S2-FGJV-ENV-PLN-0028

# BIODIVERSITY MANAGEMENT PLAN

| Approval Record | | | |
|---|---|---|---|
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# 1. ABBREVIATIONS AND DEFINITIONS

| Acronym | Definition |
|---|---|
| ACH | Aboriginal Cultural Heritage |
| AFL | Agreement for Lease |
| APZ | Asset Protection Zone |
| BAM | Biodiversity Assessment Method |
| BC Act | NSW *Biodiversity Conservation Act 2016* |
| BCD | Biodiversity and Conservation Division (formerly OEH) |
| BDAR | Biodiversity Development Assessment Report |
| BMP | Biodiversity Management Plan |
| BOS | Biodiversity Offset Strategy |
| BDAR | Biodiversity Development Assessment Report |
| BOS | Biodiversity Offset Scheme |
| CMP | Construction Management Plan |
| CMS | Construction Method Statement |
| CoA | Conditions of Approval |
| CRDD | Conservation and Regional Delivery Division |
| DEC | NSW Department of Environment and Conservation (now BCD) |
| DECC | Department of Environment and Climate Change (now BCD) |
| DoI Water | NSW Department of Industry – Lands & Water |
| DoEE | Department of Energy and Environment |
| DPIE | NSW Department of Planning, Industry and Environment |
| DPI | NSW Department of Primary Industries |
| EIS | Environmental Impact Statement |
| Exploratory Works EIS | *Environmental Impact Statement Exploratory Works for Snowy 2.0* |
| EMS | Environmental Management Strategy |
| EP&A Act | *Environmental Planning and Assessment Act 1979* |
| EPA | NSW Environment Protection Authority |
| EPBC Act | Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* |
| EPL | Environment Protection Licence |
| EWAR | Exploratory Works Access Roads |
| EWMS | Environmental Work Method Statements |
| Future Gen | Future Generation Joint Venture |
| Future Gen-PMS | Project Management System |
| GDE | Groundwater Dependent Ecosystem |
| HBT | Hollow-bearing Tree |
| KFH | Key Fish Habitat |
| KNP | Kosciuszko National Park |

| Acronym | Definition |
|---|---|
| KTP | Key Threatening Process |
| MNES | Matters of National Environmental Significance |
| NCC | Nature Conservation Council |
| NPA | National Parks Association |
| NPW Act | NSW *National Parks and Wildlife Act 1995* |
| NPW Regulation | NSW *National Parks and Wildlife Regulation 2009* |
| NPWS | NSW National Parks and Wildlife Service |
| PCT | Plant Community Type |
| PEP | Project Execution Plan |
| POEO Act | *Protection of the Environment Operations Act 1997* |
| QMP | Quality Management Plan |
| REMMs | Revised environment management measures |
| Submissions Report or RTS | *Response to Submissions Exploratory Works for Snowy 2.0* |
| SEP | Site Environmental Plan |
| SHL | Snowy Hydro Limited |
| TECs | Threatened Ecological Community |
| TPZ | Tree Protection Zone |
| UFX | Unexpected Threatened Species Procedure |
| WoNS | Weed of National Significance |
| WMS | Work Method Statement |

# 2. INTRODUCTION

Salini Impregilo, Clough and Lane have formed the Future Generation Joint Venture (Future Gen) to provide the Civil Works Package for Snowy Hydro Limited (SHL) on the Snowy 2.0 Project (the Project).

The Project is a pumped hydro project that will increase the generation capacity of the Snowy Mountains Scheme by up to 2,000mW and at full capacity will provide approximately 350,000MW/h of energy storage. The Project includes all activities associated with the civil works requirements for the Snowy 2.0 Pumped Hydro-electric Scheme.

Intake and outlet structures will be built at both Tantangara and Talbingo Reservoirs, which are in the Kosciusko National Park (KNP) in southern NSW. Approximately 27km of concrete-lined tunnels will be constructed to link the two reservoirs and a further 20km of tunnels will be required to support the facility. The power station complex will be located almost one kilometre underground.

The Project will deliver one of the largest pumped hydro schemes in the world and underscores the importance of the Snowy Scheme's role in the National Electricity Market.

Future Gen was conceived to deliver an integrated engineering, procurement and construction management service for the Project. The joint venture is backed by the combined experience of Salini Impregilo, Clough and Lane, through their experience in the infrastructure, mineral and oil and gas sectors throughout Australia and the world.

## 2.1. Purpose

The Biodiversity Management Plan (BMP or Plan) forms part of the Environmental Management Strategy (EMS) for Snowy 2.0 – Exploratory Works – Stage 2 (Exploratory Works – Stage 2). The Exploratory Works is the first phase of Snowy 2.0, a pumped hydro-electric storage and generation project which will increase the hydro-electric capacity within the existing Snowy Mountains Hydro-electric Scheme. The Main Works or second phase, will be subject to a separate Environmental Impact Statement (EIS) in 2019.

This BMP has been prepared to address the requirements of:

- the Infrastructure Approval (SSI 9208) (Approval) issued for Snowy 2.0 Exploratory Works on 7 February 2019 and modified on 2 December 2019;
- the *Environmental Impact Statement Exploratory Works for Snowy Hydro 2.0* (Exploratory Works EIS);
- the revised environmental management measures (REMMs) within the *Response to Submissions Exploratory Works for Snowy 2.0* (Submissions Report or RTS);
- the *Modification 1 Assessment Report - Exploratory Works for Snowy 2.0* (Modification 1)*;* and
- the REMMs within the *Response to Submissions - Exploratory Works Modification 1* (Submissions Report for Modification 1).

The Exploratory Works for Snowy 2.0 includes, but is not limited to:

- an exploratory tunnel to the site of the underground power station for Snowy 2.0;
- horizontal and test drilling;
- a portal construction pad;
- an accommodation camp;

- road works and upgrades providing access and haulage routes;
- barge access infrastructure;
- excavated rock management, including subaqueous placement within Talbingo Reservoir;
- services infrastructure; and
- post-construction revegetation and rehabilitation.

Exploratory Works will be delivered in three distinct stages and these stages will be completed by two different contractors. Leed Engineering (Leed) is the contractor who will be carrying out the Snowy 2.0 Stage 1 work on behalf of SHL. Future Gen is the contractor who will be delivering the Snowy 2.0 Stage 2 works on behalf of SHL.

Works to be completed by Leed on behalf of SHL:

- **Stage 1a – Pre-construction Minor Works** - Stage 1a has been approved and commenced I the first quarter of 2019. The scope of pre-construction minor works includes dilapidation studies, survey work, borehole installation, site office establishment, minor access roads, installation of monitoring equipment, installation of erosion and sediment controls, and minor clearing.
- **Stage 1b - Exploratory Works Access Roads (EWAR)** – Stage 1b has been approved and commenced in the second quarter of 2019. The scope includes roadworks and upgrades to enable access and haulage routes during Exploratory Works. This includes upgrades to 26 km of existing roads and creating about 2 km of new roads, two new bridge crossings and two temporary waterway crossings.

Works to be completed by Future Gen on behalf of SHL:

- **Stage 2 – Exploratory Works** – Pending approval and the issuing of a Works Access Licence from NPWS, works may commence in quarter three (Q3) of 2019. The scope for Stage 2 will be the remainder of the Exploratory Works, including:
    - pre-construction minor activities including dilapidation studies, survey, investigations, access etc; and
    - construction works including exploratory tunnel, portal construction pad, accommodation camp, dredging*, barge access infrastructure, excavated rock management and additional geotechnical investigation. This includes subaqueous emplacement within Talbingo Reservoir*.

***Note: these activities will not proceed unless the relevant management plans are approved by Department of Planning, Industry and Environment (DPIE).***

Further detail on construction activities and staging is presented in Section 2.7 and Figure 2 1.

**This Plan identifies the Project's environmental management measures in relation to biodiversity management for the Exploratory Works – Stage 2. It has been specifically developed for the Exploratory Works – Stage 2**

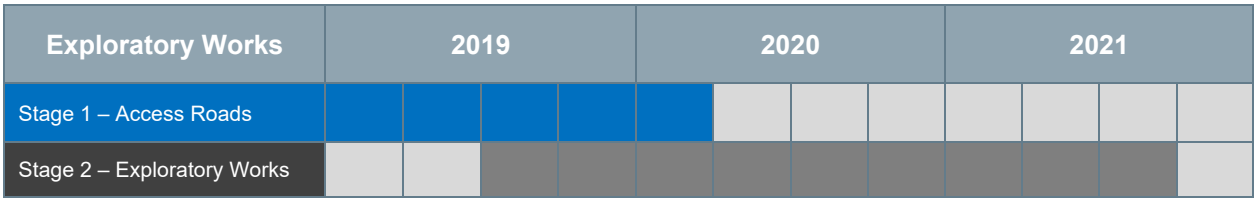



Figure 2-1: Timing of Exploratory Works stages

Stage 2 management plans have been revised from the corresponding Stage 1 management plan, as demonstrated in the document revision section of each Stage 2 plan. The intent of this arrangement is to ensure a consistent approach to managing environmental risk and regulatory requirements for the Exploratory Works project. In the event that both Exploratory Works Stages are undertaken concurrently, and / or in overlapping locations, the Stage 1 management plan will apply to the Stage 1 works, and the Stage 2 management plans will apply to the Stage 2 works. This arrangement would not affect management standards as all relevant measures from each management plan would continue to apply. As the proponent, Snowy Hydro will oversee both Stages of the Exploratory Works Project.

The timing of the preparation, consultation, submission and approval of this Plan, along with other management plans required by the Conditions of Approval (CoA), is shown within Table 4.4 and Figure 4.4 of the EMS.

Ongoing revisions to this Plan will occur in accordance with Section 1.6 of the EMS, and as required by condition 4 of schedule 4 of the Infrastructure Approval. Circumstances requiring a review, and if necessary, revision of this Plan include submission of incident reports or audit reports, approval of modifications to the CoA and directions of the Planning Secretary under condition 4 of schedule 2.

Table 2-1 presents the relationship of activities relating to biodiversity management with respect to this Plan and other management plans being prepared for the Project.

Table 2-1: Relationship to other plans

| Activities | Relevant plan | Timing of the plan* | |
|---|---|---|---|
| | | Stage 1 | Stage 2 |
| General environmental compliance including inspection, monitoring and auditing. | Environmental Management Strategy | P | R |
| Road construction | This plan | P | R |
| Other construction including site facilities | This plan | P | R |
| Monitoring for impacts on Murray crayfish in Talbingo Reservoir | Aquatic Habitat Management Plan | P | R |
| All earthworks activities | Surface Water Management Plan | P | R |
| Site facilities establishment (minimise bushfire risk) | Emergency (Bushfire) Management Plan | P | R |
| Topsoil stripping and stockpiling | Excavated Material Management Plan | P | R |
| Site rehabilitation | Rehabilitation Management Plan | P | R |

* P – prepare, R – revise

Specific on-site management measures identified in this Plan will be incorporated into site documents. 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

The Biodiversity Offset Strategy (BOS), which is to be prepared for the Project, does not form part of this Plan. It has been developed separately by SHL and is required to ensure any offsets achieve best value for the management of biodiversity values in the KNP.

## 2.2. Background

SHL is the proponent of the Project which is a pumped hydro-electric storage and generation project proposed to address increasing demands for renewable energy supplies. Snowy 2.0 involves linking Talbingo and Tantangara reservoirs within the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme) and building an underground power station between the two reservoirs.

Future Gen proposes to carry out the Exploratory Works – Stage 2 prior to the main construction works for the Project, to inform the detailed design and to reduce project risk. Exploratory Works are required to obtain detailed geological data for the location of the underground power station. An exploratory tunnel is to be constructed to gain this information. The Exploratory Works – Stage 2 will predominantly be in the Lobs Hole area of KNP. If the Exploratory Works are not undertaken, risks to the design and construct elements of the power station cavern are significantly increased.

The Exploratory Works EIS was prepared to assess the impact of these works on the environment, and included an assessment of biodiversity impacts within Chapter 5.1 and Appendices F and G.

The RTS included REMMs within Chapter 8. The management measures from that report have been addressed within this BMP.

The Exploratory Works EIS identified that the main biodiversity issue for the Exploratory Works were the impacts to several threatened species and their habitat. These species include the Smoky Mouse, Booroolong Frog and Murray Crayfish which were confirmed to be present in the study area and the Macquarie Perch. The Macquarie Perch was not detected but potential key fish habitat exists in Yarrangobilly River, warranting consideration in design and construction.

A significant effort was undertaken to understand the biodiversity values within the Project area and to design the Project to avoid and minimise impacts to the identified values. Significant controls will be implemented to minimise and mitigate direct and indirect impacts during construction. The construction of the Project will result in the clearing of 108.58 ha of native vegetation and the residual impacts will be offset through the BOS.

A referral was prepared and lodged with the Commonwealth Department of Energy and Environment (DoEE) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Commonwealth Minister's delegate determined on 10 July 2018 that Exploratory Works is not a Controlled Action, meaning that it does not require further assessment and approval under the EPBC Act before it can proceed.

### 2.2.1. Modification 1

In accordance with section 5.25 of the EP&A Act, the Infrastructure Approval issued for Exploratory Works was modified to:

- provide additional geotechnical information for the detailed design of the Snowy 2.0 power station and power waterway;

- provide a reliable long term source of construction power for the duration of Exploratory Works and will reduce the reliance on diesel generation and associated on-site storage and emissions;
- improve the efficiency of the Exploratory Works construction power;
- optimise the detailed design of construction areas and access roads; and
- improve worker safety during construction.

The Modification 1 Assessment Report was submitted to Department of Planning, Industry and Environment (DPIE) in June 2019, and was publicly exhibited between 26 June 2019 and 9 July 2019. A total of nine submissions were received, and following consideration, approval was granted by the Minister for Planning and Public Spaces on 2 December 2019.

Though Modification 1 included several changes, only the geotechnical investigations are relevant to the Stage 2 works and Future Generation's activities for the Exploratory Works project. This BMP has therefore been revised to address the biodiversity requirements and management measures from Modification 1 which are relevant to the geotechnical activities.

## 2.3. Environmental Management System

The overall environmental management system for the Project is described in the EMS.

This BMP forms part of Future Gen's environmental management framework for the Project 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.**

## 2.4. Relationship to Project management System and Other Project Plans

It is a requirement of Volume 4 Employer's Requirements – Project Execution to develop and implement a number of project plans for the Project. These plans are defined as deliverables. The BMP is required to support the deliverable plans.

The Environmental Management Strategy (EMS) will form part of the Project Management System (Future Gen-PMS) and will include any requirements specified in the contract documents, where appropriate. All Future Gen-PMS procedures will support, interface or directly relate to the development and execution of the plan.

The Project Execution Plan (PEP) is the overarching document that outlines the minimum requirements for project management on the Project. The PEP is not a standalone document and has been prepared with consideration to other project plan requirements. The PEP will also detail the interfaces between other project plans and provide information on the responsibility and management of the interfaces and project works.

All project plans are reviewed by the Quality Manager and/or Systems Manager to ensure consistency with the Quality Management Plan (QMP) and Future Gen-PMS

## 2.5. Purpose and Objectives

The purpose of this Plan is to describe how the Project proposes to minimise and manage construction impacts on biodiversity during construction of the Project.

The key objective of the BMP is to describe the management measures that are to be implemented to ensure that impacts to biodiversity are minimised and within the scope permitted by the Project CoA. To achieve this, SHL and Future Gen will:

- ensure appropriate measures are implemented to address the relevant CoA and the REMMs listed within the Submissions Report and Submissions Report for Modification 1, as detailed within Section 3.2 and 3.3 of this Plan;
- detail the existing biodiversity identified within the Project footprint during the Exploratory Works EIS including threatened and endangered flora and fauna;
- ensure reasonable and feasible measures are implemented during construction to avoid or minimise biodiversity impacts;
- detail the specific monitoring programs for the Smoky Mouse, Booroolong Frog and Murray Crayfish populations present in, and adjacent to, the Project area; and
- establish a pre-disturbance procedure and permit system.

## 2.6. Consultation

In accordance with Schedule 3, condition 6 of the Infrastructure Approval dated 7 February 2019, this BMP is to be prepared in consultation with the National Parks and Wildlife Service (NPWS) and Biodiversity and Conservation Division (BCD) The BMP must be prepared to the satisfaction of the Planning Secretary.

Preliminary consultation for the BMP, Biodiversity Monitoring Program and Weed and Feral Animals Management Plan began in November 2018.

**Table 2-2: Preliminary BMP consultations with stakeholder agencies**

| Date | Consultation | Outcomes |
|---|---|---|
| **Stage 1 consultation** | | |
| 13 November 2018 | Issued BMP to OEH and NPWS | Sent as information to these agencies for their review. |
| 16 November 2018 | Meeting with OEH | Presented the structure and contents of the BMP to OEH and discussed clearing management, threatened species protection, monitoring methods and periods and weed control. |
| 22 November 2018 | Issued revised BMP to NPWS | |
| 7 December 2018 | Received consolidated comments from OEH | Comments accepted and plans revised to address comments. |
| 12 December 2018 | Initial consultation meeting with NPWS | Outlined the Project approval process and management plan development |
| 16 January 2019 | Re-issued draft plans to NPWS | Latest revision to reflect revised comments and draft SSI 9208 conditions of consent |
| 22 January 2019 | Initial consultation meeting with NPWS | Discussed revisions to management plans and consultation and approval program |
| 31 January 2019 | Received BMP comments from NPWS | Comments accepted and plans revised to address comments. |
| 5 February 2019 | Initial consultation meeting with NPWS | Discussion with NPWS about current plans, latest comments and the ongoing consultation process. |
| 1 March 2019 | Receipt of OEH Review Comments | Comments addressed and this plan reissued for DPIE satisfaction. |

On 20 May 2019, the Plan was issued to relevant stakeholders for review and comment. Comments from consultation have been incorporated into this Plan where appropriate. Response

to the comments have been provided back to the Stakeholder Agencies. Comments are summarised in Table 2-3. A separate document has been prepared titled Agency Consultation Evidence Report detailing the consultation process. This plan has been provided to DPIE.

**Table 2-3: Stage 2 consultation with stakeholder summary**

| Date | Consultation | Outcomes |
|---|---|---|
| **Stage 2 consultation** | | |
| 27 May 2019 | Issued BMP to stakeholder agencies | Sent to agencies for their review. |
| 4 June 2019 | Agency briefing meeting with NPWS, OEH, EPA, DoI Fisheries & SHL | - |
| 13 June 2019 | Received consolidated comments from OEH | Comments accepted and BMP revised to address comments. |
| 4 July 2019 | Incorporated agencies comments in updated plan. Updated plan submitted to SHL and to DPIE on 5 July 2019. | - |

Revision 1 of the Biodiversity Management Plan (prepared in response to Modification 1 of the Infrastructure Approval), was issued to the following agencies for consultation:

- NPWS on 10 October 2019;
- Biodiversity & Conservation Division on 25 October 2019.

Comments have been incorporated into the Plan where appropriate.

## 2.7. Construction Activities

This Plan relates to Stage 2 works. Stage 2 will include the following:

- pre-construction minor works (not construction activities) including:
  - building/road dilapidation studies;
  - survey works;
  - installing groundwater bores in the Ravine beds on site for water supply;
  - establishing a temporary site office;
  - minor access roads to facilitate the pre-construction minor works;
  - installation of environmental impact mitigation measures, including the installation of monitoring equipment, erosion and sediment controls, and fencing;
  - minor clearing or translocation of native vegetation within the approved disturbance footprint for the pre-construction minor works;
- the exploratory tunnel which is approximately 3.1 km long and will lead to the site of the underground power station;
- horizontal and other test drilling, investigations and analysis in situ at the proposed cavern location and associated areas, and around the portal construction pad, access roads and excavated rock management areas all within the disturbance footprint;
- borehole drilling and geophysical surveys for further geotechnical investigation of the Snowy 2.0 power station and power waterway at Marica, Talbingo and Tantangara;
- ongoing groundwater monitoring using existing boreholes and access tracks within KNP;

- ongoing maintenance and rehabilitation of existing access tracks required for groundwater monitoring and geotechnical investigations within KNP;
- additional geotechnical drilling is proposed to enable investigation and detailed design of critical bridge works (Nungar Creek bridge) on Tantangara Road;
- additional laydown areas at Talbingo north for the transfer of plant and materials are proposed within Modification 1 to improve constructability;a portal construction pad for the exploratory tunnel. This will provide the entrance structure to the tunnel and an area for infrastructure and equipment needed to support tunnelling activities;
- an accommodation camp for the Exploratory Works construction workforce;
- barge access infrastructure to enable access and transport by barge on Talbingo Reservoir. This includes one new barge ramp at Talbingo Spillway in the northern part of Talbingo Reservoir and one new barge ramp at Middle Bay near Lobs Hole at the southern part of Talbingo Reservoir;
- excavated rock management, including subaqueous placement within Talbingo Reservoir*. Up to 750,000 m3 of excavated rock will need to be tested for its geochemical properties (ie whether the rock is reactive or non-reactive) before being managed by a combination of the following options:
    - re-use – suitable material can be used as construction materials for roads or similar. Some materials will be provided to NPWS for use in road maintenance and upgrades in other areas of KNP;
    - on land placement – material will be placed in one of two on land emplacement areas. The eastern emplacement area has been designed to safely treat reactive material during temporary storage. The western emplacement area will be used for temporary storage of materials for re-use or offsite disposal *(Note: no material is to remain at any emplacement area and must be either sub-aqueously placed at Talbingo Reservoir or removed to a suitable place outside of KNP within three years of completion of the exploratory works (should Snowy 2.0 main Works not proceed));*
    - subaqueous placement within Talbingo Reservoir* – suitable material will be placed at a suitable location within Talbingo Reservoir, subject to a number of water quality controls and monitoring; and
- services infrastructure such as diesel-generated power, water and communication;
- post-construction revegetation and rehabilitation, management and monitoring.

***Note: these activities will not proceed unless the relevant management plans are approved by DPIE.***

### 2.7.1. Works approved through Modification 1

The Exploratory Works - Modification 1 works scope is included in Table 2-4. For clarity this has been divided between Stage 1 and Stage 2 works.

The revised project boundary (disturbance footprint) for the project, as approved through Modification 1 of the Infrastructure Approval, has been included in Appendix G of this plan

**Table 2-4: Exploratory Works - Modification 1 works scope (Stage 1 and Stage 2)**

| Stage 1 | |
|---|---|
| **Activity** | **Description** |
| Lobs Hole Substation | Additional disturbance area required for the construction power connection to an existing transmission line (Line 2) at Lobs Hole for power supply to the Exploratory Works |

| | |
|---|---|
| | accommodation camp and construction areas. This will provide a reliable and long-term source of construction power and will reduce the reliance on diesel generation and associated on-site storage requirements and emissions. Works in this area will include establishing a substation, connection infrastructure, access roads and ancillary construction areas. Works in this area will include establishing a substation, connection infrastructure, access roads and ancillary construction areas.<br>This will include:<br>• construction of a 330/33 kV substation within Kosciuszko National Park and adjacent to Line 2, which forms a 330-kV connection between Upper Tumut Switching Station and Yass Substation;<br>• geotechnical investigation works to inform the detailed design of the construction power substation;<br>• replacement of one transmission support structure (Structure 54) within the existing transmission easement. This will involve removal of the existing structure and establishment of one new steel lattice tower, approximately 50 m in height;<br>• short overhead 330 kV transmission line connections (approximately 100 m in length) between the substation and the new Structure 54;<br>• 33 kV feeder connection between the substation and the Exploratory Works construction power network. This will be either overhead lines or underground cables;<br>• establishment and upgrade of access tracks and roads to the new substation and transmission line structures;<br>• installation of a fibre optic communication link into the new substation from the approved communication network; and<br>• ancillary activities, including brake and winch sites, crane pads, site compounds and equipment laydown areas.<br>(Illustrated in Appendix G, Figure 1i). |
| Camps Bridge and Wallaces Creek | Additional disturbance area around Camp Bridge and Wallaces Creek Bridge required for improved constructability of the crossings. Works within these areas will include vegetation clearing, levelling earthwork, erection of falsework, sediment controls, laydown, parking and movement of equipment.<br>(Illustrated in Appendix G, Figures 1h and 1i). |
| Lobs Hill Ravine Road and Construction Boundary Changes | Minor changes to the project boundary identified through detailed design including:<br>• revised road upgrade for Lobs Hole/Ravine Road to improve access, drainage and safety;<br>• minor additions to construction areas for design optimisation.<br>• removal of dangerous trees on Lobs Hole Ravine Road. This will involve either complete or partial removal of up to 91 trees that have been identified to pose a safety risk to road users on Lobs Hole Ravine Road and Mine Trail Road;<br>(Illustrated in Appendix G, Figures 1b to 1f and Figure 1i) |
| Operating Hours | Modify operating hours for the use of Upper Lobs Hole Ravine Road from 7 am to 6pm to sunrise to sunset. |
| Miscellaneous | Continued use of existing communications towers within KNP that were previously approved by the NPWS under a separate review of environmental factors (REF R – Wallaces Creek Geotechnical drilling) environmental impact assessment carried out under the NSW National Parks and Wildlife Act 1974 (NPW Act) and its regulation for the geotechnical investigation program; and<br>Increase in peak traffic volumes. Additional vehicles will be required to access the site to facilitate construction of Exploratory Works, however no change in impacts to the road network are expected.<br>(The location of the communications towers are illustrated in Appendix G, Figures 1a, 1f and 1l). |
| **Stage 2** | |
| **Activity** | **Description** |
| Borehole drilling and geophysical surveys | This includes:<br>• borehole drilling and geophysical surveys for further geotechnical investigation of the |

| | |
|---|---|
| | Snowy 2.0 power station and power waterway at Marica, Talbingo and Tantangara;<br>• clearing of up to 2.79 hectares (ha) of additional vegetation for access tracks and drilling pads. About 1.33 ha within Smokey Mouse potential habitat;<br>• trimming of overhanging dangerous branches on adjacent trees (these trees will not require removal);<br>• mulching of trees and vegetation;<br>• establishment of an additional 1 km of access tracks (4 m wide), including minor earthworks;<br>• placement of geofabric (as required) and import of stabilised material;<br>• establishment of eight drilling pads and boreholes at top of the cavern area, with an area of 900 m2 per pad, including minor earthworks, placement of geofabric (as required) and import of stabilised material (as required);<br>• undertaking geophysical surveys near Talbingo and Tantangara reservoirs;<br>• establishment of two drilling pads and boreholes at both Tantangara and Talbingo with an area of 900 m2 per pad, including approximately 400 m of additional access tracks and minor earthworks (as required);<br>• establishment of in-reservoir boreholes including one in Talbingo Reservoir and two in Tantangara Reservoir;<br>• drilling of additional nested vertical boreholes at each of the drilling pads up to a depth of 1,100 m;<br>• conversion of the investigation boreholes into monitoring bores;<br>• undertaking geophysical surveys;<br>• rehabilitation of the drilling pads and access tracks following completion of works;<br>• ongoing maintenance of existing access tracks required for geotechnical investigations within KNP.<br>(Illustrated in Appendix G, Figures 1j, 1k, 1l, 1m and 1n). |
| Talbingo Laydown | Outside of KNP, SHL is proposing to add four laydown locations to facilitate the construction of the communications cable linking Lobs Hole with the Tumut 3 Power Station.<br>These are proposed on existing hardstand areas along the northern foreshore of Talbingo Reservoir within Snowy Hydro owned land. Additional widening of Spillway Road for accessibility is required.<br>(Illustrated in Appendix G, Figure 1o). |
| Tantangara Access | Two additional geotechnical boreholes are required to facilitate the detailed design of cuttings, bridge foundations, retaining wall foundations, and drainage structures near Nungar Creek.<br>(Illustrated in Appendix G, Figure 1m). |
| Operating Hours | Modify operating hours for the use of Upper Lobs Hole Ravine Road from 7 am to 6pm to sunrise to sunset. |

# 3. ENVIRONMENTAL REQUIREMENTS

## 3.1. 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.

## 3.2. Conditions of Approval

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

**Table 3-1: Conditions of Approval relevant to biodiversity management**

| Condition | Requirement | Where addressed |
|---|---|---|
| **Biodiversity Management Plan** | | |
| 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: | Section 1<br>This plan |
| | (a) be prepared in consultation with the NPWS and BCD | Section 2.6 |
| | (b) include a description of the measures that would be implemented to:<br>• protect vegetation and fauna habitat outside the approved disturbance area; | Section 6 and Table 6-1,of this plan |
| | • minimise native vegetation clearing in the approved disturbance area; | Section 6, Table 6-1 and Appendix C (Pre-clearing Procedure) of this Plan |
| | • minimise the loss of key fauna habitat; | Section 5.1, Section 6, Table 6-1, Appendix B (Biodiversity Monitoring Program), and Appendix C (Pre-clearing Procedure) of this Plan |
| | • undertake pre-clearance surveys of fauna; | Section 6, Table 6-1 and Appendix C (Pre-clearing Procedure) of this Plan |
| | • minimise the impacts of the development on threatened flora and fauna species, including the:<br>– Smoky Mouse (*Pseudomys fumeus*);<br>– Boorolong Frog (*Litoria booroolongensis*);<br>– Eastern Pygmy-possum (*Cercatetus nanus)* | Section 3, Table 3-2, Section 5.1, Section 6 Table 6-1, Appendix B (Biodiversity Monitoring Program), and Appendix E (Fauna Handling and Rescue Procedure) of this Plan |
| | • 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; | Section 6, Table 6-1, Section 6.3.1of This Plan, Appendix F (Weed and Feral Animals Management Plan), and Excavated Material Management Plan Section 6.2 (for the salvage and management of topsoil containing vegetative matter and native seed bank) |
| | • collect and propagate seed for use in rehabilitation; | Section 6 and Table 6-1 of this Plan, and Rehabilitation Management Plan |
| | • control the spread of weeds and pathogens, including *Phytophthora cinnamomi* (*P. cinnamomi*); | Section 3, Table 3-2, Section 6, Table 6-1, Section 6.3.1, Section 5, and Section 7.1.1 of This Plan, and Appendix F (Weed and Feral Animals Management Plan) |
| | • control the spread of feral pests; | Section 3, Table 3-2, Section 6, and Section 7 of this Plan, Appendix F (Weed and Feral Animals |

| Condition | Requirement | Where addressed |
|---|---|---|
| **Biodiversity Management Plan** | | |
| | | Management Plan) |
| | • minimise the potential for erosion; and | Section 6, Table 6-1 of this Plan, Surface Water Management Plan |
| | • minimise bushfire risk; | Section 6, Table 6-1 of this Plan, Emergency Plan |
| | (c) include a program to monitor and report on the effectiveness of these measures. | Appendix B (Biodiversity Monitoring Program) |
| Sch 3, Cond 7 | The Proponent must implement the approved Biodiversity Management Plan for the development. | This Plan |

## 3.3. Revised Environmental Management Measures

Environmental safeguards and management measures are included in the Exploratory Works EIS in Section 6.3. During preparation of the Submissions Report, REMMs were developed and are included in Section 8 of the Submissions Report.

REMMs relevant to the Exploratory Works Modification 1 are included in Section 8 of the Exploratory Works Modification 1 Response to Submissions Report.

The REMMs relevant to this Plan are listed in Table 3-2 below, including some measures applicable to Stage 1 work only which have been included for completeness. If additional measures are cross-referenced from another section of the Exploratory Works EIS, Submissions Report, these measures are also included. The revised environmental management measures from Modification 1 have also been incorporated into Table 3-2.

**Table 3-2: Management measures relevant to biodiversity**

| Impact | Ref # | Environmental management measure | Where addressed |
|---|---|---|---|
| Impacts to biodiversity | ECO01 | The Biodiversity Management Plan (BMP) will include the following:<br>• identification of guidelines relevant to construction, the matters they apply to and what is required to ensure compliance;<br>• pre-disturbance inspection requirements to identify features of conservation significance and select appropriate management measures and environmental controls which will include:<br>– exclusion fencing around all areas of retained significant vegetation and fauna habitat adjacent to construction compounds and the camp (to avoid damage from camp activities);<br>– 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<br>– vegetation clearing is to follow a two-staged process based on non-habitat and habitat vegetation.<br>• standard precautions and mitigation measures in Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update) (Fisheries NSW 2013);<br>• tree assessment and management protocols consistent with AS 4970-2009 Protection of trees on development sites; and<br>• terrestrial and aquatic weed, pest and pathogen prevention and management protocols which will include;<br>– construction of wash-down stations or the use of alternate | Section 3.5<br>Appendix C<br><br>Section 6<br><br>Appendix F |

| Impact | Ref # | Environmental management measure | Where addressed |
|---|---|---|---|
| | | hygiene protocols at suitable locations where practicable;<br>– 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;<br>– implementation of a weed and pathogen monitoring program;<br>– implementation of a weed control program if weeds are identified within the site;<br>– 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;<br>– remote camera monitoring for feral animals at the accommodation camp;<br>– a predator control program will be implemented, in conjunction with OEH and NPWS, to control feral animals;<br>– 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 (Elodea canadensis) known to be present in Talbingo Reservoir) and pest fish;<br>– 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<br>– all personnel working within the waters should be instructed on how to identify potential pests.<br>• pre-clearance procedures; and<br>• an unexpected threatened species finds procedure. | Appendix C<br>Appendix D |
| Impacts to biodiversity | ECO02 | 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. | Section 6 |
| Impacts to biodiversity | ECO03 | The accommodation camp will be sited in areas of lower quality vegetation where practicable. | Section 6 (Stage 2) |
| Impacts on threatened species | ECO04 | Potential impacts to Threatened Species will be managed and measured through the Biodiversity Management Plan during construction. The Biodiversity Management Plan will include:<br>• Murray Crayfish monitoring program (Talbingo Reservoir);<br>• Smoky Mouse monitoring program; and<br>• Boorolong Frog monitoring program. | This plan<br>Appendix B<br>Appendix B |
| Impacts on threatened species | ECO05 | Vehicle traffic movements along Upper Lobs Hole Ravine Road will be:<br>• limited to day time hours only (except for emergencies). Day time hours are to be taken as between First Light and Last Light;<br>• limited to 40km/h; and<br>• where practicable, reduced through the use of Talbingo Reservoir to barge heavy machinery, construction equipment and materials. | Section 6 |
| Impacts on threatened species | ECO06 | 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. | Section 6 |

| Impact | Ref # | Environmental management measure | Where addressed |
|---|---|---|---|
| Impacts on threatened species | ECO07 | Fauna spotters will check areas adjacent to Yarrangobilly River prior to clearing for Booroolong Frog and translocate them to adjacent habitats away from impacts. | Section 6<br>Appendix E |
| Impacts on threatened species | ECO08 | During construction the Yarrangobilly River buffer zone will be revegetated and weed species removed, where practicable. | Section 6<br>Appendix F |
| Impacts on threatened species | ECO09 | 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. | Section 6 |
| Impacts on fish eggs and larvae due to extraction of water from Talbingo Reservoir sedimentation | ECO10 | The water pipeline intake will be designed to:<br>• prevent adult fish from entering the intake and discourage adult fish from approaching the intake which may include:<br>• incorporation of an enclosed, dark and long passage approach to the intake;<br>• if feasible, screening of the intake with at least 5 mm 3 mm mesh screen;<br>• 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<br>• if feasible, limiting the approach water velocity at the headwall during normal operation ideally to 0.1 m/s.<br>• locate the intake pump in deeper water where possible; and<br>• allow for pump start up procedures involving initial slow water velocity to reduce likelihood of aquatic biota being drawn into the pump. | Section 6<br>Aquatic Habitat Management Plan |
| Impacts to fish passage | ECO11 | 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). | Section 6<br>Aquatic Habitat Management Plan (Stage 1) |
| Impacts to fish passage | ECO12 | The temporary bridges at Yarrangobilly River and at Wallaces Creek will be designed, constructed and removed to<br>• 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:<br>– 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;<br>– maintaining some unmodified channel so that a weir effect or flow through rock interstices only is not created where practicable; and<br>– temporary in-stream structures will be inserted during low-flow periods where practicable<br>• ensure any build-up of debris which potentially obstructs fish passage will be removed; and<br>• the temporary structures will be removed and the river channel rehabilitated following construction of the permanent bridges. | Section 6<br>Aquatic Habitat Management Plan (Stage 1) |
| Impacts to fish passage | ECO13 | Construction and removal of the temporary bridge at Yarrangobilly River will avoid or minimise in stream works during the migration time of | Section 6 |

| Impact | Ref # | Environmental management measure | Where addressed |
|---|---|---|---|
| | | Macquarie Perch (October to January) where possible. | |
| Impact to aquatic ecology from erosion and sedimentation | ECO14 | The water quality controls described in in WAT01 to WAT05 and WM1.1 to WM 8.8 will be implemented. | Section 6<br>Surface Water Management Plan |
| Impacts to aquatic habitat and biota during dredging and subaqueous placement | ECO15 | The subaqueous placement monitoring program for Talbingo Reservoir will be developed and implemented.<br>Measures relevant to aquatic ecology will be implemented as described below including:<br>• monitoring of water quality indicators including turbidity, pH and dissolved oxygen within and downstream of the construction area and, if a decline in water quality is detected as a result of the works, investigate potential causes and develop and implement an appropriate response;<br>• the extent of the placement area will be minimised as far as practicable;<br>• the extent of the dredge footprint will be minimised as far as practicable;<br>• subaqueous placement would not occur shallower than 3 m below minimum operating level (i.e. where aquatic habitat, such as aquatic plants are less likely to occur);<br>• placement of large rocks within the placement area will occur and is expected to enhance the value of this habitat for fish and mobile invertebrates by providing hard surface and refuges;<br>• un-necessary noise and vibration disturbances should be kept to a minimum where practicable to avoid impacts to fish and other aquatic species;<br>• removing wood debris from within the dredge footprint and subaqueous placement location and spreading it back into the reservoir in relatively shallow water (0-10 m) where fish are more likely to occur;<br>• where feasible, mapping/identification of aquatic habitats within and adjacent to the subaqueous placement areas and other reference areas to characterise the habitat and place this in context of that present throughout the entire reservoir; and<br>• mapping of aquatic habitats would include searches for crayfish burrows along the shoreline, as these could indicate the presence of Murray crayfish and would inform the final placement area extent. Deployment of crayfish traps along the shorelines adjacent to the placement area and within the placement area could be used to re-locate any large mobile invertebrates (including any Murray crayfish) from these areas to nearby sections of the reservoir that would not be affected by placement;<br>• prior to commencement of seismic surveys, smaller releases of compressed air will be undertaken just below the surface;<br>• during seismic surveys, operators will be vigilant to potential harm to fish and invertebrates. If any harmed or dead biota are observed during works then this would result in the scaling back of works or review and adjustment of methodology (e.g. magnitude, frequency and/or duration of releases);<br>• minimising suspension of sediment and turbidity by implementing WAT14 and WAT15. | Subaqueous Management Plan and Dredge Environmental Management Plan (Stage 2) |
| Smoky Mouse | M1.2 | The existing Smoky Mouse monitoring program will be extended to | Appendix B - |

| Impact | Ref # | Environmental management measure | Where addressed |
|---|---|---|---|
| | | include the Marica area. | Biodiversity Management Plan |
| Fauna strike | M1.3 | Restrictions on vehicle movements in the Marica area limited to speeds of 20 km/h between dusk and dawn.(Superseeded by revised CoA - Restrict vehicle speeds along Coppermine Trail, Wallaces Creek Trail and access tracks in the Marica area to 20 km/h between sunrise and sunset.<br>*Note: Sunrise and sunset times are to be taken from the nearest Bureau of Meteorology centre*) | Table 6-1<br>Traffic Management Plan (Section 5.1.2) |

## 3.4. Permits and Licences

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. This plan is written in accordance with all requirements in the EPL.

Future Gen are required to establish an Agreement for Lease (AFL) with NPWS, with an accompanying Works Access Licence in order to carry out the relevant Stage 2 Exploratory Works in accordance with the Exploratory Works EIS, CSSI 9208 and the approved Management Plans.

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

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 maybe used.

## 3.5. Guidelines

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

- Fairfull, S (2013). Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 Update). NSW Department of Primary Industries
- Fairfull, S. and Witheridge, G. (2003) Why do Fish Need to Cross the Road? Fish Passage. Requirements for Waterway Crossings. NSW Fisheries, Cronulla,
- SW DPI Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013) (NSW DPI, 2013). This replaces the Policy and Guidelines for Aquatic Habitat Management and Fish Conservation (NSW DPI, 1999) and the former Policy and Guidelines for Fish Friendly Waterway Crossings (NSW DPI 2003);
- NSW Fisheries, January 2003, Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings, Fairfull and Witheridge, 2003;
- NSW National Parks & Wildlife Service. 2001. Policy for the Translocation of Threatened Fauna in NSW: Policy and Procedure Statement No. 9 Threatened Species Unit, Hurstville NSW;
- DECCW, 2008, Hygiene protocol for the control of disease in frogs;

- NSW Fisheries, 1999, DPI Policy and Guidelines: Aquatic Habitat Management and Fish Conservation;
- SOS Conservation Strategy; and
- relevant recovery plans, priority action statements and best practice guidelines.

# 4. EXISTING ENVIRONMENT

The following section summarises existing terrestrial and aquatic flora and fauna within and adjacent to the Project including species, communities and habitats based on the information contained in Section 5.1 and Appendix F of the Exploratory Works EIS and Section 6.1 and Appendix C of Modification 1. Appendix F of the EIS includes the Biodiversity Development Assessment Report (BDAR).

## 4.1. Native Vegetation

Native vegetation across the Project area is located in six key areas:

- Lobs Hole Ravine Road - vegetation along the upper (southern) extent of Lobs Hole Ravine Road is largely intact, with minimal disturbance evident. Vegetation comprises tall montane forests with large trees and a shrubby understorey. Weed invasion is minimal and limited to road edges. The lower reaches of Lobs Hole Ravine Road, generally below 1,200 m, comprise dry sclerophyll forests with a shrubby to grassy understorey;
- Lobs Hole - first used in the early 1800s for the movement of stock, Lobs Hole has since been the site of prospecting, mining, grazing, settlement, refuge from the winters of Kiandra, gardening and agriculture. From the 1860s to approximately 1917, it was the site of a copper mine. Lobs Hole is now a public camping area with a boat ramp which is used to access the southern reaches of Talbingo Reservoir. These activities and past land uses have resulted in significant amounts of clearing and disturbance of vegetation in the area, and have modified native vegetation and fauna habitats;
- Northern end of Talbingo Reservoir - the area around the proposed barge access infrastructure at the northern end of Talbingo Reservoir has been subject to clearing and disturbance associated with the construction of the dam wall and Tumut 3 power station. Large areas have been cleared and are largely devoid of native vegetation. However, some areas of moderate quality vegetation are in the Project area;
- Lobs Hole and areas adjacent to Talbingo Reservoir - vegetation in the lower section of Lobs Hole at Talbingo Reservoir consists of dry sclerophyll forests and grassy woodlands. Native vegetation, which includes fauna habitats, have been modified by past disturbances associated with land clearing, livestock grazing and weed invasion. Native vegetation has re-established itself throughout Lobs Hole; however, Blackberry, a weed of national significance, has established itself to the point of infestation within the area, particularly in gullies and along the Yarrangobilly River; and
- Marica area, located west of Wallace's Creek Fire trail - the vegetation within the Marica area consists of tall montane forests and grassy woodlands. Disturbance in this area is minimal, and vegetation is largely intact.

Vegetation within the southern end of Tantangara Reservoir mainly consists of grasslands and grassy woodlands,which is moderately disturbed as a result of fire damage, historical clearing and weed invasion. In 2003 a large scale bushfire burnt thousands of hectares within the Australian Alps, particularly affecting Tantangara. Native vegetation has re-established itself throughout Tantangara with regeneration occurring. The high threat weed Ox-eye daisy(Leucanthemum vulgare) has established itself to the point of infestation within the southern part of Tantangaraand

spanning west towards Nungar track. The Exploratory Works are predominantly located within the KNP which is largely vegetated across its 673,543 ha extent. The Exploratory Works EIS found that the native vegetation is largely intact, with 90% native vegetation cover within a 1,500 m buffer of the survey area, providing a high degree of connectivity to large and contiguous patches of vegetation.

### 4.1.1. Plant Community Types

Plant community types (PCTs) are a NSW classification used to identify plant communities. The Exploratory Works EIS included a review of regional vegetation mapping which identified twenty-four PCTs within the Exploratory Works survey area.

Site investigations identified the presence of nine PCTs within the Exploratory Works disturbance footprint. An additional four PCTs were identified within the Modification 1 disturbance footprint. These thirteen PCTs include 29 vegetation zones. Of these zones, 2 are mapped as low condition and 27 mapped as moderate/good.

Table 4-1 below describes the thirteen PCTs and the area they cover within the Project footprint. Vegetation mapping of the plant community types is provided in Appendix A.

**Table 4-1: Plant community types within the exploratory works disturbance footprint**

| Plant community type | Vegetation formation | Vegetation class | Area (ha) |
|---|---|---|---|
| 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 | 5.41 |
| 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 | 47.51 |
| 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 Kosciuszko escarpment | Wet Sclerophyll Forests (Grassy sub-formation) | Southern Tableland Wet Sclerophyll Forests | 9.80 |
| 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 | 12.00 |
| 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 | Tableland Clay Grassy Woodlands | 0.31 |
| 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 | 2.87 |
| PCT 643 – Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion | Alpine Complex | Alpine Heaths | 0.13 |
| 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 | 23.96 |
| PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South | Dry Sclerophyll Forests (Shrubby | Southern Tableland Dry | 1.09 |

| Plant community type | Vegetation formation | Vegetation class | Area (ha) |
|---|---|---|---|
| Eastern Highlands Bioregion and Australian Alps Bioregion | sub-formation) | 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 | 0.64 |
| PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion | Grassy Woodlands | Subalpine Woodlands | 0.61 |
| PCT 1196 – Snow Gum – Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Grassy Woodlands | Subalpine Woodlands | 2.98 |
| PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion | Grasslands | Temperate Montane Grasslands | 0.15 |
| PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion | Grasslands Temperate | Montane Grasslands | <0.01[1] |

*Note: 1.The area of impact for this PCT is below 0.01 ha and is not discussed further above*

### 4.1.2. Threatened Ecological Communities

Four threatened ecological communities (TECs) were identified as having potential to occur within the Project area. Following detailed desk and field studies undertaken during the Exploratory Works EIS, it was determined that none of these TECs occur in the Project area.

### 4.1.3. Threatened Flora Species

No threatened flora species as listed under the BC Act or EPBC Act were recorded in the study area during field surveys for the Exploratory Works EIS.

Based on previous records, four threatened flora species were identified as having potential to occur within the study area. One threatened flora species (slender greenhood) occurs in the Modification 1 disturbance footprint. These species and their conservation status are outlined in Table 4-2.

**Table 4-2: Threatened plant species**

| Common name | Scientific name | BC Act | EPBC Act | Occurrence likelihood | Image |
|---|---|---|---|---|---|
| Curtis' Colonbath | *Colobanthus curtisiae* | No | Yes - Vulnerable | Low |  |

| Common name | Scientific name | BC Act | EPBC Act | Occurrence likelihood | Image |
|---|---|---|---|---|---|
| Blue-tongued Greenhood | *Pterostylis oreophila* | Yes – Critically endangered | Yes – Critically endangered | Low |  |
| Slender Greenhood | *Pterostylis foliata* | Yes – Vulnerable | No | Occurs in Modification 1 disturbance footprint. |  |
| Cotoneaster Pomaderris | *Pomaderris cotoneaster* | Yes – Endangered | Yes – Endangered | Low |  |
| Austral Toadflax | *Thesium australe* | Yes - Vulnerable | Yes - Vulnerable | Low |  |

[1] Image reference - Tasmanian government.
[2] NSW Office of Environment and Heritage (Richard Hartland image).
[3] NSW Office of Environment and Heritage (Jackie Miles image).
[4] NSW Office of Environment and Heritage.

## 4.2. Fauna Habitats

### 4.2.1. Terrestrial

The upper section of Lobs Hole Ravine Road consists of tall wet sclerophyll forests to 40 m. In these areas, hollows are abundant with good numbers of large, old trees. Large logs, coarse woody debris and leaf litter are also abundant on the ground, providing shelter for a high number of fauna species.

Below approximately 1,200 m, vegetation transitions to drier sclerophyll forests. In these areas, hollows are limited to old, mature trees which tend to be rare. Large logs, coarse woody debris and leaf litter are also less common, providing more limited habitat for fauna species.

Along the intermittent and permanent watercourses in Lobs Hole a number of riparian communities occur. Where these communities are intact, large trees are moderately common and support large hollows. In many sections of the Exploratory Works survey area, the mid-storey and understorey are heavily disturbed, with significant weed invasion particularly thickets of *Rubus fruticosus* (Blackberry species aggregate). Coarse woody debris, logs and leaf litter varies from absent to

moderately sparse, depending on past disturbance. There are limited areas considered to be of good quality for fauna species.

## 4.3. Threatened Fauna

Seventeen threatened fauna were recorded during surveys for Exploratory Works and Modification 1 surveys to occur within the footprint of the Exploratory Works and Modification 1 works. Three EPBC Act listed marine and marine and migratory species were also recorded. A summary of the species (threatened and marine and marine and migratory species) confirmed to be present within the study area during Exploratory Works EIS surveys and Modification 1 assessment surveys is provided in Table 4-3.The locations that these were observed is shown in Figure 4-1 and Figure 4-2.

