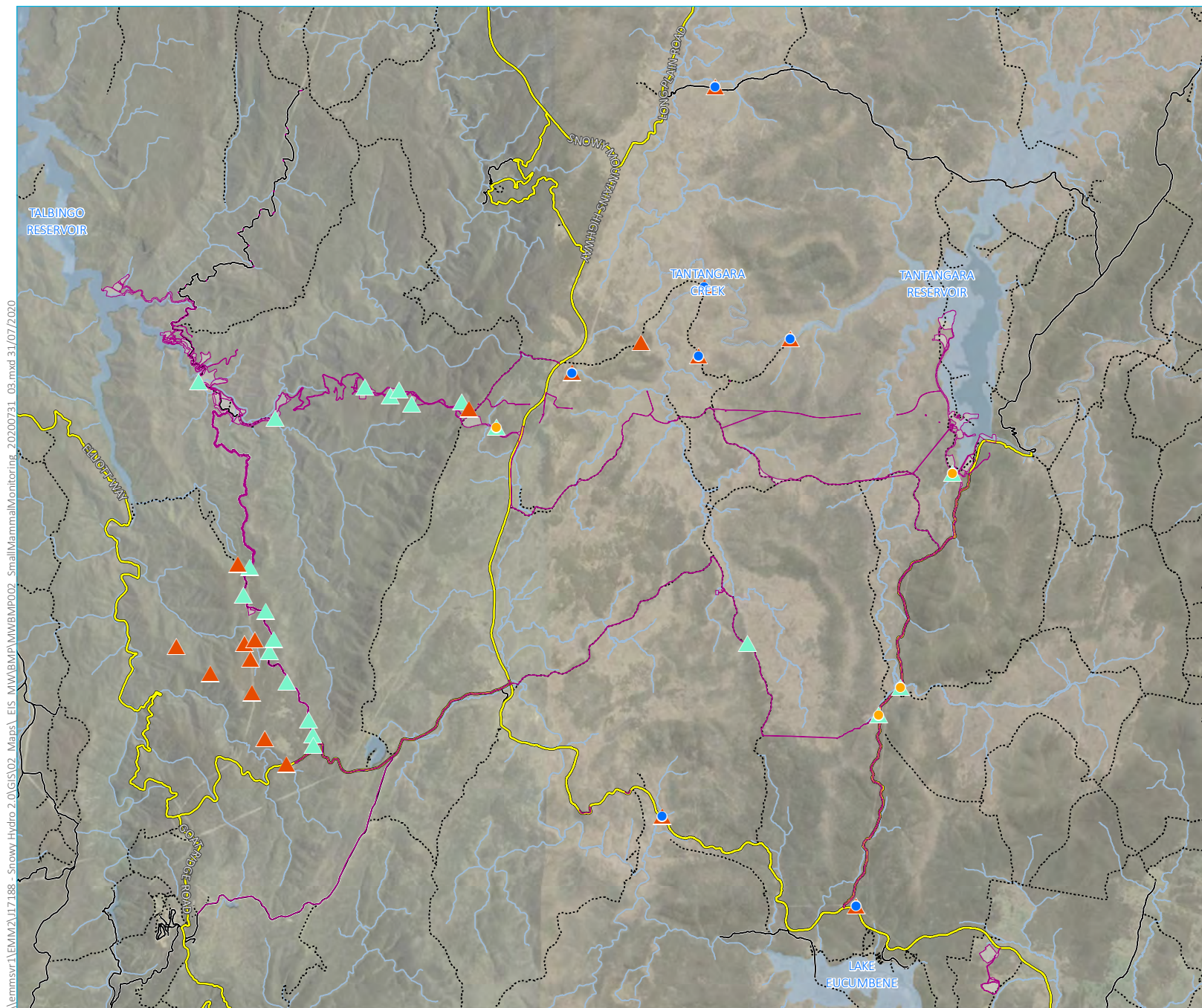
### Small Terrestrial Mammal Habitat Characteristic Monitoring

- Initial investigation to document potential causation between decline and project related impacts.
- Development of a mitigation plan, in consultation with DPIE and DAWE, addressing causes of decline as determined in initial investigation. This may include targeted weed control or additional construction related mitigation measures.
- If this is ineffective, presence/absence monitoring will be used to determine if any impacts to small terrestrial mammals will occur.



**Figure 5-2: Small terrestrial presence/absence and habitat characteristic monitoring - remote camera and transect set up**





# KEY

## Monitoring location

- Faecal pellet - control site
- Faecal pellet - impact site
- ▲ Remote camera - control site
- ▲ Remote camera - impact site

## Existing environment

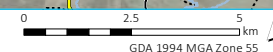
- Main road
- Local road
- ..... Vehicular track
- Watercourse / drainage line
- Waterbody
- Main Works disturbance footprint

## Small terrestrial mammal monitoring locations

Snowy 2.0  
Biodiversity monitoring program report  
Main Works  
Figure 5.3



Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





## 6. FROG MONITORING

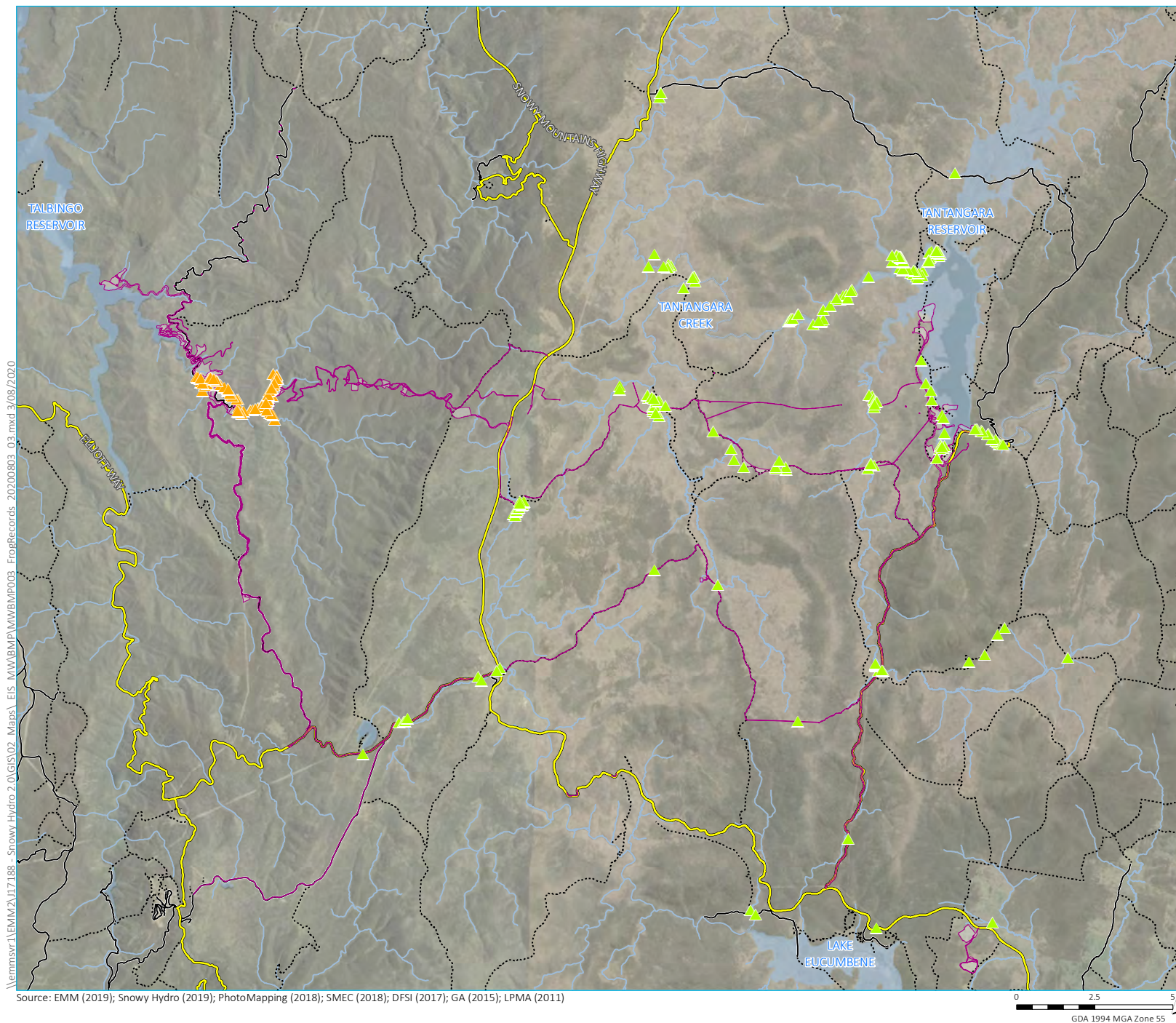
### 6.1. Known distribution

The frog monitoring program targets two threatened frog species known to occur across the project:

- Alpine Tree Frog; and
- Booroolong Frog.

The habitats for each species are disjunct, with the Booroolong Frog occurring along the Yarrangobilly River and Wallaces Creek at Lobs Hole, and the Alpine Tree Frog occurring at numerous locations across the Plateau and at Tantangara. The BDAR amphibian survey mapping at Figure 6-1 show the general locations where each frog species occurred.





- KEY**
- Records**
- ▲ Alpine Tree Frog
  - ▲ Booroolong Frog
- Existing environment**
- Main road
  - Local road
  - ..... Vehicular track
  - Watercourse / drainage line
  - Waterbody
  - Main Works disturbance footprint

Threatened frog records

Snowy 2.0  
Biodiversity monitoring program report  
Main Works  
Figure 6.1





## 6.2. Occupancy monitoring

Frog occupancy monitoring will be undertaken by a suitably qualified ecologist(s) as detailed in Table 6-1.

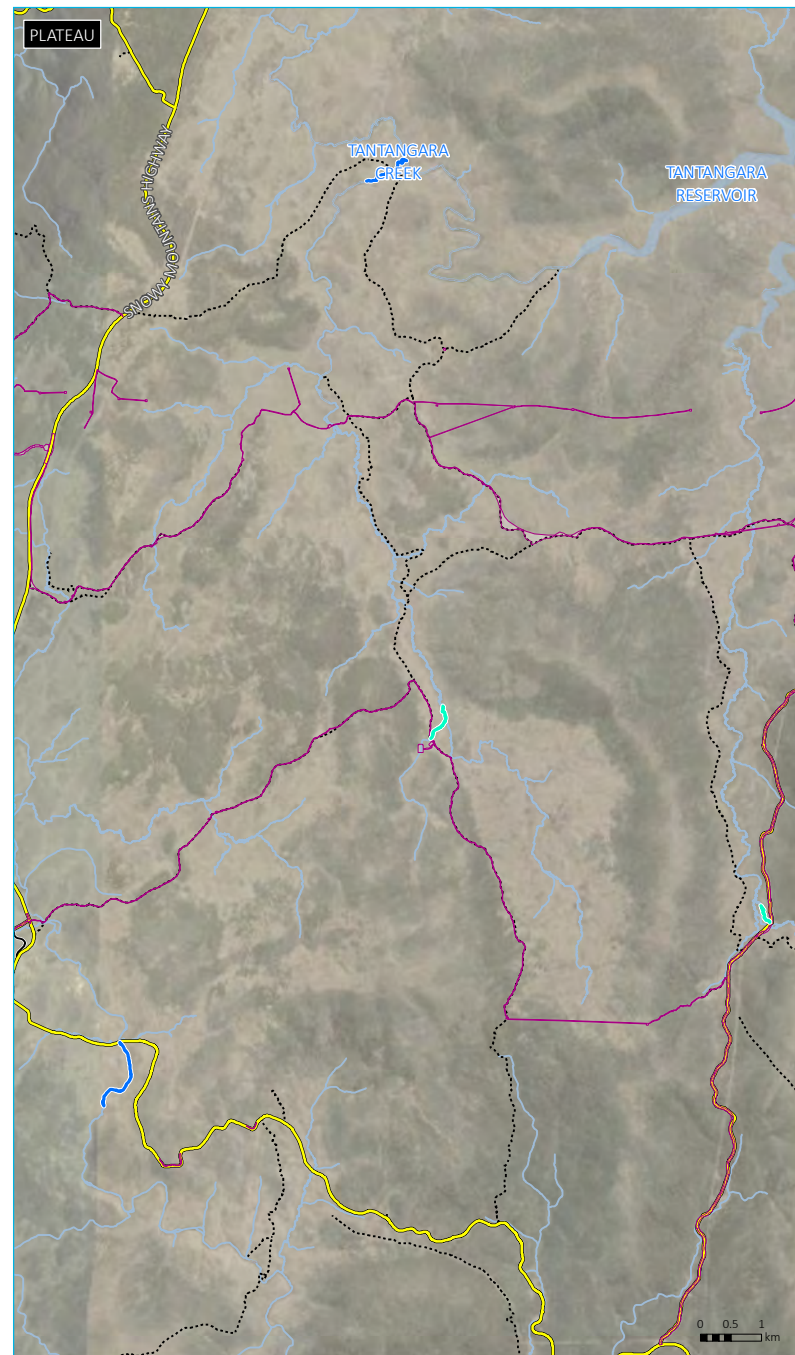
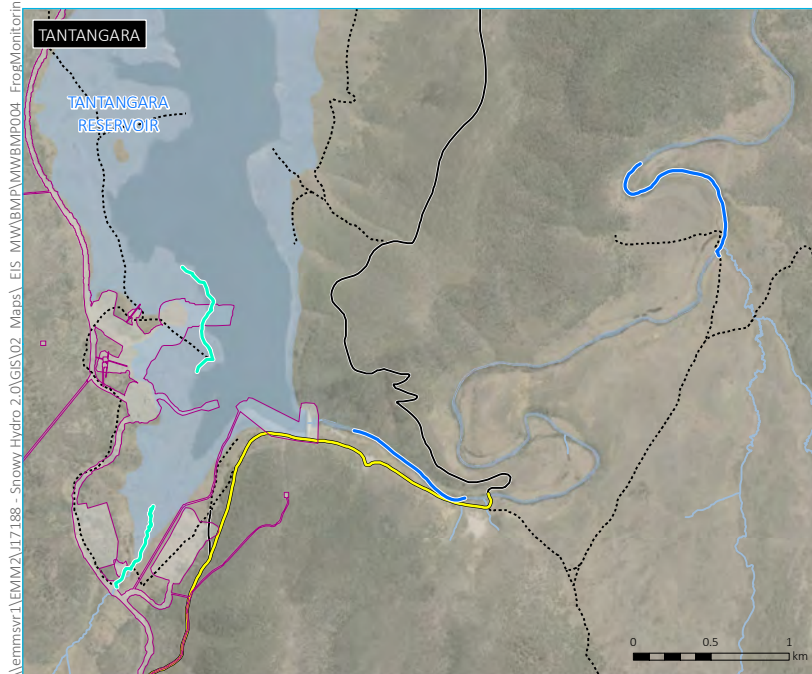
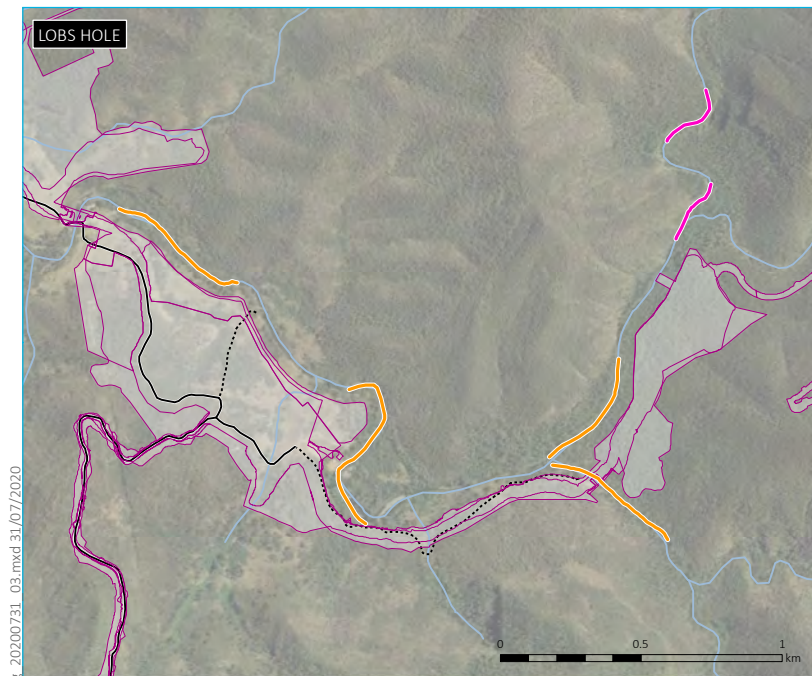
**Table 6-1: Frog occupancy monitoring**

Frog Occupancy Monitoring	
<b>Objective</b>	To determine occupancy distribution of the threatened frog target species, and document any changes arising from the Project.
<b>Sampling units</b>	Occupancy (presence/absence) and relative abundance of frogs along rocky sections of stream bank (Booroolong Frog breeding habitat) of offline pools or other areas of slow water, such as reservoirs (Alpine Tree Frog breeding habitat).
<b>Method</b>	<p><i>Occupancy monitoring</i></p> <p>Stream transects are undertaken along sections of waterways providing breeding habitat. This method is particularly focused on determining the occupancy of breeding habitat and will encompass the following:</p> <ul style="list-style-type: none"> <li>Spotlighting within the riparian zone for eye-shine.</li> <li>Spotlighting to occur in representative transects along the waterway of 500 m in length.</li> <li>Surveys are commenced with a 5-minute listening period to record locations of calling males.</li> <li>Two observers to walk each 500 m transect using a spotlight and headtorches. Searching of key microhabitats (e.g. rocky breeding habitat for Booroolong Frog and offline pools for Alpine Tree Frog) should be undertaken.</li> <li>The location, sex, and total number of frogs observed during each census to be recorded.</li> <li>Hygiene protocols to be followed to prevent the spread of chytrid fungus.</li> <li>The date, weather conditions, count, sex (where possible), location (easting and northing as well as descriptive attributes) and observers will be recorded.</li> </ul>
<b>Location</b>	<p>Survey locations will be initially selected from among the following habitat areas for each species.</p> <p>Booroolong Frog locations include streams at Lobs Holes including:</p> <ul style="list-style-type: none"> <li>four impact monitoring transects (Figure 6-2) located on the Yarrangobilly River (three transect) and Wallaces Creek (one transect); and</li> <li>two control transects (Figure 6-2) located along the Yarrangobilly River, upstream of the disturbance footprint.</li> </ul> <p>Alpine Tree Frog locations on the Plateau and at Tantangara include:</p> <ul style="list-style-type: none"> <li>four impact monitoring transects (Figure 6-2), located on:             <ul style="list-style-type: none"> <li>Kellys Plain Creek;</li> <li>Tantangara Creek;</li> <li>Nungar Creek;</li> <li>Tantangara Reservoir between MOL and FSL; and</li> </ul> </li> <li>four proposed control transects (Figure 6-2) located on Eucumbene River, Murrumbidgee River, Nungar Creek and Tantangara Creek.</li> </ul>
<b>Timing, effort and frequency</b>	<ul style="list-style-type: none"> <li>Surveys will be undertaken at night during the breeding season (November to mid-December for Booroolong Frog and December to January for Alpine Tree Frog).</li> <li>Each transect will be surveyed twice for frog abundance each year.</li> </ul>



Frog Occupancy Monitoring	
<ul style="list-style-type: none"> <li>Surveys will be undertaken during suitable conditions (no rain, low stream flows, relatively light wind and air temperature above 10 degrees).</li> </ul>	
Data analysis	
<ul style="list-style-type: none"> <li>The collected data will be tracked on a spreadsheet to determine trends in occupancy across sites and breeding seasons.</li> <li>The monitoring of control sections upstream of the project area will help to determine if any identified changes in occupancy in breeding areas within the treatment section are a result of the project or otherwise other abiotic factors (if the same changes are also observed in the control section upstream of the Project).</li> </ul>	
Triggers for adaptive management	
<ul style="list-style-type: none"> <li>A decline in relative abundance (that upon review by species experts, is also considered as biologically significant) occurs during construction and/or operation at impact sites that does not also occur at the control sites.</li> <li>Decline in relative abundance is accompanied by a decline in other monitoring parameters.</li> </ul>	
Adaptive management	
<ul style="list-style-type: none"> <li>Initial investigation to document potential causation between decline and project related impacts (e.g. sedimentation occurring outside project footprint, or increased levels of predation). This will include testing for chytrid of both control and impact sites.</li> <li>Development of a mitigation plan, in consultation with DPIE and DAWE, addressing causes of decline as determined in initial investigation. This may include increased monitoring, feral animal control or additional construction related mitigation measures.</li> <li>If this is ineffective, additional offsets may be required.</li> </ul>	





- KEY**
- Monitoring location
  - Alpine Tree Frog - control
  - Alpine Tree Frog - impact
  - Booroolong Frog - control
  - Booroolong Frog - impact
  - Existing environment
  - Local road
  - Vehicular track
  - Watercourse / drainage line
  - Main Works disturbance footprint

Threatened frog monitoring locations

Snowy 2.0  
Biodiversity monitoring program report  
Main Works  
Figure 6.2



Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

GDA 1994 MGA Zone 55





### 6.3. Habitat characteristic monitoring

Frog habitat characteristic monitoring will be undertaken for the Booroolong Frog only as detailed in Table 6-2.

**Table 6-2: Booroolong Frog Habitat Characteristic Monitoring**

Booroolong Frog Habitat Characteristic Monitoring	
<b>Objective</b>	<p>To monitor rocky breeding habitat and depth of pools within sections of the Yarrangobilly River and Wallaces Creek that occur within and adjacent to the project area, and document any changes arising from the project. Specific objectives are:</p> <ul style="list-style-type: none"> <li>to compare shifts in distribution and abundance of rocky breeding habitat between treatment (Yarrangobilly River and Wallaces Creek in the project area) and control sections of the Yarrangobilly River (upstream of the project area).</li> </ul>
<b>Sampling units</b>	Rocky sections of stream bank (breeding habitat) in treatment and control sections.
<b>Method</b>	<p><i>Habitat characteristic monitoring</i></p> <p>Aerial imagery will be collected using unmanned aerial vehicles (UAVs or drones)</p> <ul style="list-style-type: none"> <li>Drone flow just above the canopy at approximately 20m above the Yarrangobilly River/Wallaces Creek.</li> <li>Flights to be conducted between 10am and 2pm to reduce shadows.</li> <li>Flights to include two runs of each transect/waterway, with 80% front and 65% side overlap in each path, reducing the warping and gaps. Dependent on width, a third run may be necessary for wider stream sections.</li> <li>Ground control points (GCPs) should be permanently installed along each transect to register imagery, improve data quality, and remove warp.</li> </ul> <p>Data will be processed using software and classified into;</p> <ul style="list-style-type: none"> <li>cobble banks – a section of stream bank greater than 2 m in length with a continuous cover of loose rock;</li> <li>bedrock banks – defined as a section of stream bank greater than 2 m in length with a continuous cover of solid rock that is embedded in the ground</li> <li>riparian vegetation – areas of dense vegetation located along stream edges; or</li> <li>water – areas of pools, riffles or runs.</li> </ul> <p>Data will be imported into a Geographic Information System (GIS) database to digitally map the identified habitat.</p>
<b>Location</b>	Survey sites will replace Booroolong Frog occupancy monitoring.
<b>Timing, effort and frequency</b>	<ul style="list-style-type: none"> <li>Booroolong Frog habitat characteristic monitoring will be undertaken annually during the breeding season (November to mid-December).</li> </ul>
<b>Data analysis</b>	<ul style="list-style-type: none"> <li>Processing of drone captured data will be undertaken using suitable software.</li> <li>Outputs will include high-resolution imagery, 3D model of the transects, and a point cloud to assist in change detection data comparison.</li> <li>Line graphics of each transect will be produced for quick visual comparison and use in reports.</li> <li>This will allow detection of any changes in rocky breeding habitat and pool depth along the treatment sections; and</li> <li>The monitoring of control sections upstream of the project area will help to determine if any identified changes within the treatment streams are a result of the project or otherwise other abiotic factors (if the same changes are also observed in the control section upstream of the project).</li> </ul>
<b>Triggers for adaptive management</b>	



### Booroolong Frog Habitat Characteristic Monitoring

- Observed degradation, change or loss of rocky (breeding) habitat at impact sites that does not also occur at the reference sites.

#### Adaptive management

- Initial investigation to document potential causation between changes and project related impacts (e.g. sedimentation events).
- If the result of a project related event, corrective actions to address further impacts, and an assessment of whether remediation of the waterway is required, will be undertaken in consultation with DPIE and DAWE.
- Ongoing monitoring to determine if corrective actions have addressed the impact, and avoided long-term impacts.
- If this is ineffective, additional offsets may be required.



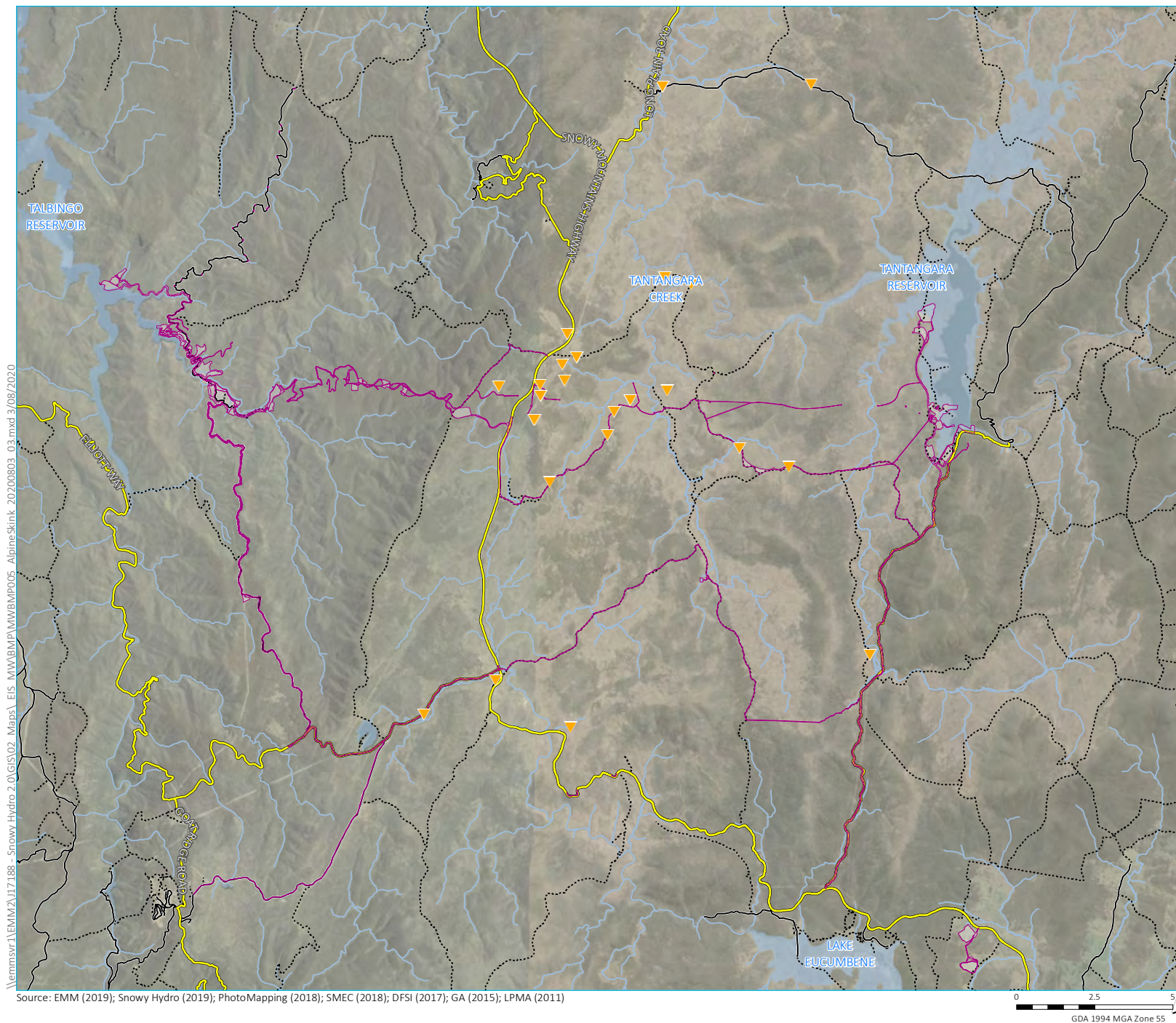
## 7. ALPINE SHE-OAK SKINK MONITORING

### 7.1. Known distribution

The Alpine She-oak Skink was recorded within and adjacent to the disturbance footprint at several locations during the biodiversity assessment for the Project (EMM, 2020). Locations of the species records are mapped in Figure 7-1.