**Table 4-3: Threatened fauna**

| Common name | Scientific name | BC Act | EPBC Act | Recorded during EIS survey | Recorded during Mod 1 survey |
|---|---|---|---|---|---|
| **Threatened bird species** | | | | | |
| Brown Treecreeper | *Climacteris picumnus* | Vulnerable | Not listed | No | Yes |
| Diamond Firetail | *Stagonopleura guttata* | Vulnerable | Not listed | Yes | Yes |
| Dusky Woodswallow | *Artamus cyanopterus* | Vulnerable | Not listed | Yes | Yes |
| Flame Robin | *Petroica phoenicea* | Vulnerable | Not listed | Yes | Yes |
| Gang-gang Cockatoo | *Callocephalon fimbriatum* | Vulnerable | Not listed | Yes | Yes |
| Latham's Snipe | *Gallinago hardwickii* | Not listed | Marine and Migratory | No | Yes |
| Masked Owl | *Tyto novahollandiae* | Vulnerable | Not listed | Yes | Yes |
| Olive Whistler | *Pachycephala olivacea* | Vulnerable | Not listed | No | Yes |
| Rainbow Bee-eater | *Merops ornatus* | Not listed | Marine | No | Yes |
| Satin Flycatcher | *Myiagra cyanoleuca* | Not listed | Marine and Migratory | No | Yes |
| Scarlet Robin | *Petroica boodang* | Vulnerable | Not listed | Yes | Yes |
| Varied Sittella | *Daphoenositta chrysoptera* | Vulnerable | Not listed | Yes | No |
| White Bellied Sea-Eagle | *Haliaeetus leucogaster* | Vulnerable | Not listed | No | Yes |
| **Threatened mammal species** | | | | | |
| Broad-toothed Rat | *Mastacomys focus* | Vulnerable | Vulnerable | No | Yes |
| Eastern Pygmy possum | *Cercartetus nanus* | Vulnerable | Not listed | Yes | Yes |
| Smoky Mouse | *Pseudomys fumeus* | Critically Endangered | Endangered | Yes | Yes |
| Spotted-tailed Quoll | *Dasyurus maculatus* | Vulnerable | Endangered | No | Yes |
| **Threatened amphibian species** | | | | | |
| Booroolong Frog | *Litoria booroolongensi* | Endangered | Endangered | Yes | Yes |
| Alpine Tree Frog | *Litoria verreauxii alpina* | Endangered | Vulnerable | No | Yes |

| Common name | Scientific name | BC Act | EPBC Act | Recorded during EIS survey | Recorded during Mod 1 survey |
|---|---|---|---|---|---|
| **Threatened aquatic species** | | | | | |
| Murray Crayfish | Euastacus armatus | Vulnerable | Not listed | Yes | No |

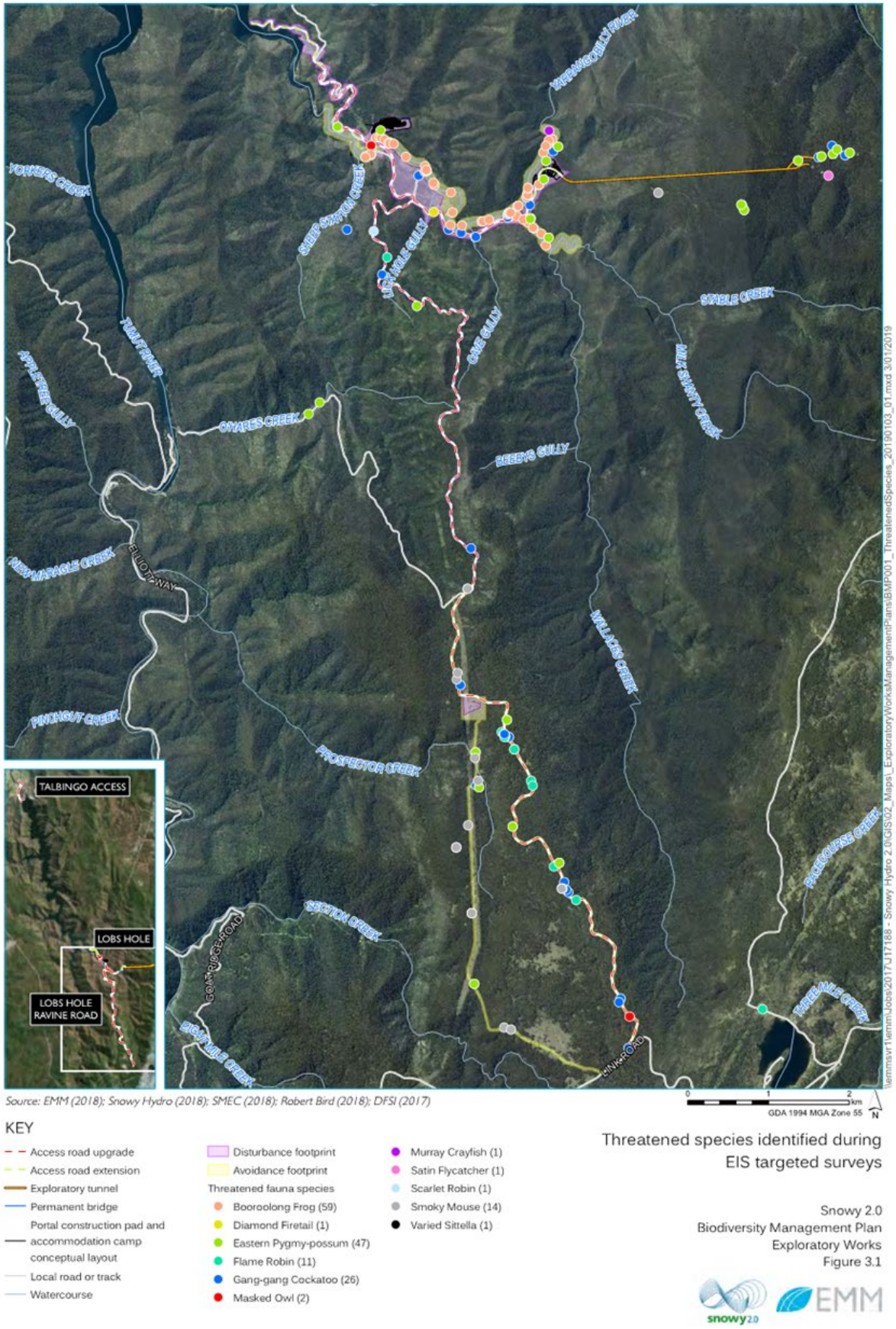



**Figure 4-1: Threatened species identified during EIS targeted surveys**

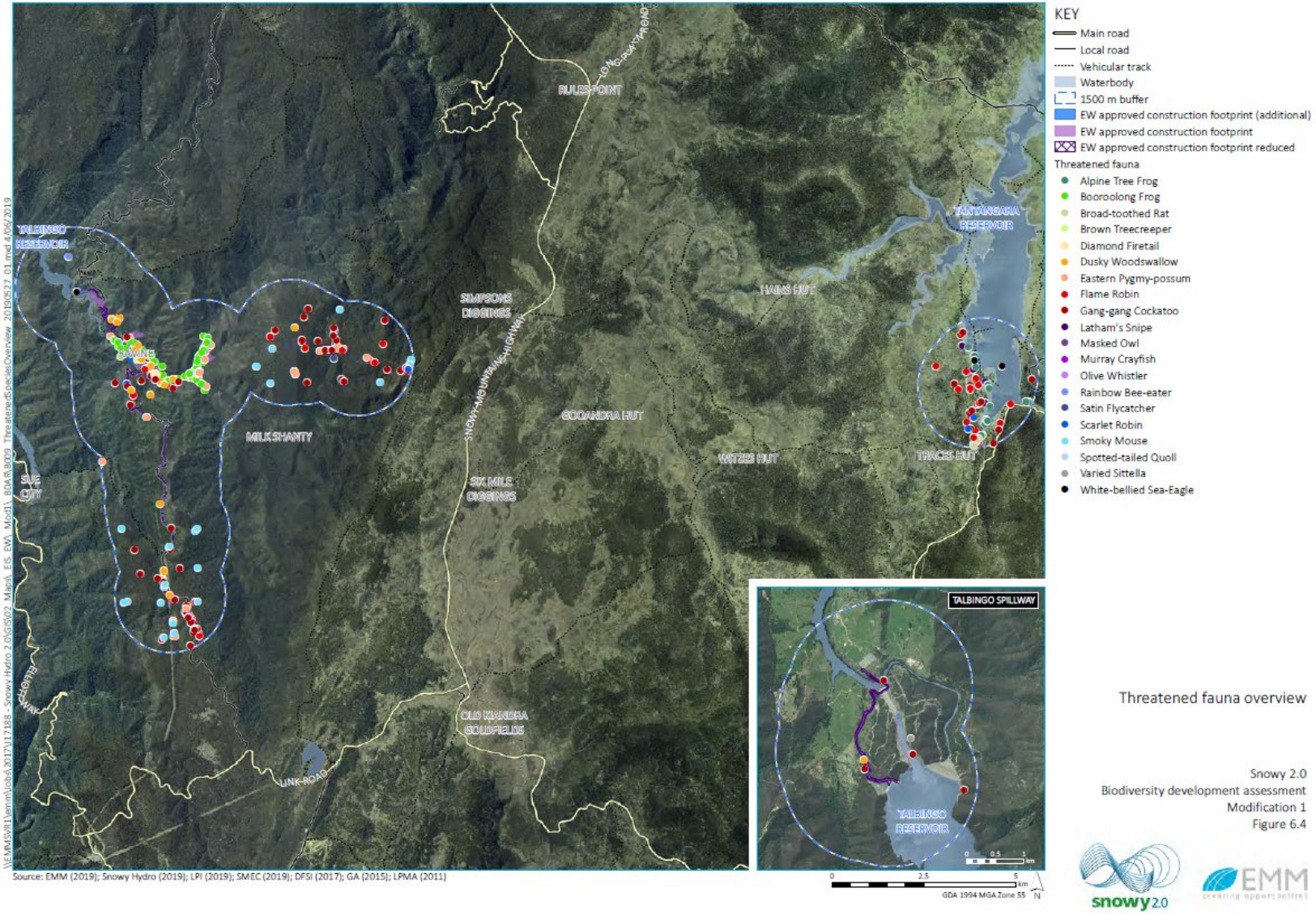



Figure 4-2: Threatened fauna overview (EMM, Modification 1)

### 4.3.1. Smoky Mouse

The Smoky Mouse local population is unknown. The species was recorded at 13 locations along the upper section of Lobs Hole Ravine Road to around 1,100 m elevation. It is likely to occupy this entire ridge, given the extent of suitable habitat in this area.

Figure 4-3: Smoky Mouse (EMM EIS)

### 4.3.2. Eastern Pygmy-possum

The Eastern Pygmy-possum was recorded at numerous locations within or adjacent to the Exploratory Works disturbance and Exploratory Works Modification footprint, within the upper reaches of Lobs Hole Ravine Road to Lobs Hole and spanning across to Marica.

Figure 4-4: Eastern Pygmy-possum

### 4.3.3. Booroolong Frog

The Booroolong Frog was recorded within the survey area along the Yarrangobilly River, from the full supply level of Talbingo Reservoir to the upper reaches of the Yarrangobilly River, as well as along Wallaces Creek.

The Yarrangobilly River provides optimal breeding habitat for this species, with a series of cobble banks and bedrock structures along stream margins, with slow flowing water. These areas are connected by larger, slow-flowing pools.

It is likely that this population extends upstream to at least Blue Creek Firetrail (Dave Hunter OEH, pers. comm.).

Figure 4-5: Booralong Frog (EMM EIS, Robert Bird 2017)

### 4.3.4. Bird Species

The Diamond Firetail, Dusky Woodswallow, Scarlet Robin and Varied Sitella were recorded at disparate locations throughout the Project area, with limited records. The Flame Robin and Gang-gang Cockatoo was found to be abundant and dispersed throughout the Project area, with records from the top of Lobs Hole Ravine Road to Lobs Hole. Breeding habitat for the Gang-gang Cockatoo is limited to the tops of Lobs Hole Ravine Road and along the Yarrangobilly River. The Masked Owl was recorded at two locations within and adjacent to the Exploratory 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. Although the species may forage throughout the local area, breeding habitat is limited to these two locations.

## 4.4. Groundwater Dependant Ecosystems

Three PCTs were identified as Groundwater Dependent Ecosystems (GDEs) during the EIS studies:

- Broad-leaved Sally grass-sedge woodland (PCT 285);
- Brittle Gum - Peppermint open forest (PCT 296); and
- Riparian Blakeley's Red Gum – Broadleaved Sally woodland (PCT 302).

These PCTs are associated with the alluvial/colluvial areas along the Yarrangobilly River or associated tributaries. The groundwater study completed for the Exploratory Works concluded that alluvial/colluvial aquifers along the Yarrangobilly River are expected to experience some reductions in baseflow however, the level predicted is considered negligible and highly unlikely to affect GDEs.

Yarrangobilly Caves is a High Priority GDE listed within the Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011. Yarrangobilly Caves is located within the groundwater model domain for the whole project, approximately 8 km north of the current project area. Yarrangobilly Caves has been studied, and monitored, as part of the EIS groundwater assessment, and there are no impacts predicted to occur at Yarrangobilly Caves as a result of the Exploratory Works (EMM 2018a).

GDEs are further discussed in the Water Management Plan Appendix B Groundwater Management Plan.

### 4.5. Pest Species

There are a number of wild animals in the KNP region, including feral cats, foxes, brumby horses, dogs and deer. Within the Exploratory Works footprint, the main pest species of concern of growth in population and activity is the *Felis catus* (feral cat) and *Vulpes vulpes* (Red Fox) and their consequent 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 (NPWS 2001, DEWHA 2008, DoE 2015) with impacts from feral cats also listed as a key threat to the Smoky Mouse (Menkhorst and Broome 2008a, 2008b). Introduced predators are also considered a threat to Eastern Pygmy-possums (NSWSC 2001).

### 4.6. Weeds

Areas which have experienced considerable disturbance within the Exploratory Works footprint exhibit evidence of weeds. There are three identified weeds of significance in gullies and along Yarrangobilly Creek and Talbingo Reservoir and one high threat weed (Ox-eye daisy) within the southern part of Tantangara spanning west towards Nungar track. These weeds are:

- *Hypercium perforatum* (St. Johns Wort);
- *Leucanthemum vulgare* (Ox-eye Daisy);
- *Rosa rubiginosa* (Sweet Briar); and
- *Rubus* spp. (Blackberry).

Both watercourses (Wallaces Creek and Yarrangobilly River) are subject to significant weed infestation and in particular with Blackberry. Blackberry, a Weed of National Significance (WoNS), has established itself to the point of infestation within the area, particularly in gullies and along the Yarrangobilly River.

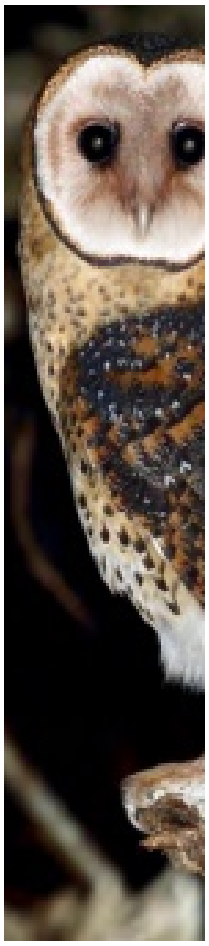
## 5. ENVIRONMENTAL ASPECTS AND IMPACTS

### 5.1. 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 biodiversity impacts are identified in Table 5-1. 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 5-1: Biodiversity aspects, impacts and environmental factors**



| Environmental Aspects (Construction activities that may impact biodiversity) | Environmental Impacts | Environment Factors (Conditions) |
|---|---|---|
| Clearing native vegetation<br>Topsoil stripping<br>Bulk earthworks<br>Soil movement and transfer<br>Material stockpiles and emplacement areas<br>Bridge construction and waterway crossings<br>Operation of compounds<br>Movement of vehicles<br>Use of artificial lights | • Loss of 108.58 ha of native vegetation<br>• Loss of 81.28 ha of potential habitat for threatened species including:<br>– Slender greenhood (0.28ha);<br>– Gang-gang cockatoo (0.91ha);<br>– Eastern pygmy possum (74.92ha);<br>– Booroolong frog (2.48ha);<br>– Masked owl (0.9ha);<br>– Smoky mouse (1.77ha);<br>– Alpine Tree Frog (0.03ha).<br>• Loss of riparian vegetation<br>• Potential for fauna mortality<br>• Potential for increase in weeds and pathogens<br>• Potential for increase in feral animals (feral cat and red fox)<br>• Disturbance of river/creek beds and banks<br>• Potential for impact on frogs and aquatic ecology<br>• Fauna species movement, reproduction and gene flow due to impacts on connectivity<br>• Fragmentation of habitats and associated impacts to connectivity and fauna movement<br>• Mobilisation of sediments during periods of wet weather | Site conditions and prior site disturbance<br>Water quality<br>Weed and pest animal presence and abundance<br>Soil types and the mobilisation of sediments |

The impacts on Smoky Mouse habitat (a critically endangered species in NSW) is potentially the most serious. No road widening works will be carried out during Exploratory Works in the area of identified habitat, which is primarily limited to the upper section of Lobs Hole Ravine Road.

The Booroolong Frog may be indirectly impacted by changes to water quality through the introduction of sediments from construction site runoff. On the basis of the assessment of the existing aquatic environment and the scope of the Exploratory Works the aquatic ecology assessment concluded that impacts would not significantly compromise the functionality, long-term connectivity, viability of habitats, or ecological processes within assemblages of biota beyond the small affected areas.

Mobilisation of fine sediments into the watercourses located in the survey area is unlikely to result in long-term impacts to aquatic environments; these events will be pulse events and will be rapidly flushed out of the system resulting in negligible impacts to threatened species (Dave Hunter OEH pers. comm.). Likewise, short term reductions in water quality are unlikely to result in impacts to aquatic environments, as they will be rapidly flushed out of the system. The key mechanism for impacting on aquatic environments will be mobilisation of large amounts of coarse sediment, which

clog interstitial spaces providing key breeding habitat for the Booroolong Frog, or long-term negative changes to water quality.

A 50 m buffer zone is proposed on either side of Yarrangobilly River and Wallaces Creek. The Mine Trail Road upgrade will disturb the proposed 50 m Yarrangobilly River and Wallaces Creek buffer zone at three discrete locations: the bridge over the Yarrangobilly River; the bridge over Wallaces Creek; and along Mine Trail Road in the eastern section of Lobs Hole Ravine. The bridge design for both locations will include a single span bridge. This has been recommended to minimise structures within the river or creek, to maintain fish passage and to avoid impacts to Macquarie Perch, if they are present.

Residual impacts following implementation of all controls include:

- clearing of 108.58 ha of native vegetation; and
- impacts to 81.24 ha of threatened species habitat for seven species credit species.

Residual impacts will be offset in accordance with the objective and principles outlined in the biodiversity offset strategy which has been developed as a separate document to the BMP.

Impacts to Murray Crayfish are addressed further in the Aquatic Habitat Management Plan and Dredge Management Plan for any impacts within the Yarrangobilly River and Talbingo Reservoir from activities associated with minor dredging. In addition, impacts to aquatic environments that might be caused by erosion associated with dredging and other waterways/ surface water activities are addressed in Surface Water Management Plan and/ or Dredge Management Plan.

During site facilities establishment, site layout will be arranged so that adequate bushfire Asset Protection Zones (APZs) can be established. Bushfire risks are addressed further in the Emergency (Bushfire) Management Plan.

# 6. ENVIRONMENTAL MANAGEMENT MEASURES

## 6.1. Management Measures

A range of environmental requirements and control measures are identified in the Exploratory Works EIS, Submissions Report and the CoA. 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 6-1. The following mitigation measures are applicable to Stage 2 scope of works. However, Stage 1 mitigation measures/requirements have also been included for completeness.

Table 6-1: Biodiversity management measures

| ID | Measure / Requirement | Application | When to implement | Responsibility | Source document |
|---|---|---|---|---|---|
| **General** | | | | | |
| 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, toolboxes and targeted training. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| BM02 | Relevant biodiversity management measures from this plan will be included in site environmental documents including for example, Work Method Statements (WMS) and/or Site Environmental Plans (SEPs) and/or Construction Management Plans (CMP). | Stage 1<br>Stage 2 | Construction | Contractor | Good practice |
| BM03 | Where changes to design require consideration of works outside the approved construction footprint, the design will be referred to Snowy Hydro for approval and advice regarding further assessment and approval requirements in accordance with the EMS. | Stage 1<br>Stage 2 | Design / Construction | Contractor | Good practice |
| BM04 | In the event that threatened species or endangered ecological communities are unexpectedly identified during construction the Unexpected Threatened Species Procedure (UFX) included in Appendix D will be followed. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01 |
| BM05 | A project ecologist will be appointed prior to the commencement of construction. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| BM06 | The accommodation camp has been sited in an area identified as lower quality vegetation and is consistent with the biodiversity assessment within the Exploratory Works EIS. | Stage 2 | Design / Construction | Contractor | REMM ECO03 |
| BM07 | Where practicable the site layout will be arranged so that adequate bushfire Asset Protection Zones (APZs) can be established without impacting the 50 m Yarrangobilly River buffer. | Stage 1<br>Stage 2 | Construction | Contractor | REMM PUS02 |
| BM08 | Vehicle traffic movements along Upper Lobs Hole Ravine Road will be:<br>• limited to between sunrise and sunset<br>• limited to 40km/h; and<br>• reduced through the use of a barge to transport heavy machinery, construction equipment and materials.<br>• Any night time movements would be limited to 20km/hr<br>Restrict vehicle speeds along Coppermine Trail, Wallaces Creek Trail and access tracks in the Marica area to 20 km/h between sunrise and sunset. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO05<br>REMM M1.3<br>Sch 3, Cond 46(b) |

| ID | Measure / Requirement | Application | When to implement | Responsibility | Source document |
|---|---|---|---|---|---|
| | *Note: Sunrise and sunset times are to be taken from the nearest Bureau of Meteorology centre* | | | | |
| BM09 | Construction lighting and resulting glare will be minimised where it can be shown that to do so would not compromise safety. All lighting should incorporate cut-off shields and be directed downward toward work activities, away from the night sky and away from known locations of light-sensitive habitat. This will include known Smoky Mouse habitat and the Yarrangobilly River. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| **Vegetation clearing, protection and management** | | | | | |
| **Preclearing** | | | | | |
| BM10 | The Contractor must not clear more than:<br>a) 0.04 ha of known breeding habitat for the Booroolong Frog;<br>b) 2 ha of dispersal and refuge habitat for the Booroolong Frog; or<br>c) 81.7 ha of habitat for the Spotted Tail Quoll. | Stage 1<br>Stage 2 | Pre-construction / Construction | Snowy Hydro/ Contractor | EIS |
| BM11 | The contractor is to apply an avoidance footprint to the following areas:<br>• provide a 50 m setback from the Yarrangobilly River and Wallace Creek to prevent disturbance of vegetation within sensitive riparian areas and Booroolong frog habitat, and<br>• limit clearing and disturbance to that approved through the EIS for the section along Upper Lobs Hole Ravine Road to avoid clearing identified Smoky Mouse (threatened species) habitat.<br>The avoidance footprint will be appropriately fenced and designated as a No-go/Exclusion Zone prior to commencement of works. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01 |
| BM12 | During Exploratory Works frog exclusion fencing will be installed in key areas where infrastructure is located in close proximity to Booroolong Frog primary habitats. The fencing will be designed to minimise frogs from being able to access the sediment basins. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO06 |
| BM13 | So as to minimise disturbance, where reasonable and feasible, remnant native vegetation shall be retained between the disturbance footprint and the approved development footprint boundary. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| BM14 | The clearing of native vegetation shall be minimised with the objective of reducing impacts to any threatened species or TECs where feasible and reasonable. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| BM15 | Within the site, exclusion zones will be established around all areas of retained | Stage 1 | Construction | Contractor | REMM ECO01 |

| ID | Measure / Requirement | Application | When to implement | Responsibility | Source document |
|---|---|---|---|---|---|
| | vegetation and fauna habitat. These areas will be fenced using appropriate fencing materials and designated and signed as 'No-go Zones' or 'Environmentally Sensitive Areas'. | Stage 2 | | | |
| BM16 | Existing trees, plants and other vegetation that are to remain within or adjacent to the Site will be maintained to prevent damage or injury to them. Operations will be planned or carried out to ensure that there is no damage to any trees or vegetation outside the disturbance footprint. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01<br>Tender guideline |
| BM17 | Tree protection zones (TPZs) will be set up around all trees retained within and adjacent to the disturbance footprint, noting that there is no access outside the assessed EIS boundary. Tree assessment and management protocols consistent with AS 4970-2009 Protection of trees on development sites will be implemented prior to clearing. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01 |
| BM18 | A collection of indigenous native seed and alpine sods shall be collected from areas identified to be disturbed, for propagation and use in the final landscaping works. | Stage 1<br>Stage 2 | Pre-construction / Construction | Snowy Hydro [update following Rehabilitation Strategy] | Rehabilitation Strategy |
| BM19 | A Clearing and Grubbing Construction Method Statement (CMS) will be prepared prior to clearing activities. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| BM20 | The pre-clearing procedure provided in Appendix C will be implemented during construction. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01 |
| BM21 | The limits of clearing will be clearly delineated on site prior to the proposed commencement of clearing.<br>An ecologist will be engaged to undertake a pre-clearing walk along the entire site with SHL prior to the proposed commencement of clearing. The ecologist will:<br>• check for the evidence of presence of flora and fauna species;<br>• flag key habitat features, including (but not limited to) nests, hollow bearing trees (HBTs) or large logs, caves, mineshafts and rock outcrops and overhangs;<br>• identify nearby habitat suitable for the release of any that may be encountered during clearing works;<br>• careful inspection of habitat for frog species within the 50m buffer zone; and<br>• 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.<br>The supervisor, operator and environmental advisor are to walk the clearing footprint | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01<br>Tender guideline<br>Good practice |

| ID | Measure / Requirement | Application | When to implement | Responsibility | Source document |
|---|---|---|---|---|---|
| | prior to commencing clearing. | | | | |
| BM22 | Clearing limits/disturbance footprint will be delineated using highly visible, durable, continuous barrier such as safety flagging, or other similarly robust and durable material. Delineation will be installed consistently through the Project to reduce the risk of error or misinterpretation of boundaries. 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.<br>"Environmental Protection Area" signs will be placed in prominent positions along each section of exclusion fencing as shown on the Drawings, sensitive areas or directed by the Principal. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01<br>Good practice<br>Tender guideline |
| BM23 | 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. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01<br>Tender guideline |
| BM24 | Prior to undertaking vegetation clearing, pre-clearance inspections will be undertaken by appropriately qualified ecologists in line with the Pre-clearing and clearing procedure (Appendix C). The pre-clearing inspections will:<br>• check for the evidence of presence of flora and fauna species;<br>• flag key habitat features, including (but not limited to) nests, HBTs or large logs; and<br>• identify nearby habitat suitable for the release of any that may be encountered during clearing works. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01<br>Good practice<br>Tender guideline |
| BM25 | HBTs marked for removal as well as caves, mineshafts and rock outcrops and overhangs will be checked by the Ecologist prior to felling/ disturbance and any animals found will be relocated to adjacent habitat. Ecologists should capture and/or remove fauna that have the potential to be disturbed as a result of clearing activities.<br>Where a HBT is felled, the tree hollows will be salvaged, and the salvaged sections reused as hollow replacements. The ecologists will monitor these periodically over the life of the EW project. Topsoil will also be salvaged, stored to retain beneficial use of native seed and re-used in the rehabilitation.<br>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 F. | Stage 1<br>Stage 2 | Construction and operation | Contractor | REMM ECO01<br>Tender guideline |
| BM26 | Prior to any disturbance of waterway banks, a thorough inspection by a qualified ecologist will be undertaken for aquatic fauna and frogs. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |

| ID | Measure / Requirement | Application | When to implement | Responsibility | Source document |
|---|---|---|---|---|---|
| BM27 | Ecologists will check areas adjacent to Yarrangobilly River prior to clearing for Booroolong Frog and translocate them to adjacent habitats away from impacts. In accordance with Appendix C and Appendix E | Stage 1 | Pre-construction / Construction | Contractor | REMM ECO07 |
| BM28 | Prior to site disturbance the site shall be inspected by the Ecologist and areas of weed infestation identified to avoid weed spread. Weed hygiene protocols, eradication and removal will be managed in accordance with the Weed and Feral Animal Management Plan included in Appendix F. | Stage 1<br>Stage 2 | Pre-construction / Construction | Contractor | REMM ECO01 |
| **Clearing** | | | | | |
| BM29 | Vegetation clearing works are to follow the Pre-clearing and clearing procedure (Appendix C), as outlined below:<br>• Stage 1 will include the removal of all non-habitat vegetation (e.g. shrubs, regrowth, ground cover and non-habitat trees). 24-48 hours will be allowed between Stage 1 and Stage 2.<br>• Stage 2 will include the removal of all habitat vegetation:<br>– nests and on-ground logs will be carefully inspected by an ecologist. Logs should be carefully rolled and inspection beneath the log undertaken;<br>– habitat trees (trees with hollows or nests) will be carefully lowered to the ground with minimal impact and nests and hollows inspected by the ecologist;<br>– any fauna species are to be relocated to habitat identified during the pre-clearing process or, if injured, transported to a veterinarian or wildlife carer;<br>– where works are undertaken during the active period for the Booroolong Frog (October to March) the frog should be relocated to the nearest area of retained riparian habitat or where works are undertaken outside of the active period outlined above frogs should be taken into care. Agreement with an appropriately qualified and licensed carer will be required;<br>• Records are to be kept of all fauna rescue events including locations to where fauna have been relocated. Provide GPS coordinates for such events.<br>• Clearing data will be recorded and will be included in Project monthly reporting requirements.<br>• Erosion and sediment controls will be installed as per the SWMP to minimise risk to biodiversity | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01<br>Tender guideline |
| BM46 | Strips of screening vegetation shall be maintained between public roads and large cleared areas. When it is necessary to cut an access route through such an area, | Stage 2 | Construction | Contractor | Best Practice |

| ID | Measure / Requirement | Application | When to implement | Responsibility | Source document |
|---|---|---|---|---|---|
| | the access route shall join the public road at an angle that will minimise the visual impact of the break in vegetation. | | | | |
| BM47 | The Contractor shall store mulch in accordance with sub-clause 3.06.34.10 Mulch, including taking special precautions to prevent fire spreading from mulched stockpiles. The Contractor shall have available, at all times, suitable equipment and supplies for use in preventing and suppressing fires. | Stage 2 | Construction | Contractor | Best Practice |
| BM48 | During clearing no materials, plant or equipment including erosion and sediment controls will be stockpiled within exclusion zones and beneath the canopies of retained trees without seeking ecologist advice prior. | Stage 2 | Construction | Contractor | Best Practice |
| BM49 | Prior to excavation commencement, topsoil will be stripped. This includes any overhanging vegetation within 2m of the excavation extent. | Stage 2 | Construction | Contractor | Best Practice |
| **Aquatic habitat** | | | | | |
| BM50 | 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:<br>• incorporation of an enclosed, dark and long passage approach to the intake;<br>• if feasible, screening of the intake with at least 5 mm to 3 mm mesh screen. 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 within and immediately adjacent to the intake location; and<br>• if feasible, limiting the approach water velocity at the headwall during normal operation ideally to 0.1 m/s;<br>• locate the intake pump in deeper water where possible away from fish habitat such as woody debris and aquatic plants; and<br>• allow for pump start up procedures involving initial slow water velocity to reduce likelihood of aquatic biota being drawn into the pump. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO10 |
| BM51 | The permanent bridges at Yarrangobilly River and at Wallaces Creek will be designed with consideration of P*olicy 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). | Stage 1 | Construction | Snowy Hydro/ Contractor | REMM ECO11 |
| BM52 | The temporary bridges at Yarrangobilly River and at Wallaces Creek will be designed, constructed and removed to:<br>• adhere where practicable to 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 including; | Stage 1 | Construction | Contractor | REMM ECO12 |

| ID | Measure / Requirement | Application | When to implement | Responsibility | Source document |
|---|---|---|---|---|---|
| | and<br>• 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;<br>• maintaining some unmodified channel remains so that a weir effect or flow through rock interstices only is not created where practicable;<br>• guidelines on the type of suitable fill material will be applied; and.<br>• temporary in-stream structures will be inserted during low-flow periods where possible, with management plans being submitted to NSW DPI detailing how high flow events will be managed to limit erosion of the structures and associated sedimentation of downstream waterways.<br>• ensure any build-up of debris which is potentially obstructing to fish passage will be removed; and<br>• the temporary structures will be removed and the river channel rehabilitated following construction of the permanent bridges. | | | | |
| BM53 | Construction and removal of the temporary bridge at Yarrangobilly River will avoid or minimise in-stream works likely to affect fish passage during the migration time of Macquarie Perch (October to January) where possible. | Stage 1 | Construction | Contractor | REMM ECO13 |
| BM54 | Streams to be crossed perpendicular to flow and where possible crossing sites selected to avoid unstable banks, bends in the channel, deep pools and confluences with other channels. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| BM55 | The bed and banks are to be reinstated to a condition similar to or better than the original condition ensuring that there are no adverse impacts on the aquatic values (different measures may be required for each crossing) and where feasible and reasonable, avoid impacts on geomorphic processes. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| BM56 | All construction materials used for watercourse crossings (rocks and gravel) are to be free of fine particles to minimise turbidity. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| BM57 | Instream and riparian disturbance will be minimised and sediment, woody snags or debris removed from a stream or stream channel will be minimised. Trimming or 'lopping' of branches and logs will be considered as a first option before moving. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| BM58 | Any instream woody debris removed during construction will be replaced at the completion of the works within the same waterways from which it was removed. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| BM59 | Fish that become stranded due to temporary access crossings or construction of temporary or permanent creek diversions must be captured and translocated | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |

| ID | Measure / Requirement | Application | When to implement | Responsibility | Source document |
|---|---|---|---|---|---|
| | following the DPI Fisheries Guidelines – A Guide to Acceptable Procedures and Practices for Aquaculture and Fisheries Research. | | | | |
| BM60 | Where possible, existing crossings would be used. Where this is not feasible or reasonable, the temporary crossings would be designed to minimise impacts on the existing aquatic ecology and water quality. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |
| BM61 | General temporary waterway access track mitigation measures would be undertaken:<br>• temporary crossings would be constructed from clean fill using pipe or box culvert cells to carry flows;<br>• all temporary works (e.g. crossings, flow diversion barriers) would be removed as soon as practicable and in a way that does not promote future channel erosion;<br>• the preferred temporary structure for crossing waterways would be consistent with Witheridge (2002) where the use of bridges is the preferred structure for Class 1 (major fish habitat waterways);<br>• scour protection works would be established at temporary crossings as required.<br>At the completion of construction, the temporary crossings would be removed and rehabilitated. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO12 |
| **Weeds, pests and disease** | | | | | |
| BM62 | 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 and Feral Animal Management Plan within Appendix F. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01 |
| BM63 | Pathogen measures as detailed within the Weed and Feral Animal Management Plan will be implemented to minimise the introduction and spread of weeds and pathogens including *P cimmamomi*. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01 |
| BM64 | If pathogens are identified on site, the measures detailed within the Weed and Feral Animal Management Plan will be implemented, including:<br>• testing may be required to confirm the presence of pathogens;<br>• advice from government departments will be sought on practical hygiene management measures;<br>• fenced exclusion zones will be identified to restrict access into contaminated areas. | Stage 1<br>Stage 2 | Construction | Contractor | REMM ECO01 |
| **Rehabilitation** | | | | | |

| ID | Measure / Requirement | Application | When to implement | Responsibility | Source document |
|---|---|---|---|---|---|
| BM65 | Woody debris including felled trees and bush rock will be re-used on site for habitat improvement where possible as detailed in the Landscape/Rehabilitation Management Plan. | Stage 1<br>Stage 2 | Construction | Contractor | Tender guideline |

## 6.2. Pre-clearing

As detailed within Table 6-1, prior to clearing the following will occur:

- the Pre-Clearing Procedure in Appendix C will be followed;
- an ecologist will be engaged for the Project;
- a Clearing and Grubbing Work Method Statement will be prepared;
- consultation with the ecologist will occur to determine the location of suitable nearby habitat for fauna release;
- clearing extent including exclusion zones, for environmentally sensitives areas as well as non-Future Gen assets, are to be physically and visually delineated prior to clearing commencement;
- "Environmental Protection Area" signs will be placed in prominent positions along each section of exclusion fencing as shown on the Drawings for items identified to remain such as sensitive areas, key flora elements, survey markers, bench marks, monuments or directed by the Principal;
- an inspection identifying the species and locations of weeds will be undertaken by the ecologist and relevant NPWS pest management officers;
    - pre-clearing surveys and assessments will be undertaken by a qualified and experienced ecologist and will demarcate all habitat trees and habitat features, including known and potential HBTs prior to the commencement of clearing. GPS coordinates will be recorded if not already available;
    - confirm the location for the release of fauna;
- 24 hours prior to clearing:
    - a check to ensure exclusion zones have been delineated and any biodiversity assets to be retained are marked;
    - a check to ensure temporary fencing required to be installed by prior to clearing, is in place. SHL are to be invited to join the inspection;
    - ecologists should capture and/or remove fauna that have the potential to be disturbed as a result of clearing activities;
    - relocate fauna into pre-determined habitat (as close to original site as possible as determined by ecologist) identified for fauna release;
    - all fauna handling should be carried out by ecologists (and liaise with licensed wildlife carers for availability of carers);
    - inform clearing contractors of any changes to the sequence of clearing if required;
    - update Sensitive Area Plans as required, as work is progressed.

## 6.3. Vegetation Clearing

A two-stage habitat removal process will be implemented and will involve the following steps:

### 6.3.1. Stage 1 – Non-habitat tree removal

When vegetation that may provide habitat for native fauna is proposed to be removed, the area will be surveyed immediately prior to clearing, to:

- obtain updated information on fauna and fauna habitat resources present;
- capture and relocate non-mobile fauna, such as reptiles and frogs and key habitat features such as active bird nests;
- if not already available, record the details for all HBTs and trees containing threatened fauna and flora include GPS location, species, type of habitat feature, size of hollow and type of hollow;
- an experienced and licensed wildlife carer and/or ecologist will be present during all removal of habitat trees to capture and relocate any encountered fauna;
- remove non-habitat vegetation first;
- trees cleared shall be cut off not higher than 300 mm above existing ground, measured on the uphill side;
- identified habitat (e.g. HBTs) will be left for 24-48 hours after removing non-habitat vegetation to allow fauna to escape;
- remove habitat trees as carefully as possible to avoid injury to any fauna remaining in trees;
- an experienced and licensed wildlife carer and/or ecologist will inspect habitat once it is removed;
- all hollows will be placed in adjacent habitat until the following day for further inspection by a licensed wildlife carer and/or ecologist to verify no fauna is present. If possible, the hollows will be permanently relocated in adjacent areas in accordance with the RMS Biodiversity Guidelines (RTA, 2011);
- cleared materials shall not be pushed or felled into areas not designated to be cleared;
- vegetation and topsoil that can be re-used as in whole form (trunks/branches >100mm diameter) or mulched is to be retained for ground and slope stabilisation and used appropriately. All other inorganic or unsuitable organic material shall otherwise be disposed of in a suitable manner;
- records are to be kept of all fauna rescue events including locations to where fauna have been relocated. Provide GPS coordinates for such events;
- all on-going weed management will be undertaken in accordance with the Weed and Feral Animal Management Plan.

### 6.3.2. Stage 2 – Habitat tree removal

Habitat trees will be retained for approximately 24-48 hours after stage 1 clearing is completed.

Trees will be inspected immediately prior to felling. Ecologists should capture and/or remove fauna that have the potential to be disturbed, injured or killed as a result of clearing activities. Captured fauna would be relocated into habitat identified for fauna release as soon as possible after capture.

Habitat trees will be felled carefully using machinery such as an excavator with a claw. Importantly, the equipment used to fell trees will be appropriately sized to handle the majority of trees on-site and the operator skilled in removing habitat trees and the two-stage clearing procedure. The

ecologist will discuss the method of felling (i.e. orientation, equipment etc.) with the operator to ensure there is a balance between operator safety and animal welfare. Once felled, habitat trees will be inspected carefully by ecologist/s and fauna would be captured, processed and, if healthy, relocated. Injured fauna will be taken to a local vet for treatment.

Clearing requirements are provided in the Roads and Maritime Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA projects (RTA, 2011). Trees cleared shall be cut off not higher than 300 mm above existing ground, measured on the uphill side. Cleared materials shall not be pushed or felled into areas not designated to be cleared.

### 6.4. Unexpected Threatened Species Find Procedure

If any threatened species or threatened ecological community is unexpectedly encountered during construction activities, the Unexpected Threatened Species Finds Procedure provided in Appendix D will be followed.

# 7. COMPLIANCE MANAGEMENT

### 7.1. Monitoring and Inspection

A number of monitoring programs will occur to assess the impacts on and survival of three key species within the Project footprint. These are for the Smoky Mouse and the Booroolong frog. These monitoring programs are presented within Appendix B and C.

Monitoring will also occur to monitor water quality within Yarrangobilly River, Wallaces Creek and Talbingo Reservoir. The Water Quality Monitoring Program is included within Appendix A of the Surface Water Management Plan. Monitoring of Aquatic habitat is presented in the Aquatic Habitat Management Plan (EMS – Appendix B7).

Details of the weed, pathogen and feral animals monitoring to be undertaken during construction are provided in the following sections.

Weekly environmental inspections of the Project will occur in accordance with Section 8 of the EMS.

#### 7.1.1. Weed and Pathogen Monitoring

Several weed and pathogen controls, are outlined in this document, to ensure the Project does not have a significant negative impact on key fauna habitats. The monitoring program will include:

- construction of wash-down stations or the use of alternate hygiene protocols at suitable locations where practicable;
- 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;
- implementation of a weed and pathogen monitoring program;
- implementation of a weed control program if weeds are identified within the site;
- soil testing, including baseline and ongoing testing, for pathogens such as *P.cinnamomi;*
- baseline surveys, prior to works, to document weed species present, as well as cover and abundance, in key habitats such as at the top of Lobs Hole Ravine Road, adjacent to the tunnel portal and construction pad, and adjacent to the accommodation camp; and

- the monitoring program will include a repeatable and objective measure of weed cover at varying distances from key infrastructure. It is suggested that a modified version of the biometric assessment method (OEH 2014) is applied.

The weed and pathogen monitoring program has been developed in conjunction with NPWS, OEH and SHL. The monitoring program outlines triggers and adaptive management measures for the monitoring program for Stage 1 Exploratory Works and has been updated to incorporate Stage 2 Exploratory Works scope. Refer to Appendix F of this plan.

### 7.1.2. Feral Species Monitoring

To document changes in the abundance of feral species arising from increased human activity, and inform location and extent of controls, a feral species monitoring program will be implemented. Monitoring will include:

- remote camera surveys along trails and adjacent to key infrastructure; and
- a predator control program will be implemented, in conjunction with OEH and NPWS, to control feral animals.

The feral species monitoring program has been developed in conjunction with NPWS, OEH and SHL. The monitoring plan outlines triggers and adaptive management measures for the monitoring program for Stage 1 Exploratory Works and has been updated to incorporate Stage 2 Exploratory Works scope.

## 7.2. Training

All site personnel will undergo the Future Gen site induction training relating to biodiversity including threatened species and habitat protection management issues.

The induction training will address elements related to biodiversity management including:

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

Targeted training in the form of toolbox talks or specific training will also be provided 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;
- the unexpected finds procedure for threatened species;
- the procedures regarding management of weeds or pathogens.

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

## 7.3. Incident Notification

Incidents will be managed in accordance with Section 8 of the EMS. In the event of the occurrence of an incident, the Future Gen Environment Manager will immediately inform SHL who will contact Department of Planning, Industry and Environment in accordance with the requirements of Schedule 4, Condition 5 of the Infrastructure Approval.

Notifications on non-compliance will be carried out in accordance with Section 9.4.2 of the EMS and Schedule 4, Condition 6 of the Infrastructure Approval.

## 7.4. Auditing

Audits will be undertaken to assess the effectiveness of the management measures, compliance with this BMP, the Project CoA (Schedule 4, Condition 9 of the Infrastructure Approval), Exploratory Works EIS, REMMs and other relevant approvals, licences and guidelines.

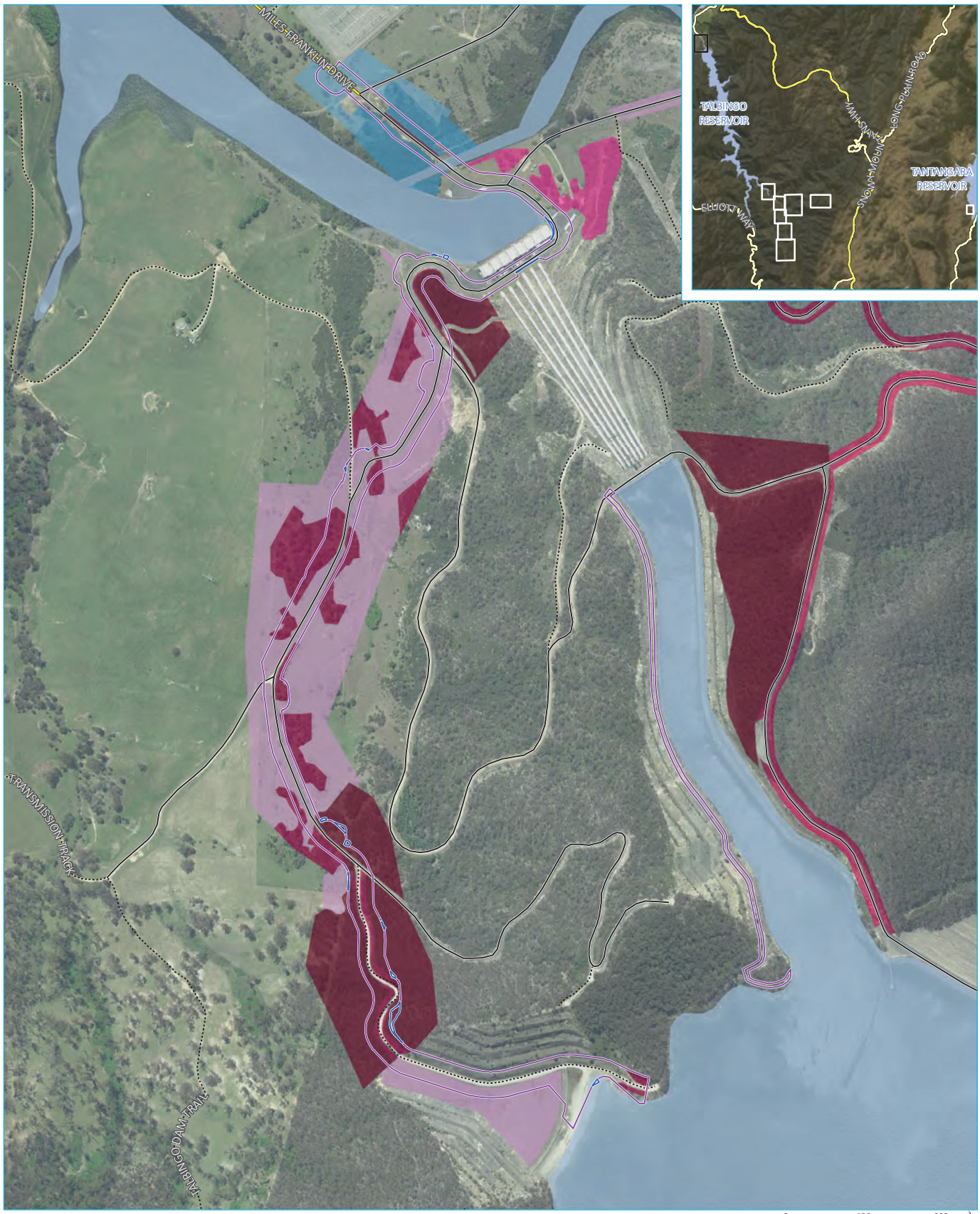
Audit requirements are detailed in Section 8 of the EMS.

## 7.5. Reporting

Reporting will include regular compliance reporting to DP&E and NPWS as required by Schedule 4, Condition 7 and 8 of the Project CoA. The regular compliance reports will track compliance against the Project CoA and the REMMs. Reporting requirements and responsibilities are documented in Section 8 of the EMS.

Future Gen are required to provide updated reports on the outcomes of clearing processes as well as digital spatial data to SHL who will provide to NPWS.

# APPENDIX A – PLANT COMMUNITY TYPES AND VEGETATION ZONE MAPPING (EIS)




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

0 150 300 m

GDA 1994 MGA Zone 55

N

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KEY

- Main road
- Local road
- Vehicular track
- EW approved construction footprint (additional)
- EW approved construction footprint
- Waterbody

PCT 311
- High
- Medium
- Low
- Poor
- Other
- Derived grassland

PCT 650
- Medium
- Derived grassland

# Plant Community Type and vegetation zone mapping within the additional Modification 1 areas

Snowy 2.0
Modification 1 Response to Submissions
2.1 a

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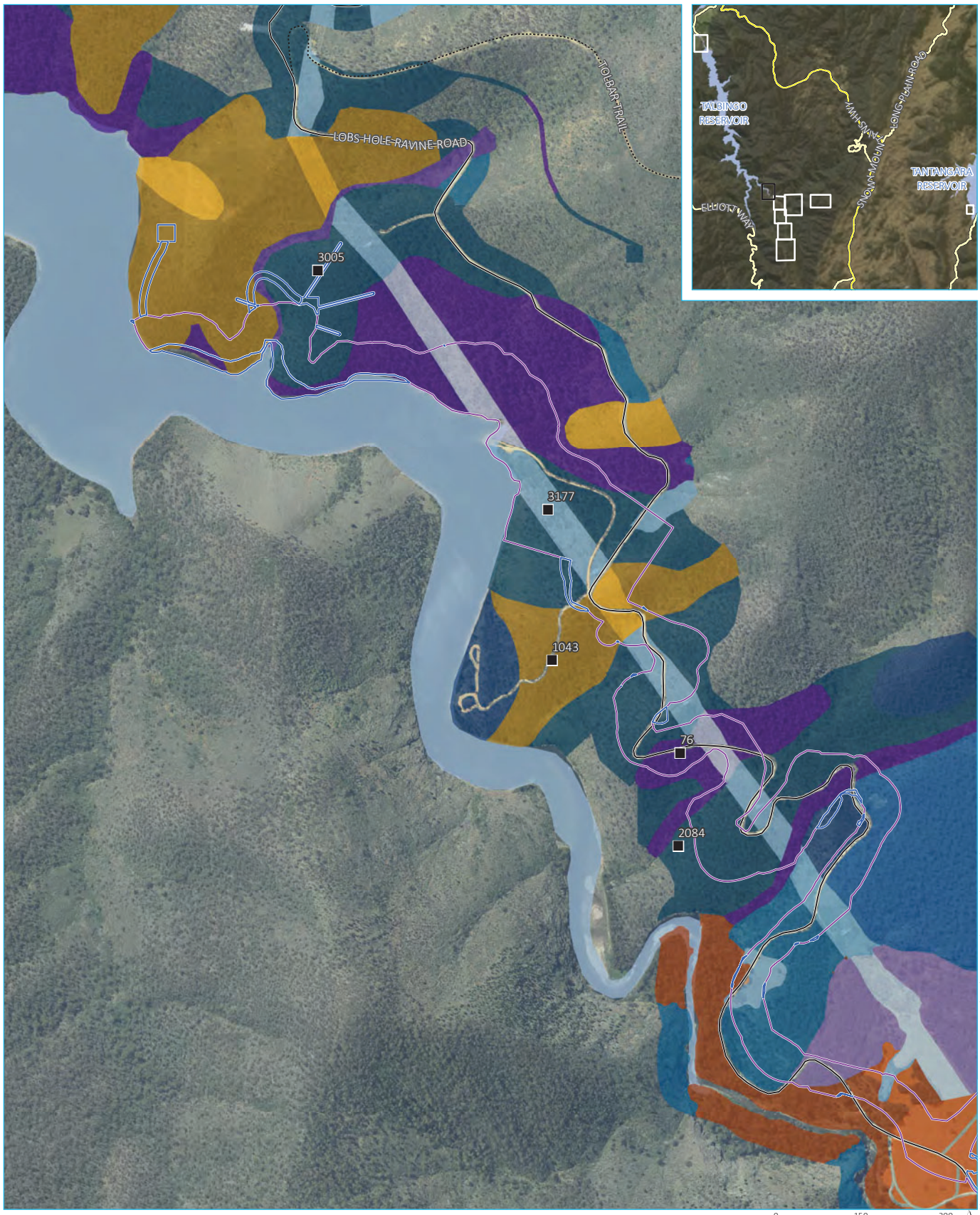


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 150 300 m

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KEY

- Plot location
- Local road
- Vehicular track
- EW approved construction footprint (additional)
- EW approved construction footprint
- Waterbody

PCT 285
- Medium
- Derived grassland

PCT 296
- High
- Medium
- Derived grassland

PCT 300
- High
- Medium
- Derived grassland

PCT 302
- High
- Medium
- Low
- Other

PCT 729
- High
- Medium
- Derived grassland

PCT 1191
- High
- Medium
- Derived grassland

# Plant Community Type and vegetation zone mapping within the additional Modification 1 areas

Snowy 2.0
Modification 1 Response to Submissions
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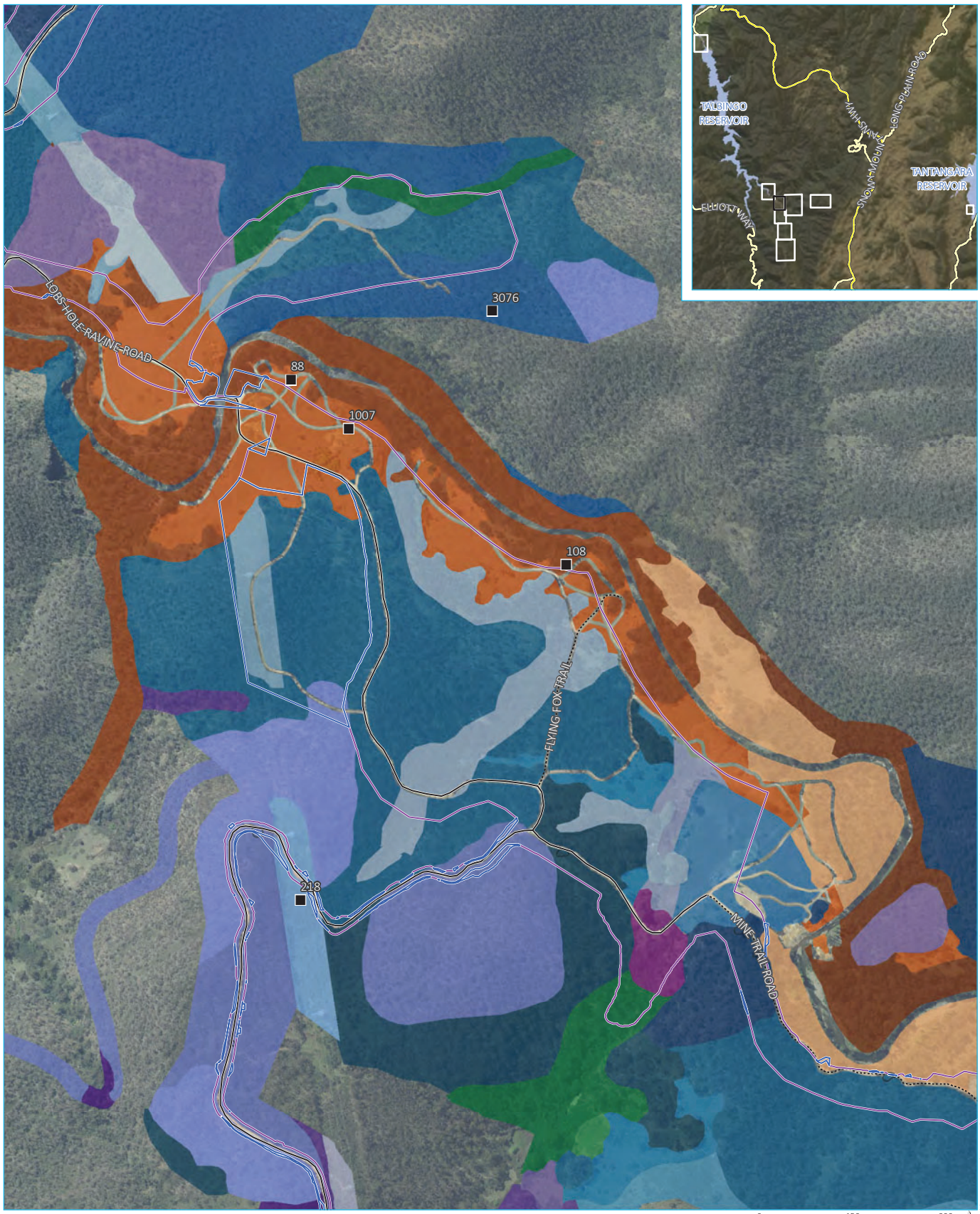


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 150 300 m

GDA 1994 MGA Zone 55

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KEY

- Plot location
- Local road
- Vehicular track
- EW approved construction footprint (additional)
- EW approved construction footprint

PCT 299
- Medium
- Low

PCT 285
- High
- Medium
- Low

Poor
Derived grassland

PCT 296
- High
- High - tree
- Medium
- Low
- Poor
- Derived grassland

PCT 300
- High
- Medium

Low
Derived grassland

PCT 302
- High
- Medium
- Low
- Poor
- Other
- Derived grassland

PCT 729
- High
- High - tree

Medium
Medium - tree

- Low
- Poor
- Derived grassland

PCT 999
- High
- High - tree
- Medium
- Derived grassland

# Plant Community Type and vegetation zone mapping within the additional Modification 1 areas

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Modification 1 Response to Submissions
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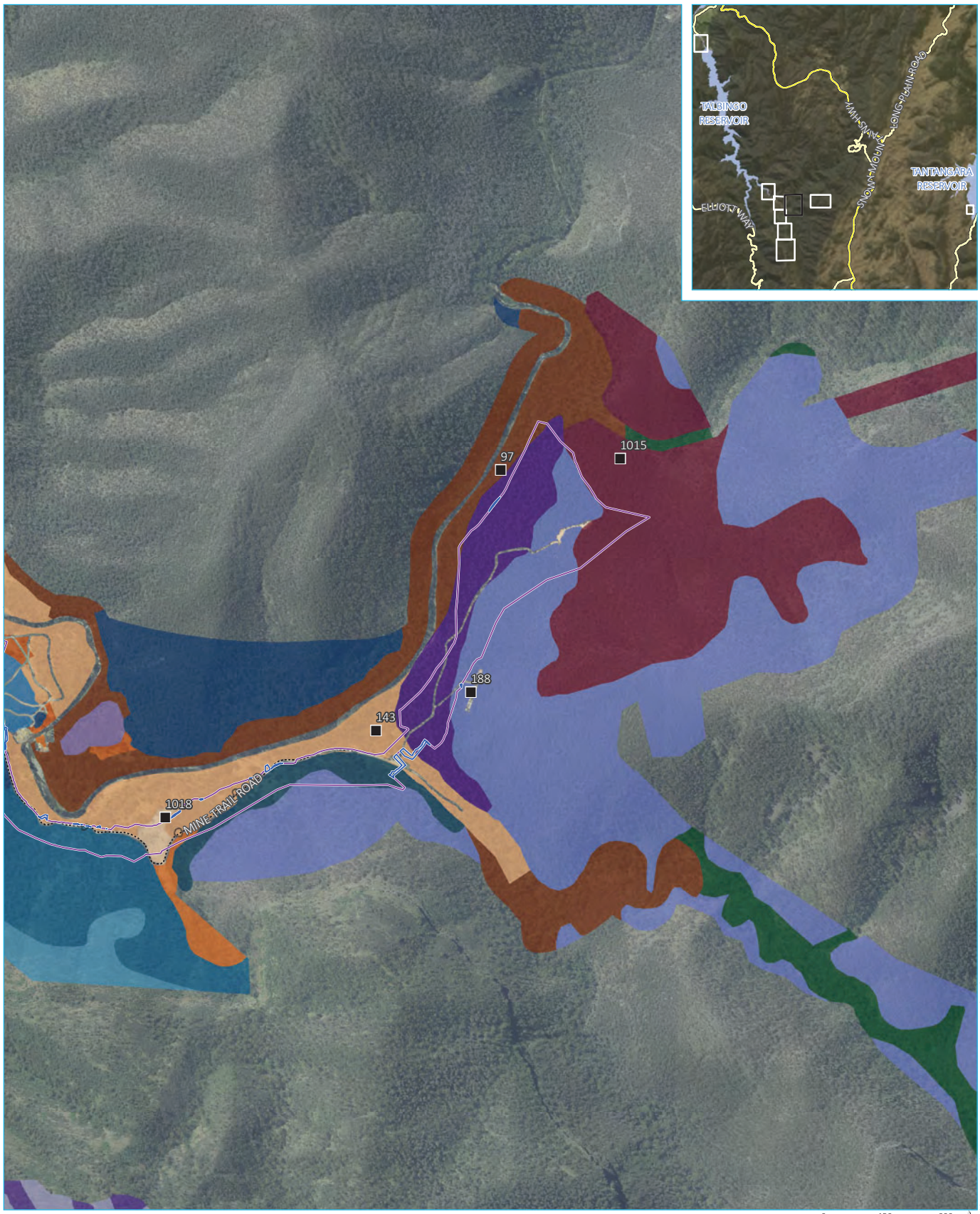


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 150 300 m
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KEY

- Plot location
- Vehicular track
- EW approved construction footprint (additional)
- EW approved construction footprint

PCT 299
- High

PCT 285
- Medium

PCT 296
- High
- Low

PCT 300
- High
- Medium
- Other

PCT 302
- High
- Low
- Poor
- Poor - tree
- Other
- Other - tree

- Derived grassland

PCT 311
- High

PCT 729
- High
- Medium
- Medium - tree
- Poor

PCT 999
- High

# Plant Community Type and vegetation zone mapping within the additional Modification 1 areas

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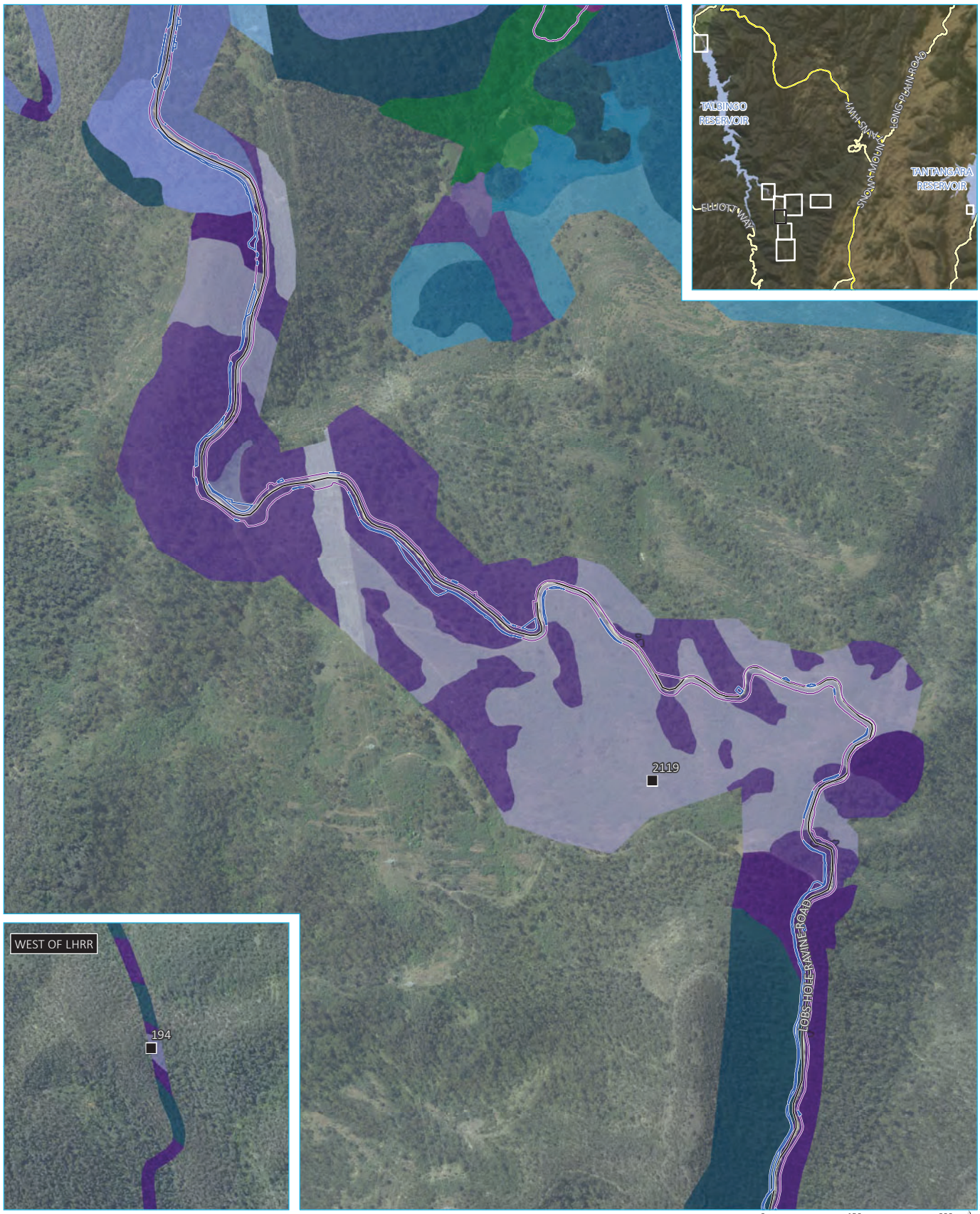


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 150 300 m

GDA 1994 MGA Zone 55

N

KEY

- Plot location
- Local road
- Vehicular track
- EW approved construction footprint (additional)
- EW approved construction footprint

PCT 299
- Medium
- Low

PCT 285
- High

PCT 296
- High

PCT 300
- High
- High - tree
- Medium
- Medium - tree
- Low
- Poor
- Other
- Derived grassland

PCT 302
- High
- Poor
- Other
- Other - tree
- Derived grassland

PCT 729
- High
- Medium
- Medium - tree
- Low

Poor

PCT 999
- High
- High - tree
- Medium
- Derived grassland

# Plant Community Type and vegetation zone mapping within the additional Modification 1 areas

Snowy 2.0
Modification 1 Response to Submissions
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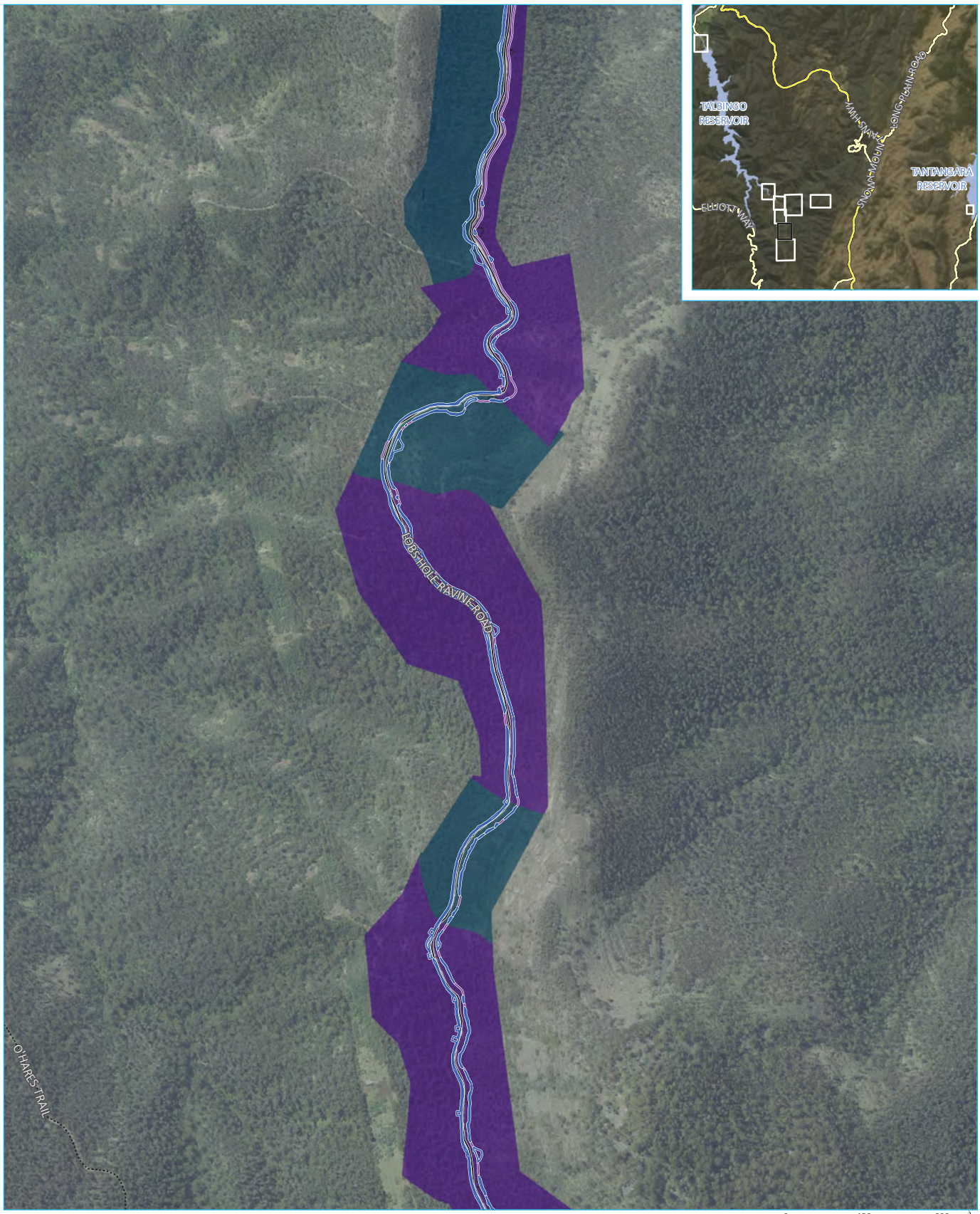


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 150 300 m

GDA 1994 MGA Zone 55

N

## KEY

- Local road
- Vehicular track
- EW approved construction footprint (additional)
- EW approved construction footprint

PCT 300
- High
- High - tree

PCT 729
- High
- High - tree

# Plant Community Type and vegetation zone mapping within the additional Modification 1 areas

Snowy 2.0
Modification 1 Response to Submissions
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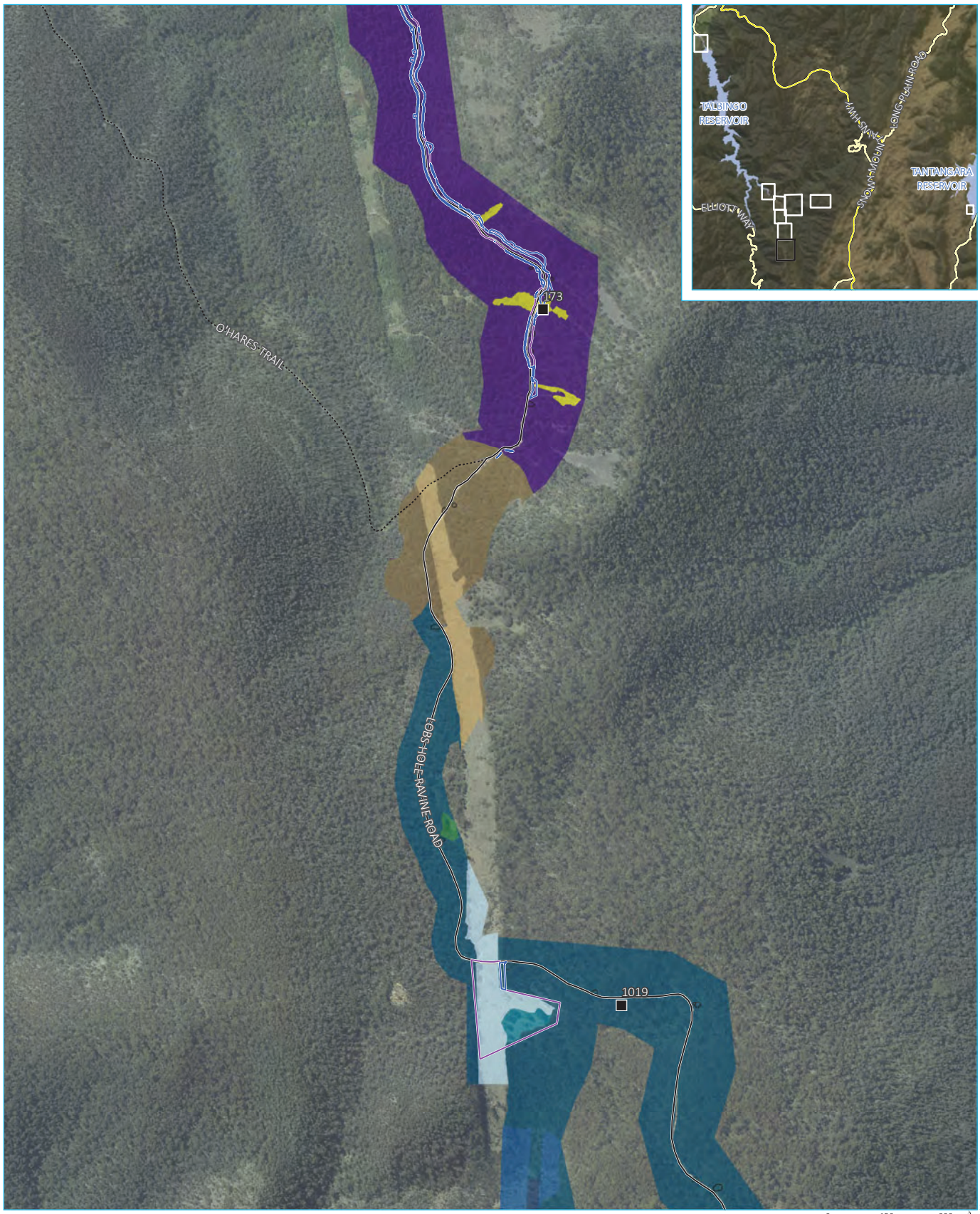


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 150 300 m
GDA 1994 MGA Zone 55

N

KEY

- Plot location
- Local road
- Vehicular track
- EW approved construction footprint (additional)
- EW approved construction footprint

PCT 296
- High
- Medium

PCT 300
- High
- High - tree

PCT 303
- High

PCT 637
- High

PCT 643
- Low

PCT 953
- High
- High - tree
- Derived grassland

PCT 1196
- High
- High - tree
- Medium
- Derived grassland

# Plant Community Type and vegetation zone mapping within the additional Modification 1 areas

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Modification 1 Response to Submissions
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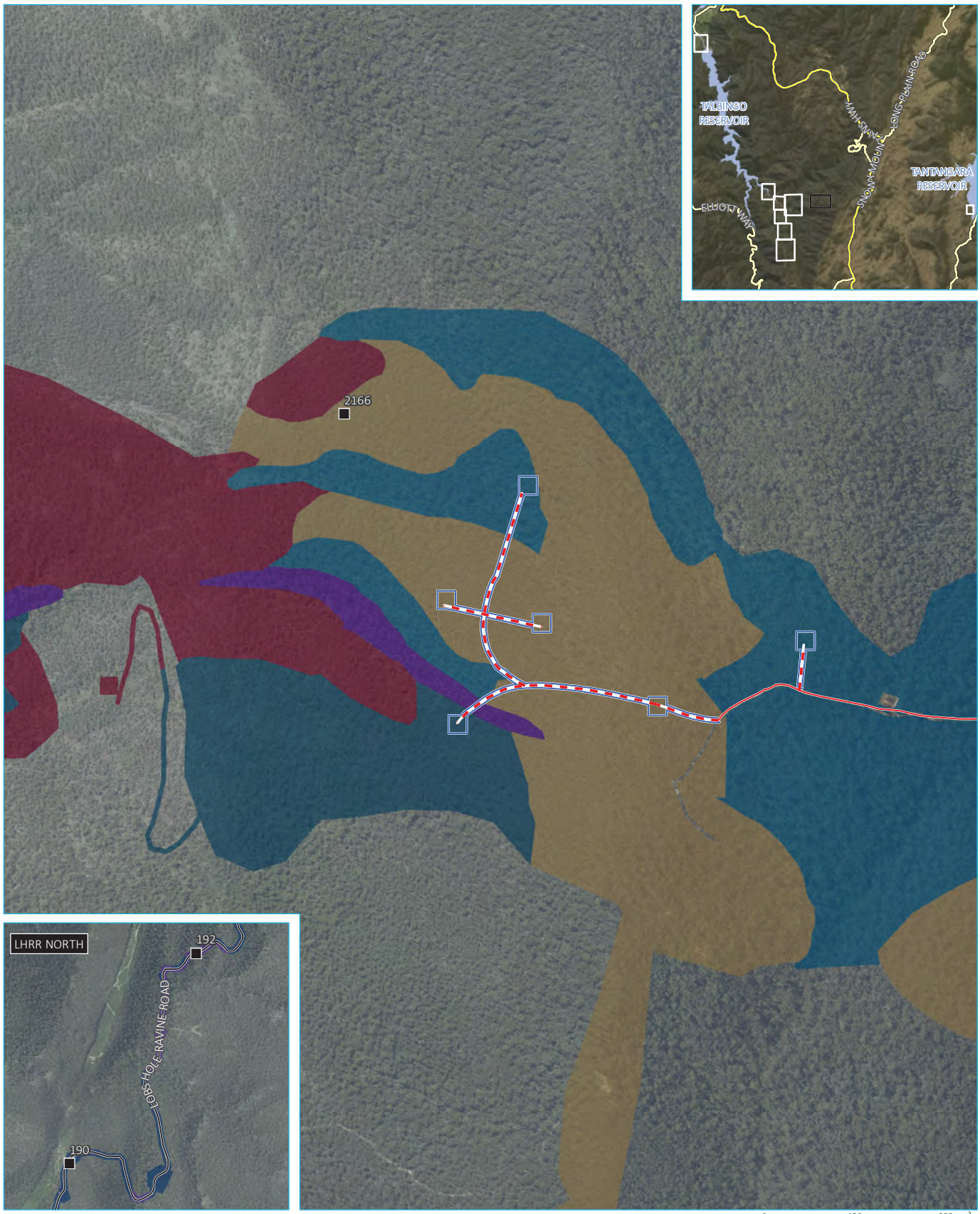


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 150 300 m
GDA 1994 MGA Zone 55

N

KEY

- Plot location
- Existing access track
- Proposed access track
- EW approved construction footprint (additional)

PCT 300
High

PCT 311
High

PCT 729
High

PCT 953
High

PCT 1196
High

# Plant Community Type and vegetation zone mapping within the additional Modification 1 areas

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Modification 1 Response to Submissions
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*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

KEY

- Plot location
- Vehicular track
- Existing access track
- Proposed access track
- EW approved construction footprint (additional)
- EW approved construction footprint
- Waterbody

- PCT 303
- High
- PCT 637
- High
- PCT 1196
- High
- PCT 1224
- High

0 100 200 m

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# Plant Community Type and vegetation zone mapping within the additional Modification 1 areas

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Modification 1 Response to Submissions
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*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous trees
- Vehicular track

PCT 285
- Medium

PCT 296
- High
- Low

PCT 302
- High
- Low

- Poor
- Poor - tree
- Other
- Other - tree
- Derived grassland

PCT 729
- High
- Medium
- Medium - tree
- Poor

PCT 999
- High

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
3.1 a

snowy 2.0

EMM creating opportunities

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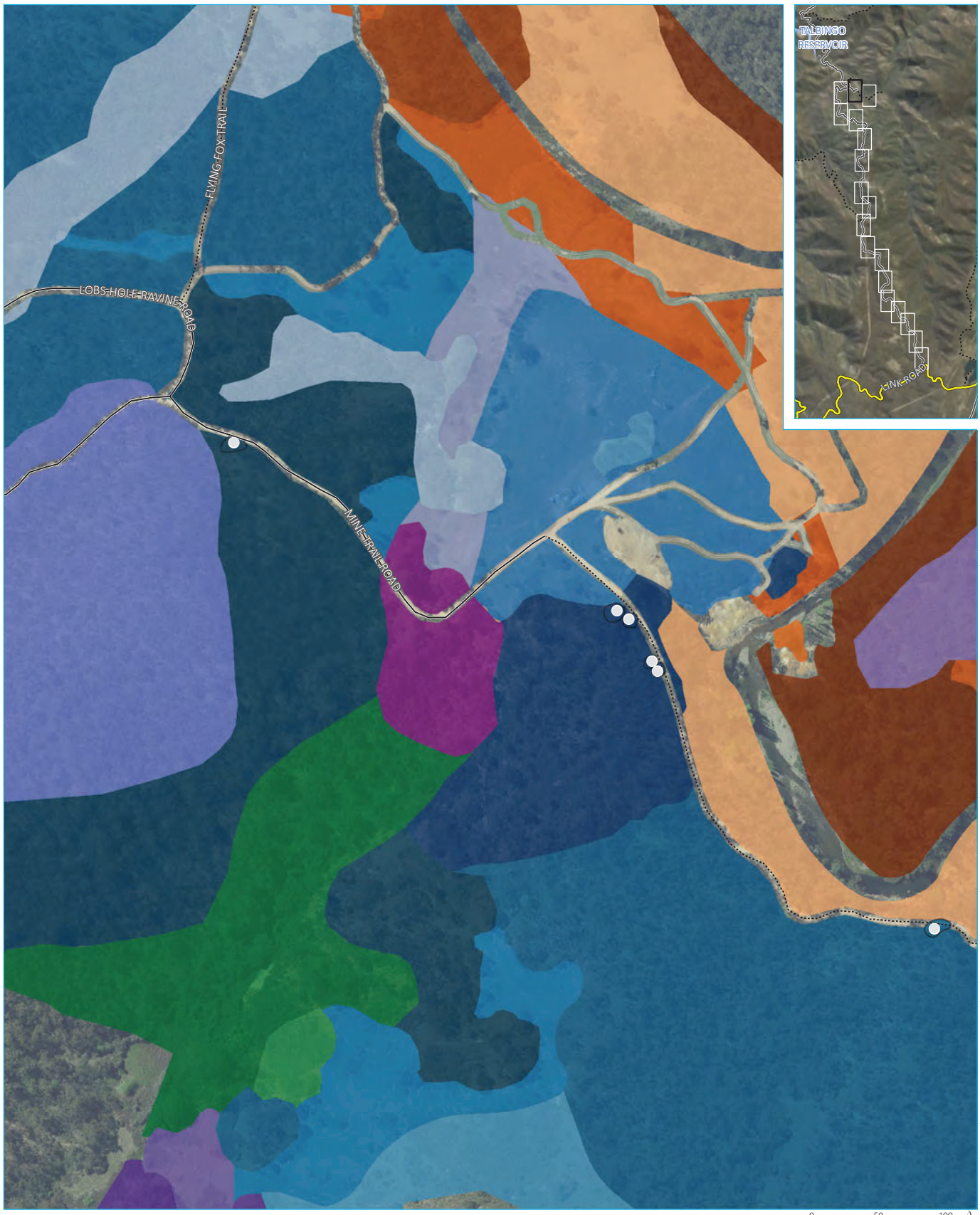


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m

GDA 1994 MGA Zone 55

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KEY

- Dangerous trees
- Local road
- Vehicular track

PCT 299
- Medium
- Low

PCT 285
- High
- Medium
- Low

Poor

PCT 296
- High
- High - tree
- Low
- Poor

PCT 300
- Medium
- Low

PCT 302
- High
- Medium
- Low
- Poor
- Other

PCT 729
- High
- High - tree
- Medium

Medium - tree
- Low
- Poor

PCT 999
- High

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
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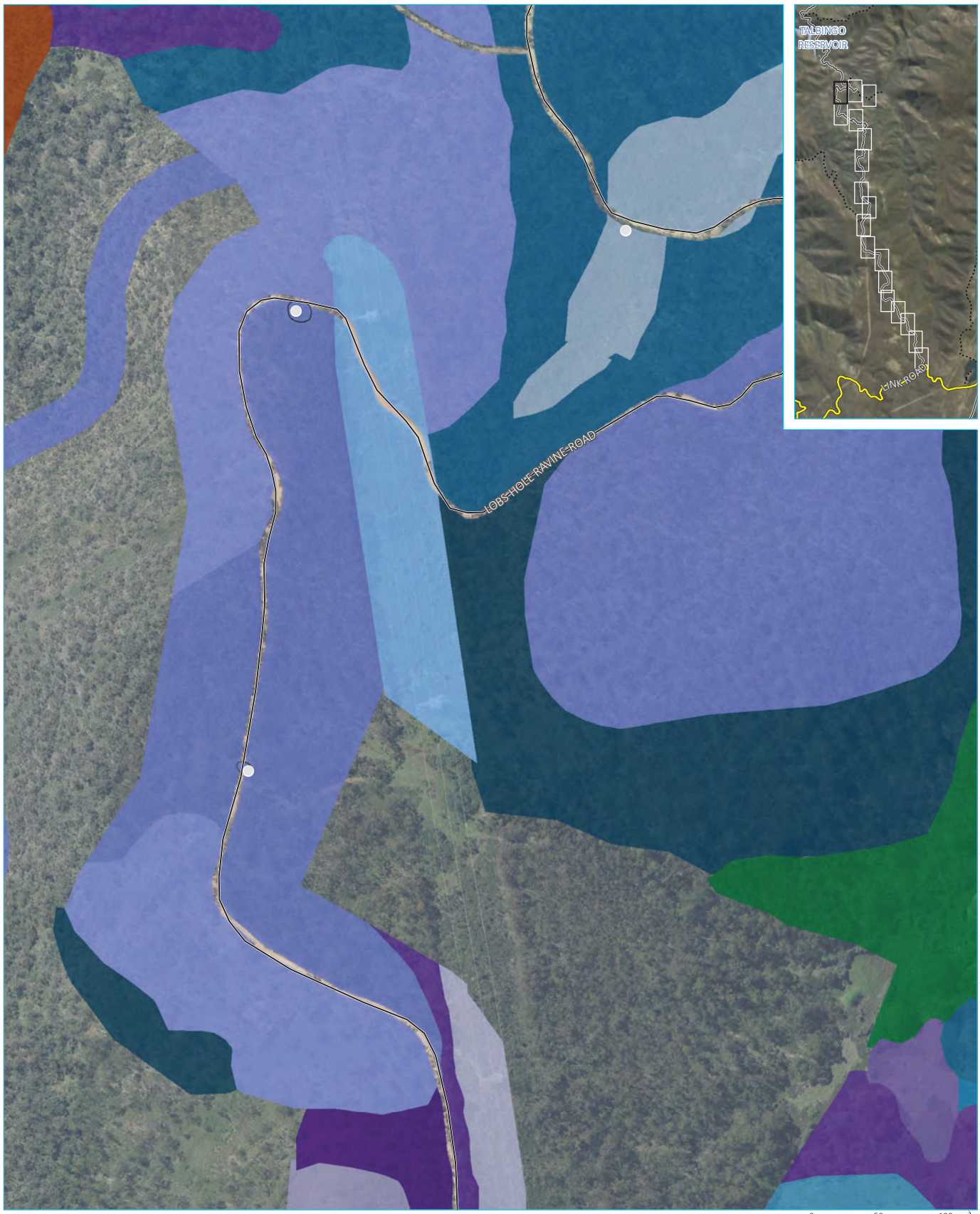


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous trees
- Local road
- Vehicular track

PCT 299
- Medium
- Low

PCT 285
- Poor

PCT 300
- High

- Medium
- Low
- Other
- Derived grassland

PCT 302
- Medium

PCT 729
- High
- High - tree
- Medium

- Low
- Poor

PCT 999
- High
- High - tree
- Medium
- Derived grassland

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
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*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m

GDA 1994 MGA Zone 55

N

KEY

- Dangerous trees
- Local road

PCT 300
- High
- Medium
- Medium - tree
- Low
- Poor
- Other
- Derived grassland

PCT 729
- High
- Medium
- Low
- Poor

PCT 999
- Medium

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
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snowy 2.0

EMM
creating opportunities

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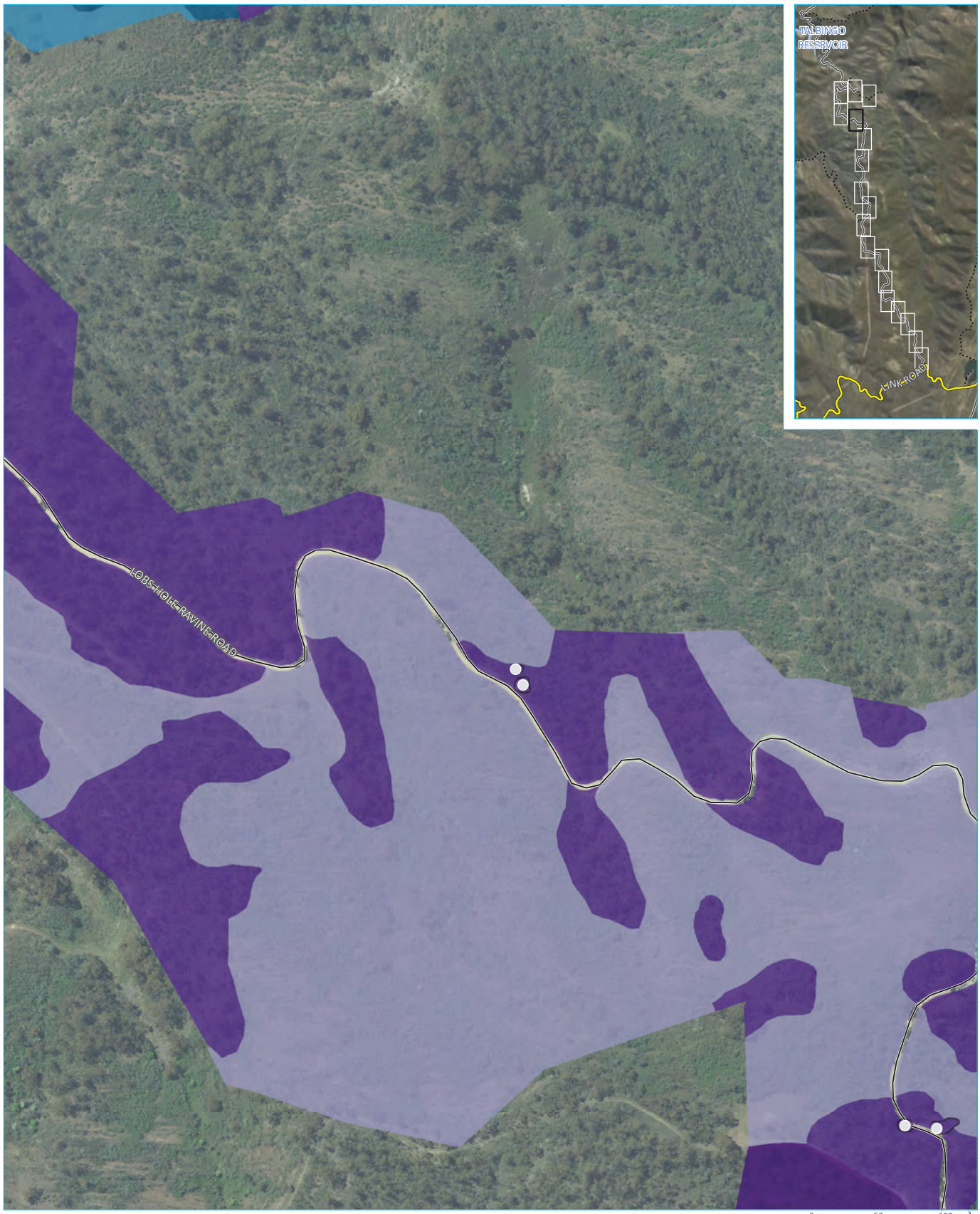


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous trees
- Local road

PCT 300
- High
- Medium
- Medium - tree
- Other

PCT 729
- Medium
- Poor

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
3.1 e

snowy 2.0

EMM
creating opportunities

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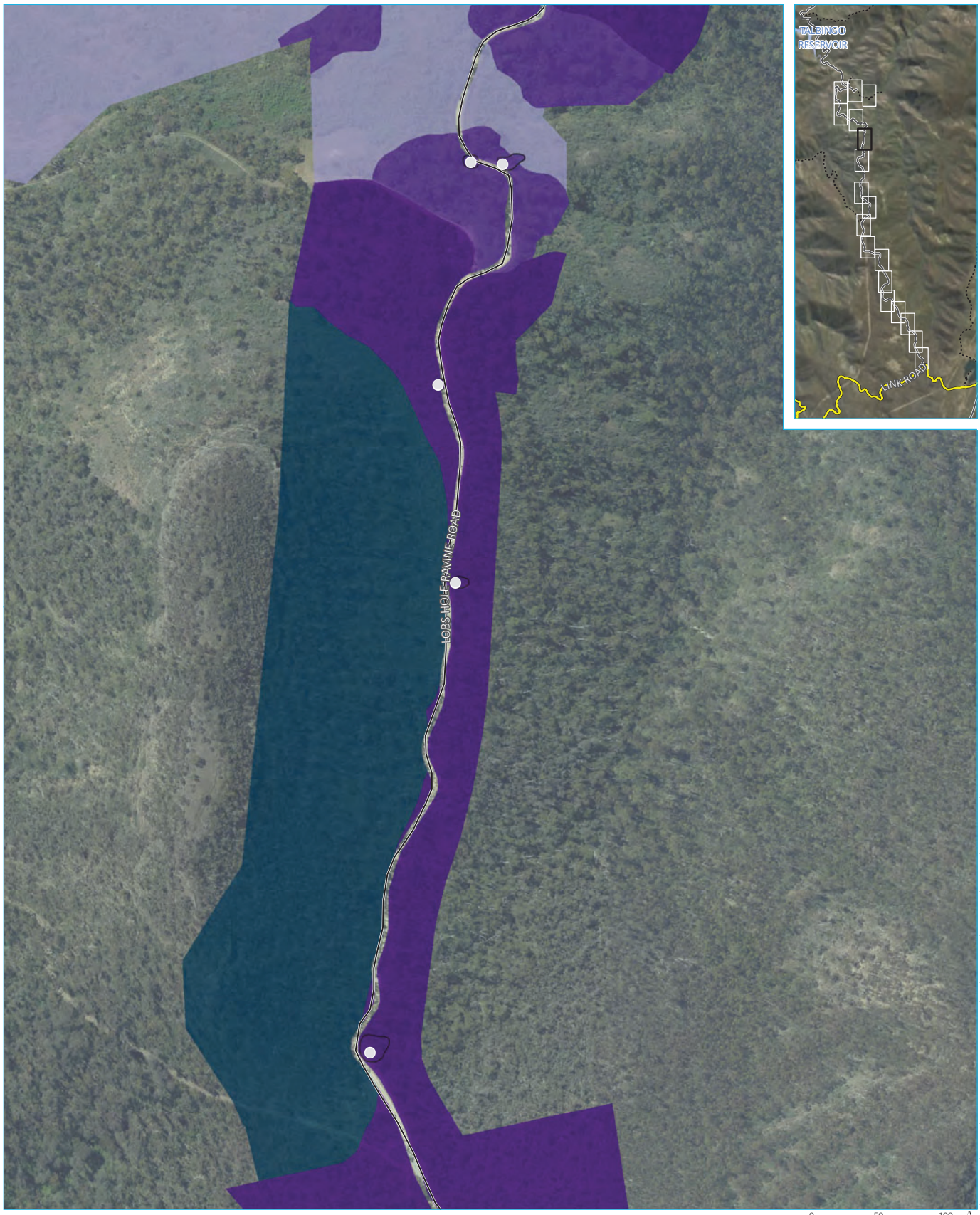


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous trees
- Local road

PCT 300
- High
- High - tree
- Medium
- Medium - tree
- Other

PCT 729
- High

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
3.1 f

snowy 2.0

EMM creating opportunities

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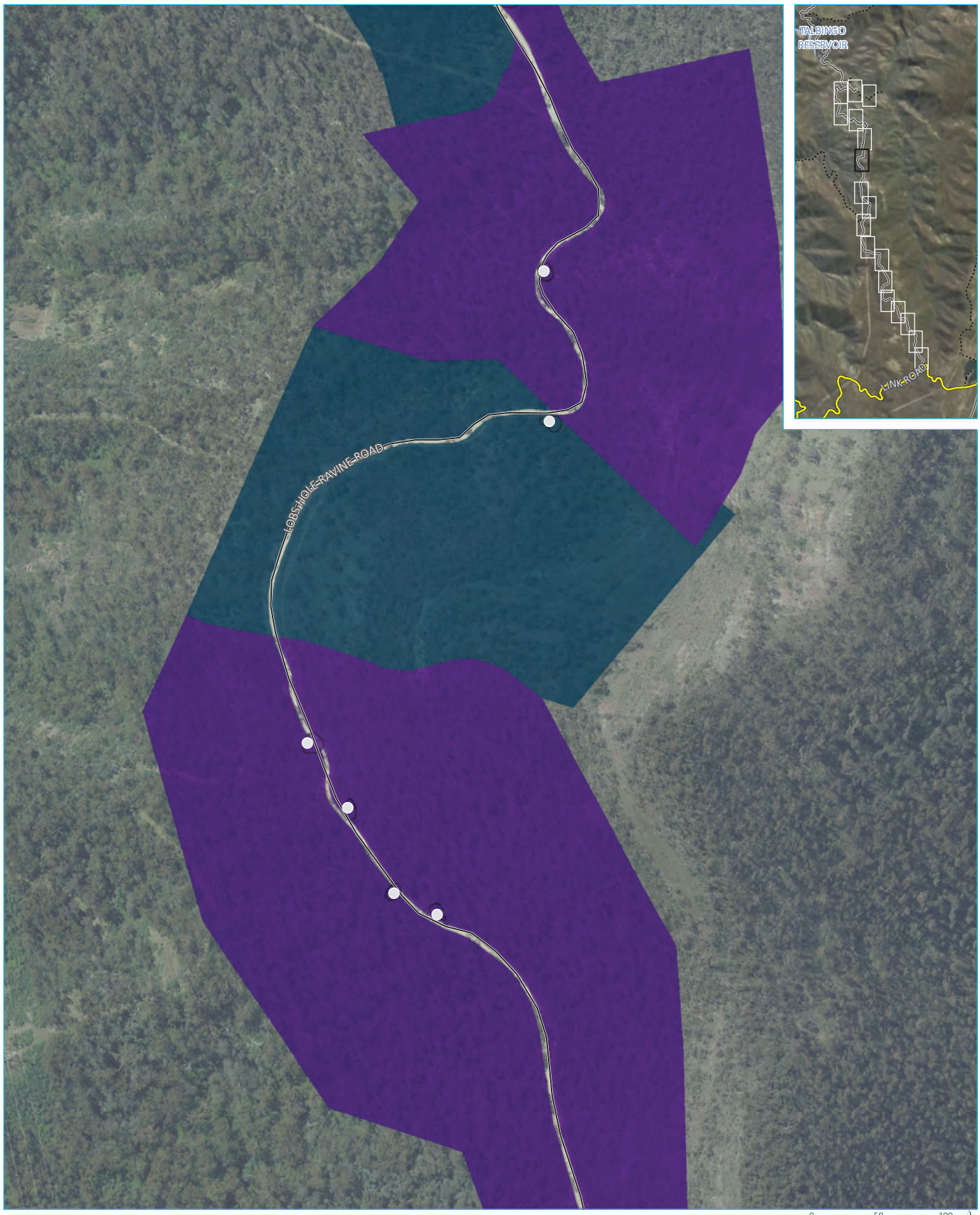


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous trees
- Local road

PCT 300
- High
- High - tree

PCT 729
- High
- High - tree

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
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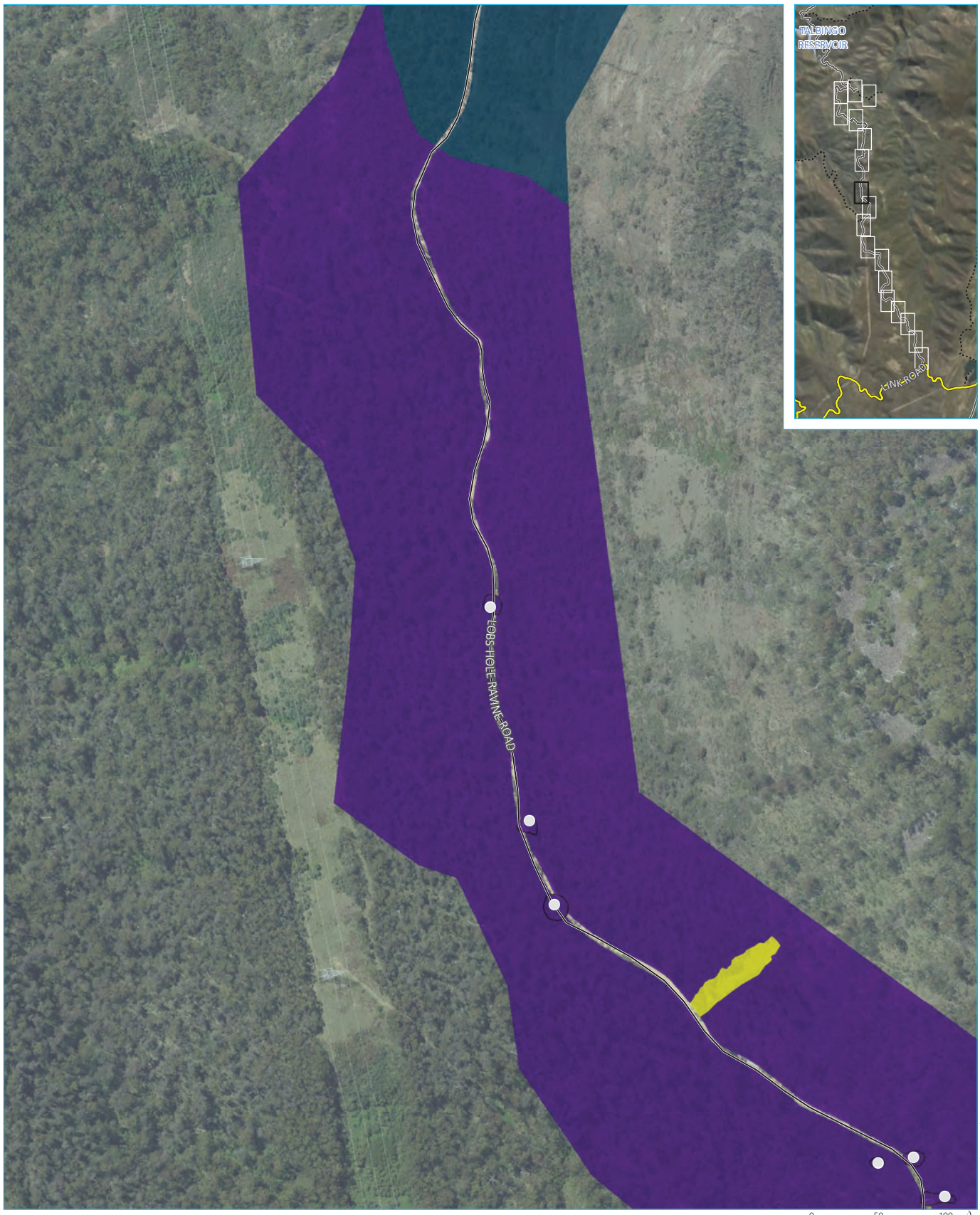


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous trees
- Local road

PCT 300
- High

PCT 643
- High - tree
- Low

PCT 729
- High

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
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snowy 2.0