The species was recorded within natural grasslands containing tussock grasses, low heath or a combination of both. The associated vegetation type was PCT 1224 – Sub alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion.





- KEY**
- ▼ Alpine She-oak Skink
  - Existing environment
  - Main road
  - Local road
  - ..... Vehicular track
  - Watercourse / drainage line
  - Waterbody
  - Main Works disturbance footprint

Alpine She-oak Skink records

Snowy 2.0  
Biodiversity monitoring program report  
Main Works  
Figure 7.1





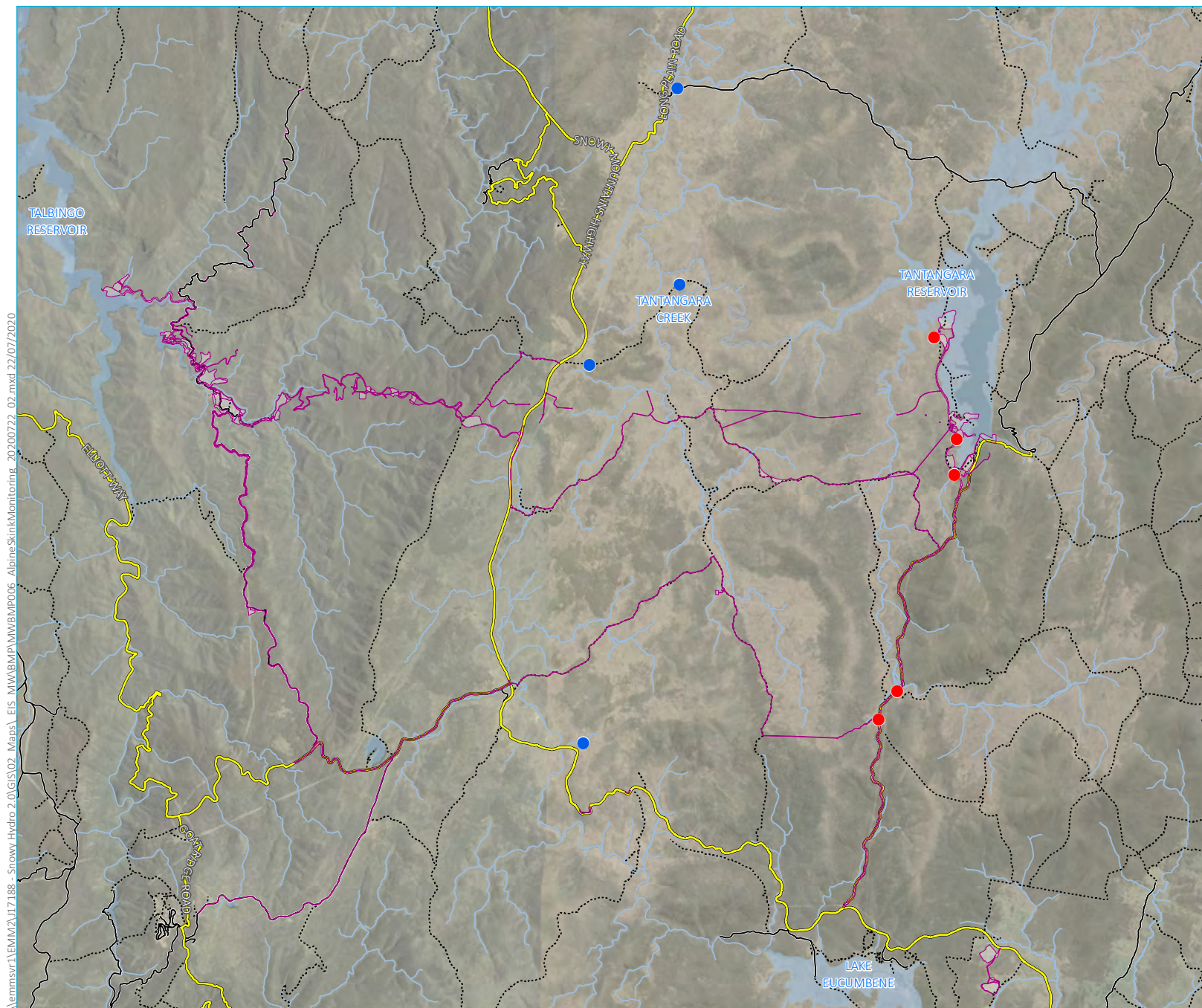
## 7.2. Presence/absence monitoring

Alpine She-oak Skink presence/absence monitoring will be undertaken by a suitably qualified person(s) as detailed in Table 7-1.

**Table 7-1: Alpine She-oak Skink presence/absence monitoring**

Alpine She-oak Skink Presence/Absence Monitoring
<b>Objective</b>
To determine the occupancy (presence/absence) of the Alpine She-oak Skink at potential habitat sites within proximity to the Project and document any changes attributable to the Project.
<b>Sampling units</b>
Tile grid monitoring
<b>Method</b>
<i>Tile grid monitoring</i> <ul style="list-style-type: none"> <li>Tile grid locations will be established at key locations adjacent to the Main Works disturbance footprint where Alpine She-oak Skink has potential to occur.</li> <li>Each tile grid will consist of five rows with five tiles in each row (25 tiles in total), with 10 m spacing.</li> <li>Tiles to be checked in the morning before air temperatures rise.</li> <li>The date, weather conditions, count, sex (where possible), location (easting and northing as well as descriptive attributes) and observers will be recorded.</li> </ul>
<b>Location</b>
Within areas of associated PCT or at sites of previous records of Alpine She-oak Skink, including: <ul style="list-style-type: none"> <li>five impact sites (Figure 7-2) including:               <ul style="list-style-type: none"> <li>Tantangara Road (two sites); and</li> <li>Tantangara construction area (three sites).</li> </ul> </li> <li>four control sites, located outside of the disturbance area and construction envelope (Figure 7-2).</li> </ul>
<b>Timing, effort and frequency</b>
<ul style="list-style-type: none"> <li>Surveys will be undertaken between October and March.</li> <li>Surveys will be undertaken during suitable conditions (early in the morning, no rain and relatively light wind).</li> <li>Each tile grid will be checked six times a year (once a month).</li> </ul>
<b>Data analysis</b>
<ul style="list-style-type: none"> <li>The collected data will be tracked on a spreadsheet to determine trends in occupancy across sites.</li> <li>Data trends to be analysed by a suitably qualified person, in order to detect changes in occupancy.</li> </ul>
<b>Triggers for adaptive management</b>
<ul style="list-style-type: none"> <li>Absence of target species from a site during construction and operational monitoring, where the species was recorded during pre-construction / baseline surveys;</li> <li>No changes in presence/absence at control sites;</li> <li>Absence recorded for greater than one year; and</li> <li>Absence is combined with an observed increase or new occurrence of a primary impact (weeds).</li> </ul>
<b>Adaptive management</b>
<ul style="list-style-type: none"> <li>Initial investigation to document potential causation between decline and project related impacts (e.g. weed invasion or feral animals).</li> <li>Development of a mitigation plan, in consultation with DPIE and DAWE, addressing causes of decline as determined in initial investigation. This may include increased monitoring, weed control, feral animal control or additional construction related mitigation measures.</li> <li>If this is ineffective, additional offsets may be required.</li> </ul>





# KEY

## Monitoring location

- Alpine She-oak Skink - control site
- Alpine She-oak Skink - impact site

## Existing environment

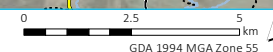
- Main road
- Local road
- ..... Vehicular track
- Watercourse / drainage line
- Waterbody
- Main Works disturbance footprint

## Alpine She-oak Skink monitoring locations

Snowy 2.0  
Biodiversity monitoring program report  
Main Works  
Figure 7.2



Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





## 8. FERAL ANIMAL MONITORING

### 8.1. Known distribution

Remote camera surveys undertaken for the project (EMM 2020) recorded the following introduced feral animals within the project area:

- Feral Cat (*Felis catus*);
- Wild Dog (*Canis lupus*);
- Red Fox (*Vulpes vulpes*);
- Rabbit (*Oryctoagrus cuniculus*);
- Feral Pig (*Sus scrofa*);
- Deer (*Cervus* spp. and *Dama* sp.); and
- Feral Horse (*Equus caballus*).

These records were not limited to any one habitat type within the project area and it is likely that they occur across the project area.

### 8.2. Presence/absence monitoring

The monitoring of feral animal presence/absence will be undertaken by a competent person(s) as detailed in Table 8-1. Installation or removal of cameras may be undertaken by appropriately trained environmental personnel under the guidance of the ecologist.

Table 8-1: Feral animal presence/absence monitoring

Feral Animal Occupancy Monitoring
<b>Objective</b>
To determine presence/absence of feral animals within proximity to the project for control.
<b>Sampling units</b>
<ul style="list-style-type: none"> <li>• Targeted Remote camera monitoring adjacent to key project infrastructure and roads.</li> <li>• RCMS sites for small mammals will also be utilised.</li> </ul>
<b>Method</b>
<p><i>Remote camera monitoring</i></p> <ul style="list-style-type: none"> <li>• Remote cameras will be placed at locations adjacent to key project infrastructure areas (i.e. accommodation camps, administration buildings) and roads.</li> <li>• Cameras to be placed at a 45-degree angle to the likely direction of travel (Figure 8-1).</li> <li>• Cameras to be attached to a tree or stake and positioned approximately 0.5 m above ground. Cameras will be unbaited and left in place for 30 days.</li> <li>• Coordinates to be recorded at each camera location, to allow returning to the same locations for each subsequent monitoring event.</li> </ul>
<b>Location</b>
<ul style="list-style-type: none"> <li>• At suitable intervals within identified Smoky Mouse habitat, and adjacent to project roads and key project infrastructure areas (i.e. accommodation camps, portal / MAT, administration buildings). See Figure 8-2.</li> </ul>
<b>Timing, effort and frequency</b>
<ul style="list-style-type: none"> <li>• Frequency will comprise four monitoring events per year for the duration of construction.</li> <li>• A remote camera monitoring event is defined as 30 days deployment of all camera traps as per the layout explained in methods.</li> </ul>



Feral Animal Occupancy Monitoring
<b>Data analysis</b> <ul style="list-style-type: none"> <li>Animals captured on digital images are to be identified with reference to a suitably qualified ecologist, field guides and species experts, if required;</li> <li>Data (date, time, location, species, individuals present) to be kept in a spreadsheet to determine presence/absence at monitoring locations between monitoring periods; and</li> <li>Data trends and statistical design are to be analysed by a suitably qualified person in order to determine changes in occupancy based on number of observation nights at each site. This will be compared to the number of animals caught during control.</li> </ul>
<b>Triggers for adaptive management</b> <ul style="list-style-type: none"> <li>Sighting of feral animals within proximity to known Smoky Mouse habitat or project infrastructure.</li> </ul>
<b>Adaptive management</b> <ul style="list-style-type: none"> <li>Sighting of feral animals trigger control in accordance with the Weed, Pest and Pathogen Management Plan (Appendix F of the BMP). Control to be arranged by FGJV or Snowy Hydro.</li> </ul>

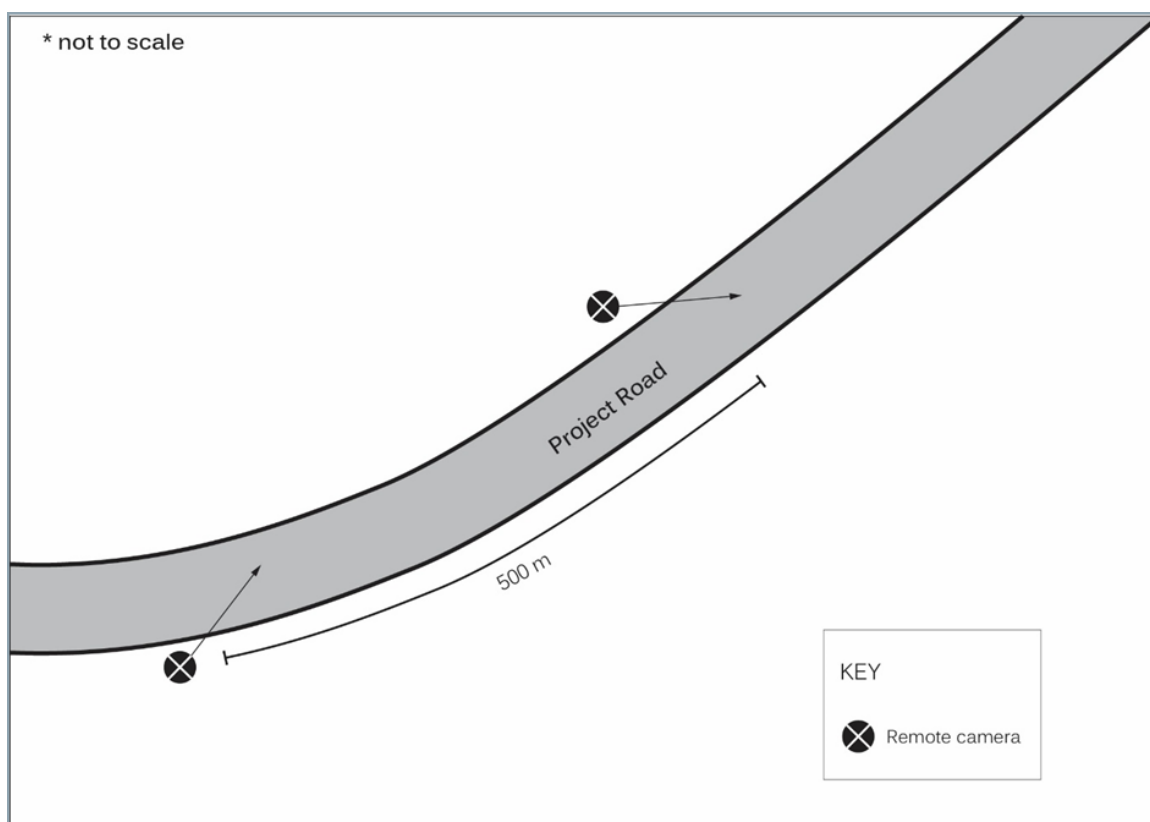


Figure 8-1: Feral animal presence/absence monitoring – remote camera set up

### 8.3. Abundance monitoring

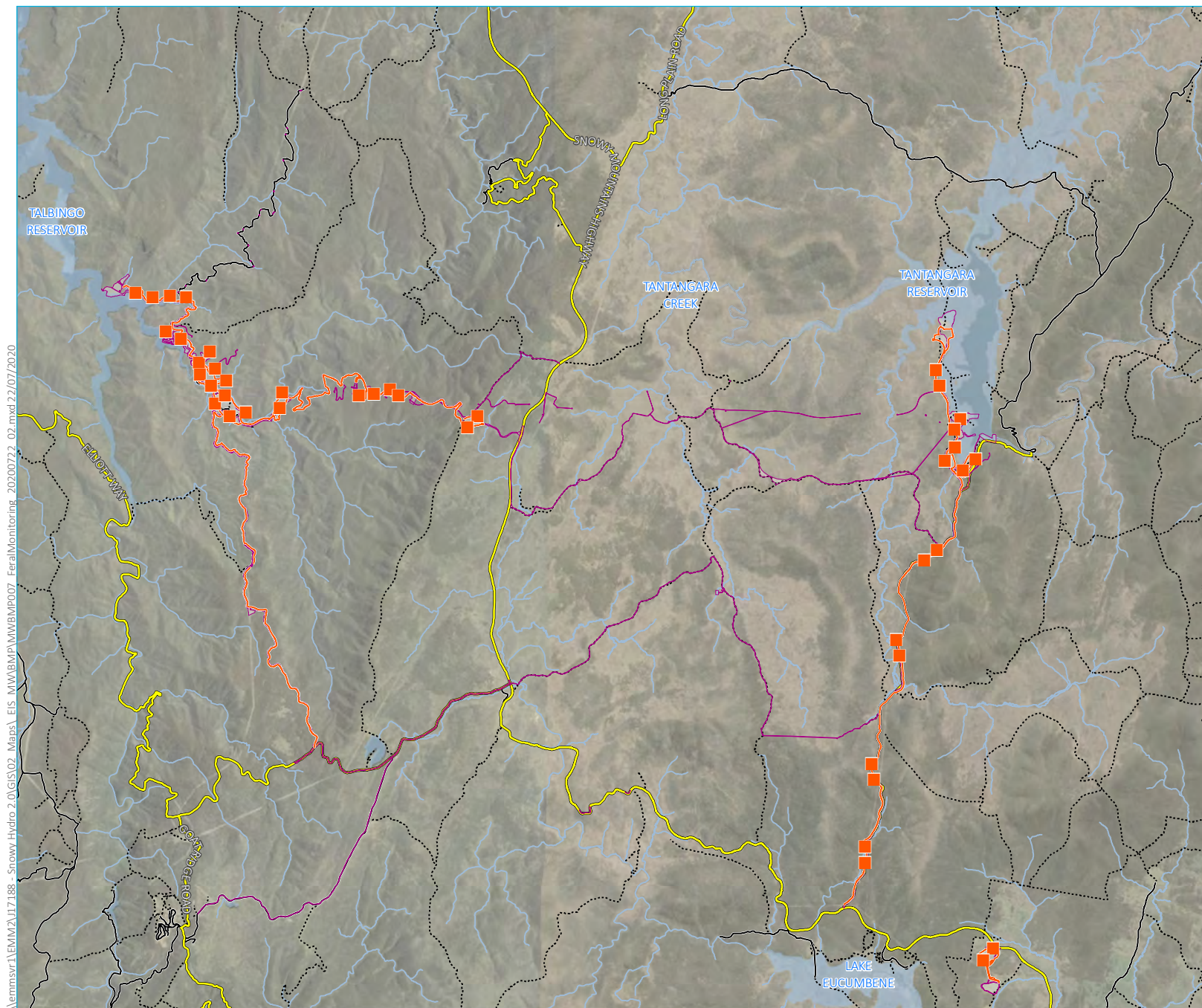
The monitoring of feral animal abundance will be undertaken by a competent person(s) as detailed in Table 8-1. Installation or removal of cameras may be undertaken by appropriately trained environmental personnel under the guidance of the ecologist.



**Table 8-2: Feral animal abundance monitoring**

<b>Feral Animal Abundance Monitoring</b>	
<b>Objective</b>	To determine abundance of feral animals within proximity to the project for control.
<b>Sampling units</b>	<ul style="list-style-type: none"> <li>Spotlight transects through key constriction areas</li> </ul>
<b>Method</b>	<p><i>Vehicle spotlight counts</i></p> <ul style="list-style-type: none"> <li>Establish transect paths along key project roads.</li> <li>A 4WD vehicle with one driver and an observer using a handheld spotlight.</li> <li>Start approximately half an hour after sunset from an established start point.</li> <li>Drive at a constant slow speed (10-15 km/h) along roads.</li> <li>Observer scans a 90° arc ahead of the vehicle with a spotlight and count animals seen within 50 m on either side.</li> <li>For each transect, record the tally on a standardised spotlight count sheet.</li> <li>Use a GPS to help maintain repeat the same transect path consistently.</li> </ul>
<b>Location</b>	<ul style="list-style-type: none"> <li>Within identified Smoky Mouse habitat, and adjacent to project roads and key project infrastructure areas (i.e. accommodation camps, portal / MAT, administration buildings). Indicative locations are provided in Figure 8-2. These will be subject to safe access during construction.</li> </ul>
<b>Timing, effort and frequency</b>	<ul style="list-style-type: none"> <li>Frequency will comprise four monitoring events per year for the duration of construction.</li> <li>A spotlight monitoring event is defined as one night of spotlighting at each nominated transect site.</li> </ul>
<b>Data analysis</b>	<ul style="list-style-type: none"> <li>After completion of each monitoring event at each location determine the sum of counts and divide them by the length of the transect to get a simple index of abundance (animals/km-1) for each road/key infrastructure area during each monitoring event.</li> <li>This will be compared to the number of animals captured during control.</li> </ul>
<b>Triggers for adaptive management</b>	<ul style="list-style-type: none"> <li>Sighting of feral animals within proximity to known Smoky Mouse habitat or project infrastructure.</li> </ul>
<b>Adaptive management</b>	<ul style="list-style-type: none"> <li>Sighting of feral animals triggers control in accordance with the Weed, Pest and Pathogen Management Plan (Appendix F of the BMP). Control to be arranged by FGJV or Snowy Hydro.</li> </ul>





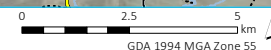
- KEY**
- Monitoring location
    - Feral animal
    - Feral animal - Spotlight
  - Existing environment
    - Main road
    - Local road
    - Vehicular track
    - Watercourse / drainage line
    - Waterbody
    - Main Works disturbance footprint

Feral animal monitoring locations

Snowy 2.0  
Biodiversity monitoring program report  
Main Works  
Figure 8.2



Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





## 9. WEED AND PATHOGEN MONITORING PROGRAM

Weed and pathogens will be monitored through a variety of survey activities including:

- Weed presence/absence monitoring (section 9.2);
- Phytophthora presence/absence monitoring (section 9.3).

### 9.1. Existing environment

Past land clearing, livestock grazing and vehicle usage has resulted in weed invasion throughout the project area, particularly around the Talbingo and Tantangara reservoirs .

Key weed species identified during flora surveys for Main Works include:

- African Lovegrass (*Eragrostis curvula*);
- Bird's-foot Trefoil (*Lotus* spp.);
- Blackberry (*Rubus* spp.);
- Browntop Bent (*Agrostis capillaris*);
- Cat's Ear/Flatweed (*Hypochaeris* spp.);
- Cocksfoot (*Dactylis glomerata*);
- Dandelion (*Taraxacum officinale*);
- Hawthorn (*Crataegus monogyna*);
- Mullein/Aarons Rod (*Verbascum thapsus* and *V. virgatum*);
- Musk Monkey Flower (*Mimulus moschatus*);
- Ox-eye Daisy (*Leucanthemum vulgare*);
- Patterson's Curse (*Echium plantagineum*);
- Sheep Sorrel (*Rumex acetosella*);
- Spear Thistle (*Cirsium vulgare*);
- St John's Wort (*Hypericum perforatum*) – an identified weed of significance;
- Sweet Briar (*Rosa rubiginosa*) – an identified weed of significance;
- Sweet Vernal Grass (*Anthoxanthum odoratum*);
- Yarrow (*Achillea millefolium*); and
- Yorkshire Fog Grass (*Holcus lanatus*).

Many of these species are prevalent in areas previously disturbed.

#### 9.1.1. Weeds of concern

Key weed species of concern, with potential to be transported into or within KNP during construction activities associated with the Project and subject to current control programs are outlined in ANNEXURE A.

Ox-eye Daisy is a weed of key concern for the project. This species has rapidly invaded areas of Kosciuszko National Park, particularly in the Tantangara area and the species has established itself to the point of infestation within the southern part of Tantangara, in Kelly's Plain, and spanning west towards Nungar track. NPWS are currently undertaking weed control measures



including spraying and track closures. Adult plants can produce up to 26,000 seeds, resulting in rapid spread of this weeds species by animals, vehicles and water. Dense infestations, as occurs in Kellys Plain, exclude other plant species, leading to simplification of vegetation, loss of diversity, soil erosion and depletion of soil organic matter. There is a real risk off project related activities resulting in the spread of this species across the project area.

Across NSW, the general biosecurity duty applicable to this weed is to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. in The Riverina, the plant should be eradicated from the land and the land kept free of the plant.

### 9.1.2. Aquatic weeds and pests

Canadian Pondweed (*Elodea canadensis*) occurs throughout Talbingo reservoir and in one discrete location within Tantangara Reservoir. It is often associated with slow-moving and stationary water bodies, coastal rivers and creeks, especially in colder areas in NSW. It grows and spreads via fragmentation and as stems readily break into pieces, these are easily transported in water. Canadian Pondweed is classified as a water weed which is known to potentially:

- Alter dissolved oxygen levels reducing the water quality;
- Restrict navigation and recreational activities on waterways; and
- Pose a drowning hazard for livestock and recreational swimmers.

Across NSW, the general biosecurity duty applicable to this weed is to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

*Perca fluviatilis* (Redfin Perch), *Gambusia holbrooki* (Eastern Gambusia) and *Carassius auratus* (Wild Goldfish) have also been recorded in watercourses affected by the Project. Redfin Perch has been recorded in Talbingo Reservoir, Yarrangobilly River and Wallaces Creek in large numbers. Eastern Gambusia and Goldfish have been recorded in Talbingo Reservoir, Lake Eucumbene and Mid-Murrumbidgee River only.

### 9.1.3. Pathogens of Concern (Not Currently Known in KNP)

Infection of native plants by *Phytophthora cinnamomi* is listed as a key threatening process under the BC Act and EPBC Act. *P. cinnamomi* can lead to death of trees and shrubs, resulting in devastation of native ecosystems (DECC 2008). Infection of susceptible communities with *P. cinnamomi* leads to

- changes in the structure and composition of the native plant communities;
- a significant reduction in primary productivity and functionality; and
- habitat loss and degradation for dependent flora and fauna (DoE 2014b).

Impacts from *P. cinnamomi* have been identified as a key threat to the Smoky Mouse (DECC 2008, Menkhorst and Broome 2008a, 2008b).

*P. cinnamomi* has not been confirmed as surviving in KNP, although it has potential to affect some species within the project area if it were to establish. However, it is unclear whether *P. cinnamomi* could be pathogenic under the conditions in the KNP (Keith McDougall BCD pers. comm. 12 September 2018). The main *Phytophthora* species of concern in the KNP is *Phytophthora gregata*, which is resulting in mortality of *Pimelea bracteata* enmasse (Keith McDougall BCD pers. comm).



12 September 2018). *Pimelea bracteata* is known to occur along Tantangara Road, and is often associated with wet heath along creeks, including in areas of alpine bogs and fens.

## 9.2. Weed presence/absence monitoring

The monitoring of weed presence/absence will be undertaken by a suitably qualified ecologist(s) as detailed in Table 9-1.