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creating opportunities

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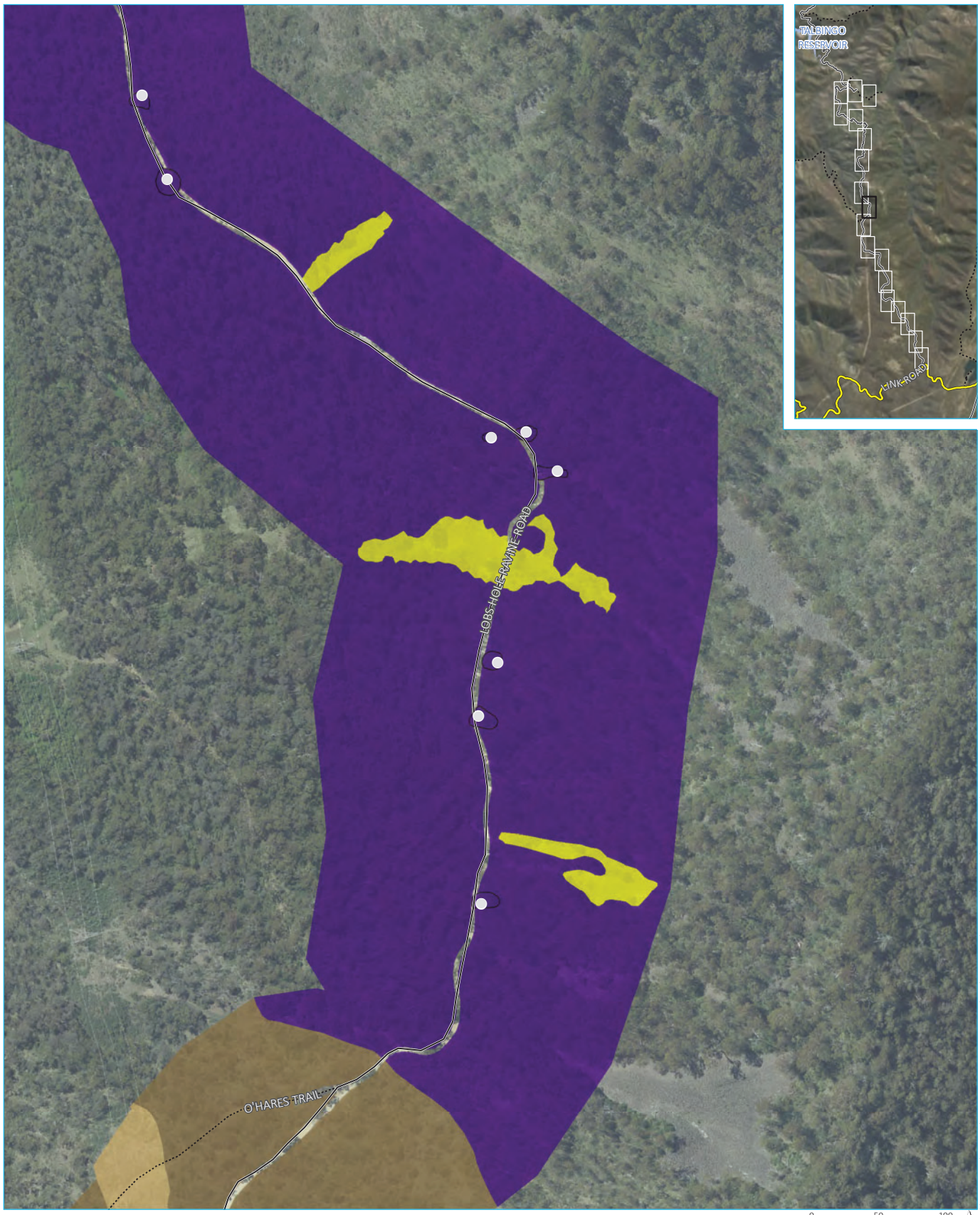


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous trees
- Local road
- Vehicular track

PCT 300
- High
- High - tree

PCT 643
- Low

PCT 953
- High

- Derived grassland

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
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creating opportunities

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

0 50 100 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous trees
- Local road
- Vehicular track

PCT 300
- High
- High - tree

PCT 643
- Low

PCT 953
- High

- High - tree
- Derived grassland

PCT 1196
- High
- High - tree
- Derived grassland

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
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snowy 2.0

EMM creating opportunities

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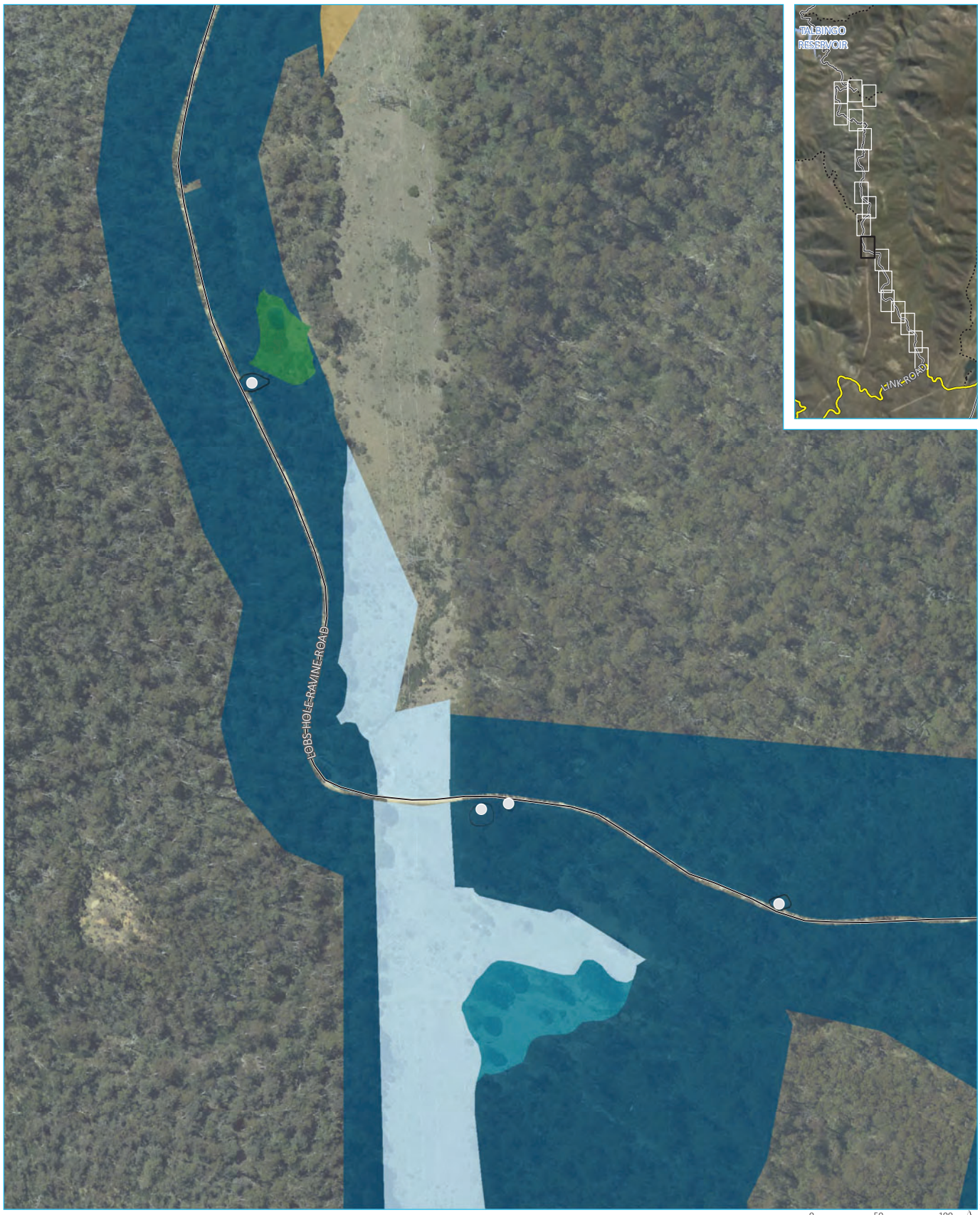


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous trees
- Local road

PCT 303
- High

PCT 637
- High

PCT 953
- High
- Derived grassland

PCT 1196
- High
- High - tree
- Medium
- Derived grassland

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
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snowy 2.0

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creating opportunities

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

0 50 100 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous trees
- Local road

PCT 1196

- High
- High - tree

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
3.1 l

snowy 2.0

EMM
creating opportunities

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

0 50 100 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous trees
- Local road

PCT 1196

- High
- High - tree

PCT 1224

- High

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
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*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous trees
- Local road

PCT 639
- High

PCT 638
- High

PCT 1196
- High
- High - tree

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
3.1 n

snowy 2.0

EMM
creating opportunities

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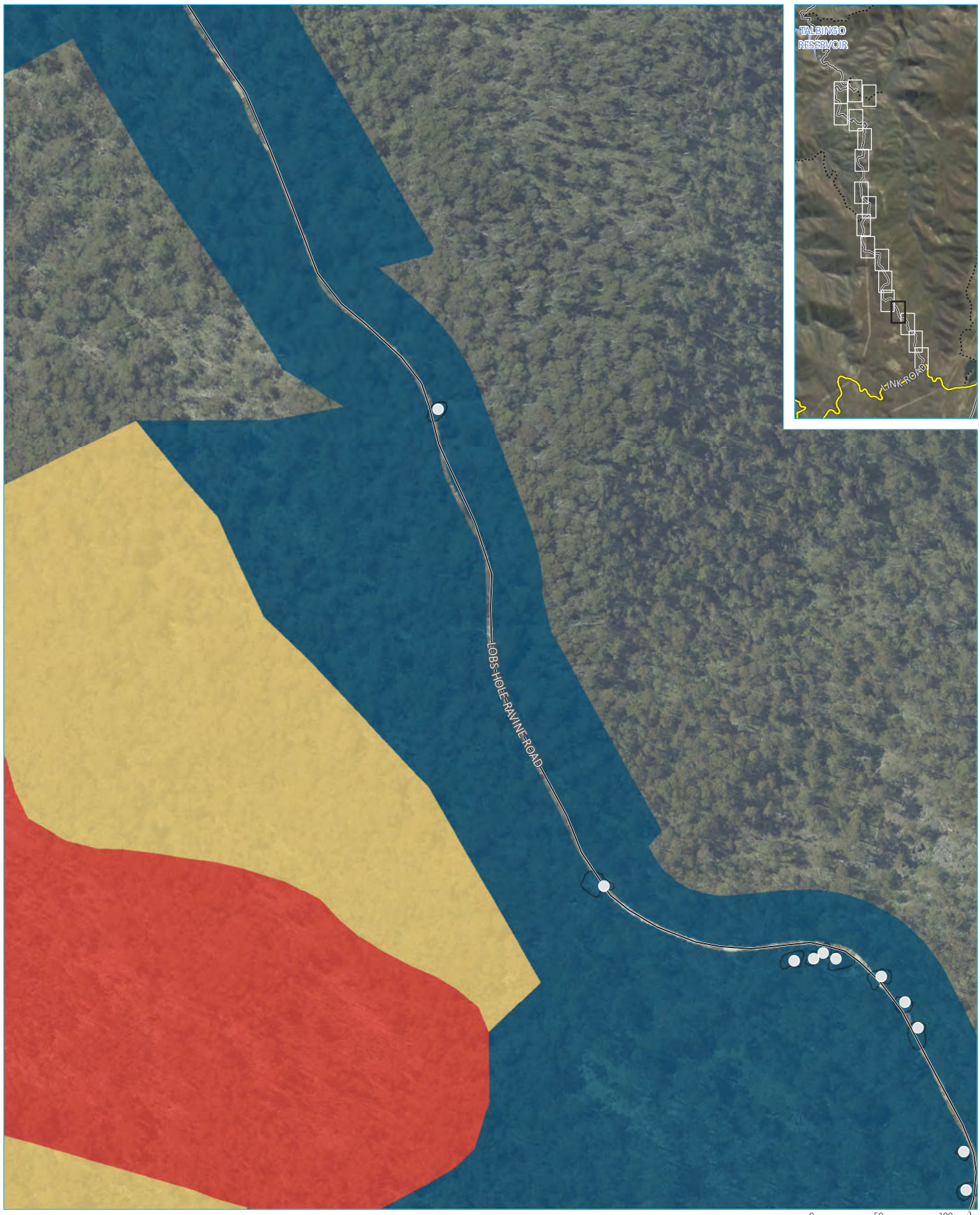


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous trees
- Local road

PCT 639
- High

PCT 638
- High

PCT 1196
- High
- High - tree

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
3.1 o

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EMM
creating opportunities

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

0 50 100 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous trees
- Local road

PCT 639
- High

PCT 638
- High
- High - tree

PCT 1196
- High
- High - tree

PCT 1224
- High

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
3.1 p

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

0 50 100 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous trees
- Local road

PCT 639
- High

PCT 638
- High
- High - tree

PCT 1196
- High
- High - tree

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
3.1 q

snowy 2.0

EMM creating opportunities

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

0 50 100 m

GDA 1994 MGA Zone 55

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KEY

- Dangerous trees
- Main road
- Local road

PCT 638

- High
- High - tree

PCT 1196

- High

# Dangerous tree locations, Plant Community Type and vegetation zone mapping

Snowy 2.0
Ecology RTS
Modification 1
3.1 r

snowy 2.0

EMM
creating opportunities

# APPENDIX B – BIODIVERSITY MONITORING PROGRAM

S2-FGJV-ENV-PLN-0028 Appendix B

# BIODIVERSITY MANAGEMENT PLAN – APPENDIX B – BIODIVERSITY MONITORING PROGRAM

| APPROVAL RECORD | | | |
|---|---|---|---|
| DOCUMENT PREPARATION, REVIEW AND APPROVAL | | NAME IN PRINT | SIGNATURE |
| Prepared by | | R Kristenson | |
| Reviewed by | | R Walker-Edwards | |
| Verified by | Environmental Manager | L Coetzee | |
| Approved by | Project Director | A. Betti | |

| DOCUMENT REVISION TABLE | | |
|---|---|---|
| REV. | DATE | DESCRIPTION OF MODIFICATIONS / REVISIONS |
| - | 18.04.2019 | - |
| A | 17.04.2019 | FOR REVIEW AND CONSULTATION |
| B | 20.05.2019 | UPDATE WITH SHL COMMENTS FOR CONSULTATION |
| C | 04.07.2019 | UPDATE WITH DP&E COMMENTS |
| D | 16.08.2019 | UPDATE FROM DPIE COMMENTS<br>FOR APPROVAL |
| 0 | 23.08.2019 | FOR APPROVAL |
| 1 | 19.11.2019 | UPDATED TO INCLUDE MODIFICATION 1 SCOPE |

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# 1. ABBREVIATIONS AND DEFINITIONS

| Acronym | Definition |
|---|---|
| AHD | Australian Height Datum |
| BAM | Biodiversity Assessment Method |
| BC Act | NSW *Biodiversity Conservation Act 2016* |
| BCD | Biodiversity and Conservation Division (formerly OEH) |
| BMP | Biodiversity Management Plan |
| BoM | Bureau of Meteorology |
| BDAR | Biodiversity Development Assessment Report |
| BOS | Biodiversity Offset Scheme |
| DEC | NSW Department of Environment and Conservation (now Office of Environment and Heritage) |
| DECC | Department of Environment and Climate Change (now Office of Environment and Heritage) |
| DNA | Deoxyribonucleic acid |
| DoI Water | NSW Department of Industry – Lands & Water |
| DoEE | Department of Energy and Environment |
| DPIE | NSW Department of Planning, Industry and Environment |
| DPI | NSW Department of Primary Industries |
| DSM | Digital surface model |
| EIS | *Environmental Impact Statement Exploratory Works for Snowy 2.0* |
| EMS | Environmental Management Strategy |
| EP&A Act | *Environmental Planning and Assessment Act 1979* |
| EPA | NSW Environment Protection Authority |
| EPBC Act | Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* |
| GDEs | Groundwater dependent ecosystems |
| KFH | Key Fish Habitat |
| KNP | Kosciuszko National Park |
| MCoA | Minister's Conditions of Approval Infrastructure Approval 9208 |
| MNES | Matters of national environmental significance |
| NCC | Nature Conservation Council |
| NPA | National Parks Association |
| NPW Act | NSW *National Parks and Wildlife Act 1995* |
| NPW Regulation | NSW *National Parks and Wildlife Regulation 2009* |
| NPWS | NSW National Parks and Wildlife Service |
| PCTs | Plant community types |
| POEO Act | *Protection of the Environment Operations Act 1997* |
| REMM | Revised environment management measures |
| Submissions Report or RTS | *Response to Submissions Exploratory Works for Snowy 2.0* |
| TECs | Threatened ecological community |
| WMS | Work Method Statement |

# 2. INTRODUCTION

## 2.1. Context

This Biodiversity Monitoring Program (program) forms an appendix to the Biodiversity Management Plan (BMP) which is an appendix of the Environmental Management Strategy (EMS) for Snowy 2.0 - Exploratory Works (the project). The purpose of the program is to detail the biodiversity monitoring requirements which are to be implemented during construction of the Snowy 2.0 – Exploratory Works project (the project).

The project is the first stage of Snowy 2.0, a pumped hydro-electric storage and generation project which will increase the hydro-electric capacity within the existing Snowy Mountains Hydro-electric Scheme.

The Environmental Impact Statement Exploratory 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 5.1 and Appendix F. The *Modification 1 Assessment Report - Exploratory Works for Snowy 2.0* (Modification 1) included an assessment of biodiversity impacts in Section 6.1 and Appendix A. The EIS identified that the main biodiversity issue for the project were the impacts to several threatened species and their habitat, including the Smoky Mouse (*Pseudomys fumeus*) and Booroolong Frog (*Litoria booroolongensis*), which were confirmed to be present within and adjacent to the project area.

The EIS also identified other potential indirect impacts to biodiversity as a result of the project including threatened species as a result of the project, including the potential for such as the introduction and/or exacerbation of weeds and pathogens, feral herbivores and feral predators. This monitoring program has been prepared to address the requirements of the Infrastructure Approval conditions and the revised environmental management measures within the Response to Submissions Exploratory Works for Snowy 2.0 (Submissions Report or RTS). Modification 1 and the REMMs within the *Response to Submissions - Exploratory Works Modification 1* (Submissions Report for Modification 1) have also been considered in the revision of this program.

Though Modification 1 included several changes, only the geotechnical investigations are relevant to the Stage 2 works and Future Generation's activities for the Exploratory Works project. This program has therefore been revised to address the biodiversity requirements and management measures from Modification 1 which are relevant to the geotechnical activities.

## 2.2. Program Structure

This introductory chapter provides the context of this monitoring program as well as an overview and schedule of the monitoring program. Subsequent chapters are arranged into one subject entity per chapter. Each chapter will:

- detail the existing conditions, impact predictions and monitoring objectives; and
- outline monitoring parameters, methods, locations, frequencies, data analysis and triggers for adaptive management.

The subject entities are:

- Smoky Mouse (Chapter 2);
- Booroolong Frog (Chapter 3);
- weeds and pathogens (Chapter 4);
- feral herbivores (Chapter 5); and
- feral predators (Chapter 6).

## 2.3. Objectives

The key objective of this program is to ensure that impacts arising from the project are in line with impacts predicted to occur, as outlined in the EIS. The primary objectives of the program are to:

- detail existing conditions;
- detail the monitoring parameters, method of data collection including frequency and location, method of data analysis and reporting requirements;
- enable the identification and quantification of any impacts;
- provide threshold triggers for implementation of adaptive management procedures; and
- demonstrate compliance with relevant consent conditions and other monitoring requirements.

## 2.4. Schedule

The monitoring schedule is summarised in Table 2-1, with further detail provided in each chapter.

Table 2-1: Monitoring schedule (allocation of responsibility required for ongoing monitoring Snowy Hydro)

| Task | Timing | | |
|---|---|---|---|
| | **Pre-construction (baseline)** | **During construction** | **Post-construction** |
| Smoky Mouse habitat characteristics monitoring (Lobs Hole Ravine Road) | Biannually (spring and autumn) | Biannually (spring and autumn) | Biannually (spring and autumn) |
| Smoky Mouse habitat characteristics monitoring (Marica Trail)* | One monitoring event pre construction | One monitoring event during construction | One monitoring event post construction |
| Smoky Mouse occupancy monitoring** | Four monitoring events per year, with each monitoring event defined as a 30-day deployment of cameras. During January to March 2019. | Four monitoring events per year, with each monitoring event defined as a 30-day deployment of cameras | Four monitoring events per year, with each monitoring event defined as a 30 day deployment of cameras |
| Smoky Mouse population monitoring** | Four monitoring events per year (quarterly), with each monitoring event defined as four nights of trapping | Four monitoring events per year (quarterly), with each monitoring event defined as four nights of trapping | Four monitoring events per year (quarterly), with each monitoring event defined as four nights of trapping |
| Booroolong Frog population monitoring | Two separate nocturnal monitoring events during the breeding season (November to mid-December) per year | Two separate nocturnal monitoring events during the breeding season (November to mid-December) per year | Two separate nocturnal monitoring events during the breeding season (November to mid-December) per year |
| Booroolong Frog habitat characteristics monitoring | Annually, and after any surface water incidents. During January to March 2019. | Annually, and after any surface water incidents | Annually, and after any surface water incidents |
| Booroolong Frog surface water quality monitoring | Refer to the Surface water monitoring program (SWMoP) | Refer to the Surface water monitoring program (SWMoP) | Refer to the Surface water monitoring program (SWMoP) |
| Weeds presence/absence monitoring | One monitoring event during January 2019 | Annual event (spring) | Biannually (spring and autumn) |
| Weed cover monitoring | One monitoring event during January 2019 | Annual event (spring) | Biannually (spring and autumn) |
| *Phytophthora* presence/absence monitoring | Four monitoring events per year (quarterly) | Annual event (spring) | Biannually (spring and autumn) |
| Other monitoring (dieback) | To be determined pending outcome of weed monitoring program | To be determined pending outcome of weed monitoring program | To be determined pending outcome of weed monitoring program |
| Feral herbivores presence/absence monitoring | One monitoring event during January 2019 | One monitoring event per year (spring or autumn) lasting 10 days | Four monitoring events per year (quarterly), with each monitoring event lasting 30 days |
| Feral herbivores abundance | One monitoring event during January 2019 | One monitoring event per year (spring or | Four monitoring events per year |

| Task | Timing | | |
|---|---|---|---|
| | **Pre-construction (baseline)** | **During construction** | **Post-construction** |
| monitoring | | autumn) lasting 10 days | (quarterly), with one monitoring event defined as four nights |
| Feral predators presence/absence monitoring | One monitoring event during January 2019 | One monitoring event per year (spring or autumn) lasting 10 days | Four monitoring events per year (quarterly), with each monitoring event defined as a 30 day deployment of cameras |
| Feral predators abundance monitoring | One monitoring event during January 2019 | One monitoring event per year (spring or autumn) lasting 10 days | Four monitoring events per year (quarterly), with one monitoring event defined as four nights |

**Note: Due to short construction program of geotechnical investigation works monitoring events will be limited to one event each pre, during and post construction*

***Note: Due to short term disturbance and construction program of geotechnical investigation works Smoky Mouse occupancy and population monitoring is not proposed to be undertaken in Marica Trail area*

# 3. SMOKY MOUSE MONITORING PROGRAM

## 3.1. Baseline Conditions

During development of the EIS, surveys for the Smoky Mouse were completed and reported in the Snowy 2.0 Exploratory Works, Biodiversity Development Assessment Report (EMM 2018). Smoky Mouse was recorded at 13 locations within and adjacent to the project disturbance footprint between December 2017 and May 2018 (Figure 3-1 and Figure 3-2). Smoky Mouse was recorded via terrestrial trapping (one record) and by remote camera (12 records). A mark-recapture study was not conducted during these investigations (aimed only to determine presence/absence) and therefore the number of individuals occupying the survey area is currently unknown.

The species distribution recorded by EMM (2018) within the survey area is predominantly associated with a single vegetation community (PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion) along the upper reaches of Lobs Hole Ravine Road, above 1,100 m. In this area vegetation consists of tall forests dominated by Mountain Gum (*Eucalyptus dalrympleana*) and Snow Gum (*Eucalyptus pauciflora*), with a moderate to dense shrubby midstorey dominated by shrubs from the plant family Fabaceae (with some *Epacridaceae* and *Mimosaceae*) and dense groundcover with abundant sub-shrubs, logs and leaf litter. Around and below 1,100 m, vegetation transitions to drier communities dominated by Peppermint (*Eucalyptus dives* and *Eucalyptus robertsonii* subsp. *robertsonii*), Brittle Gum (*Eucalyptus mannifera* subsp. *mannifera*) and Candlebark (*Eucalyptus rubida*) with a moderate to sparse midstorey and sparse grassy groundcover. Here, soils become much rockier and may be less suitable for burrowing. There is a single record from boulder streams aligned with PCT 643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion.

A conservative assessment of Smoky Mouse habitat has been undertaken by EMM (2018), with all vegetation not in 'Low' or 'Derived Grassland' conditions classes from the top of Lobs Hole Ravine Road (at the intersection with the Link Road) down to around 1,100 m identified as potential habitat (Figure 3-2). This includes:

- PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion, excluding areas in 'Low' or 'Derived Grassland' condition classes;
- PCT 639 - Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion, excluding areas in 'Low' or 'Derived Grassland' condition classes;
- PCT 643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion;
- PCT 644 - Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP South Eastern Highlands Bioregion and Australian Alps Bioregion; and
- PCT 953 - Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion.

Figure 3-1: Smoky Mouse captured via trapping near the project area

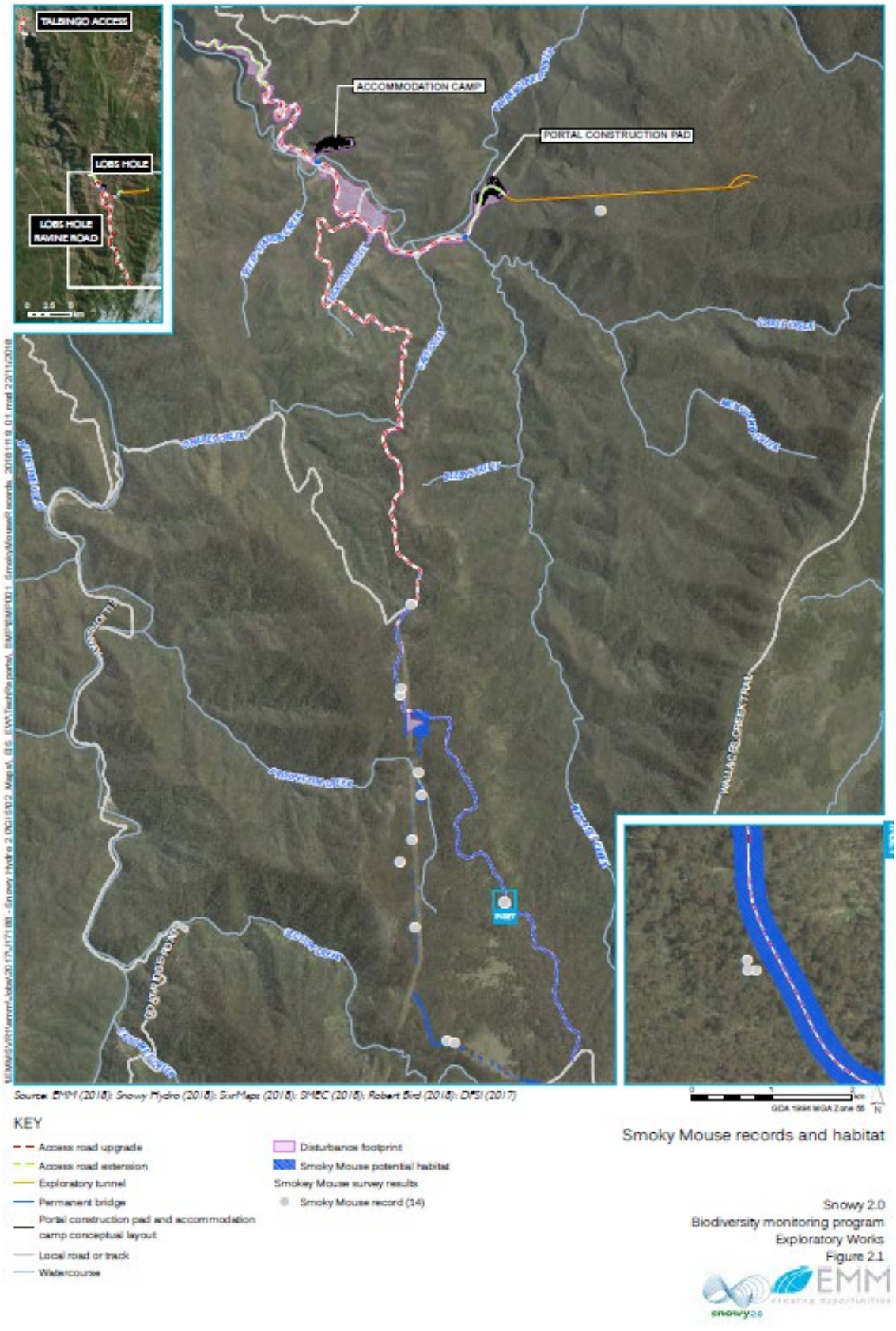


Figure 3-2: Smoky Mouse records and habitat

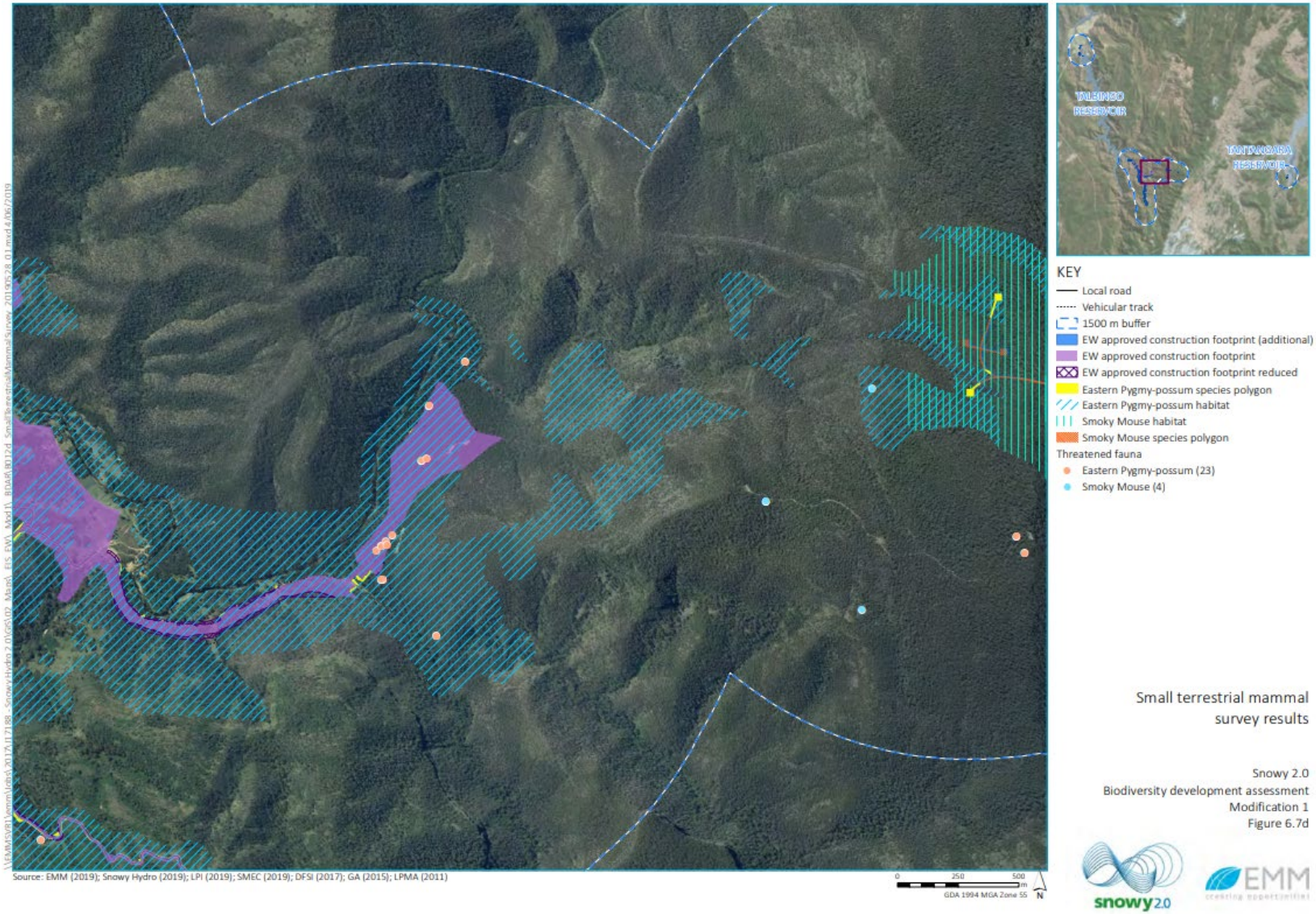


Figure 3-3: Smoky Mouse habitat and records - Marica area in vicinity of the geotechnical works

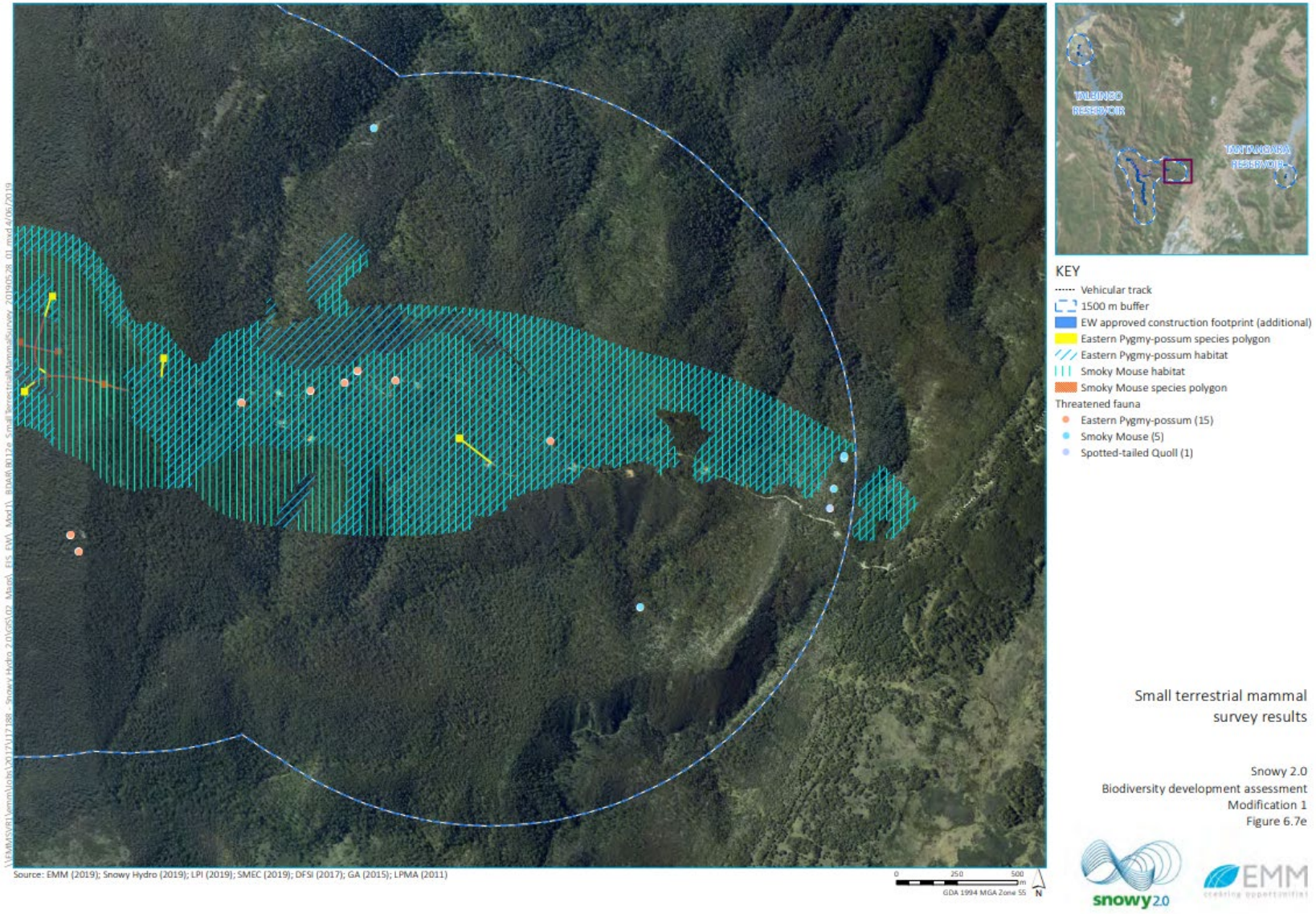


Figure 3-4: Smoky Mouse habitat and reords - Marica area in vicinity of geotechnical works

## 3.2. Mitigation Measures

In recognition of the location of the project in the Kosciuszko National Park (KNP), and associated biodiversity and other values of the KNP, the project has undergone significant steps to avoid, minimise and mitigate impacts. The main mitigation measure to avoid impacts on Smoky Mouse has been through avoidance of direct impact (clearance) on Smoky Mouse habitat, with only 1.77 ha of known and potential habitat to be cleared for the project.

After substantial efforts to avoid Smoky Mouse habitat, residual indirect impacts that could occur because of the project include:

- vehicle strike during the night time along the upper sections of Lobs Hole Ravine Road and in the Marica area when the Smoky Mouse is active. Rare or low density populations, such as the Smoky Mouse, may be at risk of significant impacts and local extinction if this impact is not managed appropriately (Hoskin & Goosem 2010);
- through the introduction of weeds or pathogens such as Phytophthora (via increased vehicular movement in the project area) that may impact upon the species' habitat; and
- through increase in feral predator numbers (resulting from increased human activity in the project area) that may prey upon the Smoky Mouse.

To prevent these indirect impacts from occurring, the following mitigation measures are being implemented for the project:

- vehicle movement will be limited to between sunrise and sunset* (except for emergencies).
- a 40 km/h speed limit will be imposed on Lobs Hole Ravine Road, with night time movements (if required) limited to 20 km/h;
- restrict vehicle speeds along Coppermine Trail, Wallaces Creek Trail and access tracks in the Marica area to 20 km/h between sunrise and sunset*.

  **Note: Sunrise and sunset times are to be taken from the nearest Bureau of Meteorology centre*
- a weed and pathogen monitoring program and implementation of weed and/or pathogen control programs if weeds and/or pathogens are identified (see Section 5);
- feral species (herbivore and predator) monitoring programs and the implementation of feral species control programs (see Sections 6 and 7);
- 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; and
- a Smoky Mouse monitoring program, to monitor any changes in habitat, occupancy and population of the species and in proximity to the project, arising from the project (this Section).

As a result of the avoidance and mitigation measures outlined above, direct impacts to Smoky Mouse habitat resulting from the project have been constrained to 1.77 ha. EMM (2018) concluded that additional controls to minimise and mitigate the risk of indirect impacts to the Smoky Mouse would largely avoid these impacts.

## 3.3. Monitoring Objectives

The overarching monitoring objective for the Smoky Mouse is to determine whether controls put in place to avoid and minimise project impacts to the species have avoided impacts to the population, specifically:

- to determine habitat characteristics of occupied habitat, within proximity to the project, and document any changes arising from the project;
- to determine occupancy at previous sites within proximity to the project and document any changes arising from the project; and
- to understand population size within proximity to the project, and document any changes arising from the project.

## 3.4. Monitoring Parameters

To determine if the mitigation measures put into place effectively mitigate indirect impacts to Smoky Mouse as a result of the project, the following parameters will be monitored:

- habitat characteristics;
- occupancy at previous sites; and
- population size.

## 3.5. Habitat Characteristics 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 3-1.

**Table 3-1: Smoky Mouse habitat characteristics monitoring**

| Objective |
|---|
| 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. |
| **Sampling units** |
| Habitat complexity at ground level (0.5 m and below). |
| **Method** |
| *Photopoints*<br>Photopoints are undertaken along the upper reaches of Lobs Hole Ravine Road and Marica Trail to monitor changes in Smoky Mouse habitat characteristics and encompasses the following:<br>• A pair of photopoints will be placed at 500 m intervals along the upper sections of Lobs Hole Ravine Road and Marica Trail;<br>• For each pair, one photopoint will be placed adjacent to Lobs Hole Ravine Road and Marica Trail at 20 m and one photopoint will be placed distant to Lobs Hole Ravine Road and Marica Trail at 120 m. Each set of photopoints will be placed perpendicular to the road, as shown in Figure 3-5.<br>• During the first monitoring event (baseline)<br>– each photopoint location will be microsited to capture suitable Smoky Mouse habitat (e.g. logs, coarse woody debris, leaf litter, dense understorey cover and key feed species);<br>– photopoints will be south oriented to avoid direct sunlight in the shot and associated glare;<br>– permanent markers (e.g. star picket marked/flagged with monitoring location name) will be installed, along with the coordinates of each monitoring location, in order to relocate for subsequent monitoring events. This will include a larger stake (to relocate the site) and a smaller stake located at 0.5 m above ground level. The second stake will be used to place the camera on top to take the photo. This will ensure subsequent monitoring photos are taken from the same location and aspect;<br>• When taking the photo, take a first photo with the monitoring location written on a board within the photo to enable later identification and a second photo that is the monitoring photo;<br>• Each photograph (taken with the same GPS enabled camera on the same settings each time) will record the habitat complexity at ground level (0.5 m) at each monitoring location;<br>• If photographs won't be curated immediately, include a record board in a bottom corner of each frame, or |

ensure location marker shows the location number (e.g. written on with a paint marker);

- Ensure not to trample vegetation when first locating then subsequently accessing monitoring locations; and
- Data will be collected via the proforma included as Appendix A. This includes the date, weather conditions, recorders, photograph number and other notable features (for example visible disturbance of Smoky Mouse habitat features).

*Transects*

Transects are undertaken along the upper reaches of Lobs Hole Ravine Road to monitors changes in habitat characteristics and encompasses the following:

- A pair of transects to be placed at 500 m intervals along Lobs Hole Ravine Road and Marica Trail;
- Each transect to be 50 m and will be placed parallel to Lobs Hole Ravine Road and Marica Trail at a distance of 20 m and 120 m from the road verge (Figure 3-6);
- The line-point intercept method will be used at 1 m intervals along each 50 m transect;
- At each 1 m interval (starting from 1 m) the following data will be recorded:
  - any species below 50 cm, to gain an estimate of habitat complexity below 0.5 m;
  - the cover of Smoky Mouse key feed species (listed in Appendix B) below 0.5 m above the ground, using a straight rod. Any intercepts or "hits" of a key feed species (for native shrubs, native grasses and native ground cover) on the rod at and below the 0.5 m mark will be recorded as present (e.g. if Epacris sp. intercepts the rod at 0.2 m, 0.3 m and 0.5 m, a three would be recorded for this species at this interval. No intercepts of key feed species at each stratum below 0.5 m records a zero;
- As data is collected for a total of 50 intervals along each transect, the cover (%) of key feed species for each stratum (native shrubs, native grasses and native ground cover) is calculated by diving the number of hits by 50, then multiplying it by 100; and
- Data will be collected via the proforma included as Appendix A.

**Location**

Upper reaches of Lobs Hole Ravine Road, above 1,100 m, as per the design shown in Figure 3-5 and Figure 3-6 and in identified potential habitat with indicative locations shown on Figure 3-7.

Section of Marica Trail in proximity to geotechnical investigation works as per Figure 3-3 and Figure 3-4. Monitoring design will be in accordance with the design shown in Figure 3-5 and Figure 3-6.

**Timing, effort and frequency**

Frequency for both photo points and transects in the Lobs Hole Ravine Road area will comprise two monitoring events per year (biannually in spring and autumn) during pre-construction, construction and post-construction phases, commencing prior to construction in January 2019.

Frequency for both photo points and transects in the Marica Trail area will comprise monitoring during pre-construction, construction and post-construction phases.

**Data analysis**

- Photographs taken at each photopoint location will be downloaded and stored in a suitable folder structure in order to visually compare with the previous monitoring event photograph;
- The use of photo boards or cover analysis software will be trialled in order to attempt to streamline the data analysis process;
- A photolog should be produced for each monitoring event, that compares the current photograph at each monitoring location with the photograph from the previous monitoring event at the same location; and
- Transect data to be kept in a spreadsheet to determine any changes in the cover (%) of key feed species at each transect location between monitoring periods.

**Triggers for adaptive management**

- Observed degradation (degradation in structure, loss of key feed species) of habitat characteristics of occupied habitat; and
- The observed degradation is combined with an observed increase or new occurrence of a primary impact (weeds, pathogens or feral herbivores as identified within Sections 5, 6 and 7 of this program).

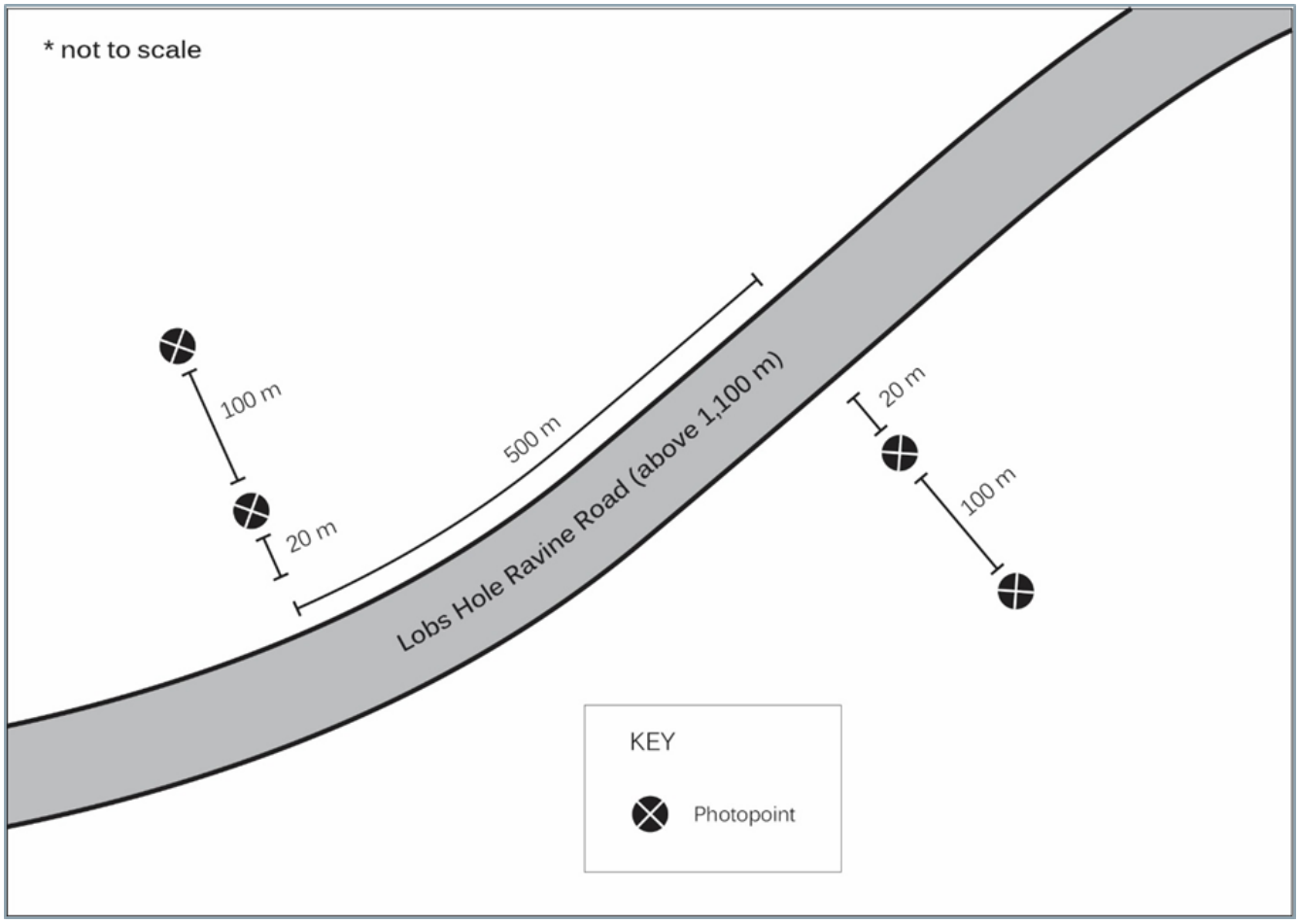


Figure 3-5: Smoky Mouse habitat characteristics monitoring – photopoint set up

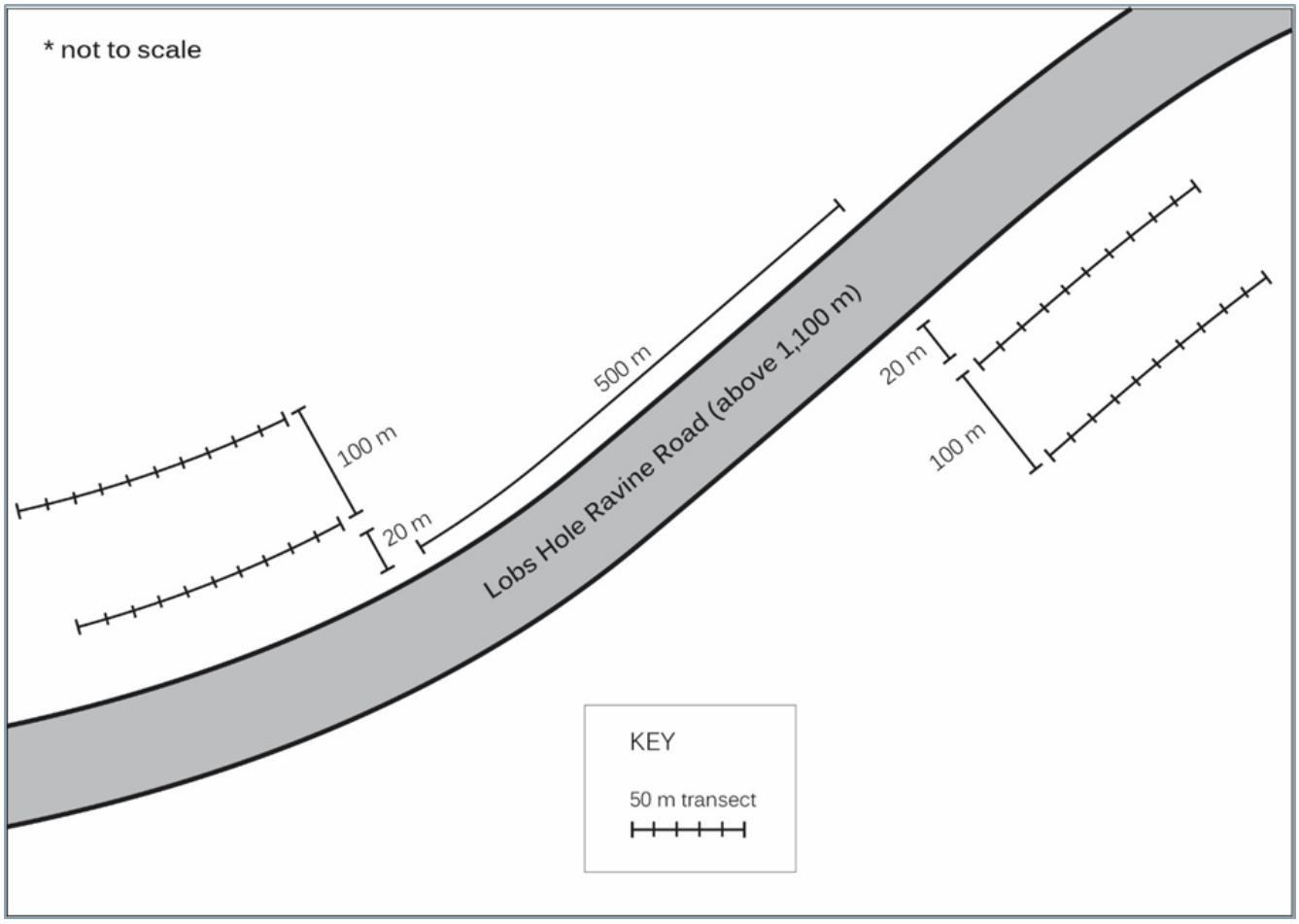


Figure 3-6: Smoky Mouse habitat characteristics monitoring - transect set up

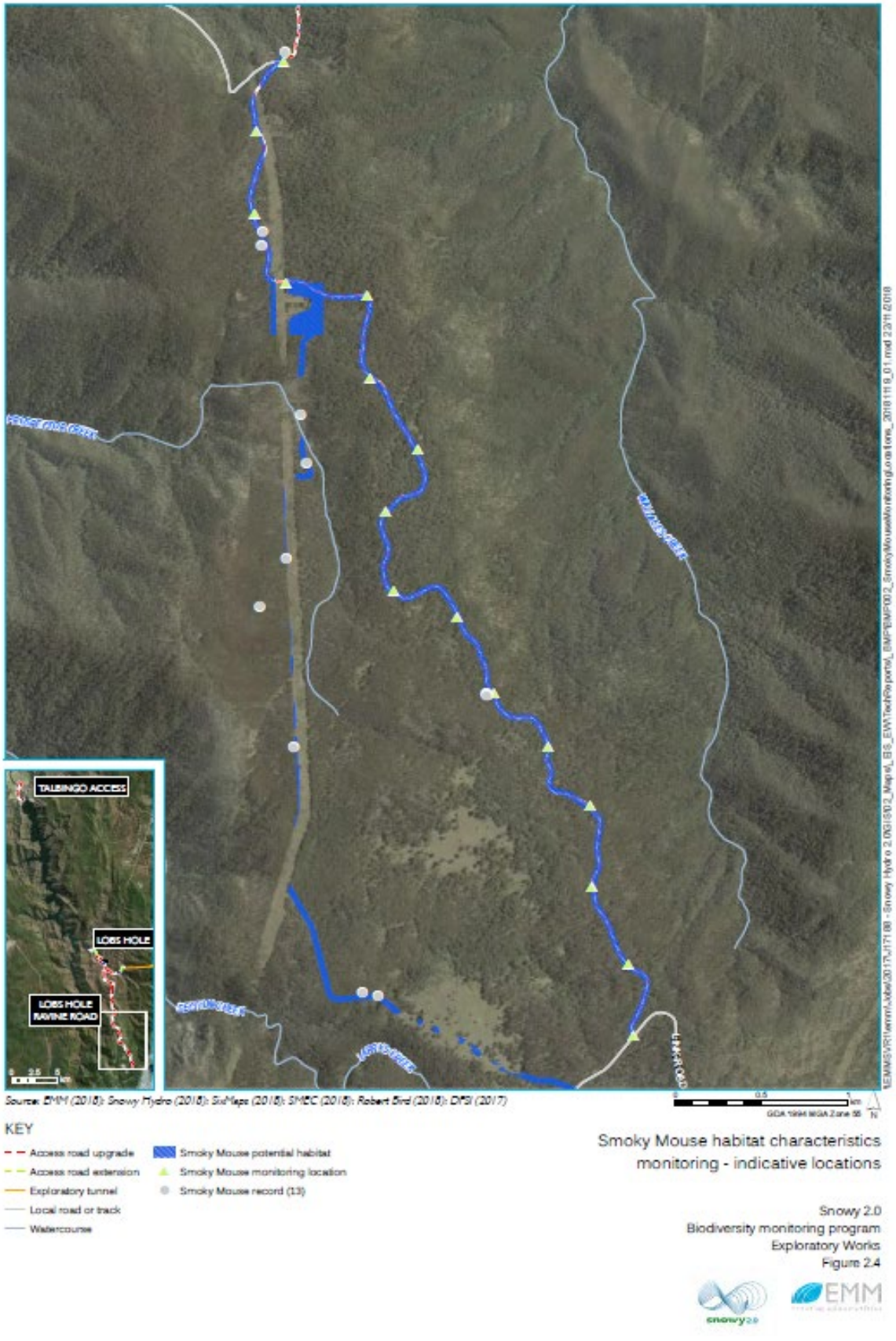


Figure 3-7: Smoky Mouse habitat characteristics monitoring indicative locations

## 3.6. Occupancy Monitoring

The monitoring of Smoky Mouse occupancy will be undertaken by a suitably qualified ecologist (s) and as detailed in Table 3-2.