**Table 9-1: Weed presence/absence monitoring**

Weed presence/absence monitoring	
<b>Objective</b>	To determine presence/absence and abundance of weeds within proximity to the project for routine control in accordance with the Weed, Pest and Pathogen Management Plan (Appendix F of the BMP).
<b>Sampling units</b>	Weed monitoring / recording
<b>Method</b>	<p><i>Weed mapping</i></p> <ul style="list-style-type: none"> <li>Surveys will be undertaken at select locations adjacent to the main project access roads, around key infrastructure areas (within a 50 m buffer of the disturbance area) and threatened flora monitoring locations, and will record:               <ul style="list-style-type: none"> <li>location using a GPS or mapping enabled tablet. Groups of individuals will be marked out with a waypoint and large infestations will be mapped out as a polygon;</li> <li>weed species identified as a priority for control as per weed species of concern in ANNEXURE A;</li> <li>an estimate of the cover number of individuals, the estimated size of infestation (e.g. m<sup>2</sup> for large infestations) and estimated cover (eg: Trace&lt;1%; Light 1-10%, Medium 11-50%, Dense &gt;50%);</li> </ul> </li> <li>Comments on any other features (flowering or fruiting); Groups of individuals will be marked out with a waypoint and large infestations will be mapped out as a polygon;</li> <li>Mapping will be updated each monitoring period to show new weed occurrences or changes in patch size.</li> </ul>
<b>Location</b>	<p>At nominated sample locations:</p> <ul style="list-style-type: none"> <li>within a 50 m buffer adjacent to Lobs Hole Ravine Road, Marica Trail and Tantangara Road;</li> <li>within a 50m buffer of accommodation camps;</li> <li>within a 50 m buffer of key construction compounds;</li> <li>within a 50 m of and including all threatened flora monitoring locations; and</li> <li>other specific locations to be established during first monitoring event.</li> </ul>
<b>Timing, effort and frequency</b>	Weed monitoring will occur yearly (early Summer) and at a time that targets growth of weeds identified as a priority for control during construction.
<b>Data analysis</b>	Weed records and associated spatial data to be kept in a GIS and accompanying spreadsheet to determine any changes in the presence of weeds between monitoring periods and to inform management activities.
<b>Triggers for adaptive management</b>	<ul style="list-style-type: none"> <li>New occurrence of weeds within proximity to project infrastructure.</li> <li>Monitoring results are identifying increases in density of high priority weeds.</li> </ul>
<b>Adaptive management</b>	<ul style="list-style-type: none"> <li>New sighting of weeds of concern (ANNEXURE A) trigger routine control in accordance with the Weed, Pest and Pathogen Management Plan (Appendix F of the BMP). Other weeds to be addressed during normal weed control procedures. Control to be arranged by FGJV or Snowy Hydro.</li> </ul>



### 9.3. Phytophthora presence/absence monitoring

Soil monitoring, to test for presence/absence of *Phytophthora*, will be undertaken by a suitably qualified person(s) and will be undertaken as detailed in Table 9-2.

**Table 9-2: Phytophthora presence/absence monitoring**

Presence/absence of Phytophthora monitoring	
<b>Objective</b>	To undertake soil sampling in order to monitor pathogens within proximity to project roads and key project infrastructure, to inform the location and extent of controls.
<b>Sampling units</b>	Soil sampling
<b>Method</b>	<p>For each location, several small sub-samples should be collected and combined into a single representative sample for that location.</p> <ul style="list-style-type: none"> <li>• Use a thick zip-lock plastic bag for collecting the group of samples from the target location;</li> <li>• label the bag with date, monitoring site code and sample number e.g. 19/12/18, Washdown01, North;</li> <li>• record GPS coordinates of monitoring site on the bag and in records;</li> <li>• place into a second bag to prevent cross contamination and as a safeguard against breakage;</li> <li>• The collection of each sub-sample will involve:               <ul style="list-style-type: none"> <li>○ use a sterile garden trowel to scrape away surface leaf litter;</li> <li>○ dig a small hole at the base of a shrub or groundcover and collect a small amount of soil consisting primarily of living plant roots;</li> <li>○ the hole does not need to be any deeper than 10 cm and you only need 100-250 grams of soils;</li> <li>○ add sub-sample to the collection bag for that location</li> <li>○ repeat sub-samples until a representative group has been collected for that location.</li> </ul> </li> <li>• store soil samples in a cool, dark place and dispatch for analysis as soon as practicable after sampling;</li> <li>• after each sample, scrub your hands and the trowel thoroughly with methylated spirits to disinfect them and prevent cross-contamination of samples; and</li> <li>• send samples to a suitable laboratory to analyse for <i>Phytophthora</i>.</li> </ul>
<b>Location</b>	<p>Routine sampling sites should include:</p> <ul style="list-style-type: none"> <li>• areas where material/vehicles have been brought onto the project site; and</li> <li>• surrounding all vehicle washdown stations.</li> </ul> <p>The same procedure can be used for sampling at sites of investigation including potential dieback sites.</p>
<b>Timing, effort and frequency</b>	Frequency will comprise one monitoring event per year during construction.
<b>Data analysis</b>	Monitoring data (laboratory results) for each monitoring location to be kept in a spreadsheet with additional results added after each monitoring program.
<b>Triggers for adaptive management</b>	A soil sample returns a positive result for <i>Phytophthora</i> species of concern such as <i>Phytophthora cinnamomi</i> or <i>Phytophthora gregata</i> .
<b>Adaptive management</b>	<p>Conduct additional soil sample testing within suspected infection area to document extent.</p> <p>Ensure anthropogenic spread from infected areas is eliminated by modifying site activities in the vicinity, controlling access, and revising hygiene procedures.</p>



#### 9.4. Other pathogen monitoring

Monitoring for signs of dieback associated with *Phytophthora* can be difficult and misleading as most dieback is not related to *Phytophthora*. It may be more useful to monitor the health of indicator species such as *Xanthorrhoea glauca*, *Pimelea bracteata* and *Phebalium squamulosum* – where they occur in or adjacent to the project area (Keith McDougall BCD pers. comm. 12 September 2018).

*Armillaria luteobubalina*, commonly known as the Australian honey fungus, is a species of mushroom in the family Physalacriaceae. Widely distributed in southern Australia, the fungus is responsible for a disease known as Armillaria root rot, a primary cause of Eucalyptus tree death and forest dieback. *Armillaria luteobubalina* is currently only known from the Round Mountain area south of Cabramurra and on the Yarrangobilly River near the Snowy Mountains Highway (Keith McDougall BCD pers. comm. 12 September 2018). There may need to be monitoring of *Armillaria luteobubalina* if that is detected in the project area.

If dieback is noted within the weed presence/absence monitoring or the weed cover monitoring this monitoring program will be reviewed to include monitoring for dieback (mapping, soil testing, using indicator species) and adaptive management measure implemented if required.

## 10. REPORTING

A 'monitoring period report' will be provided to Snowy Hydro at the end of each monitoring period. The monitoring period report will focus on items requiring routine control, such as feral animal control or weed control.

A 'quarterly report' will be provided to Snowy Hydro at the end of each quarter of monitoring. The quarterly report will include an analysis of monitoring data to date to determine how the project is tracking against objectives, how the project is tracking against triggers for adaptive management and whether any adaptive management is required. The report will also make interim recommendations for modifications to the monitoring program, if warranted.

An 'annual report' will be prepared yearly and provided to Snowy Hydro, DPIE and DAWE. The annual report will summarise all monitoring undertaken within the year and the results of the monitoring, including whether any of the adaptive management triggers outlined above have been exceeded. If so, recommendations for adaptive management will be made outlining how these should be actioned. The annual report is also an opportunity to summarise findings to feed into the annual review of the monitoring program. Monitoring data will be provided as an appendix to the annual report.

Where adaptive management other than feral animal control or weed control has been triggered this will be reported to DPIE and DAWE (for MNES), with liaison around adaptive management proposed.



## ANNEXURE A PRIORITY WEEDS FOR CONTROL

Priority weeds to target for mapping, monitoring and control

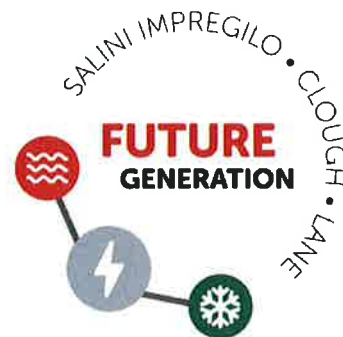
Table A-1: Priority weeds to target for mapping, monitoring and control

Species Name	Common Name
<i>Achillea millefolium</i>	Milfoil/Yarrow
<i>Agrostis capillaris</i>	Browntop Bent
<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass
<i>Barbarea verna</i>	Winter Cress
<i>Carduus nutans</i>	Nodding Thistle
<i>Cirsium vulgare</i>	Spear Thistle
<i>Cotoneaster</i> spp.	Cotoneaster
<i>Cytisus scoparius</i>	Scotch Broom
<i>Dactylis glomerata</i>	Cocksfoot
<i>Echium plantagineum</i>	Patterson's Curse
<i>Echium vulgare</i>	Vipers Bugloss
<i>Eragrostis curvula</i>	African Lovegrass
<i>Genista monspessulana</i>	Cape Broom
<i>Hieracium aurantiacum</i>	Hawkweed
<i>Holcus lanatus</i>	Yorkshire Fog Grass
<i>Hypericum perforatum</i>	St John's Wort
<i>Juncus effusus</i>	Large Rush
<i>Leucanthemum vulgare</i>	Ox-eye Daisy
<i>Lupinus</i> spp.	Lupins
<i>Lotus</i> spp.	Bird's-foot Trefoil
<i>Marrubium vulgare</i>	Horehound
<i>Mimulus moschatus</i>	Musk Monkey Flower
<i>Nassella trichotoma</i>	Serrated Tussock
<i>Onopordum acanthium</i>	Scotch Thistle
<i>Phleum pratense</i>	Timothy Grass
<i>Pinus</i> spp.	Pine
<i>Rosa rubiginosa</i>	Sweet Briar
<i>Rubus</i> spp.	Blackberry
<i>Salix</i> spp.	Willow
<i>Ulex nutans</i>	Gorse
<i>Verbascum</i> spp.	Mullein
<i>Vinca</i> spp.	Periwinkle
<i>Xanthium</i> spp.	Bathurst Burr



## APPENDIX C      PRECLEARING AND CLEARING PROCEDURE





-S2-FGJV-ENV-PRO-0008

## SNOWY 2.0 MAIN WORKS – BIODIVERSITY MANAGEMENT PLAN APPENDIX C – PRE-CLEARING AND CLEARING PROCEDURE

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Reviewed by	Environmental Manager	L. Coetzee	
Approved by	Project Director	A. Betti	

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A	29.11.2019	Initial draft for Snowy Hydro review
B	05.03.2020	Updated for Snowy Hydro review
C	02.06.2020	Updated with Main Works Infrastructure Approval
D	15.06.2020	Revised following receipt of Snowy Hydro comments
E	30.07.2020	Revised following agency comments
F	07.10.2020	Revised following DPIE comments



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## 1. PURPOSE AND OBJECTIVE

The purpose of this pre-clearing and clearing procedure is to describe how Future Generation proposes to manage clearing activities prior to and during construction so as to minimise impacts on biodiversity.

The key objective of this procedure is to describe the management measures that will be implemented during pre-clearing and clearing activities to ensure that these activities are conducted within the permitted scope of the Infrastructure Approval (SSI 9687).

## 2. TRAINING

All personnel taking part in construction activities shall be informed through the site-specific induction, prestart briefing or other targeted training of the importance of clearing limits and the significance of the surrounding environment.

All personnel involved in the clearing activities would be subject to toolbox training on the requirements of this procedure and a prestart meeting which discusses the clearing for the day; limits of clearing; processes to follow; known or potentially occurring threatened species and sensitive areas; and the locations of significant habitat features within and adjacent to the construction areas.

## 3. PRE-CLEARING

As detailed in the Biodiversity Management Plan the following is to occur prior to clearing:

- a suitably qualified and experienced ecologist will be engaged for the project;
- a clearing and grubbing work pack will be developed;
- the extent of clearing required for construction and permanent infrastructure will be confirmed on a survey plan. These boundaries will be included on the Sensitive Area Plans;
- **Clearing limits/Exclusion Zones** will be established prior to clearing commencing and will include the following:
  - for environmentally sensitive areas: exclusion/"no-go" zone fencing and signage is to be installed:
    - a 40 metre exclusion zone surrounding identified watercourses is to be observed at all times, with the exception of works permitted by the approval;
  - in other areas the clearing limits will be delineated using signage and highly visible barrier or tape such as colour-coded UV-stabilised rope, bunting, nightline or other similarly robust and durable material;
  - delineation will be installed consistently through the project to mark boundaries and sensitive areas and to reduce the risk of error or misinterpretation of boundaries;
- an inspection identifying the species and locations of weeds will be undertaken by the project ecologist. Refer to Weed, Pest and Pathogen Management Plan (Appendix F of BMP) for the management of weeds prior to clearing;
- GPS coordinates for all threatened flora will be recorded during the pre-clearing survey;
- consultation with the ecologist will occur to determine the location of suitable habitat for fauna release. Future Generation Environment team will prepare a permit for ecologists to enter no-go areas for the purpose of fauna release;



- an ecologist will undertake a pre-clearing survey along the proposed clearing areas prior to the commencement of clearing. The ecologist will:
  - identify and flag/demarcate key habitat features that are suspected to accommodate fauna, these features may include:
    - nests;
    - hollow bearing trees;
    - large logs, rock piles and woody debris;
    - heath, sedges and soaks/swamps;
    - dense understorey shrubs;
    - burrows below groundcover vegetation, runways and other established fauna routes;
    - evidence of fresh scat; and
    - other habitat features for local fauna as determined by the ecologist;
  - check for the presence of threatened flora and fauna species by thorough visual inspection of potential habitat features. Refer to the unexpected finds procedure for species with potential to occur in the area.;
  - the ecologist must consider the threatened species likely to occur in the disturbance area when flagging and identifying habitat features. GPS coordinates for all identified habitat features will be recorded during the pre-clearing survey;
  - confirm nearby habitat suitable for the release of any fauna that may be encountered during clearing works;
  - where works are to be undertaken within 50 m of watercourses, all vegetation, rocks, logs and other shelter are to be carefully inspected for frog species;
  - where possible and safe to do so collect available seed from native vegetation in the disturbance area to be used for rehabilitation works;
- a check to ensure exclusion zones have been delineated and any vegetation to be retained are clearly marked;
- a check to ensure clearing limits and other delineation required to be installed prior to clearing, is in place;
- the project ecologists will capture and/or remove fauna that have the potential to be disturbed as a result of clearing activities;
- relocate identified fauna into pre-determined habitat identified for fauna release;
- inform clearing contractors of any changes to the sequence of clearing if required;
- prior to any disturbance to the banks of Talbingo Reservoir or Yarrangobilly River, a thorough inspection by a qualified ecologist will be undertaken for Murray Crayfish;
- where possible, existing trees and other vegetation will be retained within 15 m of waterways and drainage lines until immediately before construction commences in the area;
- the supervisor, operator and/ or environmental advisor are to walk the clearing footprint prior to commencing clearing; and
- the Clearing Land Disturbance Permit will be approved prior to clearing commencing.



## 4. VEGETATION CLEARING

A two-stage habitat removal process will be implemented however, where no areas of habitat have been identified to be cleared, clearing can be undertaken in a single-stage process.

### 4.1. Stage 1 – Non-Habitat Removal

#### **Stage 1 clearing for areas where no habitat features were identified during pre-clearing surveys**

If no habitat features have been identified in the pre-clearing surveys, then two-stage clearing is not required and clearing can be undertaken in a single-stage process without the project ecologist present (subject to agreement between Future Generation environment team and project ecologist).

#### **Stage 1 clearing for areas where habitat features have been identified**

Where habitat features have been identified during the pre-clearing surveys, two-stage clearing is required. For these locations, the clearing area will be surveyed by the project ecologist within 24 hours or immediately prior to clearing, to:

- obtain updated information on fauna and flora habitat that is present, including:
  - inspection of identified habitat features for evidence of fauna habitation since the pre-clearing surveys;
  - inspection of all identified habitat features for the presence of sheltering fauna;
  - demarcate any newly identified habitat; and
- collect data on any newly identified threatened species in the area.

During Stage 1 clearing where habitat has been identified:

- the Project Ecologist will be onsite to capture and relocate non-mobile fauna, such as reptiles and frogs;
- only non-habitat vegetation will be removed. All demarked habitat features will be retained until Stage 2. This allows respite between the initial disturbance and the final removal of habitat. The changed environment and the disturbance from clearing should encourage residing fauna to individually relocate without human handling. A respite period of 24-48 hours after removal of non-habitat vegetation is intended to allow resident fauna the opportunity to vacate remaining habitats before Stage 2 clearing commences.

### 4.2. Stage 2 – Habitat Removal

Stage 2 clearing will occur approximately 24-48 hours after Stage 1 clearing. This delay is intended to assist with enabling fauna to escape after the Stage 1 disturbance.

The Project Ecologist will be present during Stage 2 clearing to:

- capture and relocate any encountered fauna to pre-identified release areas;
- advise on the appropriate removal of habitat features;
- carefully inspect habitat features prior to or during the removal process;
- ensure that any injured wildlife is transported to veterinarian or wildlife carers.



During Stage 2 clearing:

- where possible and safe to do so the ecologist will carry out inspection of all habitat features in the clearing area prior to disturbance;
- detected fauna will be encouraged to self-relocate or will be captured and released in the identified release areas;
- where breeding fauna or dependant young are detected during the clearing works, the ecologist will consult with a licensed carer to determine whether the animal/s require ongoing care or can be safely relocated to adjacent habitat;
- if the Booroolong frog is discovered outside of its active period (i.e. from April to September), the individual will be taken into care. Agreement with an appropriately qualified and licensed carer will be required;
- habitat trees will be carefully lowered to the ground with minimal impact and ecologists will inspect these for retained fauna;
- coarse woody debris and logs will be gently dismantled or rolled by machinery operators under instruction of the ecologist;
- where active burrows are suspected, fauna exclusion will be undertaken (e.g. monitoring, exclusion doors) in consultation with the project ecologist prior to disturbance;
- all retained habitat features will be thoroughly inspected (use endoscope where required) by the project ecologist immediately prior to clearing;
- tree hollows will be placed in adjacent habitat until the following day for further inspection by a project ecologist to verify no fauna is present. Hollow bearing trees and any other cleared vegetation regarded as valuable for relocation and habitat creation/enrichment will be retained;
- stockpiling/storage of cleared timber will be in dedicated stockpile areas outside the critical root zone of remaining trees;
- records are to be kept of all fauna rescue events in accordance with the Fauna Handling and Rescue Procedure (Appendix E of the BMP). Locations of fauna release (including GPS coordinates) will be recorded.

## 5. UNEXPECTED THREATENED SPECIES FINDS PROCEDURE

If during construction activities the project ecologist (or other project personnel) identify a threatened species or threatened ecological community that has not been (or is suspected to have not been) assessed as a part of the project assessment, the Unexpected Threatened Species Finds Procedure provided in Appendix D of the BMP will be followed.

The Unexpected Threatened Species Find Procedure is applicable to all activities that have the potential to impact upon threatened flora and fauna species that have not been assessed and approved.

## 6. POST CLEARING REPORT

Post clearing reports will be prepared and will include:

- the name and qualifications of the ecologist or wildlife carer present during clearing;
- an assessment of the habitat and handling of fauna;
- information on clearing operations, dates, procedures, areas;



- live animal sightings, captures, any releases or injured/shocked wildlife;
- fauna that have died as a result of clearing; and
- photographs of rescued fauna.

Post-clearing reporting will be summarised and collated in the annual biodiversity report and provided to agencies as detailed in the BMP.

The cumulative quantity of native vegetation and habitat clearing will be tracked by Future Generation to ensure the project remains consistent with the conditions of approval as detailed in the BMP.

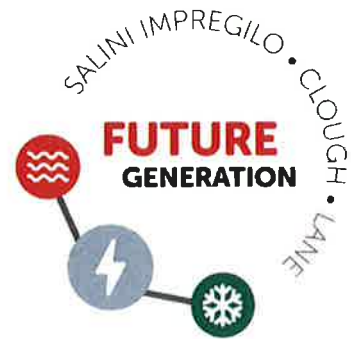




## APPENDIX D PROCEDURE

## UNEXPECTED THREATENED SPECIES FINDS





S2-FGJV-ENV-PRO-0022

## SNOWY 2.0 MAIN WORKS – BIODIVERSITY MANAGEMENT PLAN APPENDIX D – UNEXPECTED THREATENED SPECIES FINDS PROCEDURE

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Verified by	Environmental Manager	L. Coetzee	
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C	02.06.2020	Updated for Main Works approval
D	15.06.2020	Address Snowy Hydro comments
E	30.07.2020	Address agency comments. For submission to DPIE and resubmission to DAWE
F	07.10.2020	Updated to address DPIE comments



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## 1. PURPOSE

This Unexpected Threatened Species Finds Procedure details the typical actions to be taken when a threatened flora or fauna species is unexpectedly encountered on site.

The Unexpected Threatened Species Find Procedure is applicable to all activities which have the potential to impact upon threatened flora and fauna species that have not already been assessed and approved.

## 2. TRAINING

Photos and descriptions of threatened species identified as occurring in the project area are detailed within the Biodiversity Management Plan and are included within this Unexpected Threatened Species Finds Procedure.

All personnel are to be trained through inductions and toolboxes of the biodiversity values of Snowy 2.0 Main Works, including the potential for the identification of threatened species and this unexpected threatened species finds procedure.

## 3. SUPPORTING DOCUMENTS

This procedure shall be read and used in conjunction with the Future Generation Environmental Management Strategy and the Biodiversity Management Plan.

## 4. THREATENED SPECIES LIKELY TO OCCUR IN THE AREA

The *Environmental Impact Statement Main Works for Snowy 2.0* (EIS) was prepared to assess the impact of the of the project on the environment, and included an assessment of biodiversity impacts within Chapter 6.3 and Appendix M. The EIS identified that the main biodiversity concerns from the project were the impacts to several threatened species and their habitat. The Revised BDAR (Appendix G) from the Main Works RTS updated the biodiversity impacts of the project.

### 4.1. Threatened Flora

Ten threatened flora species were recorded within the construction envelope. Nine species are listed under the BC Act, and three are listed under the EPBC Act. A further three threatened flora species were recorded outside but adjacent to the construction envelope. These species are summarised in Table 4-1.

There were no threatened flora species recorded in the Talbingo Reservoir. *Caladenia montana* was found at Lobs Hole and Marica, and one specimen of Slender Greenhood was recorded at Marica. New records of Clover Glycine were recorded near Tantangara, which previously only had a very limited extent within KNP. The plateau (Plateau and Tantangara Reservoir) contains abundant records of threatened flora species.



**Table 4-1: Threatened flora species recorded within and adjacent to the construction envelope**

Species name	Common name	Threatened status		Location recorded					
		EPBC Act <sup>1</sup>	BC Act <sup>2</sup>	Talbingo	Lobs Hole	Marica	Plateau	Tantangara	Rock Forest
<i>Caladenia montana</i>	-		V		✓	✓			
<i>Calotis glandulosa</i>	Mauve Burr-daisy	VU	V				✓	✓	✓
<i>Calotis pubescens</i>	Max Mueller's Burr Daisy		E1				✓	✓	
<i>Carex raleighii</i>	Raleigh Sedge		E1				✓	✓	
<i>Discaria nitida</i>	Leafy Anchor Plant		V			✓	✓	✓	
<i>Glycine latrobeana</i>	Clover Glycine		E4A				✓	✓	
<i>Leucochrysum albicans</i> var. <i>tricolor</i>	Hoary Sunray	EN							✓
<i>Pimelea bracteata</i>	-	-	E4A				⊕	⊕	
<i>Prasophyllum innubum</i> *	Brandy Marys Leek-orchid	CE	E4A				✓		
<i>Prasophyllum retroflexum</i>	Kiandra Leek Orchid	-	V				✓	✓	
<i>Pterostylis alpina</i> *	Alpine Leek Orchid		V				✓	✓	
<i>Pterostylis foliata</i>	Slender Greenhood		V			✓			
<i>Rutidosia leirolepis</i> *	Monaro Golden Daisy	VU	V				✓	✓	
<i>Thelymitra alpicola</i>	Alpine Sun Orchid		V				✓		

<sup>1</sup> EPBC Act categories: VU- Vulnerable; EN- Endangered, CR- Critically Endangered

<sup>2</sup> BC Act categories: V- Vulnerable; E1- Endangered; E4A- Critically endangered

\* these species were recorded outside of but adjacent to the Construction Envelope and will not be impacted by the Project

⊕ This species was not recorded during BDAR assessment but has been indicated to occur in the Kellys Plain Creek area within the construction envelope (Keith McDougal of BCD, pers. obs. 2020).

## 4.2. Threatened Fauna

Twenty-five threatened fauna species listed under the BC Act have been recorded within and adjacent to the disturbance footprint, with six of these species also listed under the EPBC Act. These species are summarised in Table 4-2.

The ravine (Talbingo Reservoir, Lobs Hole and Marica areas) contains limited threatened flora but has a number of threatened bird and mammal species, including the Eastern Pygmy-possum and Smoky Mouse which were recorded within habitat along Lobs Hole Ravine Road and at Marica. The Booroolong Frog was also recorded along the Yarrangobilly River at Lobs Hole.

The plateau contains abundant records of threatened fauna species including Alpine Tree Frog, Alpine She-oak Skink and Broad-toothed Rat.



Table 4-2: Fauna species recorded within and adjacent to the construction envelope

Species name	Common name	Threatened status		Location recorded					
		EPBC Act <sup>1</sup>	BC Act <sup>2</sup>	Talbingo	Lobs Hole	Marica	Plateau	Tantangara	Rock Forest
EPBC Act Migratory species									
<i>Gallinago hardwickii</i>	Latham's Snipe	M				✓	✓	✓	
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M				✓	✓		
<i>Hirundapus caudacutus</i>	White-throated Needletail	M, VU						✓	
BC Act Ecosystem credit species									
<i>Artamus cyanopterus</i>	Dusky Woodswallow		V	✓	✓	✓	✓	✓	✓
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper		V		✓				
<i>Daphoenositta chrysoptera</i>	Varied Sittella		V		✓	✓		✓	
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	EN	V			✓			
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		V		✓	✓	✓	✓	
<i>Haliaeetus leucogaster</i> <sup>B</sup>	White-bellied Sea-Eagle		V	✓	✓			✓	
<i>Hieraaetus morphnoides</i> <sup>B</sup>	Little Eagle		V				✓		
<i>Lophoictinia isura</i> <sup>B</sup>	Square-tailed Kite		V				✓		
<i>Miniopterus schreibersii oceanensis</i> <sup>B</sup>	Large Bent-winged Bat		V	✓	✓	✓	✓	✓	
<i>Neophema pulchella</i>	Turquoise Parrot		V		✓				
<i>Ninox strenua</i> <sup>B</sup>	Powerful Owl		V		✓				
<i>Pachycephala olivacea</i>	Olive Whistler		V		✓				
<i>Petroica boodang</i>	Scarlet Robin		V		✓	✓	✓	✓	✓
<i>Petroica phoenicea</i>	Flame Robin		V		✓	✓	✓	✓	✓
<i>Stagonopleura guttata</i>	Diamond Firetail		V		✓				
<i>Tyto novahollandiae</i> <sup>B</sup>	Masked Owl		V		✓				
BC Act Species credit species									
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo		V	✓	✓	✓	✓	✓	✓
<i>Cercartetus nanus</i>	Eastern Pygmy-possum		V		✓	✓			
<i>Cyclodomorphus praealtus</i>	Alpine She-oak Skink	EN	E1			✓	✓	✓	
<i>Litoria booroolongensis</i>	Booroolong Frog	EN	E1		✓	✓			
<i>Litoria verreauxii alpina</i>	Alpine Tree Frog	VU	E1				✓	✓	
<i>Mastacomys fuscus</i>	Broad-toothed Rat	VU	V			✓	✓	✓	



Species name	Common name	Threatened status		Location recorded					
		EPBC Act <sup>1</sup>	BC Act <sup>2</sup>	Talbingo	Lobs Hole	Marica	Plateau	Tantangara	Rock Forest
<i>Myotis macropus</i>	Southern Myotis		V		✓				
<i>Petroica rodinogaster</i>	Pink Robin		V	Recorded outside Project footprint					
<i>Pseudomys fumeus</i>	Smoky Mouse	EN	E4A		✓	✓			

<sup>1</sup> EPBC Act categories: VU- Vulnerable; EN- Endangered, M- Migratory

<sup>2</sup> BC Act categories: V- Vulnerable; E1- Endangered; E4A- Critically endangered

<sup>B</sup> Confirmed breeding habitat for this species, where impacted, attracts species-credit offsets even though the species is otherwise considered an ecosystem credit.

## 5. IMPLEMENTING THIS PROCEDURE

This procedure is applicable to all activities that have potential to impact upon threatened flora and fauna species which have not already been assessed and approved. In the event that an unexpected threatened species is encountered in a location previously unknown, the process outlined in Figure 5-1 will be implemented.

The process in Figure 5-1 will either result in a recommencement of works (with updated controls where necessary), or if a resolution cannot be found then escalation beyond this procedure will be required. This escalation may involve updating the approval through modification or some other process at the discretion of the Planning Secretary and consulting agencies.



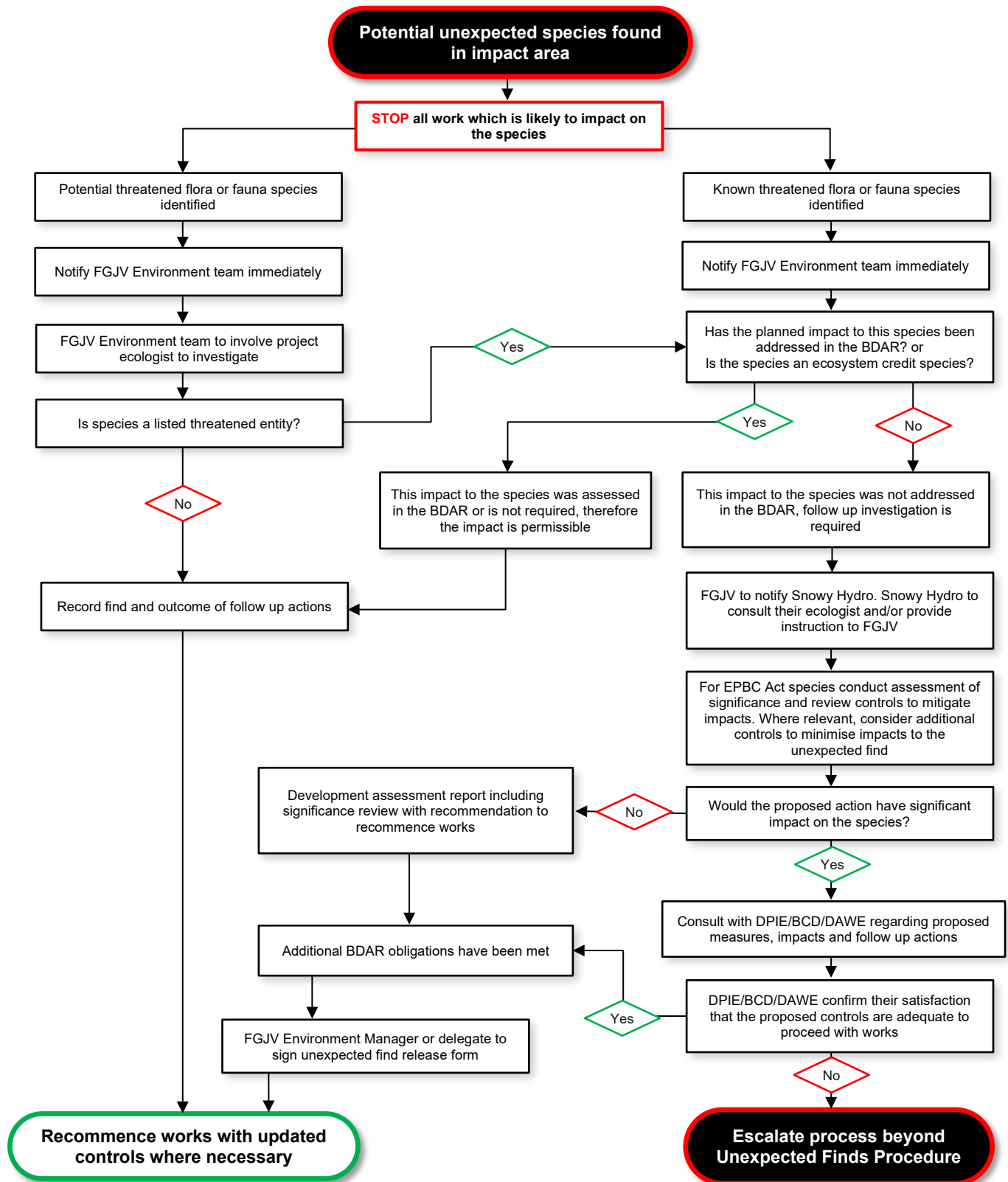









Figure 5-1: Unexpected threatened species finds procedure flow diagram






Table 5-1: Threatened species known to occur in the project area

Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>MAMMALS</b>						
<b>Smoky Mouse</b>	<i>Pseudomys fumeus</i>	Critically endangered	Endangered		<ul style="list-style-type: none"> <li>Fine, soft, pale grey to bluish grey to black fur</li> <li>A grey to white belly and ears and feet that are flesh-coloured with sparse white hair</li> <li>Similar in size to a small rat, the length of individuals, including the tail, is between 180–250mm</li> <li>Primarily nocturnal species</li> </ul>	This species was recorded at 12 locations along the upper section of Lobs Hole Ravine Road to around 1,100 m elevation. The species is likely to occupy this entire ridge, given the extent of suitable habitat in this area. Breeding season is from September to April, and males may be more active and transient during this period as they search for mates.
<b>Eastern Pygmy Possum</b>	<i>Cercartetus nanus</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>Eastern Pygmy-possums are tiny, only weighing 15 to 43 grams</li> <li>Adults have a body length between 70-110 mm</li> <li>Almost bare, prehensile (capable of curling and gripping) tail</li> <li>Big, forward-pointing ears</li> <li>Light-brown fur above and white belly below</li> <li>Active climbers</li> </ul>	The Eastern Pygmy Possum was recorded at numerous locations within the Main Works survey area, from the upper reaches of Lobs Hole Ravine to Lobs Hole.
<b>Spotted-tailed Quoll</b>	<i>Dasyurus maculatus</i>	Vulnerable	Endangered		<ul style="list-style-type: none"> <li>The Spotted-tailed Quoll is about the size of a domestic cat.</li> <li>The average weight of an adult male is about 3500 grams and an adult female about 2000 grams.</li> <li>It has rich-rust to dark-brown fur above, with irregular white spots on the back and tail, and a pale belly.</li> </ul>	The Spotted-tailed Quoll is found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common.






Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>Eastern False Pipistrelle</b>	<i>Falsistrellus tasmaniensis</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The Eastern False Pipistrelle has a head-body length of about 65 mm.</li> <li>It is dark to reddish-brown above and paler grey on its underside.</li> <li>It has long slender ears set well back on the head and some sparse hair on the nose.</li> </ul>	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania.
<b>Large Bent-winged Bat</b> (formerly the Eastern bent-wing bat)	<i>Miniopterus schreibersii oceanensis</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The Large Bent-winged Bat has chocolate to reddish-brown fur on its back and slightly lighter coloured fur on its belly.</li> <li>It has a short snout and a high 'domed' head with short round ears.</li> <li>It has a head and body length of about 6 cm and a wingspan of 30 - 35 cm.</li> </ul>	The Large Bent-wing bat occur along the east and north-west coasts of Australia. Recorded at Lobs Hole.
<b>Southern Myotis</b>	<i>Myotis macropus</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>It has disproportionately large feet; more than 8 mm long, with widely-spaced toes which are distinctly hairy and with long, curved claws.</li> <li>It has dark-grey to reddish brown fur above and is paler below. It weighs up to 15 grams and has a wingspan of about 28 cm.</li> </ul>	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Recorded at Lobs Hole.
<b>Broad-toothed Rat</b>	<i>Mastacomys fuscus</i>	Vulnerable	Vulnerable		<ul style="list-style-type: none"> <li>A tubby, compact rodent that are very much an Australian native 'guinea-pig' in appearance and character.</li> <li>It is brown above, with attractive, rufous highlights.</li> <li>The tail is shorter than the head and body length (Rattus species have tails as long or longer than the head and body).</li> </ul>	In NSW the Broad-toothed Rat occurs in two widely separated areas: the wet alpine and subalpine heaths and woodlands in Kosciuszko National Park, adjacent Nature Reserves (Bimberi and Scabby NR) and State Forest (Buccleuch SF) in the south of the State, and on the Barrington Tops, north-west of Newcastle.







Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>HERPETOFAUNA – Reptiles and amphibians</b>						
<b>Booroolong Frog</b>	<i>Litoria booroolongensis</i>	Endangered	Endangered		<ul style="list-style-type: none"> <li>• Medium sized tree frog, with adults growing to about 50 mm</li> <li>• Their body-colour may be grey, olive or brown with indistinct black markings</li> <li>• The abdomen is white</li> <li>• The skin usually has a slightly warty appearance</li> <li>• The fingers and toes have well developed discs, and the toes are strongly webbed</li> <li>• The call is a soft, purring 'craw'</li> </ul>	A healthy population of the Booroolong Frog was recorded along the entire length of the Yarrangobilly River within and adjacent to the Early Works project area; this population is likely to extend upstream to at least Blue Creek Firetrail.
<b>Alpine She-oak Skink</b>	<i>Cyclodomorphus praealtus</i>	Endangered	Endangered		<ul style="list-style-type: none"> <li>• The Alpine She-oak Skink is a slender medium-sized lizard reaching a maximum length of around 350 mm, with a snout to vent length up to 130 mm.</li> <li>• It is olive-green to reddish-brown and has smooth, overlapping scales with dark lateral edges that create a series of thin, longitudinal dark lines. Scales may have black and grey flecks.</li> <li>• The tail is tapered and is relatively short compared to similar species from coastal areas.</li> </ul>	The Alpine She-oak Skink is endemic to NSW and Victoria, where it is restricted to sub-alpine and alpine grasslands. In NSW, the Alpine She-oak Skink has only been observed within Kosciuszko National Park between Smiggin Holes and Kiandra. In Victoria, the species is found in the north east of the state, extending as far south as Lankey Plain on the Dargo High Plains.
<b>Alpine Tree Frog</b>	<i>Litoria verreauxii alpina</i>	Endangered	Vulnerable		<ul style="list-style-type: none"> <li>• The Alpine Tree Frog is a relatively small tree frog, growing to about 3 cm long.</li> <li>• Colouration is highly variable; there are green, brown and grey forms. They have a black stripe from the nostrils, through the eyes, to the top of the foreleg, and a (usually divided) broad brown stripe from the eyes and down the back.</li> <li>• The call is a "trilled whistle 'cree...cree...cree...'"</li> </ul>	The Alpine Tree Frog occurs in the south-eastern NSW and Victorian high country (alpine and sub-alpine zones) generally above 1100 m above sea level. Most locations are within National Park and some are close to alpine resorts.

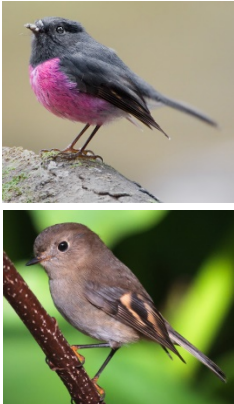



Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>BIRDS</b>						
<b>Gang-gang Cockatoo</b>	<i>Callocephalon fimbriatum</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>Gang-gang Cockatoos are primarily slate-grey, with the males easily identified by their scarlet head and wispy crest</li> <li>Females have a grey head and crest and feathers edged with salmon pink on the underbelly</li> </ul>	The Gang-gang Cockatoo was found to be common throughout the Main Works survey area, with the species observed at numerous locations foraging. The species was observed to be most common in sub-alpine woodlands (such as at the top of Lobs Hole Ravine Road) and riparian areas at lower elevations (close to the Yarrangobilly River).
<b>Masked Owl</b>	<i>Tyto novaehollandiae</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>A medium-sized owl to 40 - 50 cm long</li> <li>Dark eyes set in a prominent flat, heart-shaped facial disc that is encircled by a dark border</li> <li>The feet are large and powerful, with fully feathered legs down to the toes</li> <li>The owl exists in several colour forms, with wide variation in plumage</li> </ul>	The Masked Owl was recorded at two locations within and adjacent to the Main Works disturbance footprint during targeted surveys; on the Yarrangobilly River in Lobs Hole and in the upper sections of Lobs Hole Ravine Road, near the intersection with Link Road.
<b>Diamond Firetail</b>	<i>Stagonopleura guttata</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The Diamond Firetail is a large (length 10-12cm, weight 17 grams), striking finch with a bright red bill, and red eyes and rump</li> <li>The white throat and lower breast are separated by a broad black breast-band that extends into the strongly white-spotted, black flanks</li> </ul>	The Diamond Firetail is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia.








Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>Dusky Woodswallow</b>	<i>Artamus cyanopterus cyanopterus</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>Medium-sized bird (16-19.5cm, 35g), with a longish tail</li> <li>Mostly dark grey-brown, merging to blackish on the tail, with a small black-brown mask</li> <li>Bluish bill with a black tip</li> </ul>	Dusky woodswallows are widespread in eastern, southern and south western Australia.
<b>Varied Sittella</b>	<i>Daphoenositta chrysoptera</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The Varied Sittella is a small (10cm) songbird with a sharp, slightly upturned bill, short tail, barred undertail, and yellow eyes and feet.</li> <li>In flight the orange wing-bar and white rump are prominent.</li> </ul>	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands.
<b>Flame Robin</b>	<i>Petroica phoenicea</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The Flame Robin is a small Australian robin that reaches 14cm in length.</li> <li>The male has a dark grey head and upperparts, a small white forehead patch, and white wing stripes and white tail-edges.</li> </ul>	The Flame Robin is endemic to south eastern Australia, and ranges from near the Queensland border to south east South Australia and also in Tasmania.
<b>Scarlet Robin</b>	<i>Petroica boodang</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The Scarlet Robin is a small Australian robin that reaches 13 cm in length.</li> <li>The male has a black head and upperparts, with a conspicuous white forehead patch, white wing stripes and white tail-edges.</li> <li>The male has a bright scarlet-red chest and a white belly.</li> <li>The female is pale brown, darker above, and has a dull reddish breast and whitish throat. The whitish mark on the female's forehead is smaller than the male's.</li> </ul>	The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia.






Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>Pink Robin</b>	<i>Petroica rodinogaster</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The male Pink Robin has a sooty black throat and upperparts. The wings have faint, tan-buff wing-bars. The breast and belly are deep lilac-pink, and there is a small white patch on the forehead. The tail is plain, making this species the only 'red' robin with no white markings on the tail.</li> <li>The female has warm olive-brown upperparts and cinnamon-buff underparts, a buff forehead spot, and may have a slight pink wash on the breast. The chestnut-buff wings and the absence of white in the tail, distinguishes the female from all other female robins.</li> </ul>	The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. The species was not recorded in the Project area but was observed in the locality during surveys.
<b>Brown Treecreeper</b>	<i>Climacteris picumnus victoriae</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The Brown Treecreeper, is a grey-brown bird with black streaking on the lower breast and belly and black bars on the undertail.</li> <li>The face is pale, with a dark line through the eye, and a dark crown.</li> <li>The male has small patches of black and white streaking on the centre of the uppermost breast</li> <li>The females exhibit a rufous and white streaking.</li> <li>Juveniles differ from adults mainly by the pattern of the under-body, and by their a pale bill and gape.</li> </ul>	The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges.


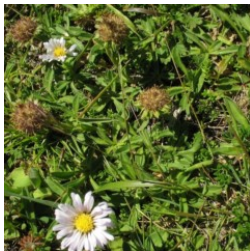


Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>White-bellied Sea-Eagle</b>	<i>Haliaeetus leucogaster</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The White-bellied Sea-Eagle is a large eagle that measures 75–85 cm in length, and has a wingspan of 180–220 cm.</li> <li>Adults are predominantly white and grey. The large, hooked bill is grey with a darker tip, and the eye is dark brown. The legs and feet are cream-white, with long black talons.</li> <li>Both sexes are similar in appearance but females are larger than the males. Juveniles are brown with lighter markings.</li> </ul>	<p>The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin.</p> <p>In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways.</p>
<b>Square-tailed Kite</b>	<i>Lophoictinia isura</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The Square-tailed Kite is a reddish, medium-sized, long-winged raptor, about the size of a Little Eagle or harrier.</li> <li>Adults have a white face with thick black streaks on the crown and finer streaks elsewhere.</li> <li>A key character in flight is the long fingered, upswept wings with a large white patch at the base of the barred 'fingers'.</li> </ul>	<p>The Square-tailed Kite ranges along coastal and subcoastal areas. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March.</p>
<b>Olive Whistler</b>	<i>Pachycephala olivacea</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The Olive Whistler is a small, stocky bird that grows up to 22 cm long, including the 10 cm tail.</li> <li>It has a dark grey head, olive-brown upperparts, a grey throat and buff-brown underparts.</li> <li>The female is duller in colour than the male.</li> </ul>	<p>The Olive Whistler inhabits the wet forests on the ranges of the east coast. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range.</p>



Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>Little Eagle</b>	<i>Hieraaetus morphnoides</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The Little Eagle is a medium-sized bird of prey that occurs in two colour forms: either pale brown with an obscure underwing pattern, or dark brown on the upper parts and pale underneath, with a rusty head and a distinctive underwing pattern of rufous leading edge, pale 'M' marking and black-barred wingtips.</li> <li>Both forms have a black-streaked head with a slight crest, a pale shoulder band on the upperwings, a rather short and square-tipped barred tail, and feathered legs.</li> </ul>	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW.
<b>Regent Honeyeater</b>	<i>Anthochaera phrygia</i>	Critically Endangered	Critically Endangered		<ul style="list-style-type: none"> <li>Medium-sized, black and yellow honeyeater with a sturdy, curved bill. Adults are 20 - 24 cm long and have a wingspan of 30 cm.</li> <li>Its head, neck, throat, upper breast and bill are black and the back and lower breast are pale lemon in colour with a black scalloped pattern.</li> <li>Flight and tail feathers are edged with bright yellow.</li> <li>Characteristic patch of dark pink or cream-coloured facial-skin around the eye.</li> <li>The call is a soft metallic bell-like song; birds are most vocal in non-breeding season.</li> </ul>	<ul style="list-style-type: none"> <li>Inhabits temperate woodlands and open forests of the inland slopes of south-east Australia.</li> <li>Only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region.</li> <li>In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests.</li> <li>Reported to have been observed flying overhead at Lobs Hole</li> </ul>






Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>Turquoise Parrot</b>	<i>Neophema pulchella</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>Highly distinctive bird with bright green upperparts and a turquoise-blue crown and face.</li> <li>Chestnut red patch on the upper wing and yellow abdomen.</li> <li>The call of the Turquoise Parrot in flight is a tinkling sound, while at other times it may emit a sharp “sit-sit” alarm call.</li> </ul>	<ul style="list-style-type: none"> <li>The Turquoise Parrot’s range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range.</li> <li>Recorded at Lobs Hole.</li> <li></li> </ul>
<b>Powerful Owl</b>	<i>Ninox strenua</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>Largest owl in Australasia. Adults reach 60cm in length and have a wingspan of up to 140cm. Males are larger than females.</li> <li>Typical hawk-owl with large yellow eyes and no facial disc.</li> <li>The upper parts of the Powerful Owl are dark, greyish-brown with off-white bars. The underparts are whitish with dark greyish-brown V-shaped markings.</li> <li>It has a slow, deep and resonant double hoot.</li> </ul>	<ul style="list-style-type: none"> <li>In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains.</li> <li>Recorded at Lobs Hole.</li> <li></li> </ul>
<b>AQUATIC FAUNA</b>						
<b>Murray Crayfish</b>	<i>Euastacus armatus</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>Murray crayfish have large white claws and a dark olive/grey/black carapace, all of which are covered in short robust spikes.</li> <li>Murray Crayfish have been reported to grow to 3 kg and are the second largest freshwater crayfish in the world behind the Tasmanian Freshwater Crayfish.</li> </ul>	Murray Crayfish can be found in the Murray River upstream of Mildura, in the Murrumbidgee River and in some dams, and are the only species in the Euastacus genus that live in both cold and warm water habitats.



Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>FLORA</b>						
<b>Mauve Burr-daisy</b>	<i>Calotis glandulosa</i>	Vulnerable	Vulnerable		<ul style="list-style-type: none"> <li>The Mauve Burr-daisy is a sprawling, branched herb that grows to 20 cm tall and up to 1 m wide.</li> <li>It has soft, bright green, hairy leaves with indented edges. They are up to 3 cm long and 9 mm wide.</li> <li>The 2 cm wide flower-heads are solitary, mauve, and have a yellow centre. They appear in spring and summer. Flowers are followed by a head of brown burrs that may stick to clothing and animals' coats.</li> </ul>	The distribution of the Mauve Burr-daisy is centred on the Monaro and Kosciuszko regions. There are three known sites in the upper Shoalhaven catchment. There are old and possibly dubious records from near Oberon, the Dubbo area and Mt Imlay.
<b>Max Mueller Burr Daisy</b>	<i>Calotis pubescens</i>	Endangered	Not listed		<ul style="list-style-type: none"> <li>Perennial herb with thick and fleshy underground stems (rhizomes), and forms large mats.</li> <li>Leaves are very woolly when young.</li> <li>Single mauve or white flower-heads in December.</li> </ul>	This species has been recorded from five sites in the Snowy Mountains of NSW (four of which, all in Kosciuszko National Park, are extant). Recorded at Tantangara and Plateau.







Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>Raleigh Sedge</b>	<i>Carex raleighii</i>	Endangered	Not listed		<ul style="list-style-type: none"> <li>Raleigh Sedge is a small sedge that grows from underground stems (rhizomes) to 25 cm tall.</li> <li>Its leaves and stem are very thin and wiry.</li> <li>Up to five flowering spikes are clustered towards the ends of the stems, with a leaf-like process (bracts) extending well beyond them.</li> <li>Unlike <i>Carax hebes</i>, its flower-spike is longer than broad.</li> </ul>	Raleigh Sedge is found only in areas above about 1000 metres on the Southern Tablelands. Most populations are in Kosciuszko National Park (eg. Charlottes Pass area, Muellers Pass, Tantangara area and the upper Tooma and Tumut valleys). Also occurs in vicinity of Snowy Plain (private land and travelling stock reserve) and on the coastal escarpment at the headwaters of Tantawangalo Creek within South East Forests National Park.
<b>Leafy Anchor Plant</b>	<i>Discaria nitida</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>The Leafy Anchor Plant is 1 - 3 m high, but occasionally to 5.5 m tall.</li> <li>The spines and stems are greyish brown except in the current season's growth, which is green.</li> <li>Leaves are narrow and blunt, mostly 1-1.5 cm long (but can be up to 25 mm long) and 6 mm wide, light green and glossy when young, darkening as the season progresses.</li> <li>The flowers are tiny and white and in clusters of up to nine arising from beneath the base of the spines. Individual flowers are 2 mm long and 3 mm across.</li> <li>Flowering occurs in late November to early December, with individual flowers being very short-lived. The seed capsule is a domed, globular, usually 3-chambered structure 3-4 mm in diameter.</li> </ul>	The Leafy Anchor Plant is confined to the far south of the Southern Tablelands of NSW and the north-east highlands of Victoria. In NSW the Leafy Anchor Plant grows mostly within Kosciuszko National Park, south from the Blue Water Holes - Yarrangobilly Caves area to south-west of Jindabyne, at altitudes above 900 m. In NSW 18 sites are known with a total population of about 2,800 plants (Wright & Briggs, 2000).

Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>Clover Glycine</b>	<i>Glycine latrobeana</i>	Critically endangered	Not listed		<ul style="list-style-type: none"> <li>The Clover Glycine is a low-growing herb growing to only a few cm high.</li> <li>Leaves are split into three, like a classic clover leaf, 5–20 mm long and 4–12 mm wide.</li> <li>Flowers in spring in the lower elevation parts of its range and in summer in higher elevation areas.</li> <li>Up to eight small, compact, deep purple flowers are borne on 'stems' 5–10 cm long.</li> <li>Seed pods are 20–25 mm long and 5 mm wide, dark brown and contain 3–5 ovoid, smooth, dark brown seeds.</li> </ul>	The Clover Glycine is endemic to south-eastern Australia, where it is widely distributed from Port Pirie in South Australia, through much of Victoria to near Hobart in Tasmania. It was recently discovered in Kosciuszko National Park.
<b>Hoary Sunray</b>	<i>Leucochrysum albicans</i> var. <i>tricolor</i>	Not listed	Endangered	 	<ul style="list-style-type: none"> <li>The Hoary Sunray is a low tufted to mounding perennial straw daisy. It grows to 15 cm tall and flowers in spring and summer (Sinclair 2010). After flowering it dries out to rootstock (Sinclair 2010).</li> <li>The flowerheads are 2–5 cm in diameter and surrounded by numerous white overlapping ovate-oblong bracts, with the outer layer often tinged purple or brown (Sinclair 2010).</li> <li>The stems are branched and woody near the base or can be erect with the older stems spreading horizontally.</li> <li>The flower heads are solitary and at the ends of long stalks that bear a few small, scattered bracts (leaf-like structures).</li> </ul>	The Hoary Sunray occurs at relatively high elevations in woodland and open forest communities, in an area roughly bounded by Goulburn, Albury and Bega. On the Project, the Hoary Sunray was recorded in high numbers at the Rock Forest site.

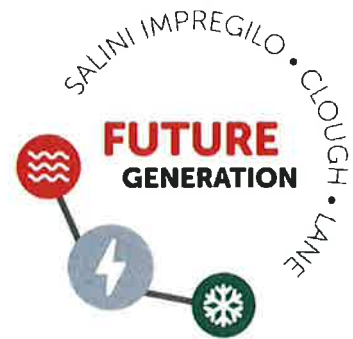


Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>Brandy Mary's Leek-orchid</b>	<i>Prasophyllum innubum</i>	Critically endangered	Critically endangered	<i>Image unavailable</i>	<ul style="list-style-type: none"> <li>It has a single tubular, bright green leaf and up to twenty brownish-green, white and purplish flowers.</li> <li>Terrestrial herb growing singly or in loose groups</li> <li>Erect leaf 25-50cm long and with 6-20 small brownish-purple flowers with a white or pinkish labellum</li> </ul>	Endemic to New South Wales. It occurs east of Tumbarumba in the Southern Tablelands, at Brandy Mary's Bago State Forest Crown leases, on adjacent private land and in Bago State Forest. Recorded at the Plateau <u>outside of the construction envelope</u> .
<b>Rice flower</b>	<i>Pimelea bracteata</i>	Critically Endangered	Not listed		<ul style="list-style-type: none"> <li>Shrub to 2 m high, stems glabrous</li> <li>Leaves narrow-elliptic to oblanceolate, those immediately below the involucre often wider, usually 6–10 mm long, 3–6 mm wide, often with a purplish tinge.</li> <li>Flowers in bracteate heads, bracts completely surrounding the head; head usually nodding on short lateral shoot; peduncle 1–5 mm long. Bracts 6–8, 10–18 mm long, 7–15 mm wide, glabrous, yellow-green often tinged with purple or red. Flowers 15–26 in each head, 12–17 mm long, pale yellow.</li> <li>Fruit 3–4.5 mm long, green.</li> </ul>	<p><i>Pimelea bracteata</i> typically grows along creek lines, and a population may have a linear distribution along a creek for many kilometres</p> <p>In wet heath and along creek banks at higher altitudes in the Kiandra area.</p> <p>Suspected of occurring in the Kellys Plain Creek area of the project.</p>
<b>Kiandra Leek Orchid</b>	<i>Prasophyllum retroflexum</i>	Vulnerable	Vulnerable		<ul style="list-style-type: none"> <li>Kiandra Leek Orchid consists of a single hollow leaf that is up to 30 cm tall.</li> <li>Flowers open very widely and are green with deep purple stripes and blotches, or they may be completely purple. They are sweet-smelling and are arranged densely in a single spike of up to 80 flowers.</li> </ul>	All populations are thought to occur within Kosciuszko NP (in the Long Plain, Kiandra, Tantangara area).