**Table 3-2: Smoky Mouse occupation monitoring**

| **Objective** |
|---|
| To determine Smoky Mouse occupancy (presence/absence) at previous sites within proximity to the project and document any changes as a result of the project. |
| **Sampling units** |
| Remote camera monitoring along Lobs Hole Ravine Road. |
| **Method** |
| *Remote camera monitoring*<br>• Remote cameras will be placed at known (previously surveyed) locations along Lobs Hole Ravine Road (three sites), as well as at 500 m intervals along Lobs Hole Ravine Road;<br>• At each site, a pair of cameras will be placed out, with one camera placed adjacent to Lobs Hole Ravine Road at 20 m and one placed distant to Lobs Hole Ravine Road at 120 m, as shown in Figure 3-9;<br>• Cameras to be attached to a tree or stake and positioned approximately 25 cm above ground with bait stations placed 1.5 m away;<br>• Bait station to be baited with walnuts;<br>• Microsite cameras to face suitable Smoky Mouse habitat (e.g. logs, coarse woody debris, leaf litter, dense understorey cover and key feed species) (see Figure 3-8);<br>• 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;<br>• Cameras are to be deployed for 30 days per survey (Nelson *et al.* (2009) detected Smoky Mouse on baited cameras on or before the 10$^{th}$ night of a survey); and<br>• Coordinates to be recorded at each camera location, in order to repeat the method during each subsequent monitoring event. |
| **Location** |
| Upper reaches of Lobs Hole Ravine Road, above 1,100 m, as per the design shown in Figure 3-9 and in identified potential habitat with indicative locations shown on Figure 3-10. |
| **Timing, effort and frequency** |
| • A monitoring event is defined as minimum one month deployment of all camera traps as per the layout explained in methods; and<br>• Frequency will comprise three monitoring events per year during pre-construction between January and March 2019 and three monitoring events per year during and post constuction . |
| **Data analysis** |
| • Animals captured on digital images are to be identified with reference to appropriate field guides and by consultation with Smoky Mouse experts, if required;<br>• Data to be kept in a spreadsheet to determine presence/absence between monitoring periods; and<br>• Data trends to be analysed by a suitably qualified person, in order to detect absence or decline. |
| **Triggers for adaptive management** |

- Absence of Smoky Mouse from >50% of sites where the species was recorded during baseline surveys, as monitored during construction; and
- Absence recorded for greater than one year; and
- The absence is combined with an observed increase or new occurrence of a primary impact (weeds, pathogens, or feral herbivores/predators as identified within Sections 5, 6 and 7 of this program).


**Figure 3-8: Smoky Mouse captured on remote camera near the project area, showing suitable habitat features**

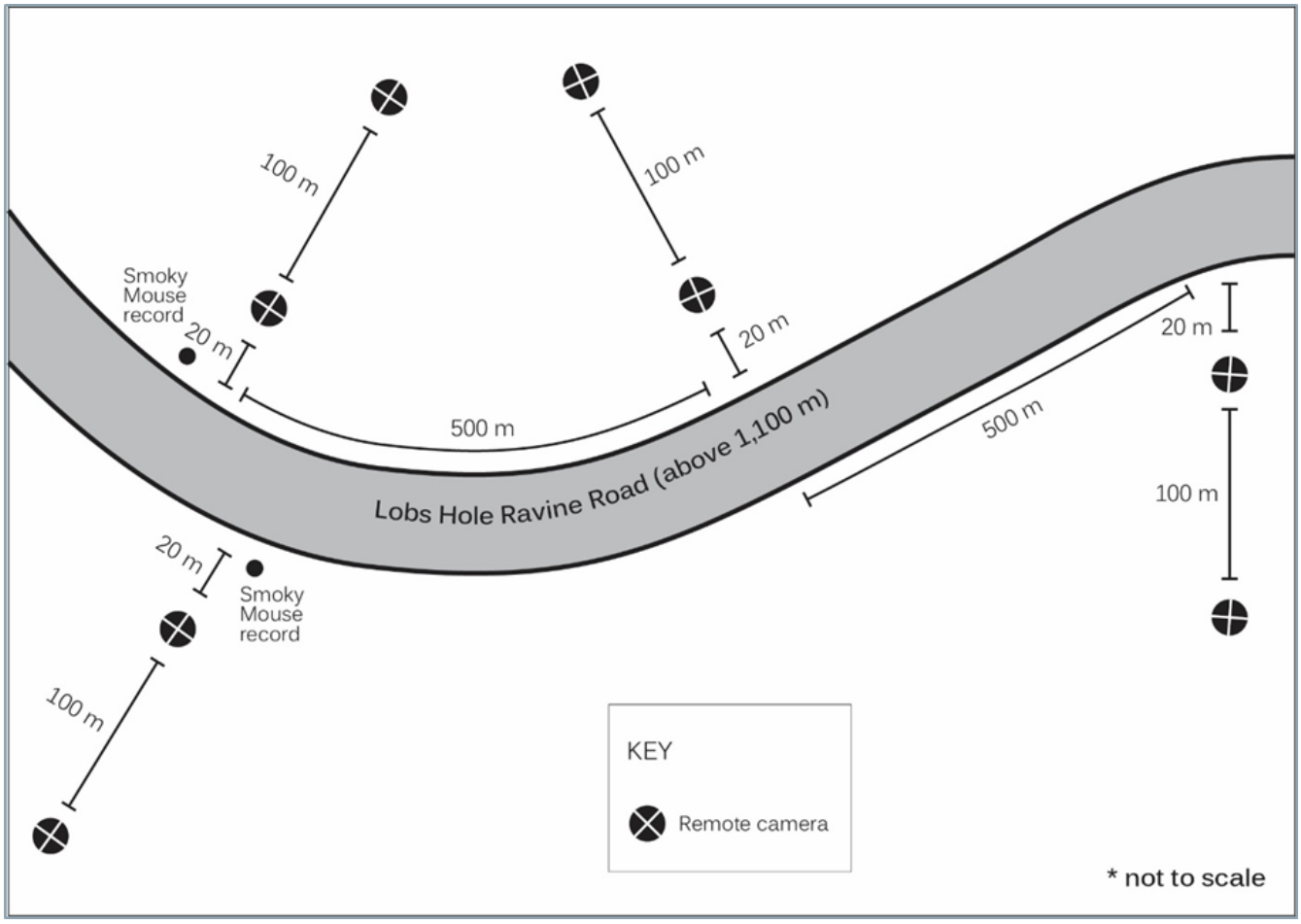


Figure 3-9: Smoky Mouse occupancy monitoring - remote camera set up

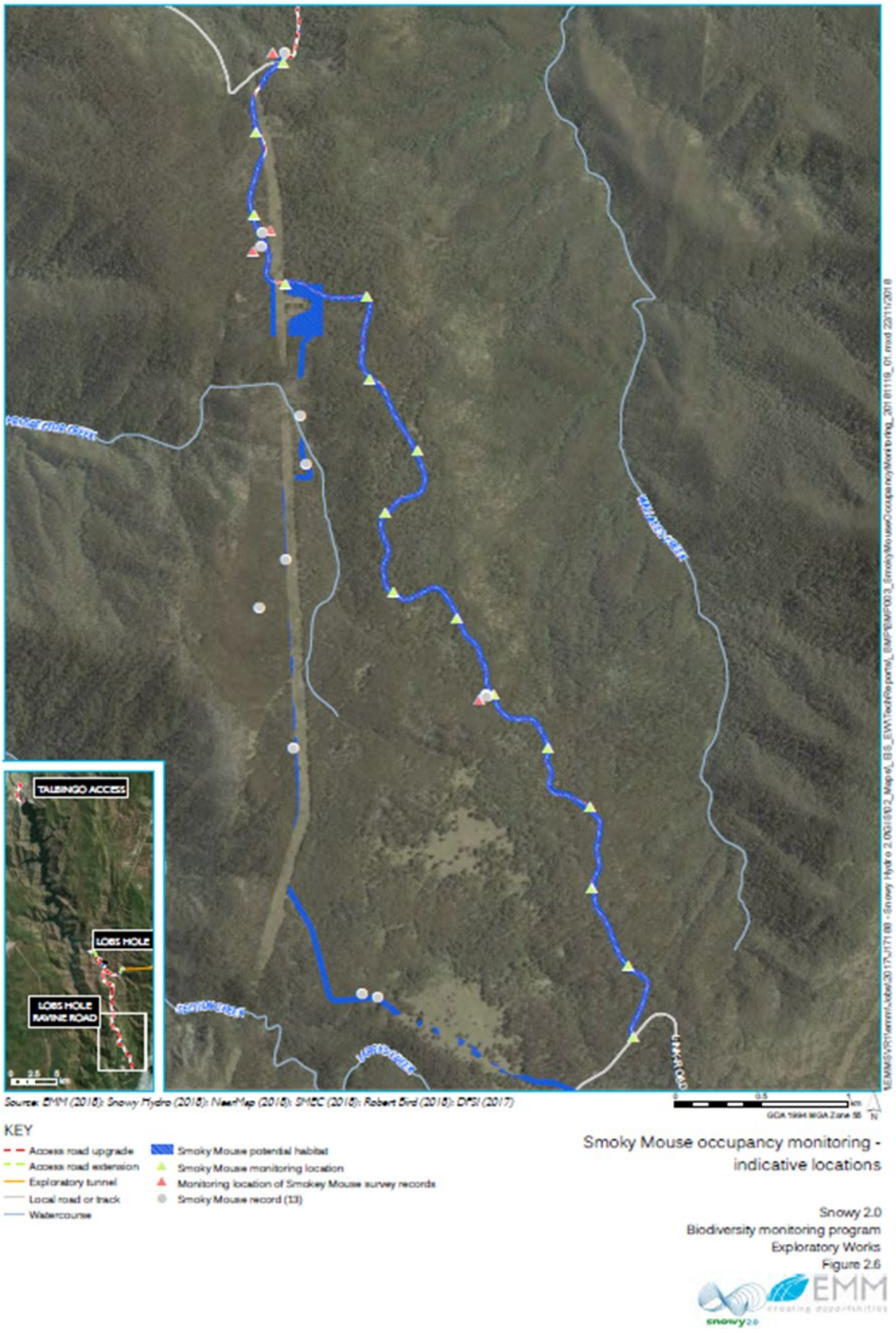


Figure 3-10: Smoky Mouse occupancy monitoring indicative monitoring locations

## 3.7. Population Monitoring

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

**Table 3-3: Smoky Mouse population monitoring**

| **Objective** |
|---|
| To understand Smoky Mouse population size within proximity to the project and document any changes as a result of the project. |
| **Sampling units** |
| Trapping and pit tagging within identified habitat in proximity to the project area. |
| **Method** |
| *Trapping and pit tagging*<br>• Elliot A traps will be placed at known (previously surveyed) locations along Lobs Hole Ravine Road;<br>• Traps will be placed in parallel transects, at 500 m intervals along Lobs Hole Ravine Road;<br>• At each monitoring location, a total of 25 Elliot A traps will be placed in two parallel lines (each line being 90m) perpendicular to the road, 10 m apart and separated by 25m (Figure 3-11);<br>• Coordinates to be recorded at each trap transect location, in order to successfully find the traps during each monitoring event and well as repeat the method during each subsequent monitoring event;<br>• Traps to be placed out for 4 nights per monitoring period;<br>• Traps to be baited with walnuts;<br>• Traps checked early in the morning and closed for the day;<br>• Traps opened and rebaited in the late afternoon;<br>• Smoky Mouse captured to be pit tagged to allow mark-recapture data; and<br>• Trapping and pit tagging to be undertaken as per best practice methods and under appropriate scientific and animal ethics licences. |
| **Location** |
| Upper reaches of Lobs Hole Ravine Road, above 1,100 m, as per the design shown in Figure 3-11 and in identified known habitat (previously recorded) and potential habitat as per the locations for occupancy monitoring and as shown in Figure 3-10. |
| **Timing, effort and frequency** |
| • A monitoring event is defined as 4 nights deployment of the traps as per the layout explained in methods and shown in Figure 3-11;<br>• Frequency will comprise three monitoring events per year during each project stage (pre-construction, construction and post-construction), commencing in January 2019; and<br>• It is noted that frequency of trapping for monitoring studies and repeated capture of pregnant or lactating females should be kept to a minimum (Nelson *et al.* 2009). This will be mitigated by closing traps if lactating females are captured. |
| **Data analysis** |
| • Animals captured are to be identified and pit-tagged by a suitably qualified ecologist with reference to appropriate field guides and in consultation with Smoky Mouse experts;<br>• Data to be kept in a spreadsheet to determine population trends between monitoring periods; and<br>• Data trends to be analysed by a suitably qualified person, in order to detect any decline in |

| |
|---|
| population. |
| **Triggers for adaptive management** |
| • A statistically significant population decline (that upon review by species experts, is also considered as biologically significant) occurs during construction and/or post-construction when compared with pre-construction surveys. Given the variability of natural systems, a statistically significant population decline is here defined as an alpha value of 0.1; and<br>• The decline is combined with an observed increase or new occurrence of a primary impact (weeds, pathogens, or feral herbivores/predators as identified within Section 5, Section 6 and Section 7 of this program). |

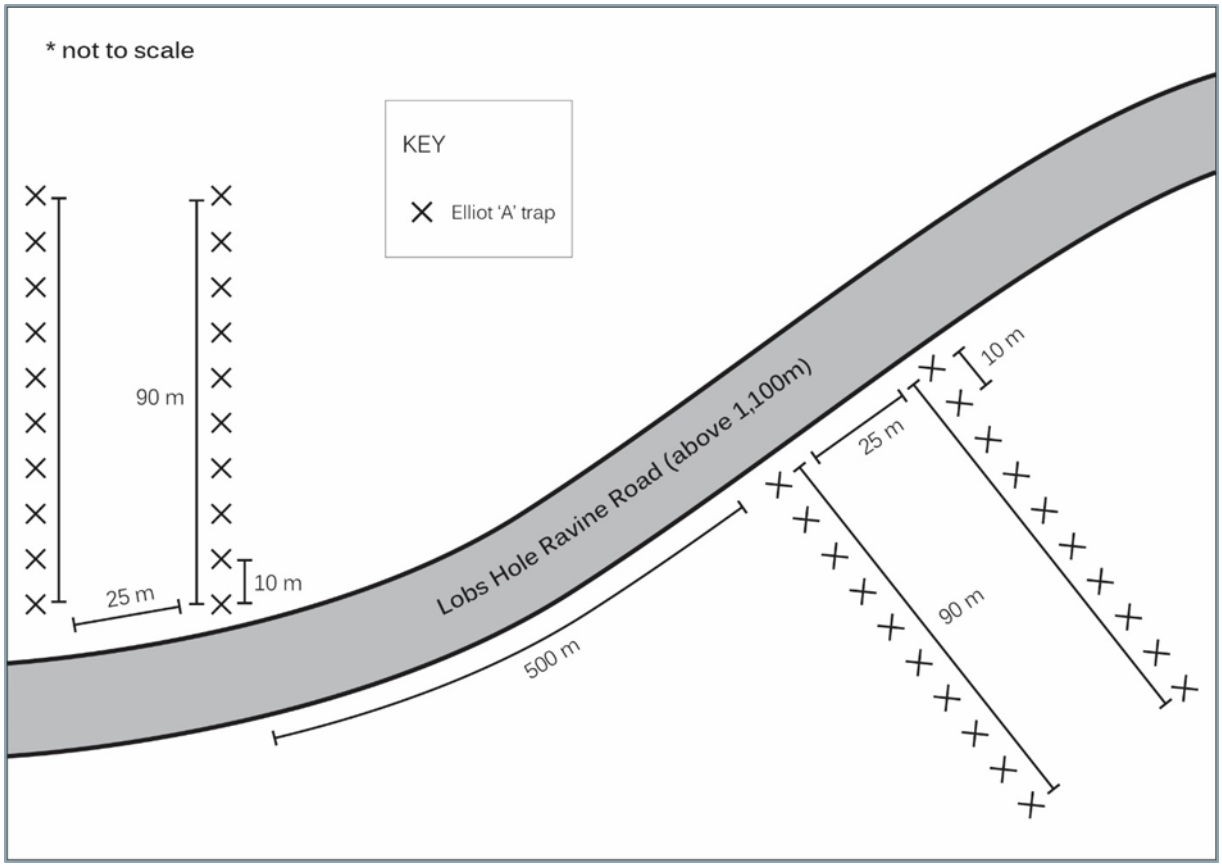


Figure 3-11: Smoky Mouse population monitoring - trapping set up

# 4. BOOROOLONG FROG MONITORING PROGRAM

## 4.1. Baseline Conditions

Surveys for the Booroolong Frog were completed for the Snowy 2.0 Exploratory Works, Biodiversity Development Assessment Report (EMM 2018). The Booroolong Frog was recorded at 59 locations within the survey area along the Yarrangobilly River, from the full supply level (FSL) of Talbingo Reservoir to the upper reaches of the Yarrangobilly River, as well as along Wallaces Creek (Figure 4.1). It is likely that this population extends upstream to at least Blue Creek Fire Trail (Dave Hunter OEH, pers. comm.).

Water quality sampling has been undertaken by EMM (2018) at four locations in the Yarrangobilly River and at three locations in Wallaces Creek, with samples obtained on three occasions between February to April 2018. All sampling was undertaken during base flow conditions. A summary of the water quality results is presented in Appendix C. Key results from water quality sampling are summarised as follows:

- pH ranged between 7.5 to 8.4, within the ANZECC (2000) guideline rage of 6.8 to 8.5;
- electrical conductivity (an indicator of salinity) ranged between 32 to 185 µS/cm, within the guideline range of 30 to 350 µS/cm;
- suspended solids and turbidity were consistently either below detection limits or within the lower end of the guideline range. This is in line with expectations given the clear appearance of the water;
- phosphorus and nitrogen concentrations were below guideline values in all samples except for a single sample form the Yarrangobilly River that recorded a Nitrate concentration of 1.9 mg/L; and
- all dissolved metal concentrations were below guideline values following hardness adjustments except for:
    - a single sample of Aluminium that was marginally elevated relative to the guideline value;
    - all samples of Barium were elevated relative to the low reliability trigger value; and
    - a single sample of Fluoride that was elevated relative to a low reliability trigger value.

These results indicate the Yarrangobilly River is in good condition, reflecting the predominantly undisturbed catchment contained within a national park.

The Yarrangobilly River provides optimal breeding habitat for Booroolong Frog, with a series of cobble banks and bedrock structures along stream margins, with slow-flowing water. These areas are connected by larger, slow-flowing pools. Breeding habitat in Wallaces Creek is much more limited, with only small sections providing suitable breeding habitat. It is likely this area provides sub-optimal breeding habitat as well as connective and dispersal habitat.

During the breeding season the species shelters under rocks or amongst vegetation near the ground on the stream edge (Anstis 2002, Robinson 1993). In winter, the frogs have been observed under rocks within the riparian zone (Anstis et al. 1998, OEH 2012). The Booroolong Frog is not known to move very far along the stream from where they are recorded (less than 50 m within a season) with maximum movements recorded being 300 m (Hunter 2001). During targeted surveys, the Booroolong Frog was observed up to 130 m from the Yarrangobilly River during a high rainfall event that saw key breeding habitat flooded. During this period the majority of frogs were observed within the riparian zone (i.e. within 50 m of the Yarrangobilly River, see Figure 4-2).

Based on the above information, the Yarrangobilly River and Wallaces Creek have been identified as breeding habitat, while areas within 50 m of this breeding habitat has been identified as potential dispersal and refuge habitat.

Figure 4-1: Booroolong Frog captured within the project area

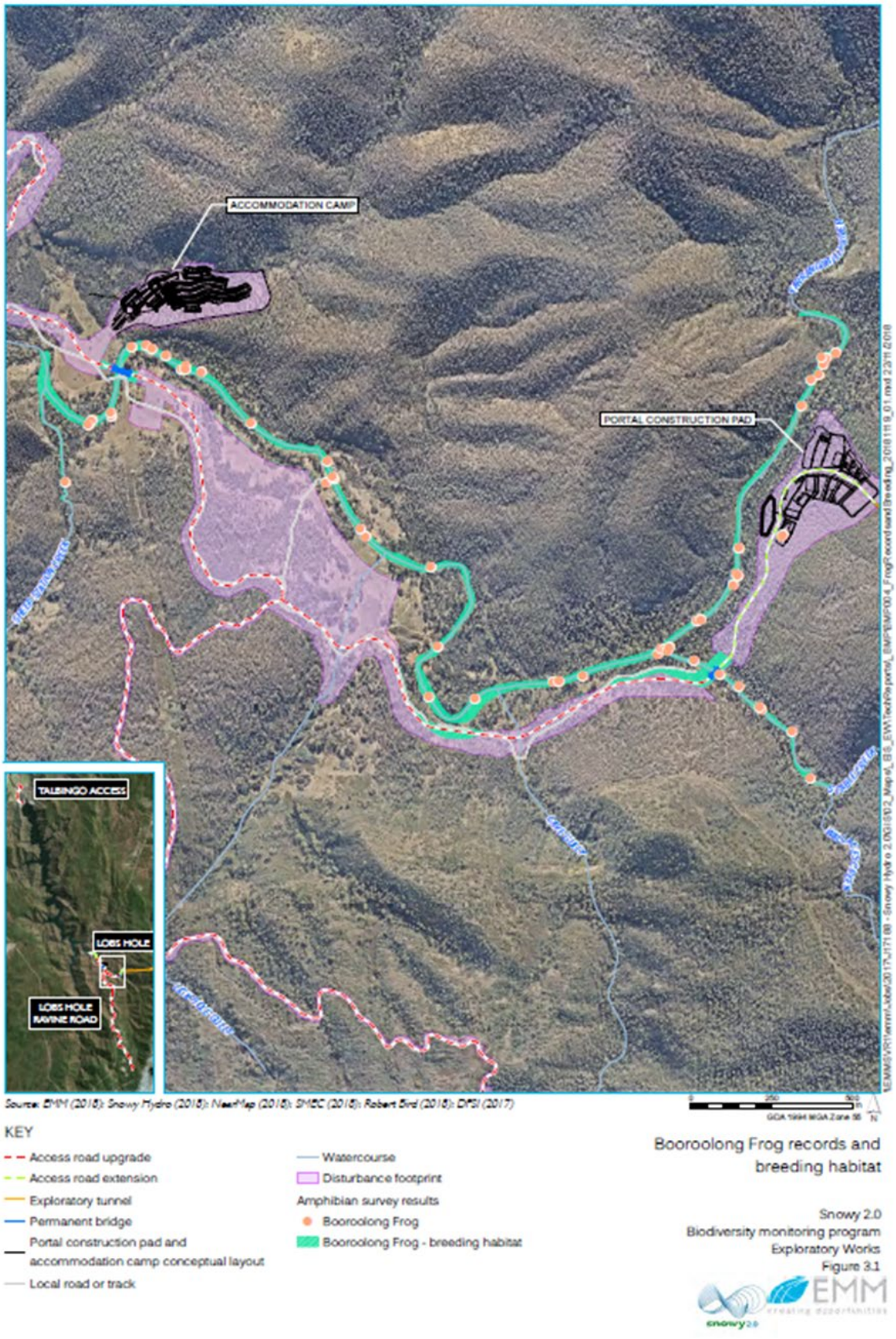


Figure 4-2: Booroolong Frog records and breeding habitat

## 4.2. Mitigation Measures

In recognition of the location of the project in the Kosciusko National Park (KNP), and associated biodiversity and other values of the KNP, the project has undergone significant steps to avoid, minimise and mitigate impacts. The main mitigation measure to avoid impacts on Booroolong Frog has been through avoidance of direct impact (clearance) on Booroolong Frog habitat. Early in the design stage of the project, a key measure to avoid impacts to Booroolong Frog has been the development of a buffer along the Yarrangobilly River of 50 m, and avoidance of works within this buffer area to protect the species' habitat. In consultation with species experts from OEH, it was determined that if works can be avoided within this 50 m buffer direct impacts to Booroolong Frog can be avoided, along with most indirect impacts.

After substantial efforts to avoid Booroolong Frog habitat, residual direct impacts that will occur as a result of the project include:

- the proposed road upgrade will impact on the 50 m buffer at three locations:
  - the bridge over the Yarrangobilly River;
  - the bridge over Wallaces Creek; and
  - along Mine Trail Road in the eastern section of Lobs Hole.

Residual potential indirect impacts that could occur as a result of the project include:

- the mobilisation of large amounts of coarse sediments into Booroolong Frog habitat, with the key period for mobilisation being during initial earthworks for the road upgrades; and
- the potential for contamination of receiving waters due to accidental leaks and spills or surface water discharge.

To prevent these indirect impacts from occurring, the following mitigation measures are being implemented for the project:

- a sedimentation and erosion control plan will be prepared for each construction zone for the project with a range of sediment controls being put into place within the disturbance footprint and to mitigate any impacts to the Yarrangobilly River (see Sedimentation and Erosion Control Plan);
- during construction and operations frog exclusion fencing will be installed in key areas where infrastructure is near 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;
- fauna spotters will check areas prior to clearing for Booroolong Frog and translocate them to adjacent habitats away from impacts;
- a surface water management plan will be prepared for the project with a range of surface water controls being put into place within the disturbance footprint and to mitigate any impacts to the Yarrangobilly River (see Surface Water Management plan).
- no water will be extracted from the Yarrangobilly River for the project, all water will be sourced from the Talbingo Reservoir;
- a surface water monitoring program will be implemented to ensure run-off does not result in changes in water quality within the Yarrangobilly River (see this Section and the Surface Water Monitoring Program – Appendix B.3 of the EMS); and
- it is intended that the exploratory tunnel, portal and construction portal will be decommissioned and rehabilitated following completion of the project.

Following measures to avoid impacts to Booroolong Frog and its habitat outlined in EMM (2018) the project will result in direct impacts to 2.48 ha of habitat for the Booroolong Frog. The implementation of a 50 m buffer will also avoid the majority of indirect impacts. To determine the effectiveness of this control measure EMM (2018) recommended a monitoring program will be implemented, and include the following:

- water quality monitoring;
- population monitoring; and
- habitat monitoring.

## 4.3. Monitoring Objectives

The overarching monitoring objective for Booroolong Frog is to determine whether controls put in place to avoid and minimise project impacts to the species have avoided impacts to the population, specifically:

- to determine ongoing population trajectory of the Yarrangobilly Booroolong Frog population;
- to compare shifts in distribution and abundance of Booroolong Frog rocky breeding habitat between treatment (Yarrangobilly River and Wallaces River within Lobs Hole in the project area) and control (upstream of the project area) sections of the Yarrangobilly River;
- to compare changes in the depth of pools between treatment and control sections of stream; and
- to identify and quantify any water quality impacts (within the Yarrangobilly River and Wallaces Creek) arising from the project that may impact upon the Booroolong Frog.

## 4.4. Monitoring Parameters

To determine if the mitigation measures put into place effectively mitigate indirect impacts to Booroolong Frog as a result of the project, the following parameters will be monitored:

- population;
- habitat characteristics; and
- surface water quality.

## 4.5. Population Monitoring

The monitoring of Booroolong Frog population will be undertaken by a suitably qualified ecologist(s) and will be undertaken as detailed in Table 4-1.

**Table 4-1: Booroolong Frog population monitoring**

| **Objective** |
|---|
| To determine ongoing population trajectory of the Yarrangobilly Booroolong Frog population, and document any changes arising from the project. |
| **Sampling units** |
| Occupancy (presence/absence) and relative abundance of male frogs along rocky sections of stream bank (breeding habitat) along the Yarrangobilly River and Wallaces Creek. |
| **Method** |
| *Stream transects*<br>Stream transects are undertaken along rocky sections (breeding habitat) of the Yarrangobilly River and Wallaces Creek. This method is particularly focused on determining the occupancy of breeding habitat by mature male frogs and will encompass the following:<br>• Spotlighting within the riparian zone for eye-shine;<br>• Spotlighting to occur in representative transects along the Yarrangobilly River and Wallaces Creek of 500 m in length;<br>• Two observers to walk each 500 m transect using a spotlight and headtorches;<br>• Hygiene protocols to be followed to prevent the spread of chytrid fungus;<br>• The location, sex, and total number of frogs observed during each census to be recorded; and<br>• Data will be collected via the proforma included as Appendix B. This includes recording, as a minimum, the date, weather conditions, count, sex, location (easting and northing as well as descriptive attributes), accuracy of location recorded and recorders. |
| **Location** |
| A total of five transects will be located within the sections of streams subject to the project works (treatment section, four in Yarrangobilly River, one in Wallaces Creek), as well as two transects within the control section upstream of the works, along the Yarrangobilly River. Each transect is to be located along rocky sections of stream bank (breeding habitat). See Figure 4-3: Booroolong Frog population monitoring - transect set up for an indicative layout of the transect set up and Figure 4-4 for indicative locations within the treatment and control sections. |
| **Timing, effort and frequency** |
| • Two separate nocturnal monitoring events during the breeding season (November to mid-December) per year;Surveys will be undertaken during suitable conditions (no rain, low stream flows, relatively light wind and air temperature above 10 degrees);<br>• Each 500 m transect will be surveyed for frog abundance each year on two separate occasions between the start of November and mid-December; and<br>• More than four nights and two observers may be required to survey all indicated transects four times within each of the two events. |
| **Data analysis** |
| • Breeding habitat is defined as an area of rocky habitat occupied by one or more mature male Booroolong Frog during the breeding season;<br>• The collected data should be entered into a database for comparison of occupancy of Booroolong Frog in identified breeding habitat between each breeding season; and<br>• 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). |
| **Triggers for adaptive management** |

- 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 and that does not also occur at the control sites;
- Decline in relative abundance is accompanied by a decline in other monitoring parameters (see Section 3.6 and Section 3.7).

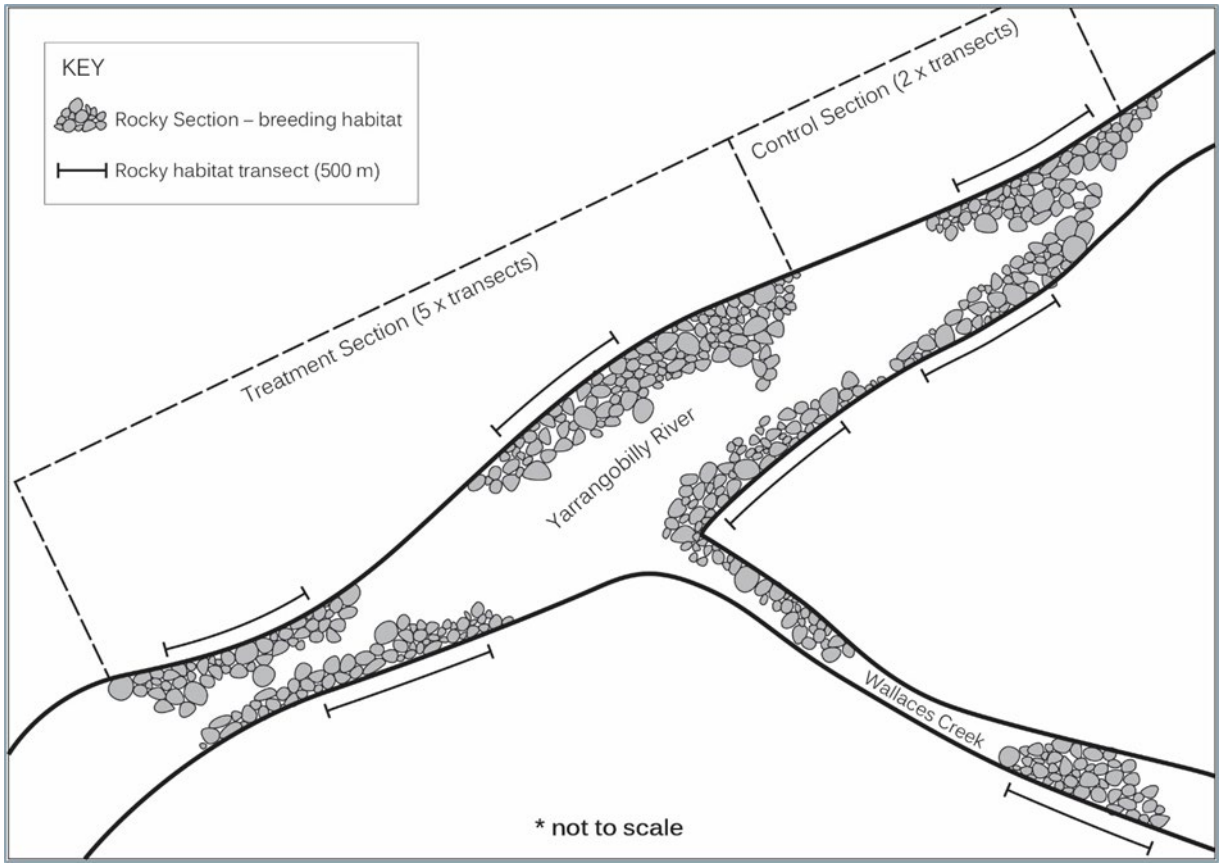


**Figure 4-3**: **Booroolong Frog population monitoring - transect set up**

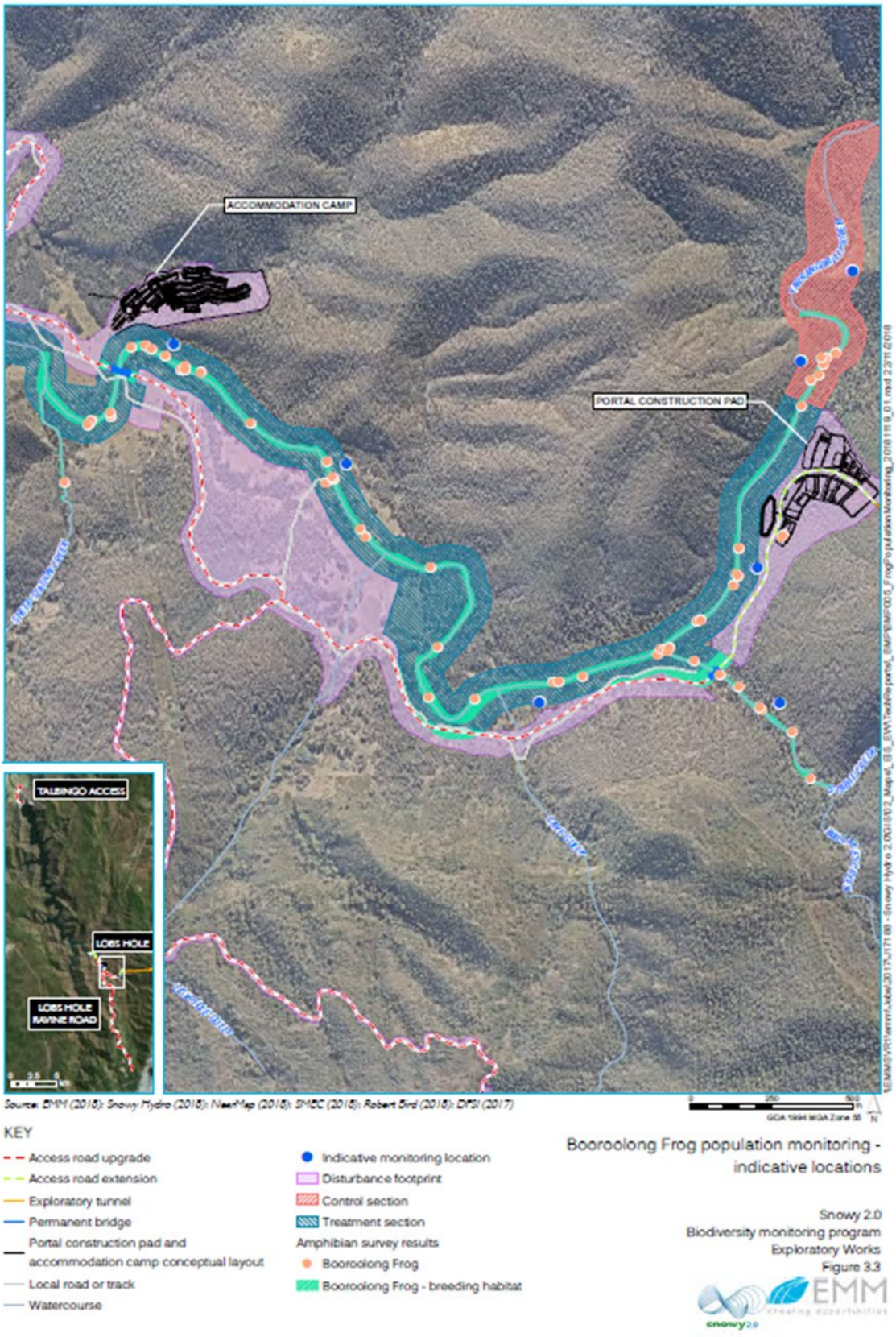


Figure 4-4: Booroolong Frog population monitoring indicative locations

## 4.6. Habitat Characteristics Monitoring

The monitoring of Booroolong Frog habitat characteristics will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 4-2.

**Table 4-2: Booroolong Frog habitat characteristics monitoring**

| Objective |
|---|
| To monitor rocky breeding habitat and depth of pools within sections of the Yarrangobilly River and Wallaces Creek that occur within the project area, and document any changes arising from the project. Specific objectives are:<br>• 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); and<br>• to compare changes in the depth of pools between treatment and control sections of stream. |
| **Sampling units** |
| Rocky sections of stream bank (breeding habitat) in treatment and control sections; and<br>Depth of pools in treatment and control sections. |
| **Method** |
| *Rocky breeding habitat monitoring*<br>• Measures the distribution, type, and length of rocky habitats along the stream banks of the Yarrangobilly River and Wallaces Creek within the treatment sections (five representative transects measuring 500 m in length, four in Yarrangobilly River and one in Wallaces Creek) and also along the stream banks of the control section of the Yarrangobilly River (two representative transects measuring 500 m in length). The location of these transects could be replicated from the population monitoring transects. Rock type is divided into two broad categories:<br>– cobble banks - a section of stream bank greater than 2 m in length with a continuous cover of loose rock; and<br>– 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.<br>• Sections of habitat are recorded separately where they are separated by more than 1 m of unsuitable habitat;<br>• A GPS waypoint is taken to record the location of the start of each section of breeding (rocky) habitat, with the position of the habitat also recorded as left bank, right bank, or middle (when facing upstream);<br>• The length of each rocky section is measured in metres, relative to the approximate centre-line of the stream.<br>*Pool depth monitoring*<br>• A pool is defined as a discrete deeper section of stream with relatively slow flow;<br>• Pool depth monitoring is recorded when a GPS waypoint is taken to record the location of the centre of each pool;<br>• The location and approximate maximum depth of each pool is recorded in centimetres, as well as the pool length in metres, to the nearest 10 cm;<br>• Pool depth monitoring is to occur within the treatment sections of the Yarrangobilly River and Wallaces Creek (five representative transects measuring 500 m in length, four in Yarrangobilly River and one in Wallaces Creek) and also along the control section of the Yarrangobilly River (two representative transects measuring 500 m in length). These transects cannot be replicated from the rocky breeding habitat monitoring and population monitoring as they are measuring pool depth; |

- Data will be collected via the proformas included as Appendix A. This includes recording the information explained above for both rocky breeding habitat monitoring and pool depth monitoring, as well as the date, weather conditions, accuracy of locations mapped, photos of each area of habitat recorded (with GPS enabled camera), any other notable features (for example visible disturbance) and recorders;
- Data will be imported into a Geographic Information System (GIS) database in order to digitally map the identified habitat;
- The GPS enabled photographs and notes on the identified habitat will be attached to each mapped area within the GIS mapping. This will allow comparison of data and habitat mapping between each monitoring period.

**Location**

*Rocky breeding habitat monitoring*

A total of five representative transects will be located within the sections of streams subject to the project works (treatment section, four in Yarrangobilly River, one in Wallaces Creek), as well as a total of two transects within the control section upstream of the works, along the Yarrangobilly River. Each transect is to be located along rocky sections of stream bank (breeding habitat).

*Pool depth monitoring*

A total of five representative transects will be located within the sections of streams subject to the project works (treatment section, four in Yarrangobilly River, one in Wallaces Creek), as well as a total of two transects within the control section upstream of the works, along the Yarrangobilly River. Each transect is to be located along representative areas with pools.

See Figure 4-5 for an indicative layout of the transects set up. Indicative monitoring locations within the treatment and control sections are not shown, as suitable locations will need to be determined during the first monitoring event.

**Timing, effort and frequency**

The entire treatment section and control section will be mapped on a yearly basis, and after any surface water incidents that have the ability to mobilise large amounts of coarse sediments into Booroolong Frog habitat, with the key period for mobilisation being during initial earthworks for the road upgrades.

**Data analysis**

- Data and habitat mapping from each monitoring event will be compared to that collected and mapped for the previous monitoring event;
- This will allow detection of any changes in rocky breeding habitat and pool depth along the treatment sections; and
- 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).

**Triggers for adaptive management**

- Observed degradation, change or loss of rocky (breeding) habitat or pools within the Yarrangobilly River and Wallaces Creek that occur within the treatment section, that is not also observed in the control section of the Yarrangobilly River (upstream of the project area).

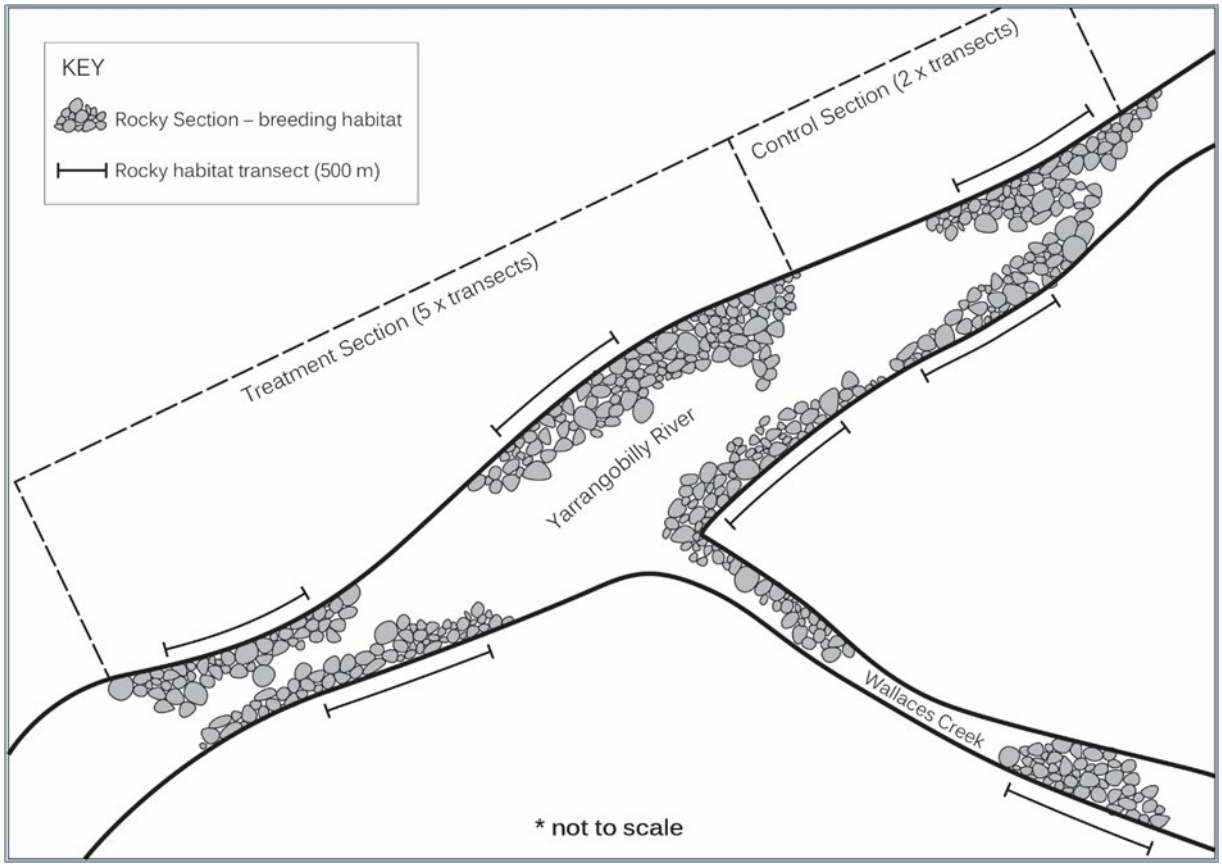


Figure 4-5: Booroolong Frog population monitoring - transect set up

## 4.7. Surface Water Quality Monitoring

Appendix B2 of the EMS contains the Surface Water Management Plan (SWMP) and related Surface Water Monitoring Program (Appendix B of the SWMP) for the project.

An Environment Protection Licence (EPL) (No 21266) has been obtained for the project. The EPL prescribes water quality parameters to be measured and associated discharge criteria for licenced stormwater basins and construction sediment basins. It also details the monitoring and analytical requirements by reference to authority publications e.g. Approved Methods for Sampling and Analysis of Water Pollutants in NSW, 2004.

Mobilisation of fine sediments into the watercourses located in the project area is unlikely to result in long-term impacts to habitat for the Booroolong Frog; these events will be pulse events and will be rapidly flushed out of the system resulting in negligible impacts to this species (Dave Hunter OEH pers. comm.). Likewise, short term reductions in water quality are unlikely to result in impacts to habitat for the Booroolong Frog, as they will be rapidly flushed out of the system. The key mechanism for impacting on habitat for the Booroolong Frog will be mobilisation of large amounts of sediment, which clog interstitial spaces providing key breeding habitat for the Booroolong Frog, or long term negative changes to water quality.

The data collected during regular monitoring for the Surface Water Monitoring Program will be used to monitor surface water quality for the Booroolong Frog.

**Table 4-3: Booroolong Frog surface water quality monitoring**

| **Objective** |
|---|
| To identify and quantify any surface water quality impacts (within the Yarrangobilly River and Wallaces River) arising from the project, that may impact upon the Booroolong Frog. |
| **Sampling units** |
| • Weather;<br>• Volumetric discharge;<br>• Stormwater; and<br>• Full suite of water quality parameters. |
| **Method** |
| The following monitoring will be undertaken for the Surface Water Monitoring Program:<br>*Weather station*<br>• An automated weather station will be installed within Lobs Hole to accurately account for rainfall across the site during rain periods (Figure 4-5).<br>*Stream gauges*<br>• Stream gauges are located or will be installed within the project area to record volumetric discharge ( Figure 4-5).<br>*Flow meters*<br>• Flow meters will be installed at all process water monitoring locations to determine water usage and the net extraction or discharge to Talbingo Reservoir during construction.<br>*Stormwater monitoring*<br>• Stormwater monitoring will be undertaken in accordance with the SWMP.*Water quality monitoring*<br>The Surface Water Monitoring Program will involve the monitoring of a suite of properties.<br>Large amounts of coarse sediments, as a result of surface water runoff within the project area, have been identified as being the key potential impact to Booroolong Frog habitat within the treatment sections and therefore monitoring of TSS will be useful. Other parameters have not been identified as having a potential significant impact to the Booroolong Frog or its habitat within the treatment sections |

(Dave Hunter OEH pers. comm. 11 October 2018). However, these parameters may be useful to review when attempting to identify any potential causes or correlations with impacts to the species habitat or population.

**Location**

The above parameters will be monitored at each of the monitoring locations as shown on Figure 4-5.

**Timing, effort and frequency**

- *Weather station*: continuous;
- *Stream gauges*: continuous;
- *Flow meters:* continuous;
- *Stormwater monitoring:* quarterly or as defined within the approved WMP;
- *Water quality monitoring*: monthly or as defined within the approved WMP; and
- Liaison between the site environmental representative, the project staff member responsible for surface water monitoring and the project Ecologist in charge of Booroolong Frog monitoring is essential to share collected water quality data and to respond effectively to event based monitoring, if required.