Common name	Scientific name	BC Act	EPBC Act	Image	Appearance	Location
<b>Alpine Leek Orchid</b>	<i>Pterostylis alpina</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>Is a greenhood orchid.</li> <li>There is a rosette of 3-5 basal leaves, 2–6 cm long, 10–15 mm wide.</li> <li>The flowering stem is rough and to 30 cm tall.</li> <li>The flower is about 3 cm long, erect, dark green and white.</li> </ul>	<p>In NSW the species occurs in the Southern Tablelands south from Bondo State Forest.</p> <p>Recorded at the Plateau and Tantangara <u>outside of the construction envelope</u>.</p>
<b>Slender Greenhood</b>	<i>Pterostylis foliata</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li><i>Pterostylis foliata</i> is a greenhood orchid with 3-6 roughly ovate leaves 2–5 cm long, 8–16 mm wide.</li> <li>The flowering stem is up to 30 cm high and is smooth.</li> <li>The flower is about 2 cm long, dark green and white with brown in the galea.</li> </ul>	<p><i>Pterostylis foliata</i> is found in NSW, Australian Capital Territory (ACT), Victoria, South Australia, Tasmania and New Zealand (type location). In NSW the species occurs mainly in the Southern Tablelands south from Batlow.</p>
<b>Monaro Golden Daisy</b>	<i>Rutidosia leiopis</i>	Vulnerable	Vulnerable		<ul style="list-style-type: none"> <li>Low, tufted perennial with a woody root-stock.</li> <li>Leaves are dark green, woolly underneath, to about 10 cm long and 3 mm wide.</li> <li>Flower-heads are conspicuous and bright yellow, and surrounded by pale brown, translucent, papery bracts.</li> <li>Flowers appear in summer</li> </ul>	<p>The Monaro Golden Daisy is found in scattered populations on the Monaro, and in low subalpine plains of Kosciuszko National Park.</p> <p>Recorded at the Plateau and Tantangara <u>outside of the construction envelope</u>.</p>
<b>Alpine Sun Orchid</b>	<i>Thelymitra alpicola</i>	Vulnerable	Not listed		<ul style="list-style-type: none"> <li>Single erect, dark green grass-like leaf and up to six relatively large, deep purplish blue flowers with darker streaks.</li> <li>Flowers late October to January.</li> </ul>	<p>Endemic to eastern Australia. It grows in subalpine to montane habitats.</p> <p>Recorded at Plateau</p>



## APPENDIX E FAUNA HANDLING AND RESCUE PROCEDURE



S2-FGJV-ENV-PRO-0007

## SNOWY 2.0 MAIN WORKS - BIODIVERSITY MANAGEMENT PLAN APPENDIX E – FAUNA HANDLING AND RESCUE PROCEDURE

Approval Record			
Document preparation, review and approval		Name in print	Signature
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Reviewed by	Environmental Manager	L. Coetzee	
Approved by	Project Director	A. Betti	

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A	29.11.2019	Initial draft for Snowy Hydro review
B	02.06.2020	Updated for Main Works approval
C	30.07.2020	Revised following Agency consultation
D	07.10.2020	Revised following DPIE review



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## 1. PURPOSE

This Fauna Handling and Rescue Procedure is applicable to the handling of any fauna which has potential to occur on site.

Handling of fauna may be necessary when they are encountered and need to be relocated or if injured, taken to a vet or wildlife carer. Fauna handling will be undertaken either by the project ecologist or a person skilled in handling the species of fauna encountered.

Should any threatened species be identified the Unexpected Threatened Species Find Procedure (Appendix D) would be implemented. The Unexpected Threatened Species Find Procedure is applicable to all activities that have the potential to impact upon threatened flora and fauna species that have not been assessed and approved.

## 2. GENERAL REQUIREMENTS

- All potential fauna habitat (for example hollow-bearing trees) will be identified prior to removal in accordance with the pre-clearing and clearing procedure (Appendix C).
- Vegetation clearing will be carried out in two steps. 1. Non-habitat features will be removed first, and 2. Habitat features removed in accordance with pre-clearing and clearing procedure 24-48 hours after stage 1 (Appendix C).
- All fauna observed, captured, relocated, injured or killed during the habitat removal phase of the project must be recorded using the Fauna Handling Record Sheet (Annexure A). The following data will be recorded; date, species, sex (if known), location of observation (easting/northings), location of the release site, notes regarding deposit of fauna to veterinarian or wildlife shelter and any other relevant notes.
- Suitable relocation habitat will be identified as part of the pre-clearing and clearing procedure (Appendix C).

## 3. GENERAL HANDLING REQUIREMENTS

- Fauna in hollows will be extracted by hand from the hollow. This may require cutting the entrance of the hollow with a chainsaw. Extreme care is advised. If a chainsaw must be used to increase the entrance size, it is strongly recommended that a suitable plug (for example, several scrunched-up cloth capture bags or towels), be placed between the animal and the chainsaw. Care must be taken not to injure the animal during the extraction process. Firm but gentle pressure will be applied, to encourage the animal from the hollow. The use of an inverted cloth capture bag is recommended if appropriate to the circumstance, so that when the animal is extracted, the bag can be pulled over the animal immediately. Where it is not possible to extract the animal from a hollow, the log can be carefully removed intact and located outside of the disturbance area so that the fauna can leave of their own accord. Ensure that egress from the hollow is not blocked when placing the log down.
- If nocturnal fauna are required to be kept during the day, they will be kept in either standard pet carrying cages, ventilated cardboard/plastic animal boxes or cloth capture bags. Captive fauna will generally be kept at a cool or ambient temperature and shaded conditions to avoid any heat stress. Water will be provided if necessary. Injured fauna may require external heat. The project ecologist is to regularly monitor captive fauna.
- In the event that juvenile fauna are displaced and cannot be re-united with its parent(s), they must be deposited with an authorised wildlife shelter within the region.



- In the event that fauna are injured during construction, the animal should initially be assessed and first aid rendered by the project ecologist (if available) and subsequently taken to a Veterinarian for further assessment and treatment, and if necessary, euthanasia.

A severely injured animal (for example, deep cut with exposed organs, bone fracture, protruding bone etc.) may require immediate euthanasia. It is preferable to take animals to a veterinarian for euthanasia however, at times this may not be possible, practical or in the best interests of the animal (i.e. prolonged suffering). In these cases, it may be necessary to undertake euthanasia in the field. The method of euthanasia will be suited to the size of the animal. In general, a sharp and forceful blow to the head with a blunt object (e.g. hammer) to cause instantaneous death is considered to be humane.

## 4. SPECIFIC HANDLING REQUIREMENTS

### 4.1. Birds

General rescue approach for birds:

- where possible and safe to do so, gain access to nests using elevated platform/ladder. Capture and remove any nestlings;
- place nestlings in cotton capture bags and assess for injuries. Store bags containing nestlings in a pet carrying cage or ventilated cardboard box. The animal container will be covered to reduce stress on the bird. Deliver to specialist wildlife carer;
- If adult birds are captured, they will be released away from construction activities.

### 4.2. Ground Dwelling Mammals – Species: Echidna

General rescue approach for echidnas:

- if echidnas are found within the construction zone or during habitat removal, they will need to be captured and relocated;
- dig echidna out by hand or carefully by shovel to the side of the echidna. The aim is to get a hand(s) beneath the echidna and to grasp a hind leg(s) and lift the echidna from the soil;
- place in a dig-proof container, such as a ventilated plastic box or garbage bin. Captive echidnas will be kept in a cool, well ventilated location, out of direct sun. Uninjured echidnas will be translocated and released as soon as possible.

### 4.3. Ground Dwelling Mammals – Species: Native Rodents

General rescue approach for native rodents:

- capture rodents using a hand net;
- once captured, rodents will be placed into a cloth capture bag, assessed and if not injured, retained until dusk and then released into appropriate habitat.

### 4.4. Ground Dwelling Mammals – Species: Kangaroos And Wallabies (Macropods)

General rescue approach for kangaroos and wallabies:

- if a macropod is within the construction zone, activities in the area which may impact the macropod may need to cease. The project environmental staff are to be notified;
- in the event that a juvenile macropod is displaced (thrown from a pouch) and cannot be re-united with its parent, orphaned macropods will be deposited with an authorised wildlife shelter within the region for hand rearing.

- Uninjured adults will be calmly ushered from the construction zone.

#### 4.5. Reptiles – Species: Snakes, Lizards, Turtles

General rescue approach for reptiles:

- Snakes will be captured by the project ecologist (when they are available) or with a person who has skills and experience in snake handling. Snakes disturbed by the development will only be captured and relocated if they present a potential threat to construction personnel or are likely to be harmed by the works. In most cases, snakes will attempt to move away from a disturbed area.
- Reptiles will be released as soon as possible after capture into suitable habitat outside of the construction zone.

#### 4.6. Frogs

General rescue approach for frogs:

- Frog searches are to be conducted by the Project Ecologist prior to any excavation/construction activities.
- The capture and relocation of frogs require specific attention to avoid disease transmission. The following hygiene protocol applies:
  - Capture, handling and housing of wild frogs will be minimised or avoided where possible.
  - Single-use Latex, nitrile or vinyl gloves or single-use plastic bags will be used at all times when handling/capturing frogs.
  - New gloves need to be used for each new frog handled.
  - Hand washing with 70% ethanol (allowing hands to dry) between handling individual frogs is acceptable if no gloves are available (note, repeated use on human skin is not recommended). Alcohol is toxic to frogs so hands must be washed thoroughly in water after treatment with alcohol.
  - Each frog must be housed separately in plastic zip lock bags (with air holes punched into the bag prior to frog capture). Bagged frogs must be kept in a cool quiet location and released into suitable habitat at the earliest opportunity (immediate release ideal or release before night fall on the day of capture).
  - No plastic bag is to be re-used and must be disposed of after a single use.
  - When moving between water bodies/wetlands, personnel will wash their boots in foot baths going from and into water bodies/wetlands. Foot baths are to consist of the following; plain water bath and 10% bleach solution bath. Personnel are to first wash their boots in plain water to remove any soil, followed by washing in 10% bleach.

*The Hygiene Protocol for the control of disease in frogs (Wellington and Haering 2008) will be implemented for all frog handling*

#### 4.7. Arboreal Mammals – Species: Possums And Gliders

General rescue approach for arboreal mammals:

- the project ecologist will be on site to inspect trees for possums and gliders that may need to be relocated;
- if possums and gliders are found during vegetation clearing, the project ecologist will determine if capture and relocation is warranted;



- possums and gliders will be captured either by hand or net and placed into a suitable cage;
- gliders will be held in cloth capture bags;
- captured possums and gliders will be released at a location deemed suitable by the project ecologist;
- in the event that juvenile possums/gliders are displaced and cannot be re-united their mother, they will be taken to an authorised wildlife shelter within the region.

#### 4.8. Microbats – Species: All Species

General rescue approach for microbats:

- there is potential for microbats to carry the Australian Bat Lyssavirus (a rabies like virus), a disease potentially fatal to humans. To reduce the risk of infection, only experienced and vaccinated persons will be authorised to handle microbats.
- the project ecologist is to be on site during the removal of vegetation and to inspect trees for microbats that may need to be relocated;
- microbats will be captured by hand using protective gloves;
- captured microbats must immediately be placed into a cloth bag hung vertically in a quiet, cool, dark place until released;
- all captured microbats will be relocated into adjacent suitable habitat;
- in the event that a juvenile microbat is displaced and cannot be re-united with its parent, orphaned microbats must be deposited with an authorised wildlife shelter within the region.

### 5. WILDLIFE CARER CONTACT DETAILS

- The wildlife carer organisations, LAOKO and SONA, will be contacted prior to commencement of each stage of clearing to determine availability to assist with caring of injured native wildlife if required.
- In the event that local wildlife carers are not available, the national WIRES contact number can be used to identify other local qualified wildlife carers.

Table 5-1: Wildlife carer contact details

ROLE	ORGANISATION	LOCATION	CONTACT DETAILS
Project Ecologist	Confirm with Environment Team	Onsite	The contact details for the Project Ecologist will be retained by project staff and will be available to personnel upon request.
Local Wildlife Carers	Looking After Our Kosciuszko Orphans (LAOKO)	Southern NSW around Jindabyne, to Vic border	6456 1313
Local Wildlife Carers	Saving Our Native Animals (SONA)	Southern NSW, around the areas of Batlow and Tumbarumba	6946 2222
Wildlife Carers	WIRES	National service utilizing local volunteers	1300 094 734
Veterinary Clinic	Tumut Veterinary Clinic	78 Adelong Rd, Tumut NSW	6947 3122

ROLE	ORGANISATION	LOCATION	CONTACT DETAILS
Veterinary Clinic	Monaro Veterinary Clinic	3 Massie Street, Cooma NSW	6452 2292



## ANNEXURE A – FAUNA HANDLING RECORD SHEET

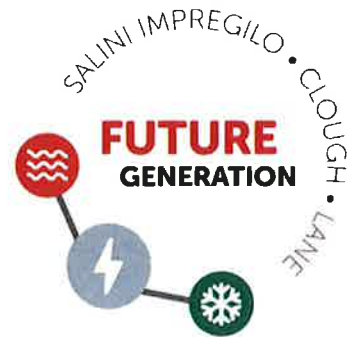
## FAUNA HANDLING RECORD SHEET - S2-FGJV-ENV-CHE-0007

ITEM	DETAIL
Date fauna located	
Time fauna located	
Weather (temperature, wind, cloud cover, precipitation)	
Location (Coordinates and description e.g. in tree hollow; under stockpile, open area etc)	
Fauna type (mammal, bird, reptile etc.)	
Species (if known)	
Observed behaviour	
Condition, general health signs, description of injuries, note if a dead specimen	
Is the fauna injured (YES / NO)	
<b>If YES, please completion Section A; If NO please complete Section B</b>	
<b>A – Injured Fauna Reporting</b>	
What time was a fauna specialist (qualified ecologist or wildlife handler) called	
What time did the fauna specialist arrive?	
Fauna specialist name and contact	
What was the outcome? (e.g. animal euthanized; animal in care; animal taken to vet; treated and relocated)	
<b>B – Non-injured Fauna Reporting</b>	
Where was the fauna relocated? (Coordinates and description) <i>NB Only a qualified fauna ecologist or wildlife handler is to relocate fauna</i>	
Time the fauna was relocated?	
Name and qualification of fauna handler	
Observed behaviour on release	
Condition – general health signs – on release	
<b>General</b>	
Other comments	
Completed by	
Signed	
Date	

This form may be subject to change or amendment during project delivery.


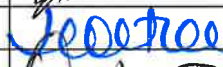
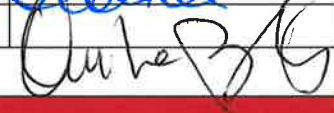


## APPENDIX F WEED, PEST AND PATHOGEN MANAGEMENT PLAN



S2-FGJV-ENV-PLN-0005

## SNOWY 2.0 MAIN WORKS BIODIVERSITY MANAGEMENT PLAN APPENDIX F – WEED, PEST AND PATHOGEN MANAGEMENT PLAN

APPROVAL RECORD			
DOCUMENT PREPARATION, REVIEW AND APPROVAL		NAME IN PRINT	SIGNATURE
Prepared by	Environmental Consultant	A. Costenoble	
Reviewed by	Environmental Manager	L. Coetzee	
Approved by	Project Director	A. Betti	

DOCUMENT REVISION TABLE		
REV.	DATE	DESCRIPTION OF MODIFICATIONS / REVISIONS
A	29.11.2019	INITIAL DRAFT FOR SNOWY HYDRO REVIEW
B	05.03.2020	UPDATED FOR SNOWY HYDRO REVIEW
C	01.06.2020	UPDATED FOR MAIN WORKS APPROVAL
D	15.06.2020	REVISED FOLLOWING SNOWY HYDRO REVIEW
E	30.07.2020	REVISED FOLLOWING AGENCY CONSULTATION
F	07.10.2020	REVISED FOLLOWING DPIE COMMENTS



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## 1. INTRODUCTION

### 1.1. Purpose and Objective

The key objective of the Weed, Pest and Pathogen Management Plan (this Plan) is to describe the management measures will be implemented to ensure that the spread of weeds, pest animals and pathogens are minimised and within the scope permitted by the Infrastructure Approval conditions.

To achieve this, Future Generation Joint Venture will:

- Ensure appropriate measures are implemented to address the relevant Infrastructure Approval conditions and the revised environmental management measures listed within the Submissions Report, as detailed in Section 5 of this Plan;
- Detail the existing weeds, pest animals and pathogens identified within the construction envelope during the EIS/RTS including any weeds and pests of concern not already within the construction envelope;
- Ensure practical measures are implemented prior to and during construction to avoid the introduction of new weeds, pest animals and pathogens and to control/minimise the spread of existing weeds, pest animals and pathogens; and
- Establish procedures to prevent the introduction of new weeds, pest animals and pathogens.

## 2. ENVIRONMENTAL REQUIREMENTS

### 2.1. Legislation

Legislation relevant to weed management includes:

- *National Parks and Wildlife Act 1974* (NPW Act);
- *Fisheries Management Act 1994* (FM Act);
- *Biosecurity Act 2015*; and
- *Pesticides Act 1999*.

### 2.2. Permits and Licences

To possess 1080, Pindone, RHDV, or PAPP baits the user must be accredited (or under the direct supervision of an accredited person) with an AQF3 Chemical accreditation or Vertebrate Pesticide Induction Training (VPIT) course accreditation. The pest control contractor will have the necessary accreditations or will secure these from the Local Land Services (LLS).

For firearm usage in KNP, an approved NPWS Shooting Operations Plan will be required. These can be put in place for fixed periods to cover annual operations through consultation with NPWS. Firearms licences, Office of Environment and Heritage (OEH) permits and safety checklists must also be provided to the satisfaction of NPWS. Refer to section 5.2.6.

### 2.3. Guidelines

The following guidelines were considered in the development and implementation of this plan:

- Regional Pest Management Strategy 2012 – 2017: Southern Ranges Region (OEH; NPWS).
- Rehabilitation Guidelines for the Resort Areas of Kosciuszko National Park (DECC 2007)
- NSW Agriculture: Noxious and Environmental Weed Control Handbook and website: <http://www.agric.nsw.gov.au/reader/weeds>



- CRC for Weed Management/DEH Introductory Weed Management Manual.
- Saving our Species Hygiene Guidelines (DPIE, 2020).
- PestSmart standard operating procedures for wild dog, fox and cat control:  
<https://pestsmart.org.au/pest-animal-species/>

### 3. EXISTING ENVIRONMENT

The following section summarises existing known weed, pest animal and pathogen species within and adjacent to the Project including species, communities and habitats based on the information contained in Section 6.3 and Appendix M of the EIS, and Appendix G of the RTS. Appendix M includes the Biodiversity Development Assessment Report (BDAR).

#### 3.1. Weeds

##### 3.1.1. Terrestrial weeds

The past activities and land uses within the project area of the KNP and around the Talbingo and Tantangara reservoirs have resulted in significant amounts of clearing and disturbance of vegetation. Native vegetation has been modified by past disturbances associated with land clearing, livestock grazing and weed invasion.

Key weed species identified during flora surveys for Main Works include:

- African Lovegrass (*Eragrostis curvula*);
- Bird's-foot Trefoil (*Lotus* spp.);
- Blackberry (*Rubus* spp) – an identified weed of significance;
- Browntop Bent (*Agrostis capillaries*);
- Cat's Ear/Flatweed (*Hypochaeris* spp.);
- Cocksfoot (*Dactylis glomerata*);
- Dandelion (*Taraxacum officinale*);
- Hawthorn (*Crataegus monogyna*);
- Mullein/Aarons Rod (*Verbascum thapsus* and *V. virgatum*);
- Musk Monkey Flower (*Mimulus moschatus*);
- Ox-eye Daisy (*Leucanthemum vulgare*);
- Patterson's Curse (*Echium plantagineum*);
- Sheep Sorrel (*Rumex acetosella*);
- Spear Thistle (*Cirsium vulgare*);
- St John's Wort (*Hypericum perforatum*) – an identified weed of significance;
- Sweet Briar (*Rosa rubiginosa*) – an identified weed of significance;
- Sweet Vernal Grass (*Anthoxanthum odoratum*);
- Yarrow (*Achillea millefolium*); and
- Yorkshire Fog Grass (*Holcus lanatus*).

Many of these species are prevalent in areas previously disturbed.

### 3.1.2. Weeds of concern

Key weed species of concern, with potential to be transported into or within KNP during construction activities associated with the project and subject to current control programs include:

- African Lovegrass (*Eragrostis curvula*) – known in the project area;
- Cape Broom (*Genista monspessulana*);
- Cinquefoil (*Potentilla* spp.);
- English Broom (*Cytisus scoparius*);
- Forget-me-not (*Myosotis laxa* subsp. *caespitose*);
- Large-flowered Mountain Trumpet (*Collomia grandiflora*);
- Lupins (*Lupinus polyphyllus*);
- Mouse-eared Hawkweed (*Hieracium pilosella*);
- Orange hawkweed (*Hieracium aurantiacum*);
- Ox-eye Daisy (*Leucanthemum vulgare*) – known in the project area;
- Phalaris (*Phalaris* spp.);
- Serrated Tussock (*Nasella trichotoma*) and
- Willows (*Salix* spp.).

Priority weeds for control are detailed in Annexure B.

Within the Tantangara Area of Kosciuszko National Park, the population of Ox-Eye Daisy has spread rapidly since bushfires in 2007. Ox-eye daisy aggressively invades remote subalpine grasslands, snowgum woodlands and wetlands in Kosciuszko National Park where it is a threat to multiple threatened species. It is a priority that management measures seek to contain the spread of ox-eye daisy and protect native species threatened by the weed in Kosciuszko.

Recently, there has been growing concern about the introduction of Orange Hawkweed (*Hieracium aurantiacum*) to new areas of the KNP. Currently there are seven infestations, totalling approximately 10 ha, confined to an area of 8,165 ha in the Jagungal wilderness area, which is situated over 50km south of the project area. Orange Hawkweed presents a major threat to primary production and biodiversity across south-eastern Australia, and is on the National Alert List of Environmental Weeds. In addition, Orange Hawkweed is recognised as an agricultural sleeper weed in Australia. Orange hawkweed is listed as Prohibited Matter under the NSW *Biosecurity Act 2015*.

### 3.1.3. Aquatic weeds and pests

*Elodea canadensis* (Canadian Pondweed) occurs throughout Talbingo reservoir and in one discrete location within Tantangara Reservoir. It is often associated with slow-moving and stationary water bodies, coastal rivers and creeks, especially in colder areas in NSW. It grows and spreads via fragmentation and as stems readily break into pieces, these are easily transported in water. Canadian Pondweed is classified as a water weed which is known to potentially:

- Alter dissolved oxygen levels reducing the water quality;
- Restrict navigation and recreational activities on waterways; and
- Pose a drowning hazard for livestock and recreational swimmers.

Across NSW, the general biosecurity duty applicable to this weed is to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or



ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

*Perca fluviatilis* (Redfin Perch), *Gambusia holbrooki* (Eastern Gambusia) and *Carassius auratus* (Wild Goldfish) have also been recorded in watercourses affected by the Project. Redfin Perch has been recorded in Talbingo Reservoir, Yarrangobilly River and Wallaces Creek in large numbers. Eastern Gambusia and Goldfish have been recorded in Talbingo Reservoir, Lake Eucumbene and Mid-Murrumbidgee River only. Operational risks for distribution of these pests are addressed in the Biosecurity Risk Management Plan and the Threatened Fish Management Plan as required under Schedule 3, condition 22 and 24 of the infrastructure approval respectively.

### 3.2. Pathogens of Concern

Infection of native plants by *Phytophthora cinnamomi* is listed as a key threatening process under the BC Act and EPBC Act. *Phytophthora cinnamomi* can lead to death of trees and shrubs, resulting in devastation of native ecosystems. Infection of susceptible communities with *P. cinnamomi* leads to:

- changes in the structure and composition of the native plant communities;
- a significant reduction in primary productivity and functionality; and
- habitat loss and degradation for dependent flora and fauna.

Impacts from *P. cinnamomi* has been identified as a key threat to the Smoky Mouse.

*Phytophthora cinnamomi* has not been confirmed as surviving in KNP, although it has potential to affect some species within the project area if established. The main *Phytophthora* species of concern in the KNP is *Phytophthora gregata*, which is resulting in mortality of *Pimelea bracteata* enmasse (Keith McDougall OEH pers. comm. 12 September 2018). *Pimelea bracteata* was not recorded within the Project area, however, *P. gregata* has been indicated as occurring in the area of Kellys Plain Creek (Keith McDougall, OEH pers. comm. 9 July, 2020). Kellys Plain Creek crosses Tantangara Road and Quarry trail and drains into the southern extent of Tantangara Reservoir (Figure 3-1). Specific controls will be required to manage the *Phytophthora* threat in this area.

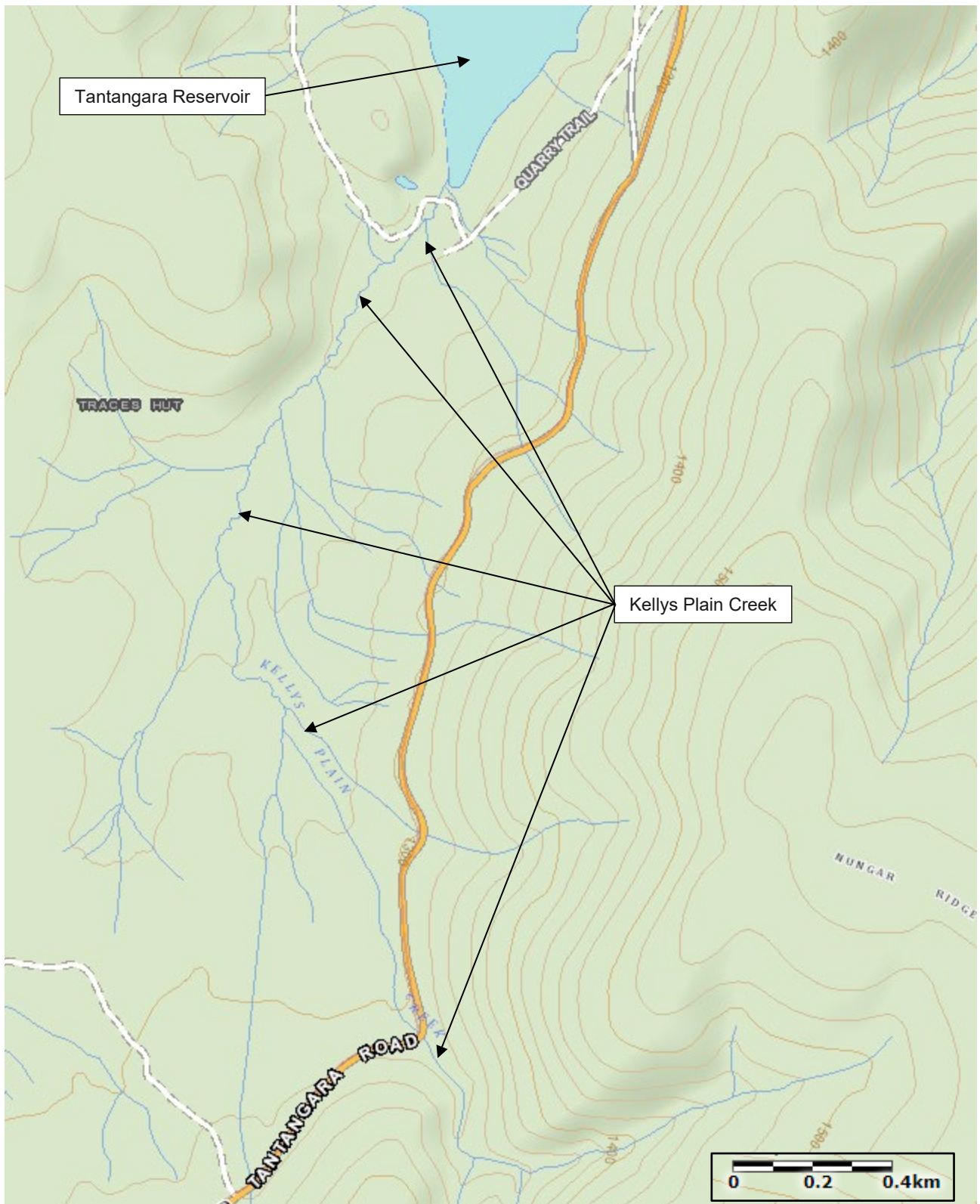


Figure 3-1: Kellys Plain Creek *Phytophthora* risk area

### 3.3. Pest Animal Species

There are a number of introduced species in the KNP region, including feral cats, foxes, brumby horses, pigs, dogs and deer. Within the Main Works footprint, the main pest species of concern of



growth in population and activity is the feral cat (*Felis catus*) and red fox (*Vulpes vulpes*) and their consequent impacts on native animals. Predation by feral cats and red foxes is listed as key threatening processes under the BC Act and EPBC Act with impacts from feral cats also listed as a key threat to the Smoky Mouse.

### 3.4. Herbivore Pest Species

Remote camera surveys, spotlighting and opportunistic sightings undertaken during the EIS recorded the following herbivore pest species within the project area:

- Horse (*Equus caballus*);
- Deer (*Damas* spp., *Cervus* spp., *Axis* spp); and
- Rabbit (*Oryctolagus cuniculus*)

Observations of herbivore pests were not limited to any one habitat type and it is possible that they occur throughout the project area.

### 3.5. Predator Pest Species

Remote camera surveys, spotlighting and opportunistic sightings undertaken during the EIS recorded the following predator pest species within the project area:

- Cat (*Felis catus*)
- Dingo/Wild Dog (*Canis lupus*); and
- Fox (*Vulpes vulpes*)

Observations of predator pest species were not limited to any one habitat type and it is possible that they occur throughout the project area.

## 4. ENVIRONMENTAL ASPECTS AND IMPACTS

### 4.1. Impact Summary

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 that could result in weed impacts are identified in Table 4-1. The extent of these impacts will depend on the nature, extent and magnitude of construction activities and their interaction with the natural environment (Column 2).

**Table 4-1: Weed, pathogen and feral animal aspects, impacts and environmental factors**

Environmental Aspects (Construction activities that may impact biodiversity)	Environmental Impacts	Environment Factors (Conditions)
<ul style="list-style-type: none"> <li>• Movement of vehicles</li> <li>• Clearing native vegetation</li> <li>• Topsoil stripping</li> <li>• Bulk earthworks</li> <li>• Soil movement and transfer</li> <li>• Bridge construction and waterway crossings</li> <li>• Barge activities</li> <li>• Operation of compounds</li> <li>• Imported materials</li> <li>• Movement of vehicles and vessels into and out of site</li> <li>• Waste management</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of weeds, pest animals and pathogens</li> <li>• Spread of weeds, pest animals and pathogens, resulting in degradation of retained native vegetation and habitat</li> <li>• Increase in pest animal species, resulting in increased predation and competition and a consequent reduction in populations of native species</li> </ul>	<ul style="list-style-type: none"> <li>• Presence of existing weeds, pest animals and pathogens within the project area</li> <li>• The presence of weeds, pest animals and pathogens adjacent to the Project site</li> </ul>

## 5. ENVIRONMENTAL MANAGEMENT MEASURES

A range of environmental requirements and control measures are identified in the EIS, Submissions Report and the Infrastructure Approval conditions. Safeguards and management measures will be implemented to avoid, minimise or manage impacts from the introduction and spread of weeds, pathogens and pest animals.

Specific safeguards and management measures to address weed, pest animal and pathogen impacts of the Project are identified in the Biodiversity Management Plan.

Management measures for the control of weeds, pathogens and pest animals will take four forms:

- Prevention;
- Monitoring (covered in Appendix B of the BMP);
- Control; and
- Disposal.

### 5.1. Detailed Weed and Pathogen Mitigation Measures

#### 5.1.1. Prevention

Preventing introduction of weeds into the project areas is a first order control required under Schedule 2, Condition 13 (c) of the Main Works infrastructure approval as follows:

*13. The Proponent must ensure that all plant and equipment used on site, or in connection with the development, is:*

*(c) kept free of weeds, seeds and pathogens when entering or leaving the site.*

Future Generation will implement the following measures to prevent the introduction or spread of weeds/pathogens on site:

- Hygiene inspections of plant and equipment being transported to site;
- Washdown stations at access points to site; and
- Restricted access to areas of known weed/pathogen infestation.



#### 5.1.1.1. Hygiene declaration and inspections

All suppliers of plant and equipment will be informed of their general obligation under the *Biosecurity Act 2015* to prevent the introduction and spread of pests, diseases, weeds and contaminants. The suppliers will be expected to present their materials and equipment clean and free of dirt, mud, seed and biological materials including weeds, seeds, pathogen and other organisms. The supplier will complete the Hygiene Declaration Form (Annexure A) prior to entry to site.

Future Generation will establish a checkpoint to carry out visual inspections of plant and equipment. Checkpoints will be located at or prior to the main access points to site. Checkpoint inspections will involve personnel surveying the incoming plant/equipment for compliance with the Hygiene Declaration Form (Annexure A). Where cleanliness standards are not met, thorough wash down will be required prior to site access being granted. Suppliers will be required to remove the plant and equipment and arrange thorough cleaning offsite prior to entry.

The completed Hygiene Declaration Form will be kept in the relevant vehicle during transportation and presentation at the project access point and then the completed forms will be kept in the project office for audit and compliance tracking purposes.

#### 5.1.1.2. Washdown stations

Washdown stations will be established in the vicinity of the key access points to the site, as soon as practically possible<sup>1</sup>, at the commencement of construction. These locations include:

- entry to Lobs Hole Ravine Road (near Link Road);
- access to Tantangara (initially near Snowy Mountains Highway, to be relocated to Quarry trail post upgrade of Tantangara Road); and
- access to Marica (near to junction of Snowy Mountains Highway).

Where incoming vehicles/equipment do not satisfy the cleanliness requirements of the Hygiene Declaration Form, washdown will be required. Only relevant equipment that is cleaned to the specified standard will be accepted to site. To prevent the distribution of weeds and pathogens, all dirty water from washdown stations will be treated and not used for dust suppression on site.

In certain locations of key weed or pathogen outbreaks, vehicle and machinery inspection and washdown (if necessary) will be required upon entering the project site from outside and when leaving restricted areas (section 5.1.1.3).

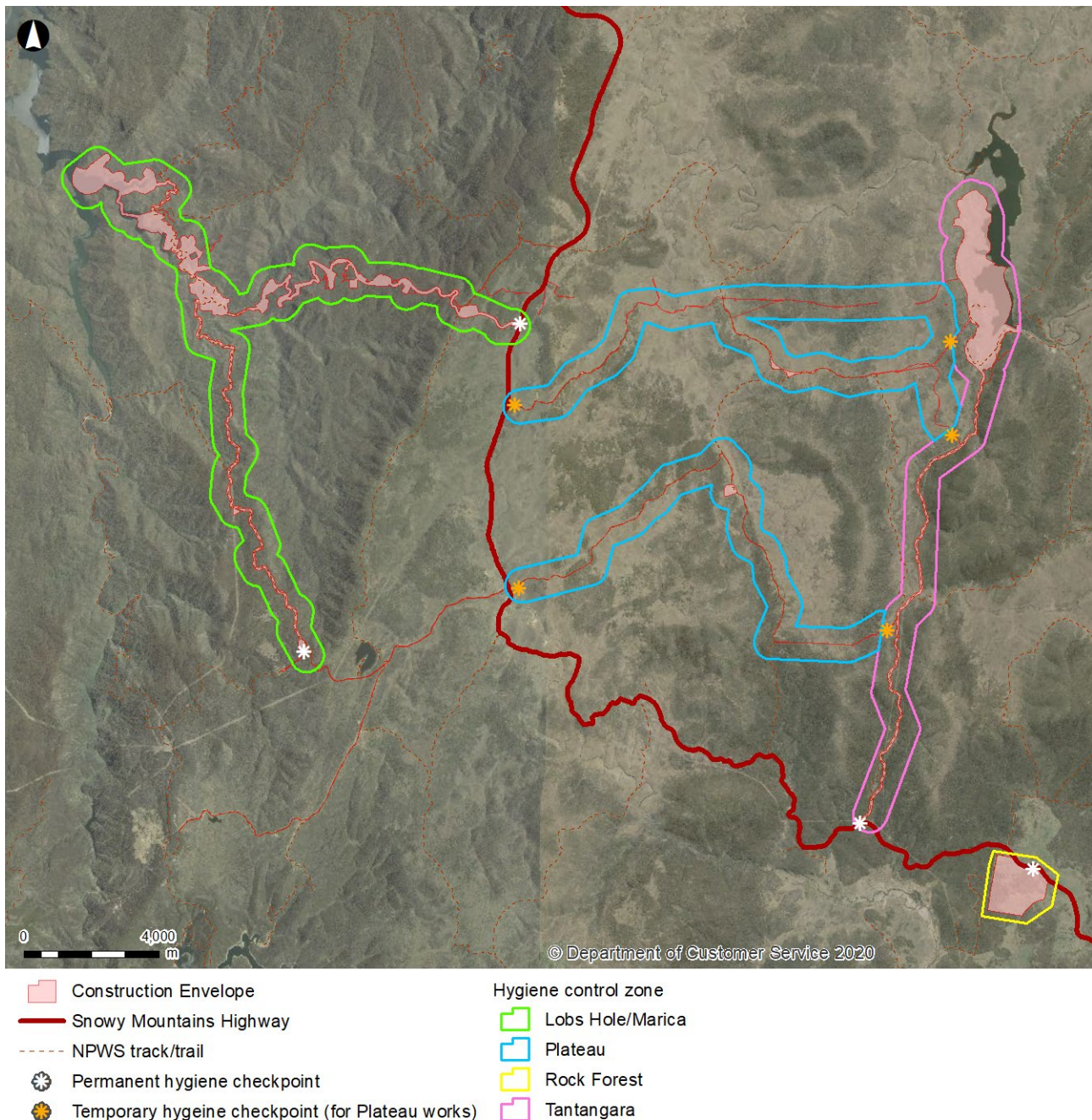
The general washdown procedure is detailed in Table 5-1. When equipment has been used in a known or suspected site containing *Phytophthora* sp., additional disinfecting procedures will be applied. Once equipment satisfies the cleanliness standard specified in the Hygiene Declaration Form (Annexure A) they will be free to move within the project area with the exception of restricted areas (section 5.1.1.3).

The project will avoid where possible transferring plant and earth-moving equipment between sites/areas of the project to limit the spread of weeds from one area to another. The project will be managed in defined hygiene control zones for example Lobs Hole (inclusive of Talbingo and

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<sup>1</sup> Practically possible means as soon as there is enough space to install the temporary or permanent washdown station. Equipment that will create the new washdown area will generally remain in that zone until this has been established. If equipment needs to move out of the area before the washdown is constructed, then it must be washed off site and complete a new Hygiene Declaration form prior to entering another work site.

Marica), the Plateau and Tintangara (Figure 5-1). Where plant is to be moved across zones, plant and equipment will be thoroughly washed down in the area that is currently operating in and be transported to the new location. This movement will be accompanied by a Hygiene Declaration form when plant will be moved across hygiene checkpoint locations (Figure 5-1). Where light vehicles move between the sites, they will be required to use wheel washes at entry and exit points. For linear activities that will occur across multiple areas and zones of the project, (for example trenching) weed and hygiene controls specific for that activity will be developed consistent with this plan and included in the work pack for this scope.



**Figure 5-1: Hygiene control zones across the project**



**Table 5-1: General washdown procedure**

Step	Description
<b>1. Check</b>	<ul style="list-style-type: none"> <li>Check the exterior and interior of vehicles and machinery for soil, plant material and other debris. Refer to Annexure A for a guide for where to focus attention.</li> </ul>
<b>2. Clean</b>	<ul style="list-style-type: none"> <li>Remove large clods of dirt and soil using a stiff brush or crowbar.</li> <li>Wash vehicle and/or machinery as soon as possible (at site entry washdown point) before entering site or leaving a restricted area. When leaving restricted areas spray tyres thoroughly with a disinfectant.</li> </ul>
<b>3. Dry</b>	<ul style="list-style-type: none"> <li>Where practical, allow vehicle or machinery to dry before proceeding</li> </ul>

#### 5.1.1.3. Restricted areas

Weed dominated areas will be demarked by the project ecologist during pre-clearing surveys. Weed or pathogen infested areas or sites of weed topsoil stockpiles will be demarked as restricted areas to limit the tracking of plant materials throughout the site. Vehicles or plant that are required to enter the restricted areas will be washdown at in-situ mobile washdown stations prior to moving to other areas of the site. Mobile washdown stations will be established in weed and pathogen restricted areas as they are identified. Once vehicles or items of mobile plant or equipment are assessed as clean to the satisfaction of the Hygiene Declaration Form they will be free to move about the project site.

Kellys Plain Creek has been indicated as an area known to contain harmful *Phytophthora* species and it will therefore be treated as a restricted area that is subject to in-situ washdown controls if being disturbed. Soil testing for *Phytophthora* will be undertaken prior to disturbance in the Kellys Plain Creek area to gain a better understanding of the extent of infection in this area and to assist in delineating the relevant restricted area.

#### 5.1.2. Controls

During clearing of project areas, topsoil from areas identified as dominated by weeds will be stockpiled separately from 'clean' topsoil from non-weedy areas. Weed topsoil stockpiles will be stored in either the area which it came from or within an area which has a similar level of weed risk. The weed topsoil stockpile will be signposted and erosion and sediment controls implemented. Future Generation will determine if this topsoil can be reused, or deep buried to minimise weed propagation.

Vegetation cleared from within an identified weed dominated area (see section 5.1.1.3) is to be removed as per Table 5-2 and disposed of or destroyed in a manner to mitigate against weed spread.

Where an area is identified as a weed infested area, signage will be installed to identify the extent of the weed infested area at both ends. Controls will be placed on the entry and exit of vehicles into that area while it is being cleared.

All other non-weed materials excavated within a weed risk area can be moved within the boundaries of that same weed risk area but cannot be taken to an area with a different weed risk.

Topsoil, mulch and spoil stockpiles will be inspected for evidence of weeds on a regular basis as a part of routine environmental site inspections. Chemical weed control will be undertaken to eradicate weeds on stockpiles and limit seed and propagule proliferation.

##### 5.1.2.1. Chemical Weed Control

A weed control contractor will be employed to implement chemical weed control across the project site as the primary means of eradicating or mitigating against the spread of weeds. The weed

control contractor will be suitably qualified in the sustainable management of the specific weed species occurring on the project site.

At minimum, a twice-annual weed control program will take place throughout the construction of the project. This will generally involve a spring and summer round of weed spraying, the timing of which will be adapted each season to maximise efficacy by targeting the most appropriate life-stage of the target species. The precise timing and locations for weed spraying will be determined by the weed control contractor.

Prior to spring, the weed contractor will prepare a customised weed spraying program which considers items such as the following:

- the specific weeds present on the site including areas for priority control;
- the seasonal and climatic factors for that year;
- weed monitoring results (as per Appendix B of the BMP);
- areas soon to be disturbed for clearing and construction (weeds in these areas should be controlled as a priority to avoid dispersal of weed plant material within the site);
- the location of existing or emerging weed infestations within and adjacent to the disturbance area;
- recent bushfire activity;
- necessity for follow-up spraying;
- NPWS current spraying activities in the wider locality and existing programs (see section 5.1.2.2);
- opportunity to manage the surrounding 50m buffer of the disturbance area;
- previous spraying activities on the site; and
- the time and resources available to carry out the proposed program.

The weed spraying program for each season will be developed to complement the Future Generation construction program and designed to focus efforts around the areas where control will be most beneficial. The weed spraying program will manage all weeds within the disturbance area of the project. In high traffic and high disturbance areas (such as main access roads, accommodation camps, tunnel portals and spoil emplacement areas) and other areas where the weed contractor recommends it, weeds within 50m buffer of the disturbance area will be sprayed. This will be done to reduce the presence of weeds around the disturbance area (personnel safety on steep terrain and legal project boundaries will be limiting factors for spraying activities beyond the disturbance area).

Coloured dye will be used in weed spraying units to allow the sprayers and Future Generation to identify which areas have been sprayed.

For all weed species there are a range of herbicide and treatment options available. Broad spectrum non-specific weed treatments are potentially problematic in areas where weed species occur in conjunction with native plants. Where available, herbicide treatments should be selective or at least partially selective. The NSW Weed Wise database will be consulted when determining chemical control options for the treatment of select weed species.

The weed-spraying program will be developed through liaison with NPWS and their weed management program being undertaken in the surrounding area for that season. This cooperation will maximise the efficacy of both programs and improve the outcomes for the wider landscape.



#### 5.1.2.2. Current NPWS practices

NPWS has communicated the following weed control programs have been undertaken in or around the project area:

- Spraying of road verges

NPWS approach has been to target specific weeds that may spread primarily through traffic movement. This has involved annual spraying of all weed species along road verges. NPWS recommend that the Project maintains this activity irrespective of weed abundance to ensure continuity of the program.

- Powerline easements

NPWS has also recently conducted a targeted weed control for St John's Wort, briar, fruit trees and blackberry along the power line easements as well as a program of ongoing monitoring for any new weeds.

- False Acacia control

False Acacia stands have been subject to a significant control program within the proposed footprint for the Main work. Disturbance associated with the works may cause them to re-sprout.

The above activities may be carried out on land within the construction envelope as a part of the chemical weed control program. Any new weed plants in the relevant project disturbance areas will be actively suppressed (section 5.1.2.1).

The Main Works Project will continue to implement the recommended controls outlined in the *Regional Pest Management Strategy 2012-2017: Southern Ranges Region* (OEH, 2012) as per Table 5-2 below. The NPWS *Regional Pest Management Strategy* is due for renewal in late 2020 and this plan will subsequently be reviewed, and if necessary revised, where changes or additions are warranted.

**Table 5-2: Weed control and management measures in NPWS Southern Ranges Regional Pest Management Strategy**

Weed	Priority for control	Recommended control*	Weed controls to be adopted on the project
Ox-eye Daisy	Critical	<ul style="list-style-type: none"> <li>• Physical removal</li> <li>• Spot spraying</li> <li>• Boom spraying</li> </ul>	<ul style="list-style-type: none"> <li>• Control access and minimise disturbance in areas of known infestation</li> <li>• Impose strict hygiene and washdown protocols on equipment and plant used in areas of infestation</li> <li>• Isolate and dispose of topsoil stripped from infested areas</li> <li>• Weed spraying program</li> </ul>
Orange Hawkweed	Critical	<ul style="list-style-type: none"> <li>• Physical removal</li> <li>• Biological control</li> <li>• Spot or boom spraying</li> </ul>	<ul style="list-style-type: none"> <li>• Control access and minimise disturbance in areas of known infestation</li> <li>• Weed spraying program (if found in project area)</li> </ul>

Weed	Priority for control	Recommended control*	Weed controls to be adopted on the project
Blackberry	Medium to lower Critical (where impact is on threatened species)	<ul style="list-style-type: none"> <li>Physical removal</li> <li>Biological control</li> <li>Stem injection/cut</li> <li>Stump/basal bark and spot spraying</li> <li>Control methods are documented in the WoNS Blackberry Control Manual</li> </ul>	<ul style="list-style-type: none"> <li>Physical removal when occurring within the clearing footprint</li> <li>Removal along the Yarrangobilly River within the Project footprint.</li> <li>Stockpiles will be incinerated in-situ</li> <li>Weed spraying program</li> </ul>
St Johns Wort	Medium to lower Critical (where impact is on threatened species)	<ul style="list-style-type: none"> <li>Physical removal</li> <li>Biological control</li> <li>Spot or boom spraying</li> </ul>	<ul style="list-style-type: none"> <li>Physical removal when occurring within the clearing footprint</li> <li>Weed spraying program</li> </ul>
Sweet Briar	Medium to lower Critical (where impact is on threatened species)	<ul style="list-style-type: none"> <li>Physical removal</li> <li>Stem injection or cut stump</li> <li>Basal bark</li> <li>Spot spraying</li> </ul>	<ul style="list-style-type: none"> <li>Physical removal when occurring within the clearing footprint</li> <li>Weed spraying program</li> </ul>

## 5.2. Feral predator and herbivore control

There is potential for increased human activity from the project to result in increased activity of predators, particularly feral cats and foxes. Increased activity of introduced predators has negative impacts on native animals. Predation by feral cats and red foxes are listed as key threatening processes under the BC Act and EPBC Act with impacts from feral cats also listed as a key threat to the Smoky Mouse.

To minimise the risk of increased predator activity in the project area, the following controls will be implemented:

- a pest predator control program will be implemented throughout construction of the project;
- food waste will be stored appropriately in inaccessible bins and disposed off-site; no waste will be left outside in open areas accessible to animals;
- a monitoring program will be implemented using remote cameras and spotlight surveys to monitor for pest animal presence (refer to Appendix B of BMP);
- opportunistic sightings in high risk areas, such as areas of habitation (e.g. the camp and tunnel portal) for pest animal activity will be documented. Targeted follow-up control actions will be implemented.

### 5.2.1. Priorities for control

A review of the species profiles and Saving Our Species strategies for each of the threatened species listed in condition 17(d) was undertaken to determine appropriate pest control management measures. The key threatened species that are being impacted by pest animals in the project area are listed in Table 5-3.



**Table 5-3: Threatened species impacted by feral pests (as per Saving Our Species strategies)**

Threatened Species	Pest animal impact	Recommended management measure outlined in species- specific SOS strategy
Smoky Mouse	Predation by feral cats	Trap cats in and around areas of known high density
	Predation by European red foxes	Implement fox control
Broad-toothed Rat	Direct degradation of suitable habitat / cover as well as competition for food from feral pigs	Aerial shooting campaign combined with trapping, targeted towards wet swampy areas
	Wild horses degrade habitat / cover and disturb the species	Continue horse trapping programmes currently implemented within Kosciuszko National Park
	Predation by European red foxes	Implement fox control
	Predation by feral cats	Trap cats in and around areas of known high density
Alpine Tree Frog	Loss or modification of habitat including damage by feral horses.	Work with Kosciuszko National Park managers to implement strategies to reduce the number and impacts of feral horses on the frog's habitat.
Booroolong Frog	Large amounts of sedimentation due to wild horse activity in the National Park, causing filling of breeding crevices	Continue horse trapping programmes currently implemented within Kosciuszko National Park
Spotted Tailed Quoll	Competition with introduced predators such as cats and foxes.	Implement (or augment) coordinated, cross-tenure, landscape scale predator control programs in areas where significant populations of spotted-tailed quoll are known to occur

Other species including Alpine She-Oak Skink and Eastern Pygmy Possum are likely to benefit from predator and herbivore pest control, although the SOS strategy for these species do not specify this.

The following sections describe the pest control methods that will be carried out during construction of the project. The proposed control activities are generally consistent with the recommended SOS pest control outcomes specified for the threatened fauna occurring within the project area. However, the specific measures being implemented vary in some instances from the SOS measures. For example, the project will not control horses directly and aerial shooting is not appropriate. Section 5.2.2 through 5.2.4 detail the feral animal control measures being implemented for the project.

### 5.2.2. Predator control program

A routine pest predator control program will be implemented throughout construction of the project. An experienced and suitably qualified pest control contractor will be employed to manage feral predators including wild dogs, foxes and cats. This program will be prepared in conjunction with the NPWS activities occurring in the broader area and will aim to complement and enhance the NPWS efforts to achieve collective conservation gains for threatened fauna in the locality.

The predator control program will consist of a combination of routine 1080 baiting, cage trapping and shooting (subject to NPWS and Future Generation safety procedures and guidelines).

The predator control program will focus efforts on the following areas in order of priority:

- key threatened species habitats (Lobs Hole Ravine Road, Marica Road and Tantangara Road in vicinity of mapped small mammal habitats);
- perimeter of camp locations;

- along access roads and tracks.

If the biodiversity monitoring program (Appendix B of the BMP) indicates the presence of predators in an area not under control, then the control activities will be adjusted accordingly. Likewise, incidental observations of feral predators will also inform the design of the routine predator control program. The feral animal monitoring program (Appendix B of the BMP) and baiting activities will be coordinated such that camera monitoring will be carried out for a month following bait placement.

The frequency and timing of control activities will be determined by the pest control contractor through discussion with NPWS. Control activity timing will be catered to the seasonal breeding cycles of the target animals where possible. Baiting programs will be determined in reference to the PestSmart guidelines for 1080 and PAPP baiting (FOX001 and FOX007 at <https://pestsmart.org.au/pest-animal-species/european-fox/>). The selection of bait, dosage, timing, frequency and method of placement will be designed to avoid mortality of non-target carnivores such as Spotted-tail quoll and goanna. Where available and appropriate the use of novel bait products such as Curiosity® bait may be used to target cats. The baiting program will comply with the requirements of the *NSW Pesticides Act 1999* and the permit requirements of Local Land Services.

### 5.2.3. Incidental predator trapping

In addition to the routine pest predator control program, cage trapping will be carried out to capture feral predators which are incidentally observed frequenting areas of human habitation such as camps and construction compounds. Cage trapping will be carried out in accordance with DPI vertebrate pest control guidelines and Pest Smart standard operating procedures (<https://pestsmart.org.au/pest-animal-species/>).

The trapping methodology will be targeted to the feral predator and locations of cages will be determined to avoid attracting native fauna. Cage traps will be checked daily and provisions for shelter and bedding will be provided to minimise stress for the captured animals. Confirmed feral predators will be euthanised and native fauna will be released into nearby habitat outside the construction envelope. The detailed procedure for cage trapping will be prepared in consultation with NPWS.

### 5.2.4. Herbivore control

Feral herbivores impact on a number of threatened species in the project area, including Broad-toothed rat, Booroolong frog, Alpine tree frog and Alpine She-Oak skink (section 5.2.1).

It is anticipated that feral herbivores will require control across the project area from time to time. Feral herbivore control may be triggered by:

- reported sightings through Biodiversity Monitoring Program (Appendix B of the BMP);
- incidental observations of feral herbivores by project personnel;
- evidence of fauna presence, such as rabbit burrows or pig rooting/wallows, detected during routine environmental inspections.