**Data analysis**

- Data from each monitoring event and parameter to be suitable stored (e.g. excel datasheet) to allow water quality data to be reviewed to identify any potential causes or correlations, to inform adaptive management.

**Triggers for adaptive management**

- Decline in water quality for three consecutive monitoring periods (see Surface Water Quality Water (S2-FGJV-ENV-PLN-0025), TARP for water quality trigger values. Step 1 of the Surface Water Quality TARP will be implemented and partnered with Booroolong Frog monitoring criteria (see above sections), to develop appropriate mitigation measures.

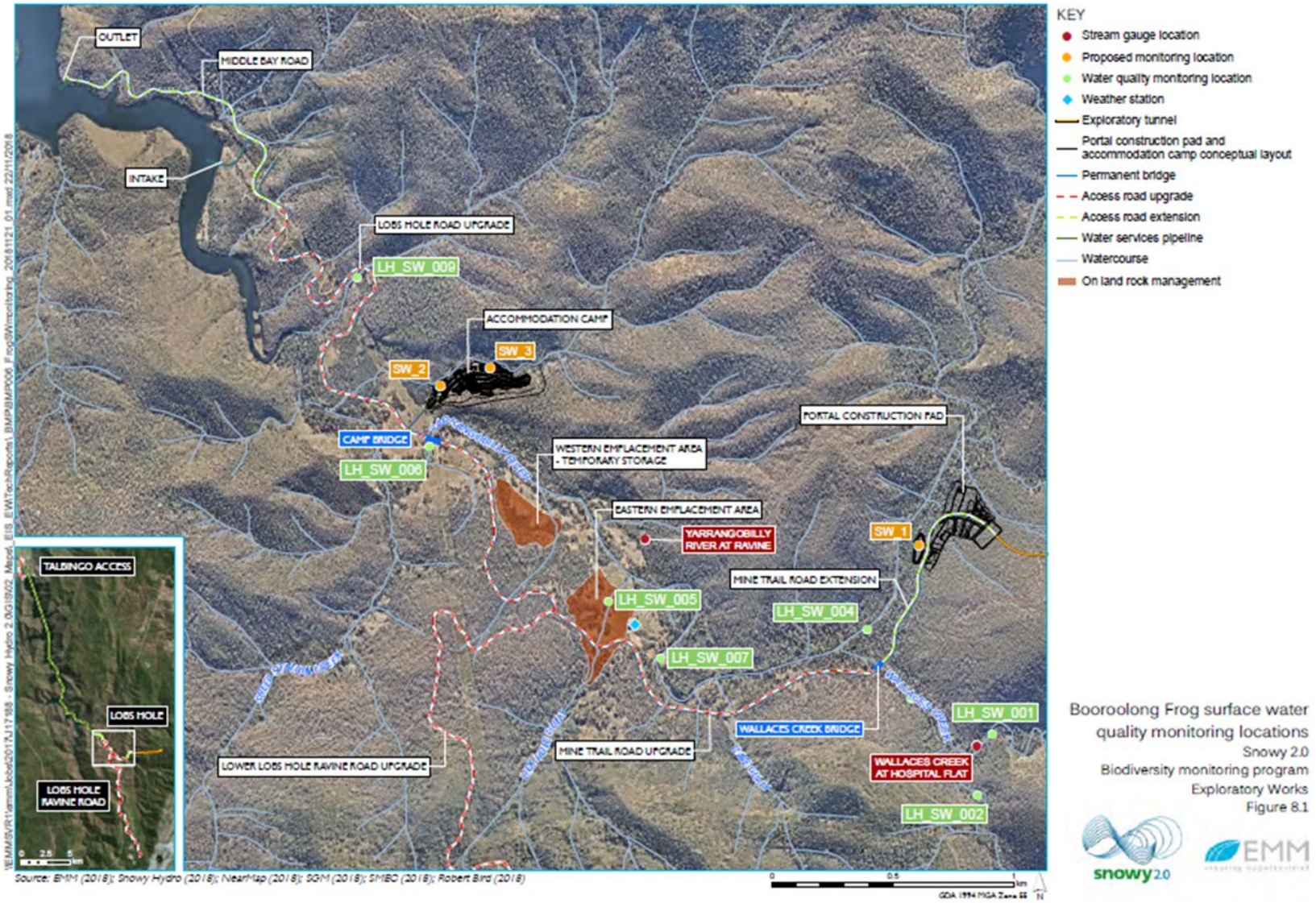


Figure 4-6: Booroolong Frog surface water quality monitoring indicative locations (refer to the SWMP)

# 5. WEED AND PATHOGEN MONITORING PROGRAM

## 5.1. Baseline Conditions

Vegetation surveys were completed for the Snowy 2.0 Exploratory Works, Biodiversity Development Assessment Report (EMM 2018). Vegetation along the upper (southern) extent of Lobs Hole Ravine Road is largely intact, with minimal disturbance evident. Vegetation comprises tall montane forests with large trees and a shrubby understorey. Weed invasion is minimal, limited to road edges. The lower section of Lobs Hole Ravine Road, generally below 1,200 m, consists of dry sclerophyll forests with a shrubby to grassy understorey. In some areas, disturbance due to past land use is evident and significant, while in other areas there is minimal disturbance. Weediness varies, depending on past land use, and is heavy in some areas.

Lobs Hole has a long history of occupation, first used in the early 1800s for the movement of stock. Since this time Lobs Hole has been the site of prospecting, grazing, settlement, refuge from the winters of Kiandra, gardening and agriculture. From the 1860s to approximately 1917, Lobs Hole was the site of copper mining. During the construction of the Snowy Scheme, Lobs Hole was well used during surveying work. A major surveying camp was set up by Major Clews at Lobs Hole (believed to be at the junction of the Yarrangobilly and Tumut rivers and now under water, but this is not confirmed) and the Wallaces Creek camp was apparently located near to the junction of Wallaces Creek and Yarrangobilly River (exact location unknown). Lobs Hole is now a public camping area (Ravine Campground) with a boat ramp which is used to access the southern reaches of Talbingo Reservoir.

These activities and past land uses have resulted in significant amounts of clearing and disturbance of vegetation in the area. Native vegetation, which includes fauna habitats have been modified by past disturbances associated with land clearing, livestock grazing and weed invasion. Native vegetation has re-established itself throughout Lobs Hole; however, Blackberry (Rubus fruticosus species aggregate), a weed of national significance, has established itself to the point of infestation within the area. The riparian zones of both Wallaces Creek and the Yarrangobilly River within the project area are reasonably well vegetated, except for the lower section of the Yarrangobilly River which has been subject to clearing in Lobs Hole. In this area some banks are unvegetated. Both watercourses are subject to significant weed infestation, in particular with Blackberry.

Key weed species identified in *Rehabilitation Guidelines for the Resort Areas of Kosciuszko National Park* (DECC 2007) and recorded during flora surveys for the broader Snowy 2.0 project include:

- Sheep Sorrel (*Acetosella vulgaris*);
- Yarrow (*Achillea millefolium*);
- Browntop Bent (*Agrostis capillaries*);
- Sweet Vernal Grass (*Anthoxanthum odoratum*);
- Spear Thistle (*Cirsium vulgare*);
- Hawthorn (*Crataegus monogyna*);
- Cocksfoot (*Dactylis glomerata*);
- Patterson's Curse (*Echium plantagineum*);
- Yorkshire Fog Grass (*Holcus lanatus*);

- St John's Wort (Hypericum perforatum);
- Cat's Ear/Flatweed (*Hypochaeris* spp.);
- Bird's-foot Trefoil (*Lotus* spp.);
- Musk Monkey Flower (*Mimulus moschatus*);
- Sweet Briar (*Rosa rubignosa*);
- Blackberry (Rubus spp.);
- Dandelion (*Taraxacum officinale*); and
- Mullein/Aarons Rod (*Verbascum thapsus* and *V. virgatum*).

Areas which have experienced considerable disturbance within the Exploratory Works footprint exhibit evidence of weeds. There are three identified weeds of significance in gullies and along Yarrangobilly Creek and Talbingo Reservoir and one high threat weed (Ox-eye daisy) within the southern part of Tantangara spanning west towards Nungar track. These weeds are:

- *Hypericum perforatum* (St. Johns Wort);
- *Leucanthemum vulgare* (Ox-eye Daisy);
- *Rosa rubiginosa* (Sweet Briar); and
- *Rubus* spp. (Blackberry).

Other 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*);
- Ox-eye Daisy (*Leucanthemum vulgare*);
- Serrated Tussock (*Nasella trichotoma*);
- English Broom (*Cytisus scoparius*);
- Cape Broom (*Genista monspessulana*);
- Lupins (*Lupinus polyphyllus*);
- Yarrow (*Achillea millefolium*):
- Large-flowered Mountain Trumpet (*Collomia grandiflora*):
- Cinquefoil (*Potentilla*)
- Phalaris (*Phalaris aquatica*);
- Willows (*Salix* spp.);
- Forget-me-not (*Myosotis laxa* subsp. *caespitose*;)
- Mouse-eared Hawkweed (*Hieracium pilosella*); and
- Orange hawkweed (*Hieracium aurantiacum*).

Recently, there has been growing concern about the introduction of Orange Hawkweed to additional areas of the KNP. Currently there are seven infestations, totalling approximately 10 ha, currently confined to an area of some 8165 ha in the Jagungal wilderness area, which is situated over 50km south of the Project area. Orange hawkweed (Hieracium aurantiacum) presents a major

threat to primary production and biodiversity across south-eastern Australia. It is on the National Alert List of Environmental Weeds. In addition, orange hawkweed is recognised as an agricultural sleeper weed in Australia. Under the Noxious Weeds Act 1993, all hawkweeds (*Heiracium* spp.) are listed as Class 1 noxious weeds.

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* has 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 remains to be established if *P.cinnamomi* could be pathogenic under the conditions in the KNP (Keith McDougall OEH 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* en masse (Keith McDougall OEH pers. comm. 12 September 2018). *Pimelea bracteata* was not recorded within the project area.

## 5.2. Mitigation Measures

In recognition of the location of the project in the KNP, and associated biodiversity and other values of the KNP, the project has undergone significant steps to avoid, minimise and mitigate impacts. The main measure to minimise impacts associated with possible weed and pathogen introduction or exacerbation, has been to place project roads and infrastructure, where possible, in areas of existing roads and disturbed areas from past land use. However, indirect impacts that could occur because of the project include:

- increased movement of vehicles has the potential to transport weeds and pathogens (such as Phytophthora) into the disturbance footprint and adjacent vegetation, resulting in degradation of vegetation and fauna habitat (including Smoky Mouse habitat).

To prevent these indirect impacts from occurring, the following mitigation measures are being implemented for the project:

- wash-down stations will be constructed at suitable locations, with wash down for weeds as well as Phytophthora. Wash-down of all vehicles will be completed prior to movement from Link Road to Lobs Hole Ravine and vice versa; and
- a weed and pathogen monitoring program and implementation of weed and/or pathogen control programs if weeds and/or pathogens are identified (this Section).

## 5.3. Monitoring Objectives

The overarching monitoring objective for weeds and pathogens is to determine whether controls put in place to ensure weed cover does not increase across the project area and to ensure pathogens do not enter the project area, particularly in key fauna habitat, are successful. The objective is to also inform the location and extent of controls, specifically:

- to determine weed presence/absence within proximity to project roads and key project infrastructure;
- to determine changes in weed cover within proximity to project roads and key project infrastructure; and
- to undertake soil sampling in order to monitor pathogens within proximity to project roads and key project infrastructure.

## 5.4. Monitoring Parameters

To determine if the mitigation measures put into place effectively mitigate potential weed and pathogen impacts, particularly in key fauna habitat, the following parameters will be monitored:

- weed presence/absence;
- weed cover; and
- soil pathogen presence/absence.

## 5.5. Weed Presence/Absence Monitoring

The monitoring of weed presence/absence will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 5-1.

**Table 5-1: Weed presence/absence monitoring**

| **Objective** |
|---|
| To determine weed presence/absence within proximity to project roads and key project infrastructure, to inform the location and extent of controls. |
| **Sampling units** |
| Weed mapping |
| **Method** |
| *Weed mapping*<br>• Surveys will be undertaken adjacent to project roads and around key infrastructure areas (within a 20 m buffer of these areas) and will record:<br>– weed species identified as a priority for control as per weed species of concern in Chapter 4.1 above and listed in Appendix D of the WFAMP<br>– location using a GPS (easting and northing);<br>– number of individuals, the estimated size of infestation (e.g. $m^2$ for large infestations) and estimated cover (Trace<1%; Light 1-10%, Medium 11-50%, Dense >50%);<br>– age class for woody weeds (seedlings, juveniles, mature, resprout);<br>– comments on any other features; and<br>– photograph of each weed area recorded.<br>– Groups of individuals will be marked out with a waypoint and large infestations will be mapped out as a polygon;<br>• Mapping will be produced that shows the areas, associated weed species and number estimates, to allow comparison between monitoring periods;<br>• Data will be collected via the proforma included as Appendix A; and<br>• Mapping will be updated each monitoring period (new areas and revisit mapped areas to record growth and/or effectiveness of management applied). |
| **Location** |

| |
|---|
| • Adjacent to project roads (Lobs Hole Ravine Road and Mine Trail Road), and within a 20 m buffer;<br>• Adjacent to accommodation camp and within a 20 m buffer;<br>• Adjacent to construction compounds and within a 20 m buffer; and<br>• Figure 5-1 shows indicative locations. |
| **Timing, effort and frequency** |
| Weed mapping will occur once prior to construction (January 2019), annually during construction (Spring) and bi-annually (seasonally based) post construction. |
| **Data analysis** |
| Weed mapping and associated data to be kept in a GIS and accompanying spreadsheet to determine any changes in the presence of weeds between monitoring periods. |
| **Triggers for adaptive management** |
| New occurrence of weeds within proximity to project roads and key project infrastructure, where previously not recorded.<br>Weed species that trigger immediate control are included within Appendix D. |

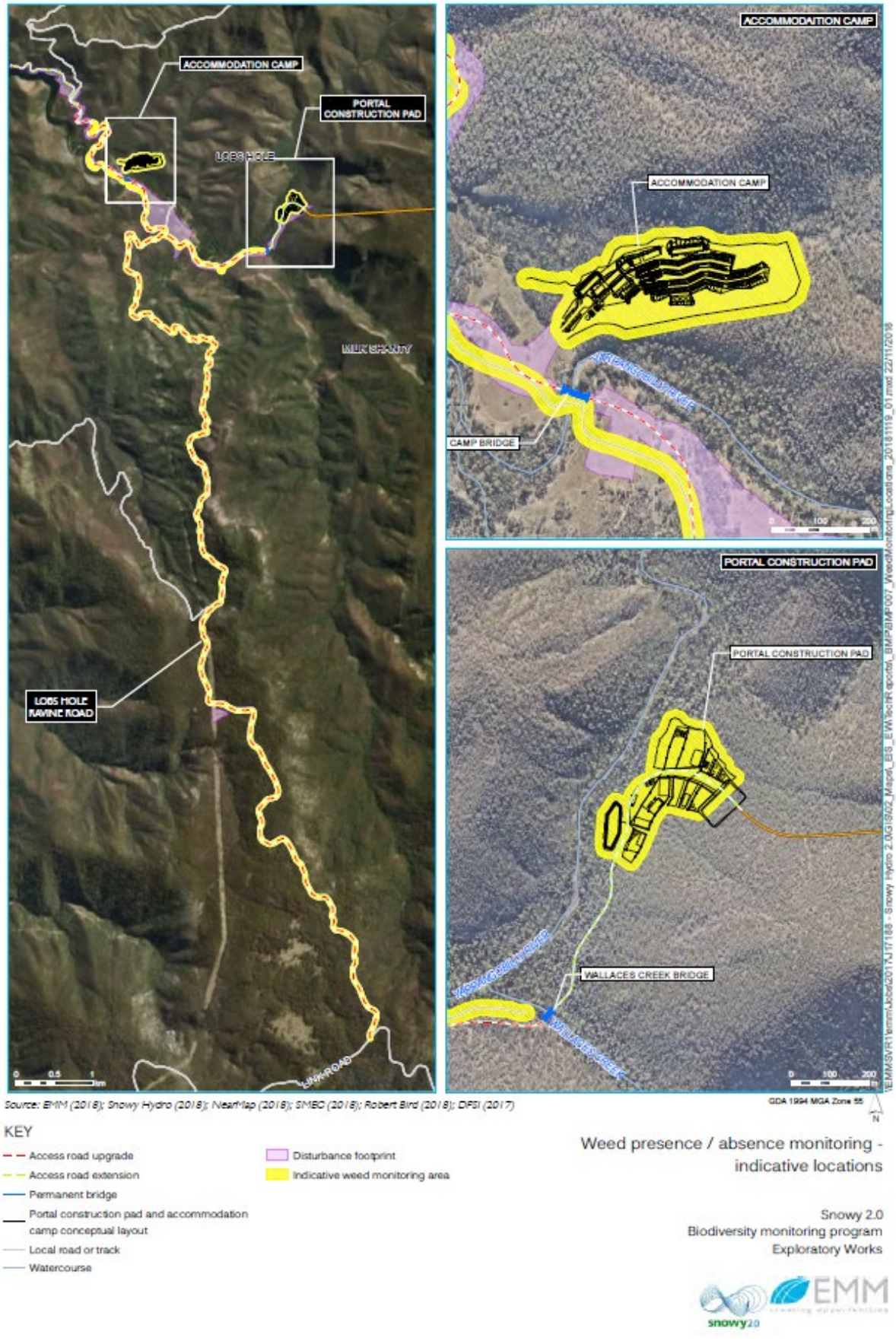


Figure 5-1: Weed presence/absence monitoring indicative locations

## 5.6. Weed Cover Monitoring

The monitoring of weed cover will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 5-2.

**Table 5-2: Weed cover monitoring**

| **Objective** |
|---|
| To determine changes in weed cover within proximity to project roads and key project infrastructure, to inform the location and extent of controls. |
| **Sampling units** |
| Weed cover |
| **Method** |
| *Transects*<br>A series of transects are undertaken adjacent to project roads and around key infrastructure areas;<br>Each set of transects to be placed at 500 m intervals along project roads and around key infrastructure areas;<br>Transects will be 50 m long and will be placed parallel to project roads and key infrastructure, with the first transect placed 10 m from the road/infrastructure area edge, the second placed 20 m from the edge and the third placed 50 m from the edge (Figure 5-2);<br>The line-point intercept method will be used at 1 m intervals along each 50 m transect;<br>At each 1 m interval (starting from 1 m), the cover of weed species will be measured, using a straight rod. Any intercepts or “hits” of a weed species on the rod will be recorded as present (with one being the upper limit for each stratum at each point). No intercepts of weed species at each stratum records a zero;<br>As data is collected for a total of 50 intervals along each transect, the cover (%) of weeds for each ground stratum (exotic shrubs <1 m, exotic grasses and exotic ground cover) is calculated by diving the number of hits by 50, then multiplying it by 100;<br>An estimate of weed cover (% see Specht) for exotic canopy species and exotic mid storey species is to be calculated every 5 m along each 50 m transect;<br>As data is collected for a total of 10 intervals along each transect, the cover (%) of mid storey and canopy weeds is calculated by determining the average of cover at each interval;<br>For the baseline monitoring event, it is necessary to install permanent markers (e.g. star picket marked/flagged with monitoring location name) and to also record the coordinates of each monitoring location, in order to relocate for subsequent monitoring events; and<br>Data will be collected via the proforma included as Appendix A. |
| **Location** |
| Adjacent to project roads (Lobs Hole Ravine Road and Mine Trail Road, as indicated in Figure 5-3);<br>Adjacent to accommodation camp; and<br>Adjacent to construction compounds. |
| **Timing, effort and frequency** |
| Weed cover monitoring will occur once prior to construction (January 2019), annually during construction (Spring) and bi-annually (Spring and Autumn) post construction. |
| **Data analysis** |
| Transect data to be kept in a spreadsheet to determine any changes in the cover (%) of weeds at each transect location between monitoring periods. |
| **Triggers for adaptive management** |
| A significant increase in weed cover, being greater than 10%. |

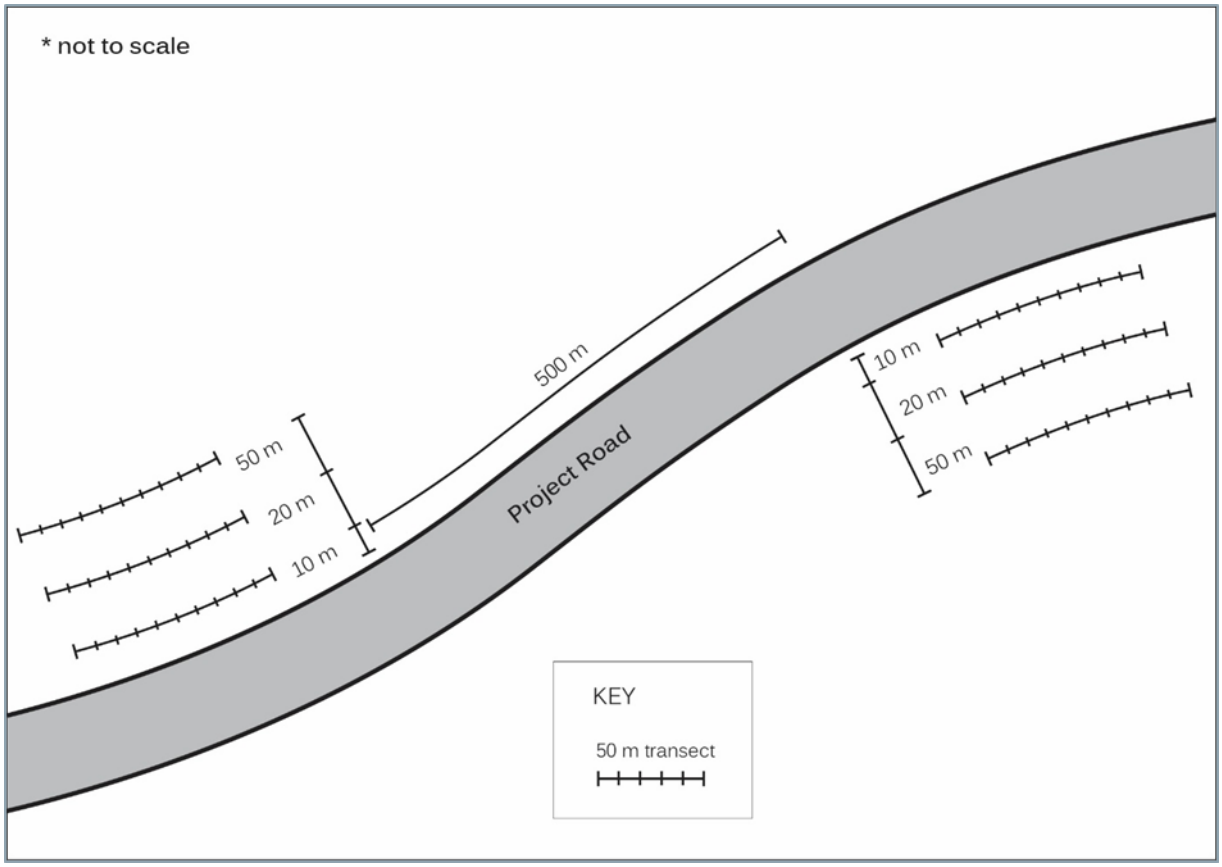


Figure 5-2: Weed cover monitoring - transect set up

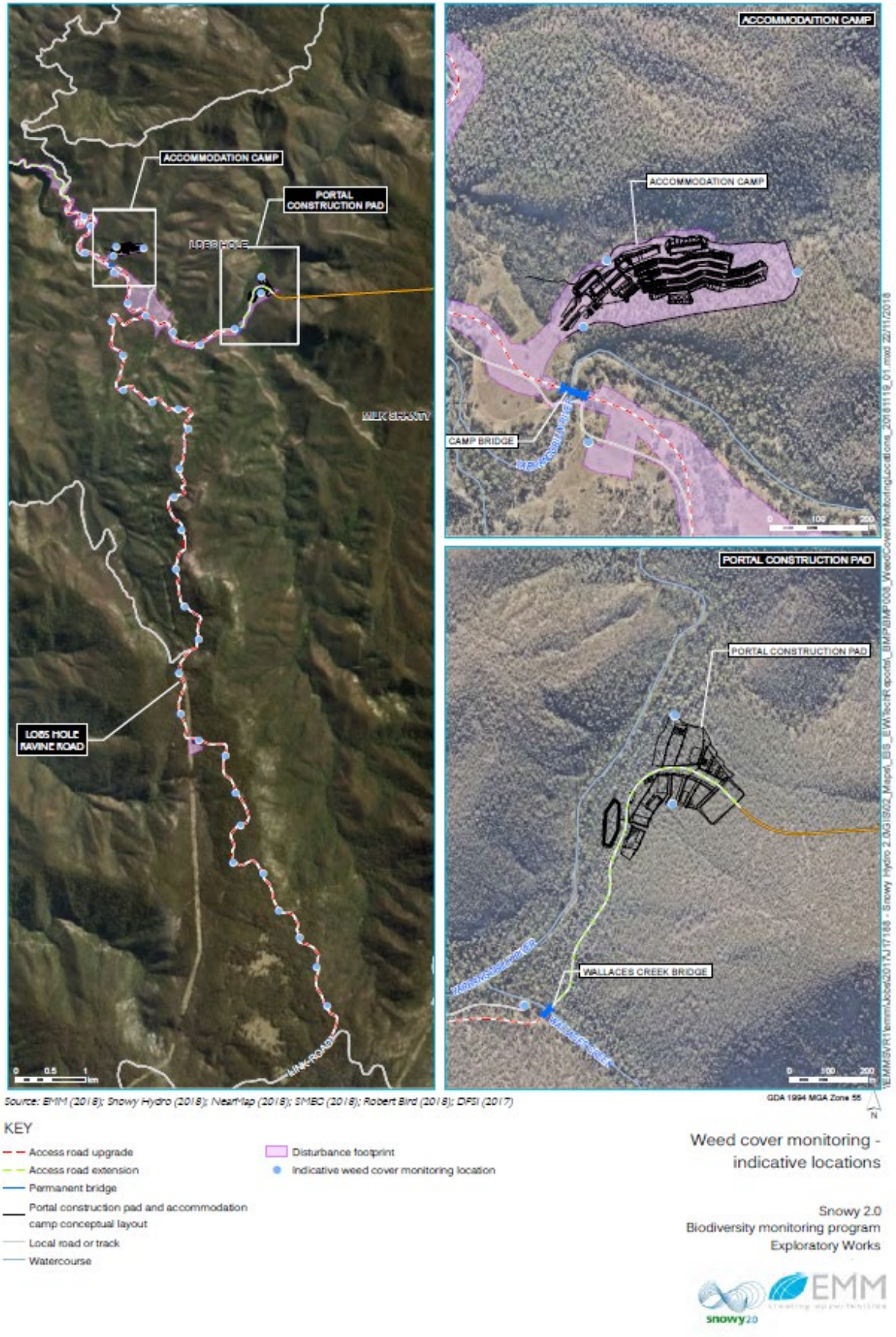


Figure 5-3: Weed cover monitoring indicative locations

## 5.7. 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 5-3.

**Table 5-3: Phytophthora presence/absence monitoring**

| **Objective** |
|---|
| 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. |
| **Sampling units** |
| Soil sampling |
| **Method** |
| *Soil sampling*<br>Soil sampling will occur in key areas such as at vehicle washdown (to ensure that hygiene measures are effective) and around key infrastructure areas and roads where there is movement of vehicles and machinery and will include, at each monitoring location:<br>• use a sterile garden trowel to scrape away surface leaf litter;<br>• dig a small hole, collect a small amount of soil and living plant roots;<br>• place them into a new, thick zip-lock plastic bag;<br>• the hole does not need to be any deeper than 10 cm and you only need 100-250 grams of soils;<br>• label the bag with date, monitoring site code and sample number e.g. 19/12/18, Washdown01, North;<br>• place into a second bag to prevent cross contamination and as a safeguard against breakage;<br>• store soil samples in a cool, dark place and dispatch for analysis as practicable after sampling;<br>• after each sample, scrub your hands and the trowel thoroughly with methylated spirits to disinfect them and prevent cross-contamination of samples; and<br>• send samples to a suitable laboratory to analyse for *Phytophthora.* |
| **Location** |
| • Vehicle washdown stations;<br>• Around key infrastructure areas;<br>• Project roadsides; and<br>• Locations to be established during first monitoring event. |
| **Timing, effort and frequency** |
| • Frequency will comprise four monitoring events per year (quarterly) during pre-construction, an annual event (Spring) during construction and bi-annually (Spring and Autumn) during post-construction phases, commencing prior to construction in January 2019. |
| **Data analysis** |
| Monitoring data (laboratory results) for each monitoring location to be kept in a spreadsheet with additional results added after each monitoring program. |
| **Triggers for adaptive management** |
| A soil sample returns a positive result for *Phytophthora.* |

## 5.8. Other Monitoring

### 5.8.1. Dieback

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 OEH 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 Eucalypt 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 OEH 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 (the proformas in Appendix A include prompts to record any dieback noted) this monitoring program will be reviewed to include monitoring for dieback (mapping, soil testing, using indicator species) and adaptive management measure implemented if required.

# 6. FERAL HERBIVORE MONITORING PROGRAM

## 6.1. Baseline Conditions

Remote camera surveys, spotlighting and opportunistic sightings undertaken for the Snowy 2.0 Exploratory Works, Biodiversity Development Assessment Report (EMM 2018) recorded the following feral herbivores within the project area:

- Horse (*Equus caballus*);
- Deer (*Damas* spp., *Cervus* spp., *Axis* spp.); and
- Rabbit (*Oryctolagus cuniculus*).

The feral herbivore records were not limited to any one habitat type within the project area and it is possible that they occur across the project area.


Figure 6-1: Rabbit captured via remote camera within the project area

## 6.2. Mitigation Measures

To minimise the risk of increased feral herbivore activity, the following controls will be implemented for the project:

- a monitoring program will be implemented using remote cameras to monitor feral herbivore activity (this program);
- remote cameras will be placed along Lobs Hole Ravine Road (north and south), Mines Trail and adjacent to key infrastructure to monitor feral herbivore movements (this program); and
- opportunistic sightings in high risk areas, such as areas of habitation (e.g. the camp and tunnel portal) for feral herbivore activity will be undertaken. Sightings will be recorded and NPWS will be notified.

## 6.3. Monitoring Objectives

The overarching monitoring objective for feral herbivores is to document changes in occupation (presence/absence) and abundance within proximity to the project, arising from increased human activity associated with the project and to inform the location and extent of controls, specifically:

- to determine occupancy and abundance along project roads and adjacent to key project infrastructure; and
- to determine occupancy and abundance on the upper sections of Lobs Hole Ravine Road (in Smoky Mouse habitat).

## 6.4. Monitoring Parameters

To determine if the mitigation measures put into place effectively mitigate indirect impacts associated with feral herbivores, the following parameters will be monitored:

- presence/absence; and
- abundance.

## 6.5. Presence/Absence Monitoring

The monitoring of feral herbivore presence/absence will be undertaken by a suitably qualified ecologist(s) and will be undertaken as detailed in Table 6.1.

**Table 6-1: Feral herbivore presence/absence monitoring**

| **Objective** |
|---|
| To determine feral herbivore presence/absence within proximity to the project and document any changes arising from increased human activity as a result of the project and to inform location and extent of controls. |
| **Sampling units** |
| Remote camera monitoring along project roads and adjacent to key infrastructure. |
| **Method** |
| *Remote camera monitoring*<br>Remote cameras will be placed at locations adjacent to project roads and around key infrastructure areas;<br>• A pair of cameras will be placed at 500 m intervals along the project roads (perpendicular to the roads with each pair of cameras placed on alternate sides of the road) as well as at project infrastructure;<br>• For each pair, one camera will be placed adjacent to the road or infrastructure at 20 m and one will be placed distant to the road or infrastructure at 120 m, as shown in Figure 6-3;<br>• Cameras to be attached to a tree or stake and positioned approximately 1 m above ground; |

- The cameras are to be unbaited, as this is more suitable for long term monitoring;
- Micro siting or otherwise trimming of vegetation with handheld 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;
- Cameras are placed out for one month (30 days) per monitoring period; and
- Coordinates to be recorded at each camera location, in order to repeat the method during each subsequent monitoring event.

**Location**

- Adjacent to project roads (Lobs Hole Ravine Road and Mine Trail Road, as indicated in Figure 6-3);
- Adjacent to accommodation camp; and
- Adjacent to construction compounds.

**Timing, effort and frequency**

- Monitoring frequency will be undertaken as follows: one monitoring event pre-construction will be undertaken in January 2019, during construction one monitoring event per year (Spring or Autumn) lasting 10 days will be undertaken, post construction four monitoring events per year (quarterly) will be undertaken with each event lasting 30 days.

**Data analysis**

- Data to be kept in a spreadsheet to determine presence/absence at monitoring locations between monitoring periods;
- Occupancy is commonly used as a metric for estimating species' occurrence and is a function of abundance (MacKenzie et al 2003; O'Connell and Bailey 2011) as it concerns the probability of a particular animal being in a given site or patch. This method can be misused by only reporting on detection sites and ignoring non-detection sites, thereby failing to calculate the detection probability (O'Connell and Bailey 2011), therefore
- Data trends are to be analysed by a suitably qualified person (e.g. biometrician), in order to determine occupancy. Software programs can also be used for calculating occupancy.

**Triggers for adaptive management**

A statistically significant increase in the number of sites at which feral herbivores recorded over consecutive monitoring periods or years.

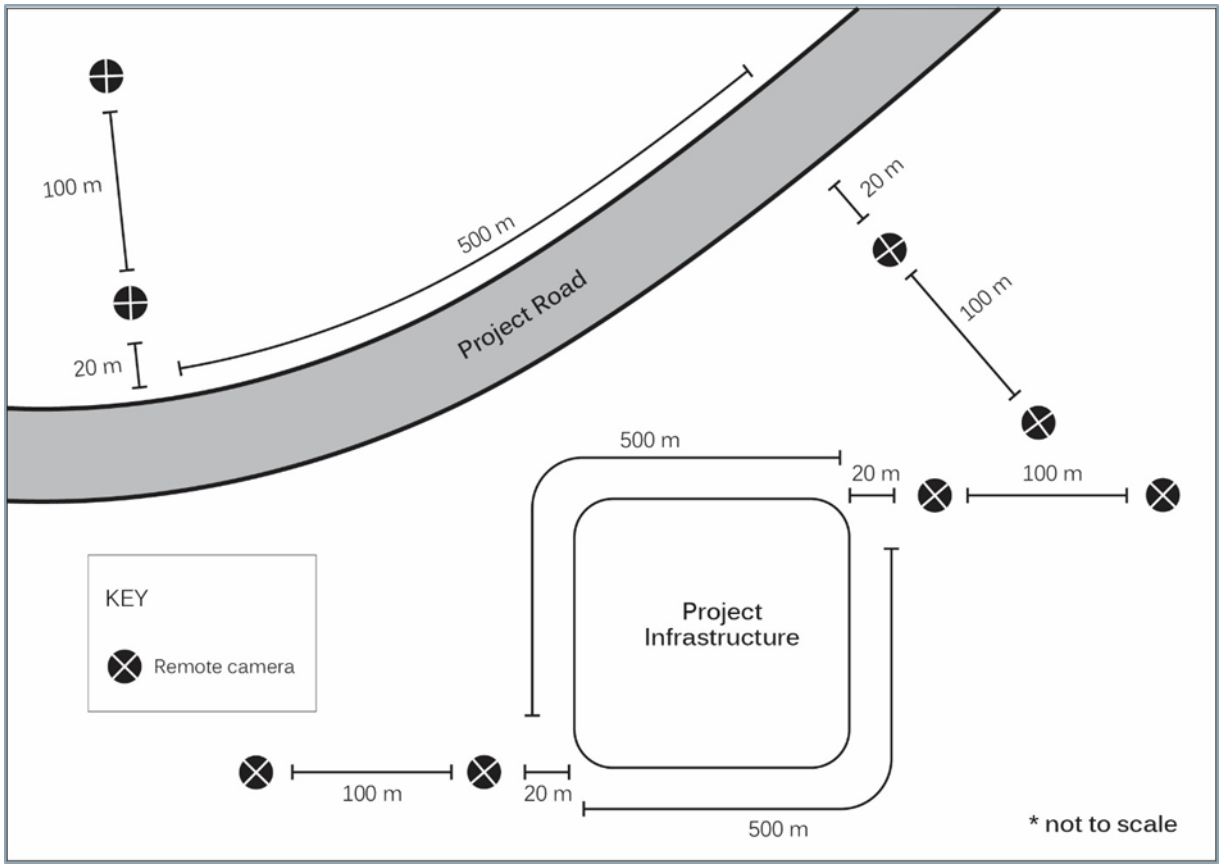


Figure 6-2: Feral herbivore presence/absence monitoring - remote camera set up

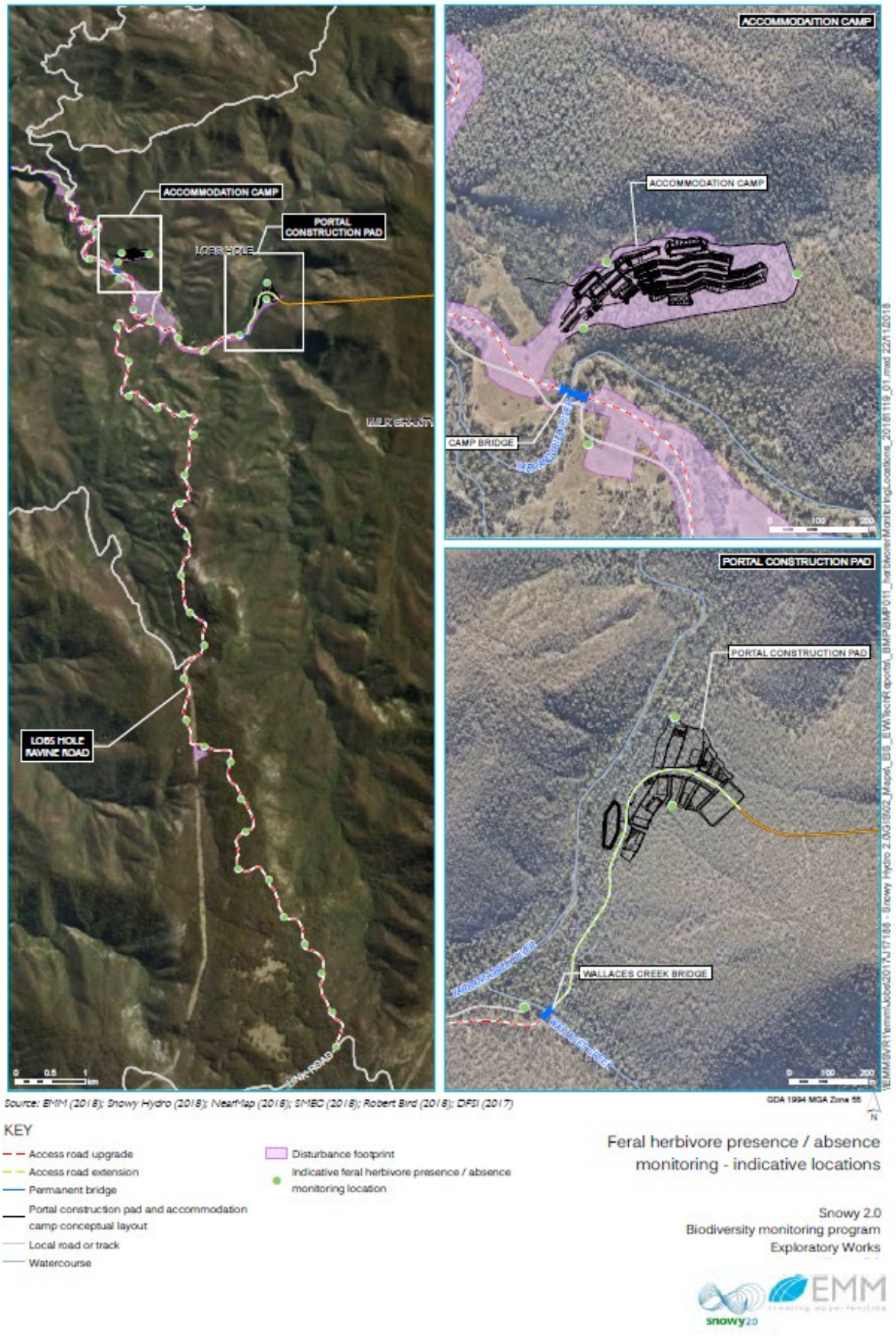


Figure 6-3: Feral herbivore presence/absence monitoring indicative locations

## 6.6. Abundance Monitoring

The monitoring of feral herbivore abundance will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 6-2.

**Table 6-2: Feral herbivore abundance monitoring**

| **Objective** |
|---|
| To determine feral herbivore presence/absence within proximity to the project and document any changes arising from increased human activity as a result of the project and to inform location and extent of controls. |
| **Sampling units** |
| Spotlight counts along project roads and adjacent to key infrastructure (vehicle and walked). |
| **Method** |
| *Vehicle spotlight counts*<br>A 4WD vehicle with one driver and an observer using a hand held spotlight (100 W – 12 V narrow beam);<br>Start approximately half an hour after sunset from an established start point;<br>One person drives and the other counts animals;<br>Drive at a constant slow speed (10-15 km/h) along all project roads (Lobs Hole Ravine Road and Mine Trail Road);<br>Observer scans a 90° arc ahead of the vehicle with a spotlight and count animals seen within 50 m on either side (a hand held tally counter is effective when the rabbit occurs in high numbers);<br>Every 1 km record the tally on a standardised spotlight count sheet (see proforma in Appendix B);<br>Repeat the count on three more consecutive nights of similar weather; and<br>On subsequent counts, start the same time as the first count, use the same route (distance and direction), vehicle, speed, spotlight and people.<br>*Walked spotlight counts*<br>Establish transect paths around key infrastructure;<br>Start approximately half an hour after sunset from an established start point;<br>Two people using two hand-held spotlights of the same power, with observers counting only one side each in a 90° arc ahead of them;<br>Walk at an easy constant walking pace;<br>Count animals seen within 50 m;<br>Every 0.5 km record the tally on a standardised spotlight count sheet (see proforma in Appendix B);<br>Repeat the count on three more consecutive nights of similar weather;<br>On subsequent counts, start the same time as the first count, use the same route (distance and direction), vehicle, speed, spotlight and people; and<br>After completion of the survey determine the average of counts and divide them by the length of the transect to get a simple index of abundance (animals/km); and<br>Use a GPS to help maintain your path. |
| **Location** |
| Vehicle spotlight counts: Lobes Hole Ravine Road and Mine Trail Road (Figure 6-4); and<br>Walked spotlight counts: around key infrastructure areas (Figure 6-4). |
| **Timing, effort and frequency** |
| • Frequency will be one monitoring event pre-construction in January 2019, one monitoring event per |

| |
|---|
| year (Spring or Autumn) lasting 10 days during construction and four monitoring events per year (quarterly) post construction (with one monitoring event defined as four nights) |
| **Data analysis** |
| After completion of each monitoring event at each location determine the average 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. |
| **Triggers for adaptive management** |
| A statistically significant increase in the number of feral herbivores per km, over multiple consecutive monitoring periods or years. |

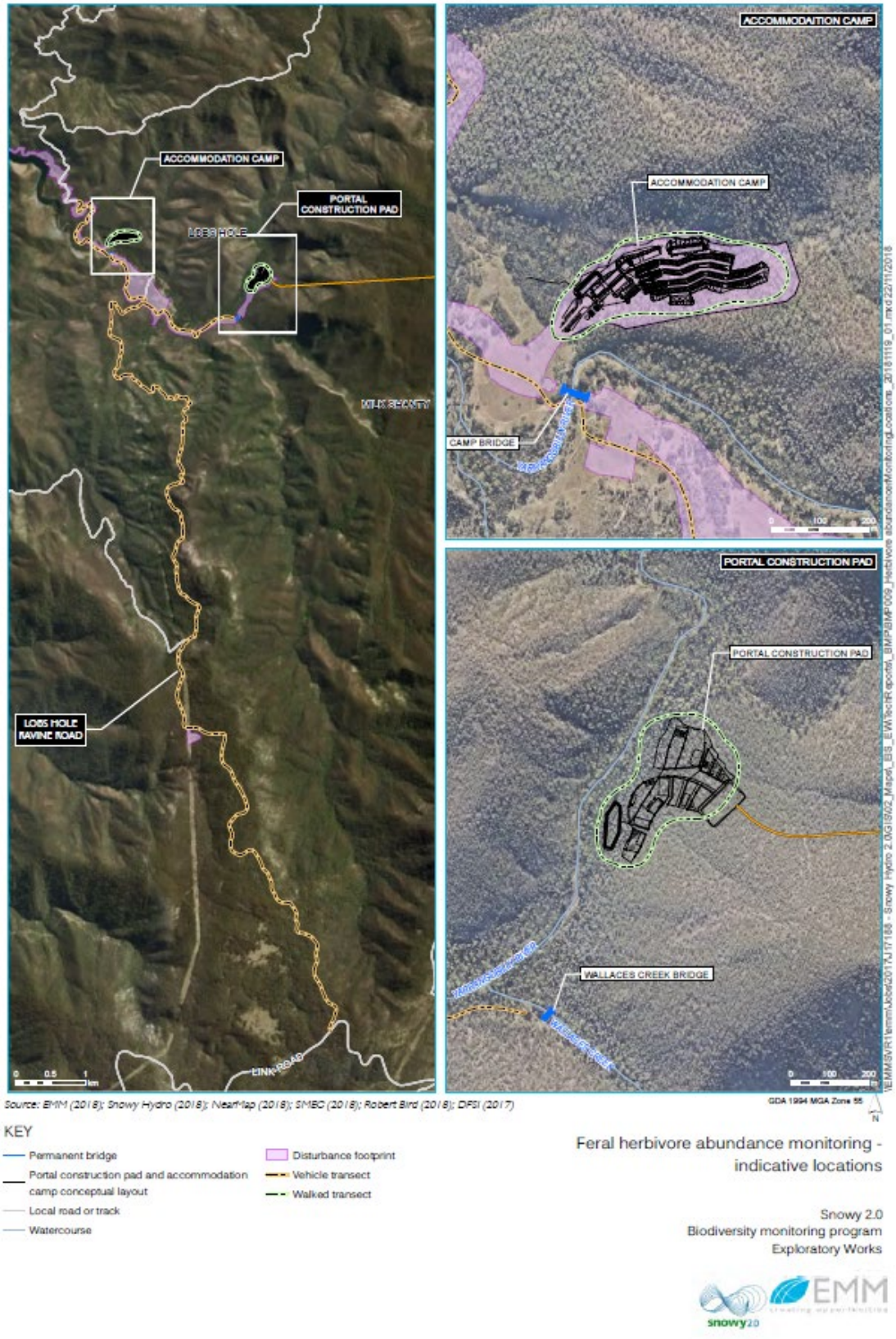


Figure 6-4: Feral herbivore abundance monitoring indicative locations

## 6.7. Limitations of Abundance Monitoring

Night-time counting using spotlights, either on foot or from vehicles, has been used for many years to survey animal species such as the rabbit (Mitchell & Balogh 2007a). This is mainly because spotlighting is easy to do and can cover large areas in a relatively short time. Spotlighting can sample different vegetation types and compare them under similar conditions within a site (i.e. season, time, weather). Simple indexes of abundance can be produced from these counts. Examples are the number of animals seen per kilometre travelled.

However, indices created from spotlighting counts have bias caused by difference between observers and also in visibility, or 'sightability', which can change with vegetation density and animal behaviour (Mitchell & Balogh 2007a). This monitoring method is also unsuitable in high wind or rain conditions, as these affect rabbit behaviour (Ballinger & Morgan 2002, cited in Mitchell & Balogh 2007a). Other sources of potential variation include the time of night that the survey is done, seasonal variations in animal behaviour and abundance, and the use of roads as transects (vegetation types will not be surveyed evenly) (Mitchell & Balogh 2007a). Despite these shortcomings, spotlighting has been found to be a reliable means of monitoring relative population size in rabbits (Mitchell & Balogh 2007a). For example, in New Zealand, spotlighting along fixed transects has become the standard method used by regional councils and the Ministry of Agriculture and Fisheries to assess rabbit populations (Fletcher et al. 1999, as cited in Mitchell & Balogh 2007a). However, there has been little standardisation of the technique, thus creating difficulties with comparisons between studies.

# 7. FERAL PREDATOR MONITORING PROGRAM

## 7.1. Baseline Conditions

Remote camera surveys undertaken for the Snowy 2.0 Exploratory Works, Biodiversity Development Assessment Report (EMM 2018) recorded the following feral predators within the project area:

- Cat (*Felis catus*) (Photograph 7.1);
- Dingo/domestic dog (*Canis lupus*); and
- Fox (*Vulpes vulpes*) (Photograph 7.2).

The feral predator records were not limited to any one habitat type within the project area and it is possible that they occur across the project area.


Figure 7-1 - Cat captured via a remote camera within the project area


Figure 7-2 - Fox captured via remote camera within the project area

## 7.2. Mitigation Measures

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 feral predators has consequent impacts on native animals. Predation by feral cats and red foxes are listed as key threatening processes under the BC Act and EPBC Act (NPWS 2001, DEWHA 2008, DoE 2015) with impacts from feral cats also listed as a key threat to the Smoky Mouse (Menkhorst and Broome 2008a, 2008b).

To minimise the risk of increased predator activity, the following controls will be implemented for the project:

- waste will be stored appropriately in inaccessible bins and disposed off-site; no waste will be left outside in open areas accessible to feral animals;
- a monitoring program will be implemented using remote cameras to monitor feral animal activity (this program);
- remote cameras will be placed along Lobs Hole Ravine Road (north and south) and Mine Trail Road to monitor feral animal movements (this program);

- opportunistic sightings in high risk areas, such as areas of habitation (e.g. the camp and tunnel portal) for feral animal activity will be undertaken. Sightings will be recorded and NPWS will be notified; and
- a predator control program will be implemented, in conjunction with OEH and NPWS, to control feral animals.

## 7.3. Monitoring Objectives

The overarching monitoring objective for feral predators is to document changes in occupation (presence/absence) and abundance within proximity to the project, arising from increased human activity associated with the project and to inform the location and extent of controls, specifically:

- to determine occupancy and abundance along project roads and adjacent to key project infrastructure; and
- to determine occupancy and abundance on the upper sections of Lobs Hole Ravine Road (in Smoky Mouse habitat).

## 7.4. Monitoring Parameters

To determine if the mitigation measures put into place effectively mitigate indirect impacts associated with feral predators, the following parameters will be monitored:

- presence/absence; and
- abundance.

## 7.5. Presence/Absence Monitoring

The monitoring of feral predator presence/absence will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 7.1.