Where herbivore control is demonstrably required through detection as listed above, targeted control will be implemented as detailed in Table 5-4. The control methods will be carried out in accordance with the DPI vertebrate pest control guidelines and Pest Smart standard operating procedures for each species.

**Table 5-4: Feral herbivore control measures**

Animal targeted	Method of control	Responsible party
Rabbit	Baiting, fumigation or warren destruction	Future Generation pest control contractor



Animal targeted	Method of control	Responsible party
Pig	Cage trapping or shooting	Future Generation pest control contractor
Horses	As specified by NPWS	NPWS will be called in to manage problem horses occupying the project area

### 5.2.5. NPWS control activities

Future Generation and Snowy Hydro will work with NPWS to coordinate the routine pest control program with ongoing NPWS pest control activities in the locality. Opportunities to extend the existing Smoky Mouse predator control program and other Saving Our Species programs will be investigated.

### 5.2.6. Use of Firearms in KNP

Subject to Future Generation HSE requirements and NPWS approval, the pest control contractor may employ shooting as a control or euthanasia method for feral predators and herbivores. Where shooting is required, the contractor will have the relevant licences and permits required to do so and will be an Office of Environment and Heritage (OEH now DPIE) Approved Firearms User (satisfying the requirements of the OEH (now DPIE) Approved Firearms Checklist for a contractor/external firearms user). An approved NPWS Shooting Operations Plan to cover the proposed control activities and an annual firearms servicing record will also be required.

## 6. REPORTING AND REVIEW

### 6.1. Reporting Schedule

As stated in the Biodiversity Management Plan, an annual report will be prepared to report on the variety of biodiversity matters addressed in the plan. This report, which will be made available to Snowy Hydro, BCD, DAWE and NPWS, will include the following matters of relevance to weed, pest and pathogen management:

- details on the weed control actions undertaken since the last report including:
  - a list of the control activities undertaken;
  - map of areas where control activities were undertaken;
  - efficacy of the control measures in relation to the objective of minimising weed, pest and pathogen distribution and/or abundance in the project area;
  - recommendations for future control activities.
- details on the vertebrate pest control activities undertaken since the last report including:
  - a list of the control activities undertaken;
  - cage trapping results;
  - baiting and shooting results (where undertaken);
  - recommendations for future control activities.
- summary of the efficacy of other control measures outlined in this plan and recommendations for revisions to controls.

These reporting inputs will be integrated into the broader biodiversity management plan report, which will include threatened species and pest monitoring program results as detailed in Appendix B of the BMP.

## 6.2. Training

All site personnel will undergo site induction training. Training of relevance to biodiversity management is outlined in the Biodiversity Management Plan. Items of relevance to weed, pest and pathogens that will be covered in this training include:

- identification of key weeds and vertebrate pests of concern;
- requirement to notify management of sightings of vertebrate pests;
- washdown procedures and hygiene standards;
- 1080 and other bait hazards; and
- identification of weed and pathogen restricted areas and relevant washdown requirements.

## 7. WEED AND FERAL ANIMAL IDENTIFICATION

### 7.1. Most Significant Weed and Feral Animal Identification

 	 
African Lovegrass	Blackberry





Serrated Tussock



Ox-eye daisy



St Johns Wort



Sweet Briar





Orange Hawkweed

Mouse-eared Hawkweed



Rabbit



Feral cat



Fox





## ANNEXURE A - HYGIENE DECLARATION FORM

# HYGIENE DECLARATION FORM

S2-FGJV-ENV-FRM-0001

PART A: INFORMATION			
Date			
Time			
Description of Equipment / Building/ Container ID			
Make / Model / Building Type			
Registration No			
Vehicle / Plant Number			
Name of Operator / Driver			
Travelling / Delivered From			
Travelling / Delivered To			
PART B: WASHDOWN LOG			
Location of Washdown and Inspection			
Is the equipment / building clean (i.e. free of all mud, seed, vegetative material, bio-security risks such as insects, animals, nests, etc.)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
If travelling / delivered from outside the KNP to inside to the KNP has the equipment / building been disinfected? If so with what? .....	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
PART C: DECLARATION (I, the undersigned declare that the information that I have provided in this declaration is true and correct)			
Name			
Signature			
Date			
PART D: CHECK AT ENTRY TO SITE (to confirm the above)			
Is the equipment / building clean and disinfected?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Name			
Signature			
Date			
If no, what remedial action is required? e.g. return to supplier, washdown offsite.			
PART E: CHECK AT ENTRY TO SITE HAVE REMEDIAL ACTIONS COMPLETED (only complete if answered no in Part D)			
Have the remedial actions been completed?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Name			
Signature			
Date			



## HYGIENE CHECKLIST

LIGHT VEHICLES / TRUCKS							
Interior	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Tyre Rims	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Engine Bay	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Side Steps	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Grill	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Chassis	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Radiator	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Axels/Diffs	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Wiper Recess	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Suspension	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Wheels & Spares	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Fuel Tank Guard	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Wheel Arches	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Draw Bar	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Mud Flaps	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Toolboxes	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Tray	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Air Filters	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
EARTHMOVING EQUIPMENT (EXCAVATORS, ROLLERS, LOADERS, GRADERS ETC.)							
Interior							
Pedal Covers	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Seat (incl. rubber shroud)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Joystick Control Housing	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Ladder	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Cabin Roof	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Footsteps	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Cabin Walls	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Floor and Floor Mats	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Air Conditioning Vents and Filter	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Cabin Housing	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Body and Engine Bay							
Air Filter and Air Filter Pre Cleaner	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Engine Cover Rubbers	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Engine Block	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Engine Covers	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Counterweights	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Wiring Harnesses	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Radiator	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Hollow Support Structures and Rails	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Radiator Shroud	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Hydraulic Rams	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Oil Cooler	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Lights and Cavities	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Belly Plates	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Rear Plates	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Tracks, Rollers, Drums, Tyres and Frames							
Rock Guards	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Track Frames	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Tracks	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Wheel Arches	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Rollers	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Wheels and Tyres	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Drive Motor	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Roller Frames	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A

# HYGIENE DECLARATION FORM

S2-FGJV-ENV-FRM-0001

Booms, Bucket, Blades, Rippers, Augers							
Blades	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Boots	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Ripper Support Frame	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Teeth	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Tines	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Booms	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Augers	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Other	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
BUILDINGS							
Internal Floors	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Shelves	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Windows	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Air condition units	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Doors	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	Others (please list below)			
Walls	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	1)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Roof	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	2)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
External Base (opposite side of the floor)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	3)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Compartments / cubicles	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	4)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A

**ATTACH PHOTOGRAPHS:**



## ANNEXURE B – PRIORITY WEEDS FOR CONTROL

Priority weeds to target for mapping, monitoring and control

### References:

#### NSW Office of Environment & Heritage (2016):

- Milfoil/Yarrow (*Achillea millefolium*);
- Vipers bugloss (*Echium vulgare*);
- St John's wort (*Hypericum perforatum*);
- Winter cress (*Barbarea verna*);
- Russell lupins (*Lupinus polyphyllus*);
- Large rush (*Juncus effusus*);
- Scotch broom (*Cytisus scoparius*)

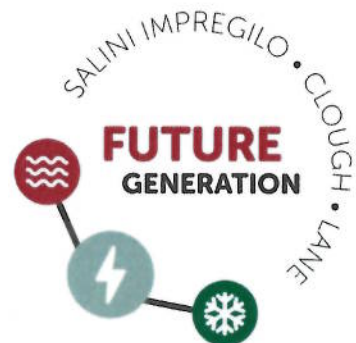
#### ACT Government: Snowy River: Pest Plants (2004):

- African Lovegrass (*Eragrostis curvula*);
- Bathurst Burr (*Xanthium spp*);
- Blackberry (*Rubus fruticosus*);
- Broom (*Cytisus scoparius*);
- Gorse (*Ulex nutans*);
- Horehound (*Marrubium vulgare*);
- Nodding Thistle (*Carduus nutans*);
- Scotch Thistle (*Onopordum acanthium*);
- Serrated Tussock (*Nassella trichotoma*);
- St John's Wort (*Hypericum perforatum*);
- Sweet Briar (*Rosa rubiginosa*);
- Vipers Bugloss (*Echium vulgare*).





## APPENDIX G FAUNA STRIKE MITIGATION STRATEGY





S2-FGJV-ENV-PLN-0105

## BIODIVERSITY MANAGEMENT PLAN APPENDIX G – FAUNA STRIKE MITIGATION STRATEGY

Approval Record			
Document Preparation, Review and Approval		Name in Print	Signature
Prepared by	Lead Ecologist Snowy 2.0	N. Garvey	
Reviewed by	Environmental Compliance Lead Snowy 2.0	C. Buscall	

Document Revision Table		
Rev.	Date	Description of Modifications / Revisions
A	01.06.2020	Revision A for Snowy Hydro review
B	15.06.2020	Revised following receipt of Snowy Hydro comments
C	24.07.2020	Revised following receipt of BCD, DAWE and NPWS comments
D	31.07.2020	Revised to address SHL comments. For issue to DAWE and DPIE
E	25.09.2020	Revised to address DPIE and agency comments
F	07.10.2020	Revised to address DPIE comments
G	09.10.2020	Revised to address DPIE comments
H	12.10.2020	Revised to address DPIE comments

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## 1. PURPOSE AND OBJECTIVE

The purpose of this Fauna Strike Mitigation Strategy is to describe how Future Generation and its subcontractors will mitigate against fauna mortality caused by vehicles on the project's main access roads within Kosciuszko National Park (KNP).

The key objective of this strategy is to implement effective controls that mitigate against fauna vehicle strike from construction traffic on the project. It has been prepared to satisfy the requirements of schedule 3, condition 18(c) and 17(e) of the Infrastructure Approval (SSI 9687). This Fauna Strike Mitigation Strategy is to be read in conjunction with the Snowy 2.0 Main Works Biodiversity Management Plan (S2-ENV-PLN-0008).

## 2. BACKGROUND

Snowy 2.0 Main Works is situated within KNP which has very high biodiversity value. Access roads for the project traverse a variety of fauna habitats and present a hazard for local fauna including macropods, birds, reptiles and other terrestrial and arboreal mammals. Introduced animals including horses, deer and pigs are also known to the area and can present a strike hazard for vehicles. Three listed species which have key habitat along access roads in the project area include:

- Smoky Mouse (*Pseudomys fumeus*);
- Broad-toothed Rat (*Mastacomys fuscus*); and
- Eastern Pygmy Possum (*Cercartetus nanus*).

Of particular concern is the critically endangered Smoky mouse, which is nocturnal and occupies habitats that fringe two of the main access roads to the project. These roads include:

- Link Road and Lobs Hole Ravine Road for access to Lobs Hole; and
- Marica Trail for access to Marica.

Figure 2-1 shows the key habitat areas and how the access roads intersect them.

The conservation status of Smoky mouse combined with the traffic increase that will result from construction of the project has raised concern that the road upgrades and the traffic using the roads could result in fauna mortality and habitat fragmentation that could adversely impact local populations.

Night-time speed limits, driver behaviour management, mortality monitoring, dedicated fauna underpasses and incident reporting are measures that will be used to minimise this impact during construction. A risk assessment process to consider the usage and placement of fauna underpasses or other measures such as fauna fencing will also be carried out. Further detail relating to the risk assessment process is provided within Section 3.1.3. This Fauna Strike Mitigation Strategy outlines the adaptive management approach that will be adopted during construction of the project.

### 2.1. The Fauna Impact: Vehicle Strike and Habitat Fragmentation

The impact of vehicle strike on fauna is clear; individual fauna mortality or serious injury occurs as a direct result of vehicle strike. While this adverse impact is not ideal, the consequence to the broader species population is a function of the rate of strike in relation to the population size in the locality. Relatively low rates of fauna strike mortality may not adversely impact on the survival of the extant population. For example, macropods are commonly struck by vehicles, but the population withstands this impact because the relative rate of mortality is low. Nevertheless, for

rare species with very low population density, low rates of fauna strike may be sufficient to cause localised population decline.

New or widened roads which pass through fauna habitats can cause fragmentation of species populations in several ways. Firstly, the gap in habitat itself impedes movement. Some species will not traverse open ground. This behavioural trait, common in small prey-species, is a survival strategy to avoid predators. Secondly, the barrier to movement may be created by vehicle strike or predation on the roads. In this case, fauna attempt to cross but are frequently hit or predated. In this case, the rate of mortality and permeability of the barrier would be dependent on the abundance of predators in the area, the volume of traffic and the behaviour of drivers. A third way in which roads fragment habitats is by introducing physical barriers to movement. These barriers may include steep batter slopes or retaining walls, linear infrastructure or fauna fencing explicitly designed to impede or direct fauna movement to crossing locations. In this case, the barrier to movement can be impermeable to some species and, depending on the length and location of the barrier, may result in population isolation.

In some circumstances the consequence of habitat fragmentation on a local population can be severe. The primary motive for fauna to move about their home range is to forage for food and to breed. Limiting access to either of these needs may result in serious population decline. In some rodent species, males and females have separate home ranges that only overlap during the breeding season. A barrier that separates the two groups, could significantly reduce the growth rate of the local population. Barriers can also create population islands of reduced genetic diversity; these isolated homogenous populations can become vulnerable to disease.

One method to reduce fragmentation on roads is to introduce fauna-friendly crossings, such as underpasses or overpasses. Typically, fauna fencing and underpasses are used in conjunction with each other such that the fence alignment is designed to channel fauna toward the underpasses. Without fencing, underpasses may be less effective because fauna are not restricted from crossing the road at any point. While new roads through native vegetation do provide a break in habitat and do contribute to habitat fragmentation (even without traffic), the use of fauna fencing along roads creates a more impermeable barrier that will substantially increase fragmentation for terrestrial species. In the case of highways with continuous high volumes of traffic, fences are necessary to protect fauna and avoid high-speed collision. However, the access roads for construction of Snowy 2.0 will not be trafficked like highways, rather vehicle passage will be frequent but intermittent and slower moving.

This Fauna Strike Mitigation Strategy seeks to balance the adverse impacts of vehicle strike and habitat fragmentation on local fauna.

## 2.2. Management Options

Options for fauna strike mitigation measures include:

- managing driver behaviour through education and night-time speed restrictions;
- fauna underpasses; and
- fencing (subject to risk assessment process).

The pros and cons of the above mitigation measures are summarised in Table 2-1. The pros and cons list shows that speed management would be the best option with the most pros and least cons of the three management options. Initially the project proposes a combination of speed limits and underpasses. Fencing may be implemented in discrete sections is deemed necessary through the adaptive management process.



### 2.3. Construction Program

The construction program determines the order of construction priorities and the timing of road upgrades. The installation of fauna underpasses on Lobs Hole Ravine Road will be undertaken as a part of access road optimisation works to be commenced in Summer 2020/21. In the brief time before underpasses are available on Lobs Hole Ravine Road fauna strike will be mitigated through driver behaviour and speed restrictions only.

Night traffic on the project access roads throughout construction would generally include but not be limited to:

- segment delivery trucks;
- light vehicles;
- transport of personnel (mini-buses); and
- after hours OSOM loads as per Heavy Vehicle National Regulator requirements.

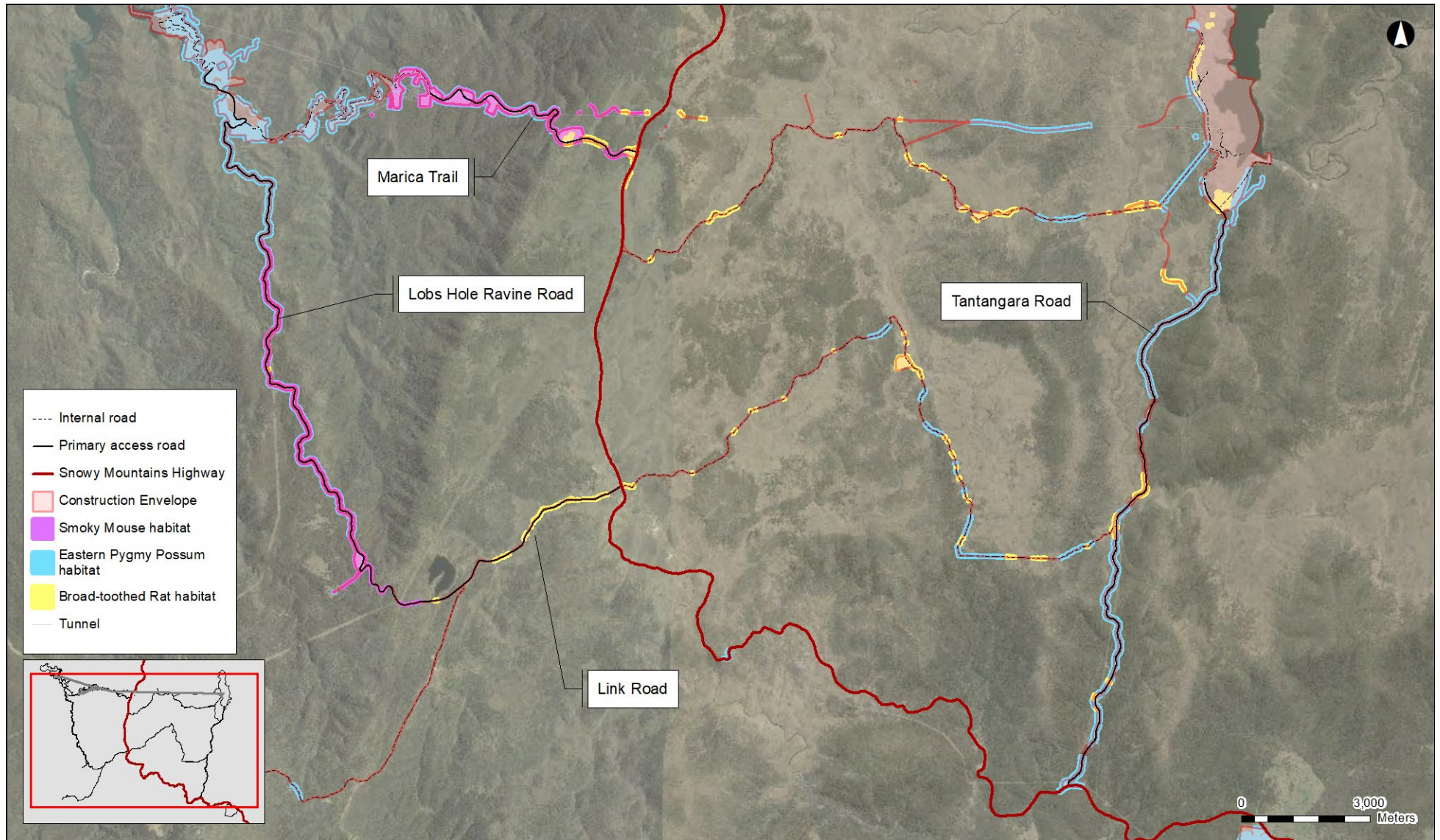


Figure 2-1: Threatened mammal fauna habitat in relation to main access roads for the project



**Table 2-1: Pros and cons of the fauna strike management considerations**

Speed management		Fauna fencing		Fauna underpasses	
Pros	Cons	Pros	Cons	Pros	Cons
<ul style="list-style-type: none"> <li>• Avoids fragmentation of fauna population</li> <li>• Allows free-movement of fauna</li> <li>• Does not increase disturbance area</li> <li>• Can be adjusted to suit circumstances</li> <li>• Diurnal fauna not affected</li> <li>• Fauna strike significantly less likely at slow speed</li> <li>• Balances strike concern with fragmentation concern</li> <li>• IVMS can enforce and monitor driver behaviour to ensure compliance</li> </ul>	<ul style="list-style-type: none"> <li>• Fauna may still occur on road night and day</li> <li>• Relies on driver reporting</li> <li>• Occasional fauna strike still possible</li> </ul>	<ul style="list-style-type: none"> <li>• Effective barrier to fauna movement</li> <li>• Passive management measure (excluding maintenance)</li> <li>• Keeps target fauna off road 24/7</li> </ul>	<ul style="list-style-type: none"> <li>• Increases population fragmentation</li> <li>• Usage of fauna underpasses not guaranteed</li> <li>• Constraints on underpass locations</li> <li>• Widens disturbance area and exacerbates habitat impact</li> <li>• Depending on location, may require ongoing maintenance</li> <li>• Can funnel fauna toward predators</li> <li>• Substantial additional cost for construction and maintenance</li> <li>• Indiscriminate targeting of species, i.e. effects a broad range of non-target fauna</li> <li>• Costly to install and difficult to maintain in heavily vegetated areas</li> </ul>	<ul style="list-style-type: none"> <li>• Provides a crossing for timid fauna that would not otherwise cross the open road</li> <li>• Through design can be targeted to specific species, E.g. sized to permit small mammals but disallow predators</li> <li>• When implemented with suitable design and at appropriate density, underpasses can effectively mitigate against both fauna strike and habitat fragmentation</li> </ul>	<ul style="list-style-type: none"> <li>• May be less effective without the use of fauna fencing</li> <li>• Introduces the additional cons of fencing if used with fencing</li> <li>• Can create focus point for predator activity</li> <li>• Constructability may cause additional habitat clearing</li> <li>• Placement location may be critical in determining fauna uptake</li> <li>• May require ongoing maintenance</li> <li>• Costly to install</li> </ul>

### 3. FAUNA STRIKE MITIGATION STRATEGY

The following mitigation strategy has been prepared in consideration of the various factors discussed in section 2.

#### 3.1. An adaptive management approach

The following sections outline the management measures proposed to mitigate against fauna strike. Table 3-1 provides an overview of the fauna strike mitigation strategy, which includes levels of management and triggers for escalation of management in the form of a Trigger Action Response Plan (TARP).

##### 3.1.1. Initial fauna strike management

In the earliest stages of the project, before the road optimisation works commence in spring/summer 2020/21, speed management and driver behaviour training will be used to mitigate fauna strike on Lobs Hole Ravine Road. Existing culverts on the existing access roads may provide fauna crossing connectivity, however, fencing will not be used to tie into these underpasses because fencing was determined through consultation to be inappropriate for use in KNP.

Initially the night-time speed limit will be set at 30km/hr (Level 1 in Table 3-1). This speed limit may be further reduced in specific areas along the access road based on reported incidents of fauna strike, near misses or if results of the threatened species monitoring program identifies the need for further restriction (Level 2).

The In-Vehicle Management System (IVMS) on project vehicles will be an important part of this adaptive management approach. The IVMS is a useful tool for monitoring driver behaviour; it allows tracking of location, aggressive braking, swerving and speed. Speed limit alarms are triggered in the vehicle if drivers exceed the nominated speed limit, this alarm reminds drivers to comply with the customised geolocated limits determined by the project. Reports are generated through the IVMS to ensure that drivers remain compliant with the code of conduct and any other relevant management measures. There is a point system in place to enforce driver compliance with the standards of the project. The IVMS will be pivotal in the implementation of Level 1 and Level 2 management.

The IVMS allows for comprehensive monitoring of driver behaviour, harsh braking or swerving locations can be isolated, and in turn the required speed management measures can be imposed.

Speed limits will be sign-posted and drivers will receive training on the fauna strike hazard, the requirement to comply with those speed limits, and the necessity to report observations of fauna on the project access roads.

##### 3.1.2. Fauna underpass installation

In Summer 2020/21 six dedicated fauna underpasses will be installed on Lobs Hole Ravine Road as a part of road optimisation works.

A review of Smoky Mouse survey locations and records derived from biodiversity surveys undertaken for Snowy 2.0 was undertaken to determine suitable locations for the installation of underpasses as a part of the road optimisation. The proposed siting of underpasses was based on three key criteria:

- risk to Smoky Mouse due to road design, with features such as sharp (90 degree) corners increasing risk of fauna strike;
- areas where we know animals cross the road based on observations of Smoky Mouse on both the eastern and western side of Lobs Hole Ravine Road; and



- key records or populations with a high density of records.

The six underpass locations are mapped in Figure 3-1. The final location of these underpasses will be generally in these locations, but subject to engineering and design considerations and may move slightly and in consultation with NPWS.

Smoky Mouse habitat is also known to occur along the Marica Trail construction road. Construction of Marica Trail is not yet scheduled because this part of the project is still being designed and construction traffic demands are not yet confirmed for Marica. It is expected that construction traffic will be substantially lower on Marica Trail than Lobs Hole Ravine Road and underpasses may not be necessary, however, underpasses will be installed on Marica Trail if warranted. The Project intends to assess the efficacy of the initial six underpasses on Lobs Hole Ravine Road and allow for the Marica designs to evolve before confirming commitments in relation to underpasses on Marica Trail. Decisions on the installation of underpasses on Marica Trail, including whether they are required, the specific location and number to be used, will be determined through consultation with BCD and NPWS prior to construction of Marica Trail.

The six initial fauna underpasses in concert with night-time speed limits and driver behaviour management (outlined in Section 3.1.1) will constitute the baseline level of fauna strike mitigation as shown in Table 3-1.

#### 3.1.2.1. Underpass design

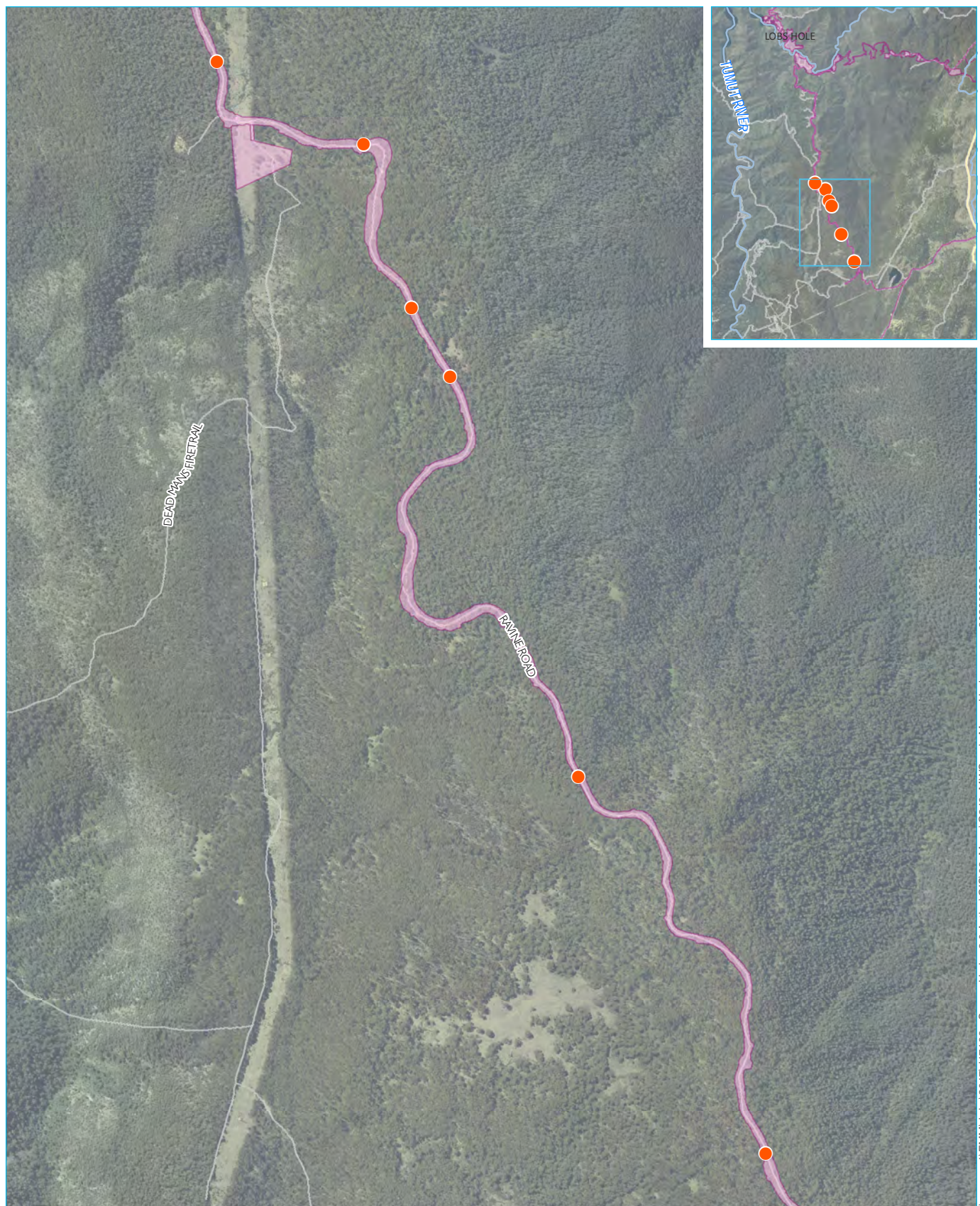
The underpass design will consist of culverts. The section of Ravine Road along which underpasses will be installed is relatively flat. Installation of large culverts in this area would necessitate large earthworks to enable sufficient drainage through the culverts, as well as works to ensure sufficient cover for animals entering and exiting culverts. Alternative culvert sizes and designs were reviewed.