**Table 7-1: Feral predator presence/absence monitoring**

| **Objective** |
|---|
| To determine feral predator presence/absence within proximity to the project and document any changes arising from increased human activity as a result of the project and to inform location and extent of controls. |
| **Sampling units** |
| Remote camera monitoring along project roads and adjacent to key infrastructure. |
| **Method** |
| *Remote camera monitoring*<br>• Remote cameras will be placed at locations adjacent to project roads and around key infrastructure areas;<br>• A camera will be placed at 500 m intervals along the project roads (placed to view across the road) as well as at project infrastructure, as shown in Figure 7-3;<br>• Cameras to be attached to a tree or stake and positioned approximately 1 m above ground. Cameras will be unbaited and left in place for 30 days<br>• Cameras are placed out for one month per monitoring period;<br>• Cameras to be placed at a 45 degree angle to the road; and<br>• Coordinates to be recorded at each camera location, in order to repeat the method during each subsequent monitoring event. |

| Location |
| --- |
| • Adjacent to project roads;<br>• Adjacent to accommodation camp; and<br>• Adjacent to construction compounds (Figure 7-4) |
| **Timing, effort and frequency** |
| • Frequency will be one monitoring event pre construction in January 2019, one monitoring event per year (Spring or Autumn) lasting 10 days during construction and four monitoring events per year (quarterly) post construction (with one monitoring event lasting 30 days). |
| **Data analysis** |
| • Animals captured on digital images are to be identified by a suitable Ecologist and with reference to field guides and species experts, if required;<br>• Data to be kept in a spreadsheet to determine presence/absence at monitoring locations between monitoring periods; and<br>• Occupancy is commonly used as a metric for estimating species' occurrence and is a function of abundance (MacKenzie et al 2003; O'Connell and Bailey 2011) as it concerns the probability of a particular animal being in a given site or patch. This method can be misused by only reporting on detection sites and ignoring non-detection sites, thereby failing to calculate the detection probability (O'Connell and Bailey 2011), therefore<br>• Data trends are to be analysed by a suitably qualified person (e.g. biometrician), in order to determine occupancy. Software programs can also be used for calculating occupancy. |
| **Triggers for adaptive management** |
| Statistically significant increase in the occurrence of feral predators observed across multiple monitoring periods and years. |

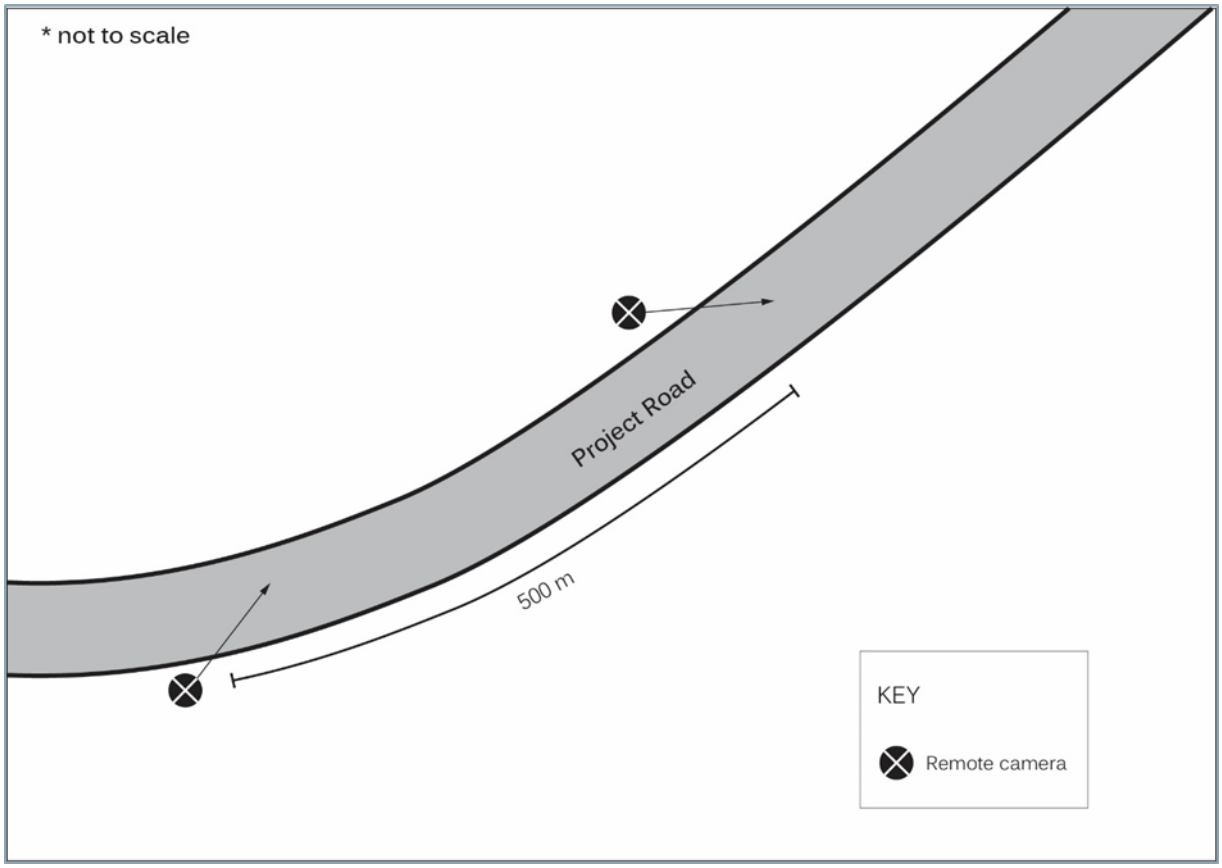


Figure 7-3: Feral predator presence/absence monitoring - remote camera set up

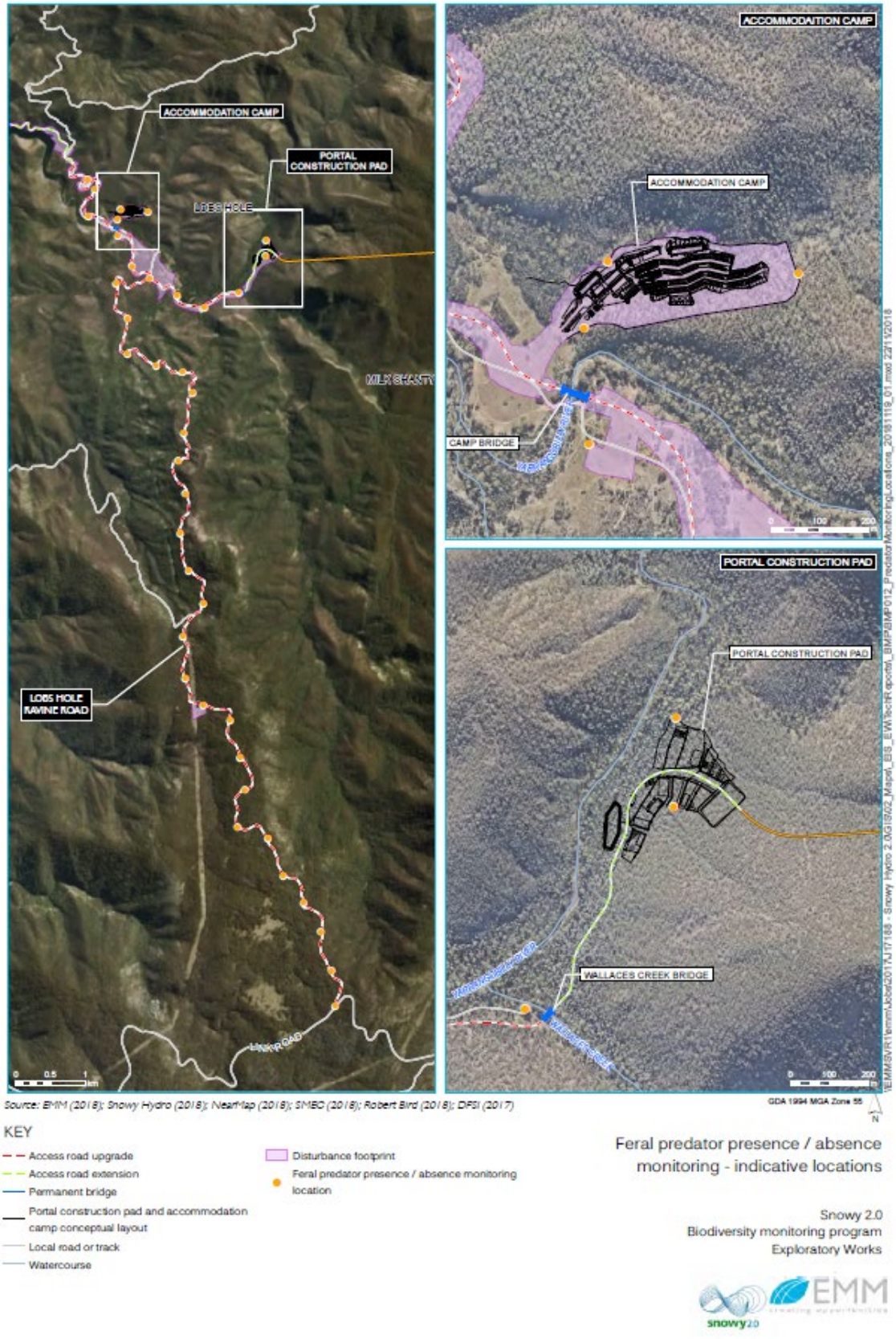


Figure 7-4: Feral predator presence/absence monitoring indicative locations

## 7.6. Abundance Monitoring

The monitoring of feral predator abundance will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 7-2.

**Table 7-2: Feral predator abundance monitoring**

| **Objective** |
|---|
| To determine feral predator abundance within proximity to the project and document any changes arising from increased human activity as a result of the project and to inform location and extent of controls. |
| **Sampling units** |
| Spotlight counts along project roads and adjacent to key infrastructure (vehicle and walked). |
| **Method** |
| *Vehicle spotlight counts*<br>• A 4WD vehicle with one driver and an observer using a hand held spotlight (100 W – 12 V narrow beam);<br>• Start approximately half an hour after sunset from an established start point;<br>• One person drives and the other counts animals;<br>• Drive at a constant slow speed (10-15 km/h) along all project roads (Lobs Hole Ravine Road and Mine Trail Road);<br>• Observer scans a 90° arc ahead of the vehicle with a spotlight and count animals seen within 50 m on either side;<br>• Every 1 km record the tally on a standardised spotlight count sheet (see proforma in Appendix B);<br>• Repeat the count on three more consecutive nights of similar weather; and<br>• On subsequent counts, start the same time as the first count, use the same route (distance and direction), vehicle, speed, spotlight and people.<br>*Walked spotlight counts*<br>• Establish transect paths around key infrastructure;<br>• Start approximately half an hour after sunset from an established start point;<br>• Two people using two hand-held spotlights of the same power, with observers counting only one side each in a 90° arc ahead of them;<br>• Walk at an easy constant walking pace;<br>• Count animals seen within 50 m;<br>• Every 0.5 km record the tally on a standardised spotlight count sheet (see proforma in Appendix B);<br>• Repeat the count on three more consecutive nights of similar weather;<br>• On subsequent counts, start the same time as the first count, use the same route (distance and direction), vehicle, speed, spotlight and people; and<br>• After completion of the survey determine the average of counts and divide them by the length of the transect to get a simple index of abundance (animals/km); and<br>• Use a GPS to help maintain your path. |
| **Location** |
| • Vehicle spotlight counts: Lobes Hole Ravine Road and Mine Trail Road; and<br>• Walked spotlight counts: around key infrastructure areas (Figure 7-5). |
| **Timing, effort and frequency** |
| • Frequency will be one monitoring event pre construction in January 2019, one monitoring event per year (Spring or Autumn) lasting 10 days during construction and four monitoring events per year (quarterly) |

| |
|---|
| post construction (with one monitoring event lasting 30 days). |
| **Data analysis** |
| After completion of each monitoring event at each location determine the average of counts (foxes and cats) 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. |
| **Triggers for adaptive management** |
| A statistically significant increase in the number of feral predators per km, over multiple consecutive monitoring periods or years. |

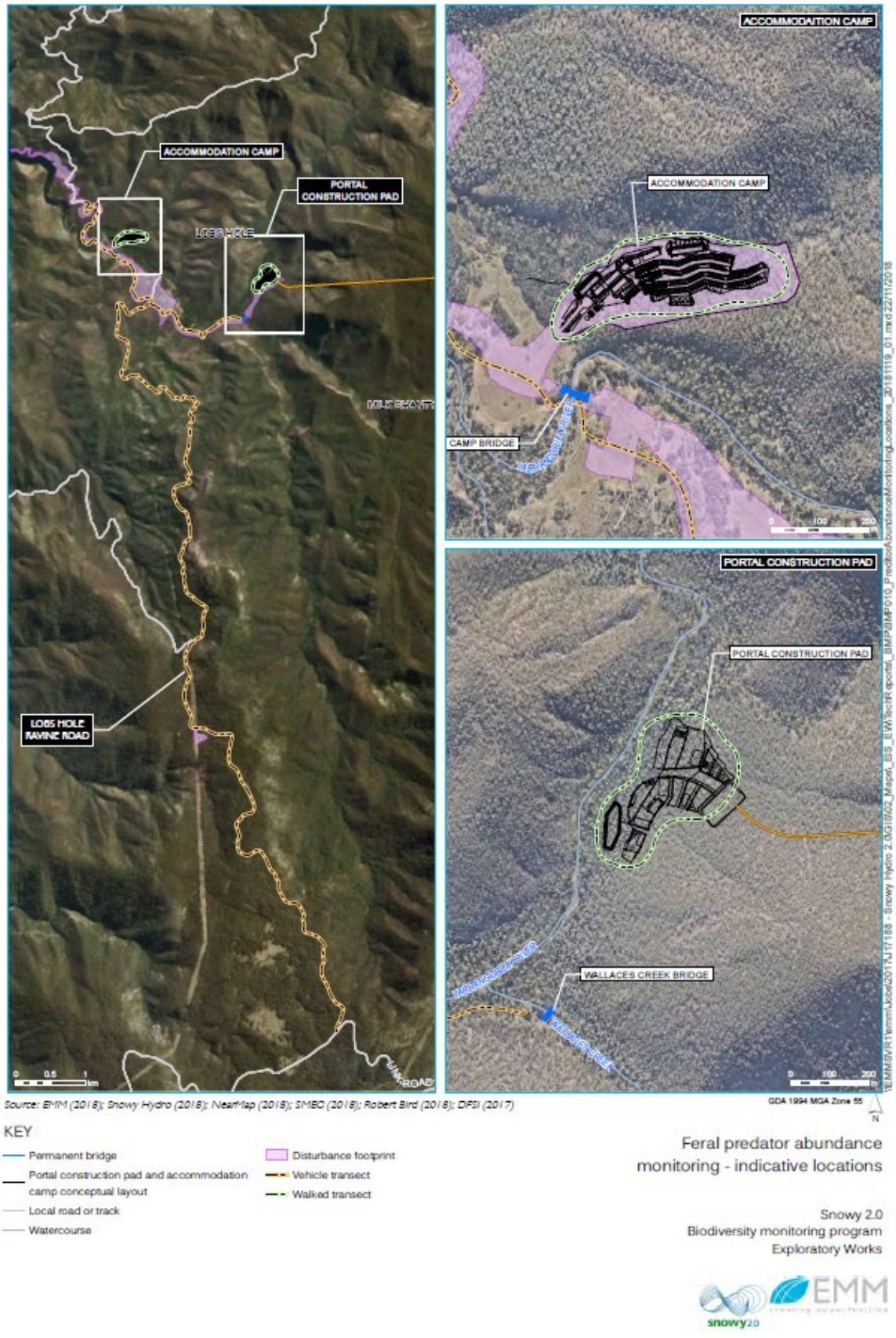


Figure 7-5: Feral predator abundance monitoring indicative locations

### 7.7. Limitations of Abundance Monitoring

Night-time counting using spotlights has been used for many years to survey foxes (Mitchell & Balogh 2007b) and simple indexes of abundance can be produced from these counts, such as the number of animals seen per kilometre travelled. However, indexes created from spotlighting counts have bias caused by the use of different observers or changes in visibility or sightability due to vegetation density (Mitchell & Balogh 2007b) other sources of potential variation include the time of night that the survey is undertaken and seasonal variations in animal behaviour and abundance. The use of roads as transects means vegetation types may not be surveyed evenly (Mitchell & Balogh 2007a). Where fox density is low, spotlighting may fail to detect their presence, and as a result, spotlighting tends to underestimate fox numbers (Mitchell & Balogh 2007b).

Despite these shortcomings, spotlighting has been extensively used in Australia, and is considered a practical tool for monitoring the relative size of the fox population, especially where the habitat is open grassland or open woodland where trees are sparse (Mitchell & Balogh 2007b). Sharp et al. (2001) (as cited in Mitchell & Balogh 2007b) suggested that spotlight counts can accurately indicate fluctuations in fox population size but may not be able to detect small changes in abundance.

Similarly, spotlighting has been used for many years to survey feral cats (Mitchell & Balogh 2007c), because it allows large areas to be monitored fairly rapidly. Spotlighting can sample different vegetation types and compare them under similar conditions within a site. Indexes of abundance, such as the number of animals seen per kilometre, can be produced from the spotlight counts; however, indexes created using spotlighting counts should also be corrected for the bias. Where feral cat density is low, spotlighting may fail to detect their presence; therefore, under these conditions, spotlighting may underestimate feral cat numbers (Mitchell & Balogh 2007c). Despite these shortcomings, spotlighting has been used extensively in Australia, and is considered a practical tool for monitoring relative population abundance of feral cats also. Edwards et al. (2000) (as cited in Mitchell & Balogh 2007c) suggested that spotlight counts would improve in precision as the feral cat population size increased, but that they may not be able to detect small changes in abundance at low densities.

## 8. REPORTING AND REVIEW

### 8.1. Reporting Schedule

An annual report will be prepared that summarises all monitoring undertaken within the year, the results of the monitoring, and any adaptive management undertaken. The annual report is also an opportunity to summarise findings to feed into the annual review of the monitoring program, as explained in the following sections.

### 8.2. Reporting and Review Schedule

The reporting and review schedule for this monitoring program is provided in Table 8-1.

Table 8-1: Biodiversity monitoring program reporting and review schedule

| Review | Schedule |
|---|---|
| 1. Consultation with OEH on draft monitoring program | 7 September to 11 October 2018 |
| 2. Snowy Hydro review draft monitoring program | 15 October 2018 |
| 3. OEH and DPE review monitoring program | 11 November 2018 |
| 4. Short report on monitoring results | After each monitoring event for each entity |
| 5. Annual report | Annually for life of the monitoring program |
| 6. Review of monitoring methods | Annually and on an as needs basis for life of the monitoring program |
| 7. Review of triggers/adaptive management actions | Annually for life of the monitoring program and in the event of any triggers |

## 8.3. Review Criteria

Reviews 1 to 3 from OEH, DPE and Snowy Hydro would focus on the practicality of implementing the monitoring program, scientific robustness and compliance with the MCoA.

The review of monitoring methods (review 6) will be annually and on an as needs basis to determine the success of the monitoring methodologies in capturing the required data. This will allow for adjustment (if required) of monitoring methodology and survey design.

The annual review (review 7) would focus on a review of triggers for adaptive management actions. These annual reviews will provide an opportunity for triggers and management that are adaptive to monitoring results.

Table 8-2: Monitoring review criteria

| Task | Timing | | |
|---|---|---|---|
| | **Pre-construction (baseline)** | **During construction** | **Post-construction** |
| Monitoring program | Draft monitoring program October 2018<br>Final monitoring program November 2018 | Methods and adaptive management triggers reviewed annually as part of annual reporting | Methods and adaptive management triggers reviewed annually as part of annual reporting |

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# APPENDIX A – ECOLOGY PROFORMAS

## Boorolong Frog Population Monitoring Proforma

### Ongoing Population Trajectory of the Yarrangobilly Boorolong Frog Population

***Rocky breeding habitat monitoring***

| Date: | Location: | Data Collectors: |
|---|---|---|
| | | |

| # Transect | Coordinates | | Position of the habitat (left, right or middle bank) | Weather Condition | Rock Type | Time | Location of the start | Notable Features: (e.g. observed degradation, change or loss of rocky (breeding) habitat or pools) |
|---|---|---|---|---|---|---|---|---|
| | East | North | | | | | | |
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## Boorolong Frog Population Monitoring Proforma

### Ongoing Population Trajectory of the Yarrangobilly Booroolong Frog Population

***Pool depth monitoring***

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Pool | Coordinates | | Accuracy of location | Approx. Max Depth (cm) | Approx. Pool Length (m) | Stream Flow | Time | Notable Features: (e.g. observed degradation, change or loss of rocky (breeding) habitat or pools) |
|---|---|---|---|---|---|---|---|---|
| | East | North | | | | | | |
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## Boorolong Frog Population Monitoring Proforma

### Ongoing Population Trajectory of the Yarrangobilly Boorolong Frog Population

***Stream Transects***

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Transect | Coordinates | | Accurate Location | Weather Condition | Count | Sex | Time | Notable Features: (e.g. habitat description, decline in abundance, abiotic factors) |
|---|---|---|---|---|---|---|---|---|
| | East | North | | | | | | |
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## Boorolong Frog Surface Water Quality Monitoring

**Identify and quantify any surface water quality impacts (within the Yarrangobilly River and Wallaces River)**

***Weather Station (continuous)***

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Station | Coordinates | | Project Phase (pre- construction, construction & post-construction) | Position of station | Weather Condition | Discharge/ Flow (mm) | Time | Notable Features: (e.g. declines, no rainfall, heavy rainfall) |
|---|---|---|---|---|---|---|---|---|
| | East | North | | | | | | |
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## Feral Animal Monitoring Proforma

### Abundance

### *Nocturnal spotlight search monitoring*

| Date | Location | Vehicle / On Foot | Km Reading | Coordinates | | Start Time | End Time | Project Phase | Weather Conditions | Staff | Species/ Count |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | East | North | | | | | | |
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| Project Phase e.g. Pre-construction, construction, post-construction | | | | | | | | | | | |
| Notable Features e.g. observed increase / new occurrence of a primary impact | | | | | | | | | | | |

## Feral Herbivore Presence / Absence Monitoring

### *Remote camera monitoring*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Camera | Coordinates | | Time | Project Phase (pre-construction, construction & post-construction) | Species recorded | Presence/ absence (rabbit) | Notable Features: (e.g. declines, no rainfall, heavy rainfall) |
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| | East | North | | | | | |
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## Feral Herbivore Abundance Monitoring

### *Vehicle spotlight counts*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Route | Coordinates | | Time | Weather | Project Phase (pre-construction, construction & post-construction) | Count | Species recorded | Total Tally |
|---|---|---|---|---|---|---|---|---|
| | East | North | | | | | | |
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## Feral Herbivore Abundance Monitoring

### *Walked spotlight counts*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Route | Coordinates | | Time | Weather | Project Phase (pre-construction, construction & post-construction) | Count | Species recorded | Total average of counts (by length of the transect) |
|---|---|---|---|---|---|---|---|---|
| | East | North | Start:<br>End: | | | | | |
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## Feral Predator Presence / Absence Monitoring

### *Remote camera monitoring*

| Date: | |
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| | |

| Location: |
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| |

| Data collectors: |
|---|
| |

| # Camera | Coordinates | | Time | Project Phase (pre-construction, construction & post-construction) | Species recorded | Presence/ absence (rabbit) | Notable Features: (e.g. significant increase in occurrence of feral predators observed) |
|---|---|---|---|---|---|---|---|
| | East | North | | | | | |
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## Feral Predator Abundance Monitoring

### *Vehicle spotlight counts*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Route | Coordinates | | Time | Weather | Project Phase (pre-construction, construction & post-construction) | Count | Species recorded | Total Tally |
|---|---|---|---|---|---|---|---|---|
| | East | North | Start:<br>End: | | | | | |
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## Feral Predator Abundance Monitoring

### *Walked spotlight counts*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Route | Coordinates | | Time | Weather | Project Phase (pre-construction, construction & post-construction) | Count | Species recorded | Total average of counts (by length of the transect) |
|---|---|---|---|---|---|---|---|---|
| | East | North | Start:<br>End: | | | | | |
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## Phytophthora Presence / Absence Within Proximity to Project Roads and Key Project Infrastructure

### *Soil Sampling (laboratory: quarterly)*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Sample | Coordinates | | Time | Project Phase (pre-construction, construction & post-construction) | Presence / Absence | % Pathogens | Notable Features: (e.g. presence of Xanthorrhoea glauca etc) |
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## Smoky Mouse Population Monitoring Proforma

### Population size within proximity to the project

***Trapping and pit tagging***

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Elliott A Trap | Coordinates | | Project Phase (pre-construction, construction & post-construction) | Weather Conditions | Time checked (morning) | Time rebaited (late afternoon) | Identified animal captures / pit-tagged | Notable Features: (e.g. Observed increase/ new occurrence of a primary impact) |
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## Smoky Mouse Occupancy Monitoring Proforma

### Presence and Absence

### *Remote Camera Monitoring*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Camera | Coordinates | | Weather Conditions | Project Phase (pre-construction, construction & post-construction) | Absence/ Presence | Notable Features: (e.g. observed increase/ new Occurrence of a primary impact) |
|---|---|---|---|---|---|---|
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## Smoky Mouse Monitoring Proforma

### *Transects*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Transect Interval | Coordinates | Any species below 50cm | Observations / Comments |
|---|---|---|---|
| 1. | | | |
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| 10. | | | |
| 11. | | | |
| 12. | | | |

## The cover of Smoky Mouse key feed species (below 0.5m above ground)

| Key feed species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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## Smoky Mouse Monitoring Proforma

### *Photo points*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| Photograph Number | Coordinates | | Weather Conditions | Absence/ Presence | Notable Features: (e.g. visible disturbance of habitat features) |
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## Boorolong Frog Surface Water Quality Monitoring

### Identity and quantify any surface water quality impacts (within the Yarrangobilly River and Wallaces River)

### *Stream gauges (continuous)*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Gauge | Coordinates | | Project Phase (pre-construction, construction & post-construction) | Position of station | Weather Condition | Discharge/ Flow (mm) | Time | Notable Features: (e.g. declines, no rainfall, heavy rainfall) |
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| | East | North | | | | | | |
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## Boorolong Frog Surface Water Quality Monitoring

### Identity and quantify any surface water quality impacts (within the Yarrangobilly River and Wallaces River)

### *Flow meters (continuous)*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Meter | Coordinates | | Project Phase (pre-construction, construction & post-construction) | Position of station | Weather Condition | Discharge/ Flow (mm) | Time | Notable Features: (e.g. declines, no rainfall, heavy rainfall) |
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## Boorolong Frog Surface Water Quality Monitoring

### Identity and quantify any surface water quality impacts (within the Yarrangobilly River and Wallaces River)

### *Stormwater monitoring (quarterly)*

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Pond | Coordinates | | Project Phase (pre-construction, construction & post-construction) | Position of station | Weather Condition | Discharge/ Flow (mm) | Time | Notable Features: (e.g. declines, no rainfall, heavy rainfall) |
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| | East | North | | | | | | |
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## Weed Species

### Weed presence / absence within proximity to project roads and key project infrastructure

***Weed mapping (biannually)***

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| Weed Species | Coordinates | | Time | Project Phase (pre-construction, construction & post-construction) | No. individuals | Size (m2) | Cover | Age Class | Notable Features (e.g. observed new occurrence, weather) |
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## Weed Species

### Weed cover monitoring

***Transects (two monitoring events per year)***

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Transect | Coordinates | | Time | Project Phase (pre-construction, construction & post-construction) | Accurate Location | Size (m2) | Cover | Age Class | Notable Features (e.g. observed new occurrence, weather, significant increase in weed cover) |
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| | East | North | | | | | | | |
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## Boorolong Frog Surface Water Quality Monitoring

**Identity and quantify any surface water quality impacts (within the Yarrangobilly River and Wallaces River)**

***Water quality monitoring (monthly and after any surface water incidents)***

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Site | Coordinates | | Project Phase (pre-construction, construction & post-construction) | pH | EC | Turbidity | DO | Temp | ORP | Cations | Anions | TSS | TDS | Total Hardness | Total R. Hydro carbons | Nutrients | Metals | Oxygen Properties |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | East | North | | | | | | | | | | | | | | | | |
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## Weed Species

### Weed presence / absence within proximity to project roads and key project infrastructure

***Weed mapping (biannually)***

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| Weed Species | Coordinates | | Time | Project Phase (pre-construction, construction & post-construction) | No. individuals | Size (m2) | Cover | Age Class | Notable Features (e.g. observed new occurrence, weather) |
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| | East | North | | | | | | | |
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## Weed Species

### Weed cover monitoring

***Transects (two monitoring events per year)***

| Date: | Location: | Data collectors: |
|---|---|---|
| | | |

| # Transect | Coordinates | | Time | Project Phase (pre-construction, construction & post-construction) | Accurate Location | Size (m2) | Cover | Age Class | Notable Features (e.g. observed new occurrence, weather, significant increase in weed cover) |
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| | East | North | | | | | | | |
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# APPENDIX B – SMOKY MOUSE KEY FEED SPECIES

| Smoky Mouse Key Feed Species/Family Group | Season | Reference |
|---|---|---|
| Bogong Moths (*Agrostis infusa*) | Late Spring/ Early Summer | NSW Office of Environment & Heritage |
| Hypogeal Fungi (*Potorous tridactylus)* | Frequent | Broome, L & Menkhorst, P, 2006, *Background and Implementation Information for the Smoky Mouse Pseudomys fumeus National Recovery Plan*, Department of Sustainability and Environment |
| Ericaceae (*Epacris impressa)* | Frequent | Broome. L, Cockburn. A & Ford. F, 2003, *Habitat preference, diet and demography of the smoky mouse, in south eastern NSW,* CSIRO |
| Prickly Broom Heath (*Monotoca scoparia)* | Frequent | Broome. L, Cockburn. A & Ford. F, 2003, *Habitat preference, diet and demography of the smoky mouse, in south eastern NSW,* CSIRO |
| Paperbark teatree *(Leptospermum trinervium)* | Spring on coast, summer on tablelands | Broome. L, Cockburn. A & Ford. F, 2003, *Habitat preference, diet and demography of the smoky mouse, in south eastern NSW,* CSIRO |
| Xanthorrhoeoideae (*Xanthorrhoea spp).* | Frequent | Broome. L, Cockburn. A & Ford. F, 2003, Habitat preference, diet and demography of the smoky mouse, in south eastern NSW, CSIRO |

# APPENDIX C – WATER QUALITY RESULTS SUMMARY: YARRANGOBILLY RIVER (BASE FLOW CONDITIONS)

| | | | Yarrangobilly River | | | | Wallaces Creek | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Unit | Guideline value | # Samples | 10th percentile | Median | 90th percentile | # Samples | Min | Median | Max |
| **Field Parameters** | | | | | | | | | | |
| Temperature | °C | | 11 | 13 | 19 | 22 | 5 | 13 | 15 | 16 |
| Dissolved Oxygen (DO) | % | 90 – 110[1] | 7 | 29 | 76 | 95 | 5 | 75 | 78 | 92 |
| Electrical Conductivity (EC) | µS/cm | 30 – 350[1] | 11 | 32 | 171 | 185 | 5 | 65 | 178 | 185 |
| pH | | 6.5 – 8.5[1] | 11 | 7.5 | 7.9 | 8.1 | 5 | 7.5 | 7.6 | 8.4 |
| Oxidising and Reducing Potential (ORP) | | - | 11 | 112 | 130 | 143 | 5 | 62 | 133 | 146 |
| Turbidity | NTU | 2 - 25 | 7 | <2 | <2 | 5 | 3 | <2 | <2 | <2 |
| **Analytical Results - General** | | | | | | | | | | |
| Suspended Solids (SS) | mg/l | - | 11 | <5 | <5 | <5 | 5 | <5 | <5 | <5 |
| Total Alkalinity (as $CACO_3$) | mg/l | - | 7 | 15 | 86 | 109 | 3 | 38 | 99 | 104 |
| Total Hardness (as $CACO_3$) | mg/l | - | 4 | 9 | 89 | 97 | 2 | 87 | 96 | 94 |
| **Analytical Results - Nutrients** | | | | | | | | | | |
| Ammonia | mg/l | 0.013 | 7 | <0.01 | <0.01 | <0.01 | 2 | <0.01 | <0.01 | <0.01 |
| Oxidised Nitrogen (NOx) | mg/l | 0.015 | 7 | 0.01 | 0.03 | 1.9 | 2 | 0.03 | 0.035 | 0.04 |
| Total Kjeldahl Nitrogen (TKN) | mg/l | - | 7 | <0.1 | <0.1 | <0.1 | 2 | <0.1 | <0.1 | <0.1 |
| Total Nitrogen (TN) | mg/l | 0.25 | 7 | 0.1 | 0.1 | 1.9 | 2 | <0.1 | <0.1 | <0.1 |

| | | | Yarrangobilly River | | | | Wallaces Creek | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Unit | Guideline value | # Samples | 10th percentile | Median | 90th percentile | # Samples | Min | Median | Max |
| Reactive Phosphorus | mg/l | 0.015 | 4 | <0.01 | <0.01 | <0.01 | 2 | <0.01 | <0.01 | <0.01 |
| Total Phosphorus (TP) | mg/l | 0.020 | 7 | 0.01 | 0.01 | 0.02 | 2 | <0.01 | <0.01 | <0.01 |
| Total Organic Carbon | mg/l | - | 4 | 1 | 11 | 23 | 2 | 8 | 16.5 | 25 |
| Dissolved Organic Carbon | mg/l | - | 4 | <1 | <1 | <1 | 2 | <1 | <1 | <1 |
| **Analytical Results - Inorganics (Dissolved)** | | | | | | | | | | |
| Fluoride | mg/l | 0.115[3] | 7 | 0.1 | 0.1 | 0.6 | 3 | 0.1 | 0.1 | 0.1 |
| **Analytical Results - Metals (Dissolved)** | | | | | | | | | | |
| Aluminium (Al) | mg/l | 0.055 | 4 | 0.01 | 0.01 | 0.06 | 2 | <0.01 | <0.01 | <0.01 |
| Arsenic (As) | mg/l | 0.013 | 4 | <0.001 | <0.001 | <0.001 | 2 | <0.001 | <0.001 | <0.001 |
| Barium (Ba) | mg/l | 0.008[3] | 4 | 0.011 | 0.0285 | 0.042 | 2 | 0.088 | 0.097 | 0.106 |
| Boron (Bo) | mg/l | 0.370 | 4 | <0.05 | <0.05 | <0.05 | 2 | <0.05 | <0.05 | <0.05 |
| Cobalt (Co) | mg/l | 0.0014[3] | 4 | <0.001 | <0.001 | <0.001 | 2 | <0.001 | <0.001 | <0.001 |
| Total Chromium (Cr) | mg/l | 0.001 | 7 | <0.001 | <0.001 | <0.001 | 3 | <0.001 | <0.001 | <0.001 |
| Copper (Cu) | mg/l | 0.0014 | 4 | <0.001 | <0.001 | <0.001 | 2 | 0.001 | 0.002[4] | 0.003[4] |
| Manganese (Mn) | mg/l | 1.9 | 4 | 0.001 | 0.001 | 0.002 | 2 | 0.001 | 0.0015 | 0.002 |
| Nickel (Ni) | mg/l | 0.011 | 7 | 0.001 | 0.001 | 0.002 | 3 | 0.001 | 0.002 | 0.002 |
| Lead (pb) | mg/l | 0.0034 | 4 | <0.001 | <0.001 | <0.001 | 2 | <0.001 | <0.001 | <0.001 |
| Selenium (Se) | mg/l | 0.005 | 4 | <0.01 | <0.01 | <0.01 | 2 | <0.01 | <0.01 | <0.01 |
| Silver (Ag) | mg/l | 0.0005 | 4 | <0.001 | <0.001 | <0.001 | 2 | <0.001 | <0.001 | <0.001 |

| | | | Yarrangobilly River | | | | Wallaces Creek | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Unit | Guideline value | # Samples | 10th percentile | Median | 90th percentile | # Samples | Min | Median | Max |
| Vanadium (Va) | mg/l | 0.006[3] | 4 | <0.01 | <0.01 | <0.01 | 2 | <0.01 | <0.01 | <0.01 |
| Zinc (Zn) | mg/l | 0.008 | 4 | <0.005 | <0.005 | <0.005 | 3 | <0.005 | <0.005 | <0.005 |
| Mercury (Hg) | mg/l | 0.00006 | 4 | <0.0001 | <0.0001 | <0.0001 | 2 | <0.0001 | <0.0001 | <0.0001 |
| Iron (Fe) | mg/l | 0.3[3] | 4 | 0.05 | 0.05 | 0.06 | 2 | <0.05 | <0.05 | <0.05 |

# APPENDIX D – 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 performatum*);
- Winter cress (*Barbarea verna*);
- Russell lupins (*Lupinus pollyphyllus*);
- 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*);
- Horsehound (*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*).

***DECC, 2007***

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

Based on these three main reference lists, the following outlines the main priority weeds to be mapped, monitored and controlled during project:

- African Lovegrass (*Eragrostis curvula*);
- St John's wort (*Hypericum performatum*);
- Blackberry (*Rubus* spp);
- Serrated Tussock (*Nassella trichotoma*);
- Ox-eye Daisy (*Leucanthemum vulgare*)
- Hawthorn (*Crataegus monogyna*)
- Willows (except Weeping Willow, Pussy Willow and Sterile Pussy Willow); (*Salix* spp.)
- Broom: English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom (*Cytisus scoparius*)
- Flax-leaved Broom, Mediterranean Broom, Flax Broom (*Genista linifolia*)
- Gorse, Furze (*Ulex europaeus*)

- Bridal Creeper (Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus) (*Asparagus asparagoides*)
- Boneseed (*Chrysanthemoides monilifera* subsp.*monilifera*)
- Prickly Pears (*Opuntia* spp. & *Cylindropuntia* spp.))
- Fireweed (Madagascar Ragwort, Madagascar Groundsel) (*Senecio madagascariensis*)
- Salivina: Giant Salivinia, Aquarium Watermoss, Kariba Weed (*Salvinia molesta*);
- Tall perennial Bunchgra (*Phalaris arundinacea*)

# APPENDIX C – PRECLEARING PROCEDURE

S2-FGJV-ENV-PLN-0028 – Appendix C

# BIODIVERSITY MANAGEMENT PLAN
# APPENDIX C – PRE-CLEARING AND CLEARING PROCEDURE

| Approval Record | | | |
|---|---|---|---|
| Document preparation, review and approval | | Name in print | Signature |
| Prepared by | | R Kristenson | |
| Reviewed by | | R Walker-Edwards | |
| Verified by | Environmental Manager | L Coetzee | |
| Approved by | Project Director | A. Betti | |

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| C | 16.08.2019 | UPDATE FROM DPIE COMMENTS<br>FOR APPROVAL |
| 0 | 23.08.2019 | FOR APPROVAL |
| 1 | 19.11.2019 | UPDATED TO INCLUDE MODIFICATION 1 SCOPE |

# CONTENTS

# 1. PURPOSE AND OBJECTIVE

The purpose of this pre-clearing and clearing procedure is to describe how Future Gen and its Contractors propose 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 so as to ensure that these activities are conducted with minimum impact to the environment and within the permitted scope of the draft baseline conditions.

# 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 Clearing and Grubbing WMS 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 further in Table 5-1 of the Biodiversity Management plan the following is to occur prior to clearing:

- an ecologist will be engaged for the project;
- a clearing and grubbing WMS or Construction Area Plan will be developed;
- the extent of clearing required for construction and permanent infrastructure shall be confirmed on a survey plan and approved with Snowy Hydro. These boundaries shall be included on the are included within 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 50 metre exclusion zone surrounding the Yarrangobilly River and Wallaces Creek is to be observed at all times, with the exception of approved bridge construction works and section of Mine Trail Road;
        - the existing disturbance footprint along the upper section of Lobs Hole Ravine Road shall be maintained. Disturbance is not permitted outside of existing disturbed areas between chainage 0 and 7750;
    - for Bridge crossing: Frog exclusion fencing will be installed;
    - in other areas the clearing limits will be delineated using signage and highly visible barrier or tape such as flagging, bunting, nightline or other similarly robust and durable material with reflective strips periodically along its length;

  - tree protection zones (TPZs) will be set up around all trees retained within the disturbance footprint;
  - 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 and Feral Animals Management Plan for the management of weeds prior to clearing;
- consultation with the ecologist will occur to determine the location of suitable habitat for fauna release;
- an ecologist will undertake a pre-clearing walk along the proposed clearing areas prior to the commencement of clearing. The ecologist will:
  - check for the evidence of presence of threatened flora and fauna species;
  - flag key habitat features, including (but not limited to) nests, hollow bearing trees or large logs. GPS coordinates for all habitat trees identified will be recorded during the pre-clearing survey;
  - confirm nearby habitat suitable for the release of any that may be encountered during clearing works;
  - undertake careful inspection of habitat for frog species within the 50m buffer zone;
  - 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;
- a check to ensure exclusion zones have been delineated and any vegetation to be retained are clearing marked;
- a check to ensure clearing limits and other delineation required to be installed prior to clearing, is in place;
- the project ecologists should 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;
- contact a wildlife carer or veterinarian to inform them of vegetation clearing works upcoming;
- prior to any disturbance of waterway banks, a thorough inspection by a qualified ecologist will be undertaken for aquatic fauna and frogs;
- fauna spotters will check areas adjacent to Yarrangobilly River prior to clearing for Booroolong Frog and translocate them to adjacent habitats away from impacts;
- where possible, existing trees and other vegetation should be retained within 15 metres of waterways and drainage lines until immediately before construction commences in the area;
- the supervisor, operator and environmental advisor are to walk the clearing footprint prior to commencing clearing; and
- the Clearing Permit Hold Point is to be approved prior to clearing commencing.

# 4. VEGETATION CLEARING

A two-stage habitat removal process will be implemented and involve the following steps:

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

Where no areas of habitat have been identified to be cleared, clearing can be undertaken in a single-stage process, and includes the under-scrubbing of non-habitat trees, shrubs and other vegetation.

When vegetation, that may provide habitat for native fauna, is proposed to be removed the area will be surveyed by the project ecologist immediately prior to clearing, to:

- obtain updated information on fauna and fauna habitat resources present:
  - inspection of trees for any new nests constructed since the pre-clearing surveys; and
  - inspection of hollow logs and wood debris for the presence of any sheltering fauna.
- identify any fauna that may have moved into the project area since the initial pre-clearing inspection;
- capture and relocate non-mobile fauna, such as reptiles and frogs and key habitat features such as active bird nests;
- if not already available, record the details for all Hollow Bearing Trees (HBTs) and trees containing threatened fauna and flora include GPS location, species, type of habitat feature, size of hollow and type of hollow;
- the project ecologist will be present during all removal of habitat trees to capture and relocate any encountered fauna; and
- remove non-habitat vegetation first.

This allows respite between the initial disturbance and the final removal of habitat. The changed environment along with the disturbance should encourage resident fauna to individually relocate without human handling. The timing should allow resident fauna at least 24-48 hours after removal of non-habitat trees to vacate remaining habitat trees.

## 4.2. Stage 2 – Habitat Tree Removal

- Identified habitat (e.g. nests, hollow bearing trees and large woody debris) will be left for at least 24-48 hours after removing non-habitat vegetation to allow fauna to escape;
- nests and on-ground logs will be carefully inspected by an ecologist. Logs should be carefully rolled and inspection beneath the log undertaken;
- habitat trees (trees with hollows or nests) will be carefully lowered to the ground with minimal impact and nests and hollows inspected by the ecologist.
- any fauna species are to be relocated to habitat identified during the pre-clearing process or, if injured, transported to a veterinarian or wildlife carer;
- where works are undertaken during the active period for the Booroolong Frog (October to March) the frog should be relocated to the nearest area of retained riparian habitat or where works are undertaken outside of the active period outlined above frogs should be taken into care. Agreement with an appropriately qualified and licensed carer will be required;
- 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 are to be retained;

- records are to be kept of all fauna rescue events including locations to where fauna have been relocated. Provide GPS coordinates for such events; and
- stockpiling/storage of cleared timber are to be in designated areas and outside the critical root zone of remaining trees.

## 5. UNEXPECTED THREATENED SPECIES FINDS PROCEDURE

If any threatened species or threatened ecological community is unexpectedly encountered during construction activities, the Unexpected Threatened Species Finds Procedure provided in Appendix F will be followed.

## 6. POST CLEARING REPORT

Post clearing reports will be compiled progressively during the clearing phase of the project and submitted to Snowy Hydro. The completed reports 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;
- any dead animals located; and
- photographs of rescued fauna.

# APPENDIX A – PRE-CLEARING AND CLEARING PROCEDURE

# CLEARING AND GRUBBING PROCEDURE

**A procedure of the S2-FGJV-ENV-PLN-0028 - Biodiversity Management Plan**

Future Generation

## MANAGEMENT AND RESPONSIBILITY

**Prepare for clearing**

- Engage the Project Ecologist (EM)
- Develop the Clearing and Grubbing WMS (EM or ENG)
- Establish the planned clearing extents for approval by Snowy Hydro (EM or ENG)
- Conduct weed identification (this can also occur at the pre-clearing inspection) (Ecol)

← Env Manager, Env Advisor, Engineers, Ecologist

↓

**Install exclusion zones and delineation**

- Install clearing limit, exclusion zones and EIS boundary (SS)
- Install signage advising of environmentally sensitive areas (SS)
- Frog fencing to be installed at bridge crossings (SS)

← Site Supervisor, Surveyor

↓

**Prior to clearing**

- The ecologist will undertake the pre-clearance inspection (Ecol)
- Identify habitat trees and habitat features and mark them up (Ecol)
- Confirm release location of fauna (Ecol)
- Arborist is to inspect for unsound trees (EM or EA)

← Env Manager, Env Advisor, Engineers, Ecologist

↓

**24 hours prior clearing**

- Clearing limits will be walked to confirm they are correct and in place. The inspection be carried out with the operator, Site Supervisor and Environmental Advisor. The Principal is also to attend a pre-clearing inspection. (EA, SS, Operator)
- The project ecologist will undertake the final inspection (Ecol)
- Capture and relocate fauna where possible (Ecol)
- Contact vet or wildlife carer to advise of clearing

← Env Manager, Env Advisor, Engineers, Ecologist

↓

**Step 1 clearing NON-HABITAT vegetation**

**Day of clearing and immediately prior to clearing**

- Supervisor, clearing operator and Env Advisor to walk area prior clearing
- Prestart training with all workers on WMS for clearing and grubbing

CLEARING PERMIT TO BE APPROVED

Clear non-habitat vegetation

← Site Supervisor, Env Advisor, Operator, Ecologist

↓

**Step 2 clearing HABITAT vegetation**

- 24 – 48 hours after initial clearing
- Ecologist to inspect trees immediately prior to felling
- Ecologist to be present during clearing of habitat trees
- Capture and relocate fauna where possible
- Relocate habitat logs etc

← Operator, Ecologist

Project: Future Generation Snowy 2.0 Exploratory Works
Procedure: S2-FGJV-ENV-PRO-0008 - Clearing and Grubbing Procedure
Approved By: Laurenne Coetzee

## DETAILED REQUIREMENTS

This Clearing and Grubbing Procedure has been prepared to summarise the clearing requirements from the Biodiversity Management Plan – Snowy 2.0 Exploratory Works – Stage 2 (BMP). It describes how Future Generation JV propose to manage the environmental matters relating to clearing and grubbing works.

### 1. TRAINING

All personnel shall be informed through the induction, prestart briefing or other targeted training of the importance of clearing limits and the significance of the surrounding environment.

All personnel involved in clearing will be subject to toolbox training on the Clearing and Grubbing Procedure.

Each morning during clearing a prestart meeting will occur which discusses items such as: clearing for the day; limits of clearing; processes to follow; known or potentially occurring threatened species; sensitive areas; and the locations of significant habitat features within and adjacent to the construction areas.

### 2. PRIOR TO CLEARING

#### 2.1 Preparing for clearing

- A Clearing and Grubbing Work Method Statement will be developed.
- The extent of clearing required will be confirmed on a survey plan and approved with Snowy Hydro.
- The boundaries will be included on the Sensitive Area Plans.

#### 2.2 Establishing clearing limits

- **Clearing limits and exclusion zones** will be established on site prior to clearing. This will include exclusion or no-go fencing and 'Environmental Protection Area' signs.
- **Boundary types –** there are three types of boundaries:
  - Clearing limit;
  - Exclusion zones (or avoidance area);
  - EIS boundary.

  Refer to Table 1 for the flagging types and guide.
- Frog fencing - for bridge crossings frog exclusion fencing will be installed.
- Tree protection zones (TPZs) will be set up around all trees retained within and adjacent to the disturbance footprint

**Table 1 - Flagging guide for clearing**

| Flagging type | Indicates | Description and definition |
|---|---|---|
|  | Limit of clearing | Set by the contract. No clearing past this point. |
|  | EIS boundary/ Site boundary | No work permitted past this point without approval of the Environmental Manager. Works in this area will likely need to be approved through subsequent approvals such as a Consistency Assessment or a Modification. |
|  OR | Exclusion zone | Also called the avoidance area. This includes:<br>• Booroolong Frog - a 50 metre exclusion zone surrounding the Yarrangobilly River and Wallaces Creek, with the exception of approved bridge construction works and section of Mine Trail Road;<br>• Smoky Mouse - the existing disturbance footprint along the upper section of Lobs Hole Ravine Road shall be maintained. Disturbance is not permitted outside of existing disturbed areas between chainage 0 and 7750;<br>• Other sensitive sites such as heritage sites where impact is not permitted will be delineated. |
|  | Habitat tree or habitat area | In the two step clearing process habitat trees must only be cleared in the second phase of clearing following the removal of non-habitat vegetation. |
| *Example of frog fencing* | Frog fencing | Frog exclusion fencing will be installed 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. |
| *To be received from SHL* | Stage 1 clearing limit | The Stage 1 project has used different flagging to define their boundary. |

Revision: 01
Date: 7/10/2019
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# CLEARING AND GRUBBING PROCEDURE



### 2.3 Inspection prior to clearing

- Prior to clearing the project ecologist will:
  - inspect the area to be cleared;
  - demarcate all habitat trees and habitat features including hollow bearing trees, large logs, caves and rock outcrops; GPS coordinates will be recorded;
  - the location for the release of fauna will be confirmed;
  - identify the species and locations of weeds. Note this inspection can occur any time prior to clearing. Refer to the **Weed and Feral Animals Management Plan** (Appendix F of the BMP) for the management of weeds prior to clearing.

### 2.4 Inspection 24 hours prior to clearing

- 24 hours prior to clearing:
  - the supervisor, operator and environmental advisor will walk the clearing footprint to check that exclusion zones are delineated and temporary fencing is installed. The pre-clearing inspection is also to occur with the Principal;
  - contact a wildlife carer or veterinarian to inform them of vegetation clearing works upcoming;
  - check for the evidence of presence of threatened flora and fauna species including Booroolong Frog for areas adjacent to Yarrangobilly River and translocate to areas away from impacts;
  - capture and/or remove fauna that have the potential to be disturbed from clearing. Relocated into the pre-determined habitat for fauna release. Any relocation of fauna is to occur in accordance with the **Fauna Handling and Rescue Procedure** (Appendix E of the BMP). A **Fauna Rescue Recording Sheet** (Appendix A of the Fauna Handling and Rescue Procedure) will be completed;
  - inform clearing contractor of any changes to the sequence of clearing if required.
- **An arborist** is to report on any unsound trees that should be removed if required.
- Where possible, existing trees and other vegetation should be retained within 15 metres of waterways and drainage lines until immediately before construction commences in the area.
- The Clearing Permit is to be approved prior to clearing commencing.

## 3. VEGETATION CLEARING

**A two-step habitat removal process will be implemented and will involve the following steps:**

### 3.1. STEP 1 – NON-HABITAT TREE REMOVAL

Where no areas of habitat have been identified, clearing can be undertaken in a single-stage process, and includes the under-scrubbing of non-habitat trees, shrubs and other vegetation.