A smaller culvert size is proposed, measuring approximately 300 mm (width) by 225 mm (height). The underpasses will have rocks and coarse woody debris, preferred by the Smoky Mouse, placed in the base of the culvert in consultation with NPWS and BCD. This combination of culvert size and inclusion of small rocks and woody debris would ensure predators such as Cats and Foxes could not access the underpass and provide refuge habitat for Smoky Mouse. This design also ensures civil works required to place underpasses beneath project roads and at entry and exit points is minimal, ensuring a smaller degree of impact from proposed works. A diagrammatic depiction of the proposed culvert design is shown in 2.

Underpass design will involve consideration of ongoing maintenance requirements.

The installation of these underpasses provides an opportunity to determine the uptake by fauna and thus the efficacy to mitigate fauna strike without (or with) guiding fencing. This will be monitored through remote cameras as outlined in Section 4.3.





Source: EMM (2020); Snowy Hydro (2020); DFSI (2017); GA (2015); LPMA (2011)

#### KEY

- Proposed underpass location
- Approved disturbance area
- Existing environment
- Local road

Proposed underpass locations

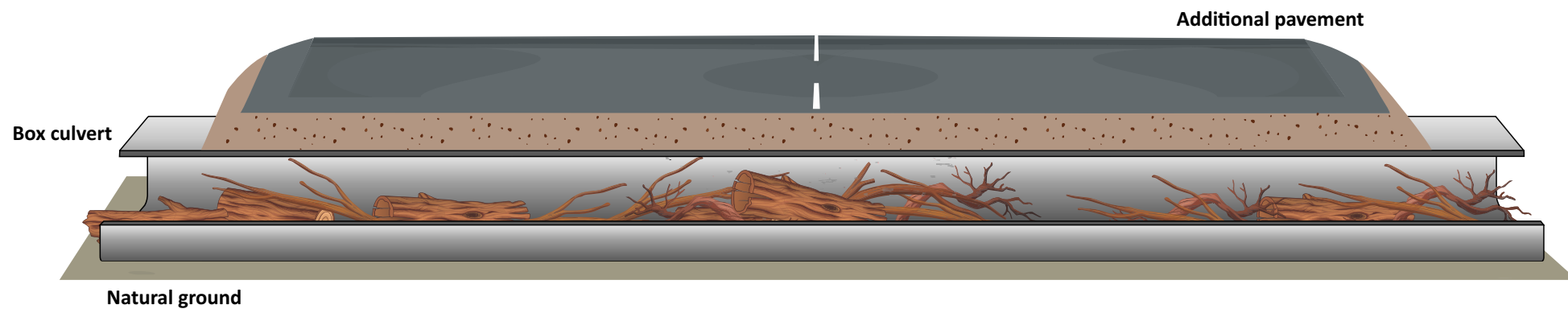
Snowy 2.0  
Biodiversity Management Plan  
Appendix G - Fauna strike mitigation strategy  
Figure 1.2



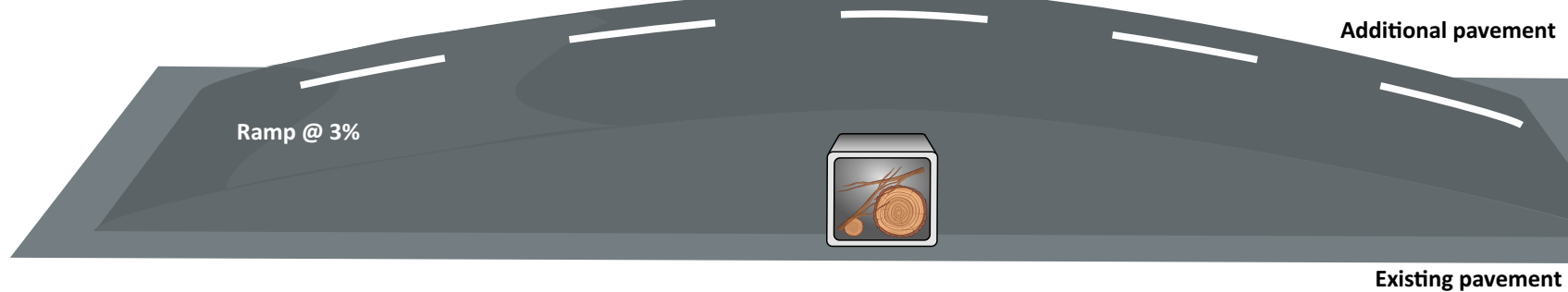
\\emmsvr1\EMM\Jobs\2017\17188 - Snowy Hydro 2.0 Active\GIS\02\_Maps\G249\_MW\SmokyMouse\MouseUnderpasses\_20200922\_01.mxd 25/09/2020



## CROSS SECTION



## LONG SECTION



**NOT TO SCALE**

*(this diagram is a conceptual representation only)*

### 3.1.3. Risk assessment framework

As detailed within section 3.1.1, an adaptive management approach has been developed to address fauna strike on the project. A risk assessment framework has been proposed to inform management decisions and to assist in determining the appropriate level of mitigation to satisfactorily mitigate the fauna strike risk to the local Smoky mouse population.

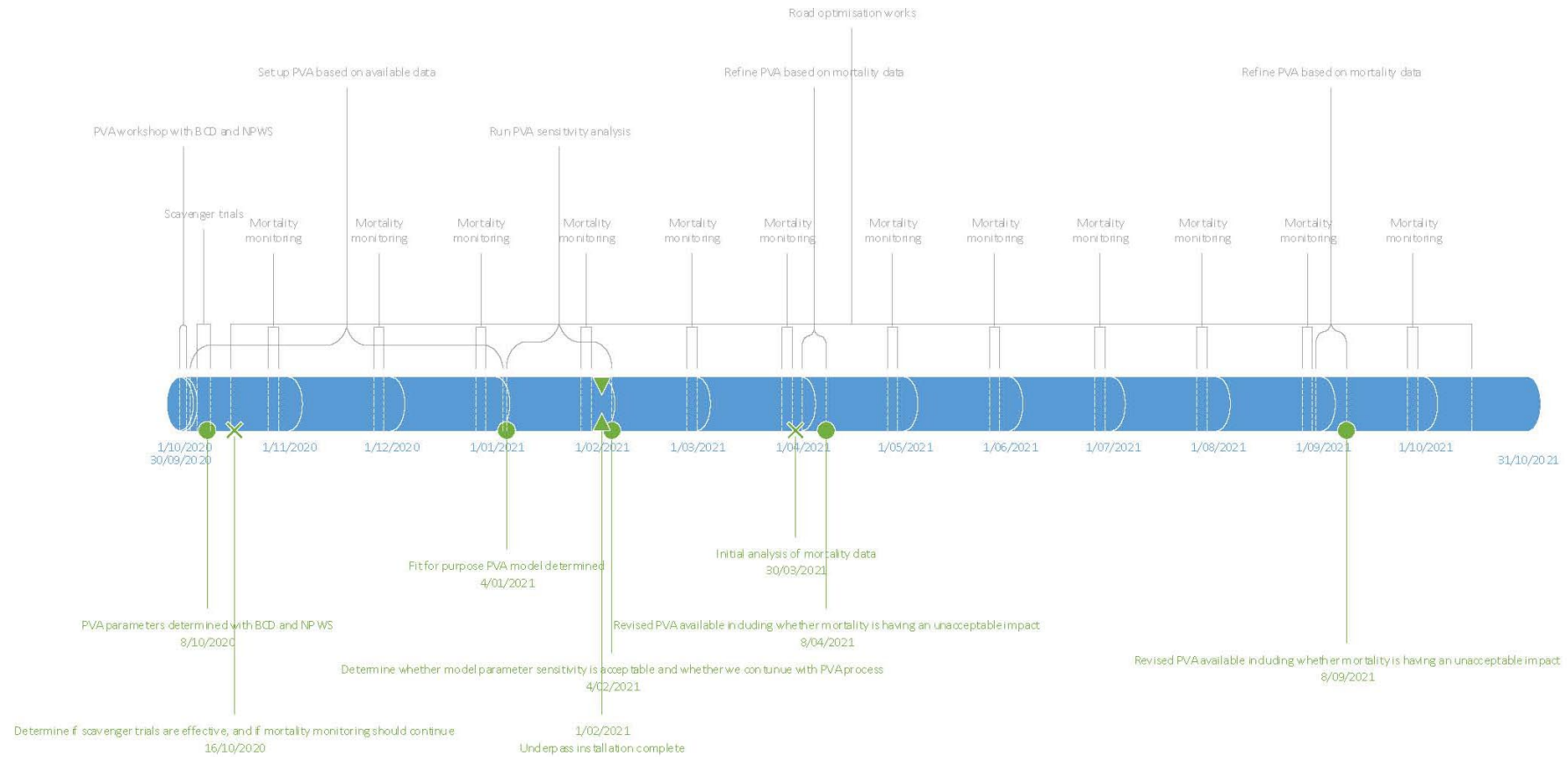
The proposed risk assessment framework is comprised of two key elements:

- a population viability analysis (PVA) to assess risk of extinction based on different strike rates; and
- mortality monitoring to determine actual fauna strike arising from the project.

The proposed risk assessment framework ensures management decisions are fully transparent and guided by accurate and reliable data. This means collection of data will be conducted in a statistically robust manner (eg, spatially and temporally replicated) and analysed using methods of best practice. Uncertainty, and importantly, the impact of uncertainty on decision-making, can be quantified and any areas that require further information can be identified.

The indicative timeline for the risk assessment framework is shown in





**Figure 3-3: Indicative timeline to conduct risk assessment framework**

### 3.1.3.1. Population viability analysis (PVA)

PVA is a modelling tool, whereby estimates of demographic parameters such as fecundity and survival of a species are used to parameterise a population model that is projected into the future to predict future abundance, evaluate extinction risk and assess the impact of different management actions. Such models can be stage- (or cohort-) based, where the life history of the study species is separated into biologically meaningful classes (eg, nestling, juvenile, sub-adult and adult) or individual based, tracking the fate of individuals through their life cycle.

Opinions on the usefulness of PVA are varied. Ludwig (1999) concluded that PVAs are not useful since their input parameters are typically very uncertain and Fieberg and Ellner (2000) concluded that the confidence intervals surrounding model outputs are often too large to be of any use. In contrast, Fagan et al. (2001) found PVA models to be useful when used to establish relative risks even though absolute estimates are uncertain, and in situations of good quality and extensive data, Brook et al. (2000) demonstrated that PVAs can be accurate for predictive purposes over relatively short time periods.

Despite the controversy, Burgman (2000) states “the primary output [of PVAs] is to reinforce the rigour and transparency of environmental decision making”. It is to this end that PVAs are a useful tool to (Beissinger and Westphal 1998, Akçakaya and Sjögren-Gulve 2000):

- integrate knowledge from all available sources to identify knowledge gaps;
- ensure model assumptions and parameter estimates are explicit and transparent;
- ensure model outputs are repeatable;
- identify influential parameters through sensitivity analyses that future research should be targeted; and
- rank management options against each other for their effectiveness.

PVAs are accepted as the basis for listing species as endangered under the IUCN categories (Brook et al. 1997, IUCN 2014) and are considered a valid means of developing quantitative conservation priorities (Mace and Lande 1991).

For the Snowy 2.0 Main Works, a PVA will be used to explore the level of fauna strike at which relative risk of extinction of the Smoky Mouse might be deemed unacceptable, by contrasting a population model in which one Smoky Mouse is removed from the population per month (ie, 12 a year), versus only one per year (ie, 1 a year).

Where possible, parameter estimates for a PVA of Smoky Mouse will be obtained from published literature on either the Smoky Mouse or other closely related species, unpublished reports in the grey literature based on formal surveys, and lastly expert opinion. Requisite data include:

- reproductive system, eg, whether the species is monogamous;
- reproductive rates, eg, age at which sexual maturity is reached, percentage of adult population considered to be breeding, number of broods per year, including brood size and sex ratio of offspring;
- maximum life span, including mortality rates of eg, 0-1 year olds, 1-2 year olds, etc.;
- initial population size and carrying capacity of the surrounding area; and
- harvesting rates. Specifically, here, scenarios in which fauna strike remove Smoky Mouse from the population.

Much of this information is currently available for published literature for the Smoky Mouse (or closely related species such as Hastings River Mouse (*Pseudomys oralis*) and New Holland Mouse (*Pseudomys novaehollandiae*)).



In situations where reliable model inputs are not obtainable, sensitivity analyses will be conducted to determine how sensitive the model is to parameter uncertainty. PVA is an iterative process, whereby when new information becomes available through research the PVA can be readily and easily updated and model outputs rerun.

The outcome of the PVA would be two-fold:

- Is there a need to undertake further mitigation? If we see very low impacts at a population level, even from high levels of fauna strike, any further mitigation may be unlikely to have any real effects.
- If we do see a population level impact from fauna strike, at what rate of fauna strike does this start to increase the risk of extinction above acceptable levels? This will inform us, along with monitoring, of triggers for further mitigation.

The project will appoint a suitably qualified statistician to undertake the PVA.

### 3.1.3.2. Mortality monitoring

Mortality monitoring would be undertaken along project roads (Lobs Hole Ravine Road and Marica) to get an understanding of actual fauna strike. Many roadkill events remain undetected during surveys using human-observers, in part because injured animals can hop into roadside verges and remain covered by longer grass. As such, the project will use detection dogs for such surveys to increase detectability of roadkill events.

Detection dogs are becoming increasingly popular for wind farms to determine mortality arising from blade strike for avifauna, including small microchiropteran bats, and have been shown to be highly effective at detecting mortality events across a variety of conditions including small mammals (del Valle et al. 2020).

The efficacy of the detection dogs would be tested using placed carcasses to see if the dogs detect the placed carcasses. These surveys would be accompanied by a series of 'scavenger trials' whereby 60 carcasses would be placed and revisited over a period of days (observation period to be determined through consultation with BCD and NPWS) to understand the rate of scavenging; i.e. how many carcasses could be missed due to scavenging by animals. This can be used to develop an adjustment factor, to correct the observed roadkill events detected by the detection dogs, for the estimated number of roadkill events that actually occurred. BCD and NPWS will be consulted on the design and findings of the detection dog scavenger trials.

Mortality monitoring would involve detection dogs walking the road verges early in the morning once initial construction traffic has entered the site, once per month for up to 12 months, with two surveys separated by 3-5 days (depending on scavenger trials, see following). The timing of surveys will be scheduled to be consistent such that no more than one-month lapses between successive surveys to provide consistent monitoring data across the calendar year. The duration and frequency of mortality monitoring may be adjusted if the scavenger trials suggest more frequent surveys are necessary or if the gap between surveys needs to be changed. Revision of mortality monitoring survey design will be done through consultation with BCD and NPWS. All fauna detected in mortality monitoring surveys will be identified to species, where feasible, or collected for further analysis. All Smoky Mouse will be retained and provided to BCD for genetic analysis. Monitoring will be reviewed after six months. If no mortality of target species has been detected monitoring frequency will be reviewed.

Mortality monitoring would provide reliable estimates of fauna strike across project roads. This data can be used to update the PVA and determine whether detected levels of fauna strike are likely to be impacting the population.

Fauna strike is a result of animal behaviour, road conditions and driver behaviour. Mortality monitoring would provide data on where we are seeing hotspots for fauna strike. This hotspot data

could be used to undertake targeted mitigation in areas where fauna strike is occurring. For example, targeted installation of fencing, underpasses, a combination of both or some other mitigation in small areas. This could avoid the need for fencing of larger areas, for example.

If mortality monitoring is unsuccessful, as indicated by scavenger trials, further consultation will be undertaken with BCD and NPWS on alternative monitoring requirements.

#### **3.1.4. Post road upgrade management**

Following access road upgrades, the management of fauna strike will include the existing speed limitations and driver behaviour training, and will be complemented by the provision of underpasses in discrete locations as detailed in section 3.1.2.

The need for additional underpasses to be installed will be informed by the PVA and the TARP. Underpasses, where installed, will be permanent and available for fauna throughout the remainder of the construction period and into operations.

### **3.2. Revision of the strategy**

The adaptive management strategy detailed in Table 3-1 includes management measures, various monitoring measures and triggers for escalation of controls. As such, this strategy provides a range of means to respond to the potential outcomes from construction. However, the controls, monitoring methods and triggers for escalation are all subject to review and may be updated where required to ensure that the stated objectives of this strategy are achieved. This version of the strategy is to address the initial construction phase while the risk assessment framework is being implemented. Where the PVA, mortality monitoring or other inputs suggest that revision of this fauna strike mitigation strategy and TARP is necessary, revision will be undertaken through consultation with BCD, NPWS and DPIE.



Table 3-1: Fauna strike adaptive management strategy TARP

Management measures program		Monitoring activities	Trigger for escalation to next level
<b>Level 1</b>	<ul style="list-style-type: none"> <li>• <b>Speed limits</b> at night (30km/hr)</li> <li>• Driver training</li> <li>• Road signage installed</li> <li>• Six fauna underpasses installed on Lobs Hole Ravine Road as a part of road optimisation works in spring/summer 2020/21*</li> </ul>	<ul style="list-style-type: none"> <li>• Recording traffic frequency overnight</li> <li>• IVMS</li> <li>• All fauna observations recorded in log</li> <li>• Incidents of hit/near miss recorded</li> <li>• Incidental reports of roadkill</li> <li>• Mortality monitoring</li> <li>• PVA process</li> <li>• Identify “hotspots” of activity from above monitoring and threatened species monitoring program results</li> </ul>	<ul style="list-style-type: none"> <li>• Reported or observed fauna strike on threatened species</li> </ul>
<b>Level 2</b>	<ul style="list-style-type: none"> <li>• Notify BCD and NPWS</li> <li>• <b>Night speed limits further reduced in “hotspot” areas of fauna strike incidents</b> (specific locations amongst target species habitat)</li> <li>• Driver training revised</li> <li>• Road signage updated</li> </ul>		<ul style="list-style-type: none"> <li>• Fauna strike on threatened species still occurring</li> </ul>
<b>Level 3</b>	<ul style="list-style-type: none"> <li>• Notify BCD and NPWS</li> <li>• Establish the PVA process</li> <li>• Run the PVA to assess risk of extinction</li> </ul>		<ul style="list-style-type: none"> <li>• PVA indicates risk of extinction for Smoky Mouse deemed unacceptable (determined in consultation with BCD)</li> </ul>
<b>Level 4</b>	<ul style="list-style-type: none"> <li>• Notify BCD and NPWS</li> <li>• Review mortality data and assess whether mortality is occurring at specific locations</li> <li>• If occurring at specific locations site specific mitigation to be installed in consultation with BCD and NPWS (eg fencing of particular sections, additional underpasses etc).</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> <li>• Increased monitoring at specific sites</li> </ul>	<ul style="list-style-type: none"> <li>• Mortality monitoring indicates fauna strike not occurring at specific locations</li> </ul>
<b>Level 5</b>	<ul style="list-style-type: none"> <li>• Notify BCD and NPWS</li> <li>• Consider installation of virtual fencing along road</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• Virtual fencing ineffective at reducing fauna strike</li> </ul>
<b>Level 6</b>	<ul style="list-style-type: none"> <li>• Notify BCD and NPWS</li> <li>• Fencing of roads to prevent animals accessing road surface</li> <li>• Installation of additional underpasses to improve access under the road</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• Nil</li> </ul>

\* additional underpasses may be installed on Marica Trail subject to the initial results from Lobs Hole Ravine Road and depending on expected need based on detailed design and forecast construction traffic load on Marica Trail (refer to section 3.1.2)

## 4. MONITORING AND REPORTING

The following monitoring and reporting activities will be carried out to track incidents of fauna strike and to inform the management measures to be employed:

- In Vehicle Monitoring System (IVMS) reports;
- fauna strike and near miss reporting;
- incidental road-kill reporting;
- remote camera monitoring;
- mortality monitoring and
- Biodiversity Monitoring Program.

These monitored aspects will be collated into the annual biodiversity report as detailed in the Biodiversity Management Plan. These results will also inform the underpass risk assessment (section 3.1.3).

### 4.1. In Vehicle Monitoring System (IVMS)

The IVMS will allow automated data collection and regular reports on the following aspects which will be used for fauna strike mitigation:

- traffic volumes on access roads;
- vehicle speed on access roads; and
- incidents of aggressive braking or swerving.

Traffic volume reports will be used to provide a count of the number of vehicles using the main access roads at night. These counts will be used in combination with incidental fauna observations, near-miss reports and fauna strike evidence to determine the rate of observation or fauna strike in relation to traffic volumes.

The vehicle speed monitoring from the IVMS will assist in enforcing speed limits by providing automated reports on driver behaviour. The IVMS also triggers an alarm when drivers exceed the nominated speed for that location providing instant feedback to drivers as a reminder of the speed limits being enforced.

Reporting on aggressive braking or swerving through the IVMS will provide an opportunity for the management team to make enquiries with the relevant driver which can ensure that incidents of fauna strike or near-miss are reported.

### 4.2. Fauna strike and near miss reporting

Training will be provided to project personnel to ensure that incidental observations of terrestrial fauna on the site are reported to the project environment team. These observations will include incidents of fauna strike, near miss, roadside observations or other fauna sightings throughout the project site. Personnel will be encouraged to report on small mammal and introduced fauna observations. Reporting of fauna will include the time and location for the sighting/incident such that hotspots of activity can be identified. In addition to live fauna sightings, personnel will also report on any sighting of roadkill along the project access roads. Where practicable and safe to do so, the Future Generation environment team or project ecologist will investigate roadkill to confirm species identification and check for surviving offspring. A vet and wildlife carer will be contacted if fauna are injured.



#### **4.3. Remote camera monitoring**

To monitor the use of underpasses by Smoky Mouse, remote cameras will be deployed on either end (upslope and downslope) of an underpass, with the camera set to record movement of animals through the underpass.

Cameras should be set up facing downwards at a height appropriate to capture the width of the underpass entry/exit. Cameras will be set to take 10 photos per trigger with a one second interval between images, and a quiet period of 30 second between triggers. Cameras will be set on all six underpasses and set to record continuously.

Using this approach, the usage of underpasses by the Smoky Mouse will be determined. A successful movement will be determined through an animal being detected on both cameras at around the same time period.

#### **4.4. Mortality Monitoring**

Smoky mouse mortality monitoring will be undertaken to inform the PVA and to use as a trigger for the TARP (Section 4.5). Details of mortality monitoring are included in Section 3.1.3.2.

#### **4.5. Trigger Action Response Plan**

The adaptive management strategy detailed in Table 3-1 will be employed as a trigger action response plan (TARP). The project will start with implementing Level 1 management measures for night traffic on the project access roads. The trigger for escalation in management response (level) is detailed in column 3.

#### **4.6. Biodiversity monitoring program**

Biodiversity monitoring for the project will be carried out in accordance with Appendix B of the BMP. This program will identify areas of fauna activity along access roads and the broader project area. Reports prepared for the monitoring program will be used as one input to inform the suitability of controls, potential locations for elevated controls and to identify suitable areas to consider the installation of additional fauna underpasses if required.

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## APPENDIX H EXPLORATORY WORKS CONDITIONS OF APPROVAL

### Exploratory Works conditions of approval (SSI 9208) relevant to biodiversity management

Condition	Requirement	Where addressed
Sch 3, Cond 6	Prior to carrying out any construction, unless the Planning Secretary agrees otherwise, the Proponent must prepare a Biodiversity Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	This plan
	a) be prepared in consultation with the NPWS and BCD;	Section 1.8
	b) include a description of the measures that would be implemented to:	Table 5-1 – BM06, BM07 and BM08, BM09, BM20 and Appendix C
	<ul style="list-style-type: none"> <li>protect vegetation and fauna habitat outside the approved disturbance area;</li> </ul>	Table 5-1 – BM05, BM20 Appendix C
	<ul style="list-style-type: none"> <li>minimise native vegetation clearing in the approved disturbance area;</li> </ul>	Table 5-1 – BM05, BM20 Appendix C
	<ul style="list-style-type: none"> <li>minimise the tree trimming required along Lobs Hole Ravine Road to allow OSOM vehicles to access the site;</li> </ul>	This condition is no longer relevant as the Main Works disturbance area negates the need for trimming on LHRR because of the wider disturbance footprint.
	<ul style="list-style-type: none"> <li>minimise the loss of key fauna habitat;</li> </ul>	Table 5-1 – BM05, BM06, BM07 and BM08, BM09 BM15 and Appendix C
	<ul style="list-style-type: none"> <li>undertake pre-clearance surveys of fauna;</li> </ul>	Table 5-1 – BM09, Appendix C
	<ul style="list-style-type: none"> <li>minimise the impacts of the development on threatened flora and fauna species, including the:               <ul style="list-style-type: none"> <li>Smoky Mouse (<i>Pseudomys fumeus</i>);</li> <li>Boorolong Frog (<i>Litoria booroolongensis</i>);</li> <li>Eastern Pygmy-possum (<i>Cercartetus nanus</i>);</li> <li>Regent Honeyeater (<i>Anthochaera phrygia</i>);</li> </ul> </li> </ul>	Table 5-1 - BM03 BM22, BM05, BM07, BM12, BM24, BM25, BM17 and BM20, Appendix C, Appendix D, Appendix E and Appendix G
	<ul style="list-style-type: none"> <li>maximise the salvage of resources within the approved disturbance area - including native vegetative material and top soil containing vegetative matter and native seed bank – for beneficial reuse in the rehabilitation of the site;</li> </ul>	Table 5-1 - BM28, BM15, BM29 BM30 and Appendix C
	<ul style="list-style-type: none"> <li>collect and propagate seed for use in rehabilitation;</li> </ul>	Table 5-1 - BM28
	<ul style="list-style-type: none"> <li>control the spread of weeds and pathogens, including <i>Phytophthora cinnamomi</i> (<i>P. cinnamomi</i>);</li> </ul>	Table 5-1 - BM32, BM33, BM34, BM35, BM36, BM37 and Appendix F
	<ul style="list-style-type: none"> <li>control the spread of feral pests;</li> </ul>	Table 5-1 - BM38, BM39 and Appendix F
	<ul style="list-style-type: none"> <li>minimise the potential for erosion; and</li> </ul>	Surface Water Management Plan
	<ul style="list-style-type: none"> <li>minimise bushfire risk;</li> </ul>	Bushfire Management Plan

Condition	Requirement	Where addressed
	c) include a program to monitor and report on the effectiveness of these measures.	Section 6.2, 6.5 and Appendix B