When vegetation, that may provide habitat is proposed to be removed, the area will be inspected by the project ecologist immediately prior to clearing, to:

- Obtain updated information on fauna and fauna habitat resources present.
- Capture and relocate non-mobile fauna, such as reptiles and frogs and key habitat features such as active bird nests. Records are to be kept of all fauna rescue events including locations to where fauna have been relocated. This is to be recorded on the **Fauna Rescue Recording Sheet**. Provide GPS coordinates for such events.
- If not already available, record the details for all Hollow Bearing Trees (HBTs) and trees containing threatened fauna and flora include GPS location, species, type of habitat feature, size of hollow and type of hollow.
- Remove non-habitat vegetation.
- Trees cleared shall be cut off not higher than 300mm above existing ground level.

### 3.2. STEP 2 – HABITAT TREE REMOVAL

- Identified habitat will be left for **at least 24-48 hours** after removing non-habitat vegetation to allow fauna to self-relocate.
- Nests and on-ground logs will be carefully inspected by an ecologist.
- Habitat trees will be carefully lowered to the ground with minimal impact and nests and hollows inspected by the ecologist.
- Any fauna species are to be relocated to habitat, or if injured, transported to a veterinarian.
- Where works are undertaken during the active period for the Booroolong Frog (October to March) the frog should be relocated to the nearest area of retained riparian habitat or where works are undertaken outside of the active period outlined above frogs should be taken into care. Agreement with an appropriately qualified and licensed carer will be required.
- 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 are to be retained.
- Records are to be kept of all fauna rescue events including locations to where fauna have been relocated. This is to be recorded on the **Fauna Rescue Recording Sheet**. Provide GPS coordinates for such events.

## 4. UNEXPECTED THREATENED SPECIES PROCEDURE

If any threatened species or a threatened ecological community is unexpectedly encountered during construction, the Unexpected Threatened Species Finds Procedure in Appendix D of the BMP will be followed.

## 5. POST CLEARING REPORT

Post clearing reports will be compiled progressively during the clearing phase of the project and submitted to Snowy Hydro. The completed reports will include the detail required in Appendix C of the BMP.

### Threatened species with the potential to occur on site

**Known threatened species in project area**

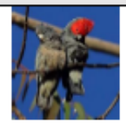
**Fauna**


Smoky Mouse


Eastern Pygmy Possum


Booroolong Frog


Murray Crayfish


Gang Cockatoo


Masked Owl


Spotted Tail Quoll


Broad-Toothed Rat


Alpine Tree Frog


White Bellied Sea-Eagle

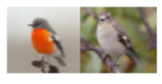

Olive Whistler

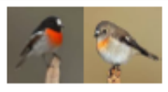

Brown Tree Creeper


Diamond Firetail


Dusky Woodswallow


Varied Sittella


Flame Robin


Scarlet Robin

**Flora**


Curtis' Colonbath


Blue-tongued Greenhood


Cotoneaster Pomaderris


Austral Toadflax


**Slender Greenhood**

# APPENDIX D – UNEXPECTED THREATENED SPECIES FINDS PROCEDURE

S2-FGJV-ENV-PLN-0028 Appendix D

# BIODIVERSITY MANAGEMENT PLAN APPENDIX D – UNEXPECTED THREATENED SPECIES FINDS PROCEDURE

| Approval Record | | | |
|---|---|---|---|
| Document preparation, review and approval | | Name in print | Signature |
| Prepared by | | R Kristenson | |
| Reviewed by | | R Walker-Edwards | |
| Verified by | Environmental Manager | L Coetzee | |
| Approved by | Project Director | A. Betti | |

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| A | 17.04.2019 | FOR REVIEW AND CONSULTATION |
| B | 20.05.2019 | UPDATE SHL COMMENTS FOR CONSULTATION |
| C | 04.07.2019 | UPDATE FROM AGENCY CONSULTATION |
| D | 16.08.2019 | UPDATE FROM DPIE COMMENTS<br>FOR APPROVAL |
| 0 | 23.08.2019 | FOR APPROVAL |
| 1 | 19.11.2019 | UPDATED TO INCLUDE MODIFICATION 1 SCOPE |

# CONTENTS

# 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.

# 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 the Snowy 2.0 Project, 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 Gen Environmental Management Strategy and the Biodiversity Management Plan.

# 4. THREATENED SPECIES LIKELY TO OCCUR IN THE AREA

The monitoring schedule is summarised in Table 2.1 of Appendix B of the Biodiversity Management Plan, with further detail provided in each chapter.

Threatened species surveys undertaken as part of the EIS did not identify any threatened flora species within or adjacent to the Exploratory Works survey area, however, four threatened flora species have a low likelihood of occurrence:

- Curtis' Colobanth (*Colobanthus curtisiae*);
- Blue-tongued Greenhood (*Pterostylis oreophila*);
- Cotoneaster Pomaderris (*Pomaderris cotoneaster*);
- Austral Toadflax (*Thesium austral*).

One threatened flora species occurs in the Modification 1 disturbance footprint:

Slender greenhood (*Pterostylis foliate*)

Seventeen threatened fauna species have been recorded within or adjacent to the Exploratory Works and Modification 1 survey area:

- Brown Treecreeper
- Smoky Mouse;
- Eastern Pygmy Possum;
- Booroolong Frog;
- Gang-gang Cockatoo;
- Masked Owl;
- Diamond Firetail;
- Dusky Woodswallow;

- Varied Sittella;
- Flame Robin;
- Scarlet Robin;
- Olive Whistler;
- White Bellied Sea-Eagle;
- Broad-toothed Rat;
- Spotted-tailed; Quoll;
- Alpine Tree Frog;
- Murray Crayfish.

## 5. IMPLEMENTING THIS PROCEDURE

This procedure is applicable to all activities that have the potential impact upon threatened flora and fauna species that have not been assessed and approved. In the event that an unexpected threatened species is encountered the flow chart in Figure 5-1 below is to be implemented.

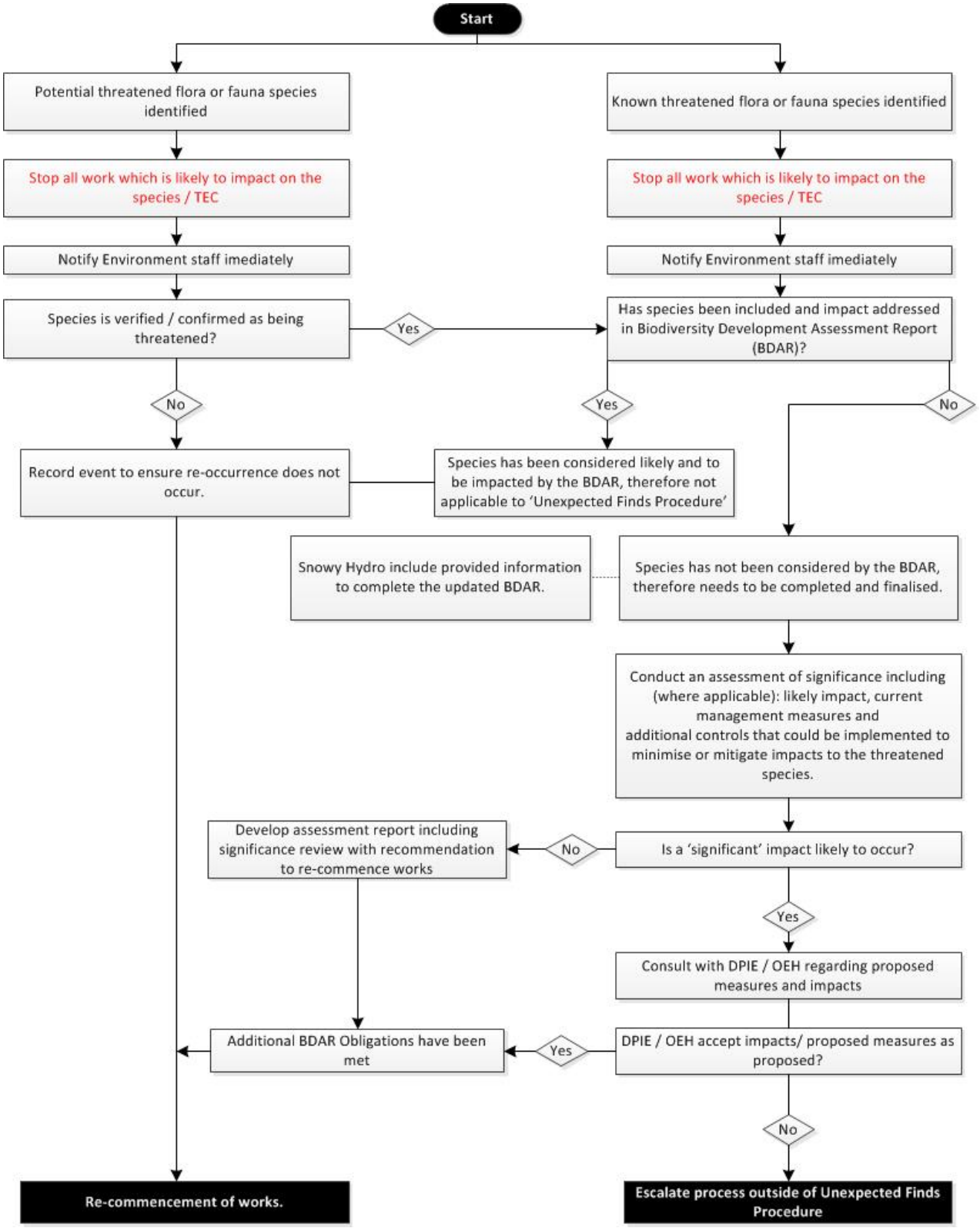



Figure 5-1: Unexpected threatened species finds procedure flow diagram

Table 5-1: Known or potential threatened species in the project area

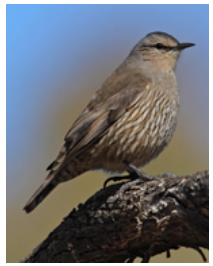
| Common name | Scientific name | BC Act | EPBC Act | Image | Appearance | Location |
|---|---|---|---|---|---|---|
| **Fauna** | | | | | | |
| **Smoky Mouse** | *Pseudomys fumeus* | Critically endangered | Endangered |  | • Fine, soft, pale grey to bluish grey to black fur<br>• A grey to white belly and ears and feet that are flesh-coloured with sparse white hair<br>• Similar in size to a small rat, the length of individuals, including the tail, is between 180–250mm<br>• Primarily nocturnal species | 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. |
| **Eastern Pygmy Possum** | *Cercartetus nanus* | Vulnerable | Not listed |  | • Eastern Pygmy-possums are tiny, only weighing 15 to 43 grams<br>• Adults have a body length between 70-110mm<br>• Almost bare, prehensile (capable of curling and gripping) tail<br>• Big, forward-pointing ears<br>• Light-brown fur above and white belly below<br>• Active climbers | The Eastern Pygmy Possum was recorded at numerous locations within the Exploratory Works survey area, from the upper reaches of Lobs Hole Ravine to Lobs Hole. |
| **Spotted Tail Quoll** | *Dasyurus maculatus* | Vulnerable | Endangered |  | • The Spotted-tailed Quoll is about the size of a domestic cat<br>• The average weight of an adult male is about 3500 grams and an adult female about 2000 grams.<br>• It has rich-rust to dark-brown fur above, with irregular white spots on the back and tail, and a pale belly | No Spotted-tail Quolls were recorded during targeted surveys within the Modification 1 disturbance footprint.<br>However, an incidental record of Quoll scat was recorded off Wallaces Creek Firetrail. |

| Common name | Scientific name | BC Act | EPBC Act | Image | Appearance | Location |
|---|---|---|---|---|---|---|
| **Broad-toothed Rat** | *Mastacomys focus* | Vulnerable | Vulnerable |  | • A tubby, compact rodent, chubby-cheeked, with a short, wide face and ears, and long, dense, fine fur.<br>• It is brown above, with attractive, rufous highlights.<br>• The tail is shorter than the head and body length (*Rattus* species have tails as long or longer than the head and body).<br>• The tail is ringed, with very little fur. | Species was recorded in adjacent areas of the<br>disturbance boundary within PCT 1224. |
| **Booroolong Frog** | *Litoria booroolongensis* | Endangered | Endangered |  | • Medium sized tree frog, with adults growing to about 5cm<br>• Their body-colour may be grey, olive or brown with indistinct black markings<br>• The abdomen is white<br>• The skin usually has a slightly warty appearance<br>• The fingers and toes have well developed discs, and the toes are strongly webbed<br>• The call is a soft, purring 'craw' | 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. |
| **Alpine Tree Frog** | *Litoria verreauxii alpina* | Endangered | Vulnerable |  | • The Alpine Tree Frog is a relatively small tree frog, growing to about 3 cm long.<br>• 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 | The Alpine Tree Frog was recorded adjacent to the Exploratory Works modification footprint in southern<br>Tantangara, and the species was recorded breeding in Tantangara Reservoir between minimum operating level<br>(MOL) and full supply level (FSL) on several occasions as water levels fluctuated ( |

| Common name | Scientific name | BC Act | EPBC Act | Image | Appearance | Location |
|---|---|---|---|---|---|---|
| **Murray Crayfish** | *Euastacus armatus* | Vulnerable | Not listed |  | • Murray crayfish have large white claws and a dark olive/grey/black carapace, all of which are covered in short robust spikes.<br>• 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. | 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. |
| **Gang Cockatoo** | *Callocephalon fimbriatum* | Vulnerable | Not listed |  | • Gang-gang Cockatoos are primarily slate-grey, with the males easily identified by their scarlet head and wispy crest<br>• Females have a grey head and crest and feathers edged with salmon pink on the underbelly | The Gang Gang Cockatoo was found to be common throughout the Exploratory 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). |
| **Masked Owl** | *Tyto novaehollandiae* | Vulnerable | Not listed |  | • A medium-sized owl to 40 - 50 cm long<br>• Dark eyes set in a prominent flat, heart-shaped facial disc that is encircled by a dark border<br>• The feet are large and powerful, with fully feathered legs down to the toes<br>• The owl exists in several colour forms, with wide variation in plumage | The Masked Owl was recorded at two locations within and adjacent to the Exploratory 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. |

| Common name | Scientific name | BC Act | EPBC Act | Image | Appearance | Location |
|---|---|---|---|---|---|---|
| **Diamond Firetail** | *Stagonopleura guttata* | Vulnerable | Not listed |  | • The Diamond Firetail is a large (length 10-12cm, weight 17 grams), striking finch with a bright red bill, and red eyes and rump<br>• The white throat and lower breast are separated by a broad black breast-band that extends into the strongly white-spotted, black flanks | The Diamond Firetail is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. |
| **Dusky Woodswallow** | *Artamus cyanopterus cyanopterus* | Vulnerable | Not listed |  | • Medium-sized bird (16-19.5cm, 35g), with a longish tail<br>• Mostly dark grey-brown, merging to blackish on the tail, with a small black-brown mask<br>• Bluish bill with a black tip<br>• | Dusky woodswallows are widespread in eastern, southern and south western Australia. |
| **Varied Sittella** | *Daphoenositta chrysoptera* | Vulnerable | Not listed |  | • The Varied Sittella is a small (10cm) songbird with a sharp, slightly upturned bill, short tail, barred undertail, and yellow eyes and feet.<br>• In flight the orange wing-bar and white rump are prominent.<br>• | The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. |
| **Flame Robin** | *Petroica phoenicea* | Vulnerable | Not listed |  | • The Flame Robin is a small Australian robin that reaches 14cm in length.<br>• The male has a dark grey head and upperparts, a small white forehead patch, and white wing stripes and white tail-edges.<br>• | 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. |

| Common name | Scientific name | BC Act | EPBC Act | Image | Appearance | Location |
|---|---|---|---|---|---|---|
| **Scarlet Robin** | *Petroica boodang* | Vulnerable | Not listed |  | • The Scarlet Robin is a small Australian robin that reaches 13 cm in length.<br>• The male has a black head and upperparts, with a conspicuous white forehead patch, white wing stripes and white tail-edges.<br>• The male has a bright scarlet-red chest and a white belly.<br>• 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. | The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. |
| **White Bellied Sea-Eagle** | *Haliaeetus leucogaster* | Vulnerable | Not listed |  | • The White-bellied Sea-Eagle is a large eagle that has long broad wings and a short, wedge-shaped tail.<br>• It measures 75–85 cm in length, and has a wingspan of 180–220 cm.<br>• Adults are predominantly white and grey. | 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.<br>In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways.<br>Recorded at Tantangara and Talbingo Reservoir . |
| **Olive Whistler** | *Pachycephala olivacea* | Vulnerable | Not listed |  | • The Olive Whistler is a small, stocky bird with a large head and strong sharp bill.<br>• It grows up to 22 cm long, including the 10 cm tail.<br>• It has a dark grey head, olive-brown upperparts, a grey throat and buff-brown underparts. | 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. |

| Common name | Scientific name | BC Act | EPBC Act | Image | Appearance | Location |
|---|---|---|---|---|---|---|
| **Brown Treecreeper** | *Climacteris picumnus* | Vulnerable | Not listed |  | • The Brown Treecreeper, Australia's largest treecreeper, is a grey-brown bird with black streaking on the lower breast and belly and black bars on the undertail.<br>• Pale buff bands across the flight feathers are obvious in flight.<br>• The face is pale, with a dark line through the eye, and a dark crown. | 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. |
| **Flora** | | | | | | |
| **Curtis' Colonbath** | *Colobanthus curtisiae* | No | Yes - Vulnerable |  | This small perennial herb flowers from November to February with most herbarium specimens collected from November to January. While flowers are necessary to confirm the identity of the species, it can be detected throughout the year | It is a grassland to grassy woodland plant, often found on rocky knolls, and can be found in areas subject to a wide variety of environmental conditions. The species responds to some disturbance.<br>Not recorded in exploratory or modification 1 footprint |
| **Blue-tongued Greenhood** | *Pterostylis oreophila* | Yes – Critically endangered | Yes – Critically endangered |  | The Blue-tongued Greenhood is a terrestrial orchid, with up to five leaves in a basal rosette before flowering. The leaves are later arranged loosely along the 20 cm tall flowering stems. The leaves are oval in shape, to 70 mm long and 20 mm wide. The flower is solitary, erect, predominantly white with narrow green stripes, somewhat bulky (the hood-like structure being about 2.5 cm long). Flowers have a curved lip of a distinctive bluish or blue-green (aqua) colour. It flowers from November to January. | Grows along sub-alpine watercourses under more open thickets of Mountain Tea-tree in muddy ground very close to water.<br>Not recorded in exploratory or modification 1 footprint |

| Common name | Scientific name | BC Act | EPBC Act | Image | Appearance | Location |
|---|---|---|---|---|---|---|
| **Slender Greenhood** | *Pterostylis foliata* | Yes – Vulnerable | No |  | Pterostylis foliata is a greenhood orchid with 3-6 roughly ovate leaves 2–5 cm long, 8–16 mm wide.<br>The flowering stem is up to 30 cm high and is smooth. The flower is about 2 cm long, dark green and white with brown in the galea. | The Slender Greenhood grows in eucalypt forests amongst an understorey of shrubs, ferns and grasses. It's known to occur on loam or clay loam soils, found on sheltered slopes. The species is endemic to south-eastern Australia. This species was not predicted to occur but was added manually.<br>Species was recorded within the Modification 1 disturbance footprint. |
| **Cotoneaster Pomaderris** | ***Pomaderris cotoneaster*** | Yes – Endangered | Yes – Endangered |  | Cotoneaster Pomaderris is a shrub growing to 4 m tall. Its young stems have a covering of short, white, star-shaped hairs. Its leaves are elliptical, to 30 mm long and 15 mm wide with a tip that is sometimes indented (thus resembling the horticultural Cotoneaster, to which it is not related). The upper surface of the leaf is bristly and the lower surface has a fine white mat of star-shaped hairs. Its petal-less flowers are cream-coloured. Flowering occurs between October and November. | Cotoneaster Pomaderris has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs.<br>Not recorded in exploratory or modification 1 footprint |
| **Austral Toadflax** | ***Thesium australe*** | Yes - Vulnerable | Yes - Vulnerable |  | Austral Toadflax is a small, straggling herb to 40 cm tall. Leaves are pale green to yellow-green, somewhat succulent, 1 - 4 cm long and 0.5 - 1.5 mm wide. Flowers are minute and white, emerging where the leaves meet the stems and appearing in spring. The fruit is small and nut-like, developing in summer. This species is often hidden amongst grasses and herbs. | Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.<br>Not recorded in exploratory or modification 1 footprint |

# APPENDIX E – FAUNA HANDLING AND RESCUE PROCEDURE

S2-FGJV-ENV-PLN-0028 Appendix E

# 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 | | R Walker-Edwards | |
| Verified by | Environment Manager | L Coetzee | |
| Approved by | Project Director | A. Betti | |

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| Rev. | Date | Description of modifications / revisions |
| A | 17.04.19 | FOR REVIEW AND CONSULTATION |
| B | 04.07.19 | UPDATE FROM AGENCY CONSULTATION |
| C | 16.08.19 | UPDATE FROM DPIE COMMENTS<br>FOR APPROVAL |
| 0 | 23.08.19 | FOR APPROVAL |
| 1 | 19.11.2019 | UPDATED FOR MODIFICATION 1 SCOPE |

# CONTENTS

# 1. PURPOSE

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 should be undertaken either by the Project Ecologist skilled in handling the type of fauna encountered.

Should any threatened species be identified the Unexpected Threatened Species Find Procedure (Appendix D) would be implemented.

# 2. GENERAL REQUIREMENTS

- Future Gen induction will include relevant sections of this procedure and other fauna management issues and obligations under the Biodiversity Management Plan to not interfere with or harm fauna
- All potential fauna habitat (for example hollow-bearing trees, dens, dreys, nests etc.) will be identified prior to removal in accordance with the Pre-clearing and clearing procedure (Appendix C).
- Vegetation clearing will be carried out in 2 steps. 1. Non-habitat tree removal and 2. Habitat tree removal in accordance with Pre-clearing and clearing procedure (Appendix C).
- All fauna observed, captured, relocated, injured or killed during the habitat removal phase of the Project must be recorded by the Project Ecologist and a Fauna Relocation Record Form. The following data should be recorded; date, species, sex (if known), location of observation (easting/northings), location of release site (including any nest boxes installed; easting/northings), notes regarding deposit of fauna to veterinarian or wildlife shelter and any other relevant notes. This data is to be supplied to OEH by the Project Ecologist.
- Suitable relocation habitat will be identified as part of the Pre-clearing and clearing procedure (Appendix C).

# 3. GENERAL HANDLING REQUIREMENTS

- Fauna in hollows should 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 should 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.
- If nocturnal fauna is required to be kept during the day, they will be kept in either standard pet carrying cages or ventilated cardboard/plastic animal boxes, or cloth capture bags. Captive fauna will generally be kept in 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 is displaced and cannot be re-united with its parent(s), orphaned fauna must be deposited with an authorised wildlife shelter within the region for hand rearing.
- In the event that fauna is injured during construction, the removal of trees, or during hand capture, the animal should initially be assessed and first aid rendered by the Project Ecologist

experienced Project Ecologist and subsequently taken to a Veterinarian for further assessment and treatment and if necessary euthanasia.

- After consultation with the veterinarian, injured fauna that requires recuperation and thus is unable to be immediately released must be deposited with an authorised wildlife shelter. Upon successful recuperation and rehabilitation, the animal is to be released into suitable habitat as close as is practical to the point of original capture.
- At all times, the welfare of individual animals must be of utmost concern to all involved in this protocol.

A severely injured animal (for example, deep cut with exposed organs, bone fracture, protruding bone etc) may require 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 should 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

Salvage approach:

- Where possible and safe to do so, gain access to nests using elevated platform/ladder. Capture and remove any nestlings, taking care not to be bitten or scratched (gloved hands may be appropriate for some species such as raptors and parrots).
- 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 should be covered to reduce stress on the bird. Deliver to specialist wildlife carer within two hours.
- If adult birds are captured, they will be released immediately away from construction activities.

## 4.2. Ground Dwelling Mammals – Species: Echidna

Salvage approach:

- 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 should be kept in a cool, well ventilated location, out of direct sun. Uninjured echidnas should be translocated and released as soon as possible. Upon release, they may dig in. Observe the animal from a distance to ensure it moves off freely and away from any roads.

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

Salvage approach:

- Capture rodents using a hand net.

- Once captured, rodents should 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)

Salvage approach:

- Only experienced personnel should deal with macropods.
- Impacts on kangaroos and wallabies include entanglement in boundary fencing ('fence hangers'), and stressed individuals being disturbed by construction activities.
- Project boundary fences should be checked each morning by construction personnel. This can be undertaken by construction personnel. If a fence hanger is observed by construction personnel, they must immediately notify the Project Ecologist.
- If a macropod is within the construction zone, activities in the area may need to cease. The Project Ecologist should be notified immediately.
- In the event that a juvenile macropod is displaced (thrown from a pouch) and cannot be re-united with its parent, orphaned macropods must be deposited with an authorised wildlife shelter within the region for hand rearing within 2 hours.

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

Salvage approach:

- Snakes can only be captured by the Project Ecologist with skills and experience in snake handling. Snakes disturbed by the development should 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 can be captured either by hand or nets; snakes can be captured using specialist hooks and grippers.
- Reptiles should be placed into cloth capture bags or ventilated plastic containers.
- Reptiles should be released as soon as possible after capture into suitable habitat outside of the construction zone.

## 4.6. Frogs

Salvage approach:

- 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 should be minimised or avoided where possible.
    - Single-use Latex, nitrile or vinyl gloves or single-use plastic bags should 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 of 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 should 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

Salvage approach:

- The Project Ecologist is to be on site during the removal of vegetation and 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.
- Captured possums and gliders will be released no more than 150 metres from point of capture.
- Once a hollow felled, it should be inspected for Possums and gliders.
- Possums and gliders should be captured either by hand or net and placed into a suitable cage.
- Gliders should be held in cloth capture bags.
- Possums and gliders are to be released into a suitable hollow or nest box within the identified release location as soon as is practical after capture.
- In the event that juvenile possums/gliders are displaced and cannot be re-united their mother, they must be deposited with an authorised wildlife shelter within the region for hand rearing within 2 hours.

## 4.8. Microbats – Species: All Species

Salvage approach:

- 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 personnel are 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.
- Once a tree or section of tree of interest is on the ground, the Project Ecologist should inspect hollows, cracks and loose bark for microbats.
- 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 within 150 meters of the capture point.
- Microbats captured are to be released into a suitable hollow or nest box within the identified release location as soon as is practical after capture.
- If microbats go into torpor, they will need to be roused, prior to release. This can be achieved by closely holding the bat in the hand or under clothing.
- 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 for hand rearing or a specialist care facility within 2 hours.

# APPENDIX A – FAUNA RESCUE RECORDING SHEET

| Item | Detail |
|---|---|
| Date fauna located | |
| Time fauna located | |
| Weather (temperature, wind, cloud cover, precipitation) | |
| Location (Coordinates and description i.e. in tree hollow; under stockpile, open area etc) | |
| Fauna type (Mammal, bird, reptile etc) | |
| Species (if known) | |
| Visual signs of behaviour | |
| Condition, general health signs, description of injuries, note if a dead specimen | |
| Is the fauna injured (YES / NO) | |
| **If YES, please completion Section A; If NO please complete Section B** | |
| ***A – Injured Fauna Reporting*** | |
| 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 – Non-injured Fauna Reporting*** | |
| Where was the fauna relocated? (Coordinates and description)<br>*NB Only a qualified fauna ecologist or wildlife handler is to relocate fauna* | |
| Time the fauna relocated? | |
| Name and qualification of fauna handler | |
| Visual signs of behaviour on release | |
| Condition – general health signs – on release | |
| **General** | |
| Other comments | |
| Completed by | |
| Signed | |
| Date | |
| *NB Completed form to be provided to the Environment Manager and filed in the Environmental Log.* | |

# APPENDIX F – WEED AND FERAL ANIMALS MANAGEMENT PLAN

S2-FGJV-ENV-PLN-0028 Appendix F

# BIODIVERSITY MANAGEMENT PLAN APPENDIX F – WEED AND FERAL ANIMAL MANAGEMENT PLAN

| Approval Record | | | |
|---|---|---|---|
| Document preparation, review and approval | | Name in print | Signature |
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| Reviewed by | | R Walker-Edwards | |
| Verified by | Environment Manager | L Coetzee | |
| Approved by | Project Director | A. Betti | |

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| - | 18/04/19 | PREPARED FOR STAGE 1 |
| A | 17/04/19 | FOR REVIEW AND CONSULTATION |
| B | 20/05/19 | UPDATE SHL COMMENTS FOR CONSULTATION |
| C | 04/07/19 | UPDATE OEH COMMENTS |
| D | 16/08/19 | UPDATE FROM DPIE COMMENTS<br>FOR APPROVAL |
| 0 | 23/08/19 | FOR APPROVAL |
| 1 | 19.12.2019 | UPDATED TO INCLUDE MODIFICATION 1 SCOPE. |

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# 1. INTRODUCTION

## 1.1. Purpose and objective

The key objective of the Weed and Feral Animal Management Plan (this Plan) is to describe the management measures that are to be implemented to ensure that the spread of weeds and 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 Section 5 of this Plan;
- detail the existing weeds, pest animals and pathogens identified within the Project footprint during the EIS including any weeds and pests of concern not already within the Project footprint;
- ensure practical measures are implemented prior to and during construction to avoid the introduction of new weeds, pest animals and pathogens and to minimise the spread of existing weeds, pest animals and pathogens;
- detail the specific identification and monitoring programs for known weeds and pest animals and pathogens present in, and adjacent to, the Project area; 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

No permits or licences are required specific to weeds and pests.

## 2.3. Guidelines

- 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.

# 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 5.1 and Appendix F of the EIS. Appendix F includes the Biodiversity Development Assessment.

## 3.1. Weeds

### 3.1.1. Terrestrial Weeds

The past activities and land uses within the Project area of the KNP and around Talbingo have resulted in significant amounts of clearing and disturbance of vegetation in the area. Native vegetation, which includes fauna habitats have been modified by past disturbances associated with land clearing, livestock grazing and weed invasion.

Native vegetation has re-established itself throughout Lobs Hole; however, Blackberry (*Rubus fruticosus* species aggregate), a weed of national significance, has established itself to the point of infestation within the area. The riparian zones of both Wallaces Creek and the Yarrangobilly River within the Project area are reasonably well vegetated, except for the lower section of the Yarrangobilly River which has been subject to clearing in Lobs Hole. In this area some banks are unvegetated. Both watercourses are subject to significant weed infestation, in particular with Blackberry.

Key weed species identified in Rehabilitation Guidelines for the Resort Areas of Kosciuszko National Park. (DECC 2007) and recorded during flora surveys for the broader Snowy 2.0 project include:

- Sheep Sorrel (*Acetosella vulgaris*);
- Yarrow (*Achillea millefolium*);
- Browntop Bent (*Agrostis capillaries*);
- Sweet Vernal Grass (*Anthoxanthum odoratum*);
- Spear Thistle (*Cirsium vulgare*);
- Hawthorn (*Crataegus monogyna*);
- Cocksfoot (*Dactylis glomerata*);
- Patterson's Curse (*Echium plantagineum*);
- Yorkshire Fog Grass (*Holcus lanatus*);
- St John's Wort (*Hypericum perforatum*);
- Cat's Ear/Flatweed (*Hypochaeris* spp.);
- Bird's-foot Trefoil (*Lotus* spp.);
- Musk Monkey Flower (*Mimulus moschatus*);
- Sweet Briar (*Rosa rubignosa*);
- Blackberry (*Rubus* spp.);
- Dandelion (*Taraxacum officinale*); and
- Mullein/Aarons Rod (*Verbascum thapsus* and *V. virgatum*).

Areas which have experienced considerable disturbance within the Exploratory Works footprint exhibit evidence of weeds. There are three identified weeds of significance in gullies and along Yarrangobilly Creek and Talbingo Reservoir and one high threat weed (Ox-eye daisy) within the southern part of Tantangara spanning west towards Nungar track. These weeds are:

- *Hypericum perforatum* (St. Johns Wort);
- *Leucanthemum vulgare* (Ox-eye Daisy);
- *Rosa rubiginosa* (Sweet Briar); and
- *Rubus* spp. (Blackberry).

### 3.1.2. Weeds of Concern

Other 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*);
- Ox-eye Daisy (*Leucanthemum vulgare*);
- Serrated Tussock (*Nasella trichotoma*);
- English Broom (*Cytisus scoparius*);
- Cape Broom (*Genista monspessulana*);
- Lupins (*Lupinus polyphyllus*);
- Yarrow (*Achillea millefolium*):
- Large-flowered Mountain Trumpet (*Collomia grandiflora*):
- Cinquefoil (*Potentilla* spp.);
- Phalaris (*Phalaris* spp.);
- Willows (*Salix* spp.);
- Forget-me-not (*Myosotis laxa* subsp *caespitose*);
- Mouse-eared Hawkweed (*Hieracium pilosella*); and
- Orange hawkweed (*Hieracium aurantiacum*).

Recently, there has been growing concern about the introduction of Orange Hawkweed to additional areas of the KNP. Currently there are seven infestations, totalling approximately 10 ha, currently confined to an area of some 8165 ha in the Jagungal wilderness area, which is situated over 50km south of the Project area. Orange hawkweed (*Hieracium aurantiacum*) presents a major threat to primary production and biodiversity across south-eastern Australia. It is on the National Alert List of Environmental Weeds. In addition, orange hawkweed is recognised as an agricultural sleeper weed in Australia. Under the Noxious Weeds Act 1993, all hawkweeds (*Heiracium* spp.) are listed as Class 1 noxious weeds.

### 3.1.3. Surveyed Weeds

A weed survey of the Exploratory Works Project area was conducted in late November and early December 2018. This study identified the following weed species within the Project footprint:

- Bird's-foot Trefoil (*Lotus spp*.);

- Blackberry (*Rubus fruiticosa aggregate*);
- Browntop Bent (*Agrostis capillaries*);
- Cat's Ear/Flatweed (*Hypochaeris spp.*);
- Cocksfoot (*Dactylis glomerata*);
- Dandelion (*Taraxacum officinale*);
- Hawthorn (*Crataegus monogyna*);
- Mullein (*Verbascum virgatum*);
- Musk Monkey Flower (*Mimulus moschatus*);
- Sheep Sorrel (*Acetosella vulgaris*);
- Spear Thistle (*Cirsium vulgare*);
- St John's Wort (*Hypericum perforatum*);
- Sweet Briar (*Rosa rubiginosa*);
- Sweet Vernal Grass (*Anthoxanthum odoratum*);
- Willows (*Salix* spp.);
- Yorkshire Fog Grass (*Holcus lanatus*).

### 3.1.4. Aquatic Weeds

Talbingo Reservoir provides substantial aquatic habitat, in particular extensive areas of wood debris (primarily submerged timber) and the non-native aquatic macrophyte *Elodea canadensis* (Elodea or Canadian pondweed) along shallow edges and embankments. 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.

It spreads via fragments. Elodea does not seed as only male flowers are found in Australia. Stems readily break into pieces which are easily transported in water.

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.

## 3.2. 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* has 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 remains to be established if P.cinnamomi could be pathogenic under the conditions in the KNP (Keith McDougall OEH 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 OEH pers. comm. 12 September 2018). *Pimelea bracteata* was not recorded within the Project area.

## 3.3. Feral Animal Species

There are a number of wild animals in the Kosciusko National Park region, including feral cats, foxes, brumby horses, pigs, dogs and deer. Within the Exploratory 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 are listed as key threatening processes under the BC Act and EPBC Act (NPWS 2001, DEWHA 2008, DoE 2015) with impacts from feral cats also listed as a key threat to the Smoky Mouse (Menkhorst and Broome 2008a, 2008b). Introduced predators are also considered a threat to Eastern Pygmy-possums (NSWSC 2001).

## 3.4. Feral Herbivores

Remote camera surveys, spotlighting and opportunistic sightings undertaken for the Snowy 2.0 Exploratory Works, Biodiversity Development Assessment Report (EMM 2018) recorded the following feral herbivores within the Project area:

- Horse (*Equus caballus*);
- Deer (*Damas* spp., *Cervus* spp., *Axis* spp); and
- Rabbit (*Oryctolagus cuniculus*)

The feral herbivore records were not limited to any one habitat type within the Project area and it is possible that they occur across the Project area.

## 3.5. Feral Predators

Remote camera surveys undertaken for the Snowy 2.0 Exploratory Works, Biodiversity Development Assessment Report (EMM 2018) recorded the following feral predators within the Project area:

- Cat (*Felis catus*) (Photograph 6.1);
- Dingo/domestic dog (*Canis lupus*); and
- Fox (*Vulpes vulpes*) (Photograph 6.2).

The feral predator records were not limited to any one habitat type within the Project area and it is possible that they occur across 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 and feral animal aspects, impacts and environmental factors**

| Environmental Aspects (Construction activities that may impact biodiversity) | Environmental Impacts | Environment Factors (Conditions) |
|---|---|---|
| Movement of vehicles<br>Clearing native vegetation<br>Topsoil stripping<br>Bulk earthworks<br>Soil movement and transfer<br>Bridge construction and waterway crossings<br>Barge activities<br>Operation of compounds<br>Imported materials<br>Movement of vehicles and vessels into and out of site | Introduction of weeds, pest animals and pathogens<br>Spread of weeds, pest animals and pathogens | Presence of existing weeds, feral animals and pathogens within the Project area<br><br>The presence of weeds, feral animals and pathogens adjacent to the Project site |

# 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;
- Control;
- Disposal.

## 5.1. Detailed Weed and Pathogen Mitigation Measures

### 5.1.1. Prevention

**Hygiene Inspections**

Future Gen is to establish a weed and pathogen checkpoint at the entry to the site, at the intersection of Links Road and Ravine-Lobs Hole Road as well as the intersection of Wharf Road (to be constructed by Stage 1) and Lobs Hole Ravine Road, within the EIS boundary, to check for evidence of weeds, vegetative, soil and organic material on and within plant, vehicles and equipment being brought to site.

**Movement of Sand, Soil, Rocks, Gravel, Fill and other Weed Risk Material**

Prior to the movement of any weed risk material to the Project site, the material is to be accompanied with a certificate stating that this material is free from weeds. If a certificate is not available, Future Gen is to conduct and document a weed inspection prior to the first movement of material from the source location and on a regular basis while material is still being delivered and during operation of the source location.

**Weed washdowns**

Prior to arrival on site

In order to minimise the risk of any new weeds being introduced to Project work areas, all vehicles, light vehicles and mobile plant shall be inspected prior to Site entry. Future Gen is expected to ensure that all vehicles have been washed down and inspected and that as a minimum, all HV have been washed down, inspected and accompanied by a vehicle inspection checklist which will include weed hygiene.

In addition to this, all vehicles and equipment will be inspected on site and documented using the Weed and Seed Inspection Form. Future Gen shall maintain a copy of this form in the vehicle and in the Project Office at all times for audit and inspection purposes, or an alternative compliance method is to be developed (e.g. windscreen stickers).

If a vehicle or equipment arrives unclean and/or without a certificate, at the inspection points at Link Road or Wharf Road, they will be refused entry and turned back to travel to the established washdown point.

**Weed Wash-down Locations**

No permanent weed wash-down areas will be located on site inside the KNP. Future Gen will establish a wash down area in a location close to site but in a built up area including Cooma, Adaminaby, Talbingo, Tumut or Cabramurra. This allows the construction of a washdown area with enough space for the required infrastructure and a ready power and water supply. The recommended method of wash down is using high pressure hoses and cleaning liquids such as Truckwash and Castrol Farmcleanse, or similar products to aid in the removal of soil (especially for pathogens) from the plant, equipment and vehicles. All dirty water is to be treated and is not to be used for dust suppression.

All suppliers will be instructed that plant and equipment is to be delivered to designated project location as clean. As outlined above, when vehicle and plant has been inspected and confirmed as clean, they will be given a hygiene certification sticker.

On-site management

Once a vehicle or item of mobile plant or equipment is operating on the Project site and has been demonstrated to be clean on entry then it will be free to move within the Site with the exception of weed risk areas. Once Plant and equipment enters a designated weed area, it is to surrender its

weed certificate while being used in a designated weed area. When it has finished working in the area, is to be washed down, reinspected and issued with a new Hygiene certificate before moving out of that area.

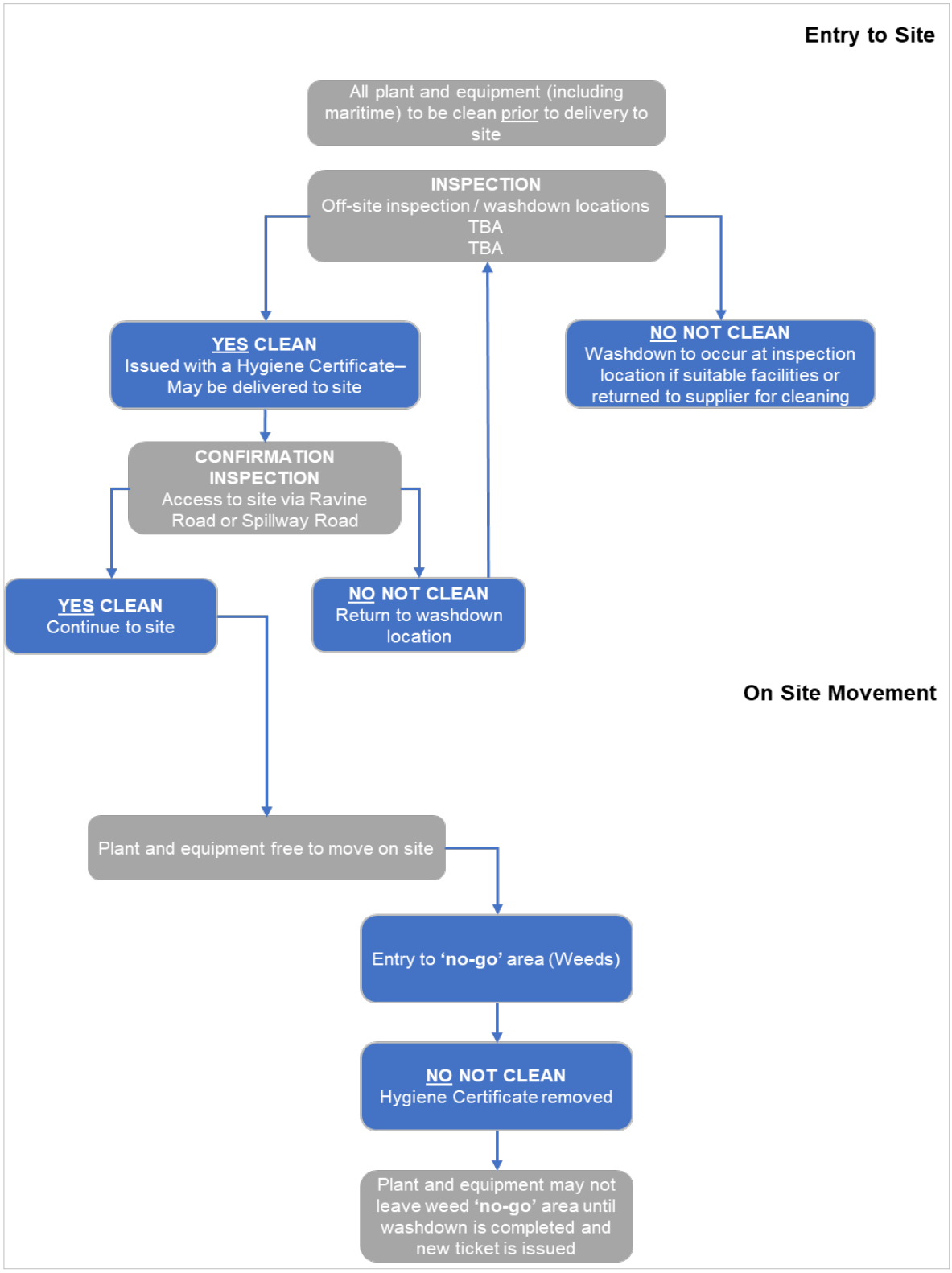



Figure 5-1: Weed and Pathogen Management Flowchart

### 5.1.2. Controls

Topsoil cleared from within a weed risk area shall be collected and stored within the same weed risk area. The topsoil shall be stockpiled, signposted and quarantined. A bund shall be placed around the toe of the stockpile. Future Gen, in consultation with Snowy Hydro and NPWS will determine if this topsoil can be reused, deep buried or whether it needs to be removed from site. All weed control measures will be in accordance and in consultation with NPWS current control practices.

Vegetation cleared from within a weed risk area is to be removed as per Table 5-1 and disposed off-site in a manner to ensure there is no risk of spread of weeds during transportation and disposal.

Where an area is identified as a weed infested area, signage should be installed to identify the extent of the weed infested area at both ends. Controls should 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 is allowed to be moved within the boundaries of that same weed risk area but cannot be taken to an area with a different weed risk.

**Stockpile management**

It is recommended that topsoil, mulch and spoil stockpiles should be monitored between spring and autumn and, where weeds establish on the stock piles, chemical weed control or physical removal should be undertaken to prevent further stockpile contamination.

**Chemical Weed Control**

There may be some benefit in undertaking chemical weed control in specific situations. In many parts of the Project footprint, such as the Ravine Road verges, exotic species co-occur with native species and chemical weed control may be detrimental. If non-target species are impacted the resulting disturbance could potentially allow the establishment of additional weed species. However, there are some situations where selective chemical weed control could be beneficial, these include:

- locations where weed seedlings establish in newly disturbed road verges within forested areas;
- material stockpiles; and
- to prevent seed set in heavily weed infested areas prior to topsoil stripping.

For all weed species there are a numerous alternative herbicide and treatment options available. Broad spectrum non-specific weed treatments are potentially problematic particularly in areas where weed species occur in conjunction with native plants. Where available, herbicide treatments should be selective or at least partially selective. As much as practical herbicide applications that minimise the likely impacts to non-target species should be selected. Weed control methods such as hand removal or the use of wick wipers could be potentially useful in sensitive situations to avoid impacts to non-target species. The NSW WeedWise database provides a range of chemical control options for the treatment of key weed species.

**Current NPWS practices**

NPWS approach has been to target specific weeds that may spread out of Ravine 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.

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 within the Ravine area for any new weeds is also undertaken.

False acacia stands in the Ravine have been subject to a significant control program within the proposed footprint for the exploratory work. Disturbance associated with the works may cause then to re-sprout. Any new plants should be actively supressed.

Where active weed management occurs, the Exploratory Works Project will continue to follow the methodology currently followed by NPWS as per outlined above and in Table 5-1 below.

**Table 5-1: Weed control and management measures in Snowy Region National Parks**

| Weed | Priority for Control | Current NPWS Control | Exploratory Works Control |
|---|---|---|---|
| Blackberry | Medium to lower<br>Critical (where impact is on threatened species) | Physical removal<br>Biological control,<br>Stem injection/cut<br>Stump/basal bark and spot spraying.<br>Control methods are documented in the WoNS Blackberry Control Manual | Physical removal where the blackberry is within the clearing footprint<br>Removal along the Yarrangobilly River within the Project footprint.<br>Stockpiles will be incinerated in-situ. |
| St Johns Wort | Medium to lower<br>Critical (where impact is on threatened species) | Physical removal,<br>Biological control<br>Spot or boom spraying. | Control to meet the requirements of the NPWS as applicable to Project weed management |
| Sweet Briar | Medium to lower<br>Critical (where impact is on threatened species) | Physical removal,<br>Stem injection or cut stump<br>Basal bark<br>Spot spraying. | Control to meet the requirements of the NPWS as applicable to Project weed management |
| Orange hawkweed | Critical | Physical removal,<br>Biological control<br>Spot or boom spraying | Control to meet the requirements of the NPWS as applicable to Project weed management |

### 5.1.3. Monitoring

#### Monitoring objectives

The overarching monitoring objective for weeds and pathogens is to determine whether controls put in place to ensure weed cover does not increase across the Project area and to ensure pathogens do not enter the Project area, particularly in key fauna habitat, are successful. The objective is to also inform the location and extent of controls, specifically:

- to determine weed presence/absence within proximity to project roads and key project infrastructure;

- to determine changes in weed cover within proximity to project roads and key project infrastructure; and
- to undertake soil sampling in order to monitor pathogens within proximity to project roads and key project infrastructure.

**Monitoring parameters**

To determine if the mitigation measures put into place effectively mitigate potential weed and pathogen impacts, particularly in key fauna habitat, the following parameters will be monitored:

- weed presence/absence;
- weed cover; and
- soil pathogen presence/absence.

**Weed presence/ absence monitoring**

The monitoring of weed presence/absence will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 5-2.

### Table 5-2: Weed presence/absence monitoring

| Objective |
|---|
| To determine weed presence/absence within proximity to project roads and key project infrastructure, to inform the location and extent of controls. |
| **Sampling units** |
| Weed mapping |
| **Method** |
| Weed mapping<br>• Surveys will be undertaken adjacent to project roads and around key infrastructure areas (within a 20 m buffer of these areas) and will record:<br>○ weed species identified as a priority for control (listed in Appendix D of the Biodiversity Monitoring Program);<br>○ location using a GPS (easting and northing);<br>○ number of individuals, the estimated size of infestation (e.g. $m^2$ for large infestations) and estimated cover (Trace<1%; Light 1-10%, Medium 11-50%, Dense >50%);<br>○ age class for woody weeds (seedlings, juveniles, mature, re-sprout);<br>○ comments on any other features; and<br>○ photograph of each weed area recorded.<br>○ Groups of individuals will be marked out with a waypoint and large infestations will be mapped out as a polygon;<br>• Mapping will be produced that shows the areas, associated weed species and number estimates, to allow comparison between monitoring periods;<br>• Mapping will be updated each monitoring period (new areas and revisit mapped areas to record growth and/or effectiveness of management applied). |
| **Location** |
| • Adjacent to project roads (Lobs Hole Ravine Road and Mine Trail Road), and within a 20 m buffer;<br>• Adjacent to accommodation camp and within a 20 m buffer;<br>• Adjacent to construction compounds and within a 20 m buffer; and<br>• Figure 4.1 shows indicative locations. |
| **Timing, effort and frequency** |
| Weed mapping will occur once prior to construction (January 2019), annually during construction (Spring) and bi-annually (seasonally based) post construction. |
| **Data analysis** |
| Weed mapping and associated data to be kept in a GIS and accompanying spreadsheet to determine any changes in the presence of weeds between monitoring periods. |
| **Triggers for adaptive management** |
| New occurrence of weeds within proximity to project roads and key project infrastructure, where previously not |

recorded.

Weed species that trigger immediate control are included within Appendix D of the Biodiversity Monitoring Program.

## Weed cover monitoring

The monitoring of weed cover will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 5-3.

**Table 5-3: Weed cover monitoring**

| Objective |
|---|
| To determine changes in weed cover within proximity to project roads and key project infrastructure, to inform the location and extent of controls. |
| **Sampling units** |
| Weed cover |
| **Method** |
| Transects<br>• A series of transects are undertaken adjacent to project roads and around key infrastructure areas;<br>• Each set of transects to be placed at 500 m intervals along project roads and around key infrastructure areas;<br>• Transects will be 50 m long and will be placed parallel to project roads and key infrastructure, with the first transect placed 10 m from the road/infrastructure area edge, the second placed 20 m from the edge and the third placed 50 m from the edge (Figure 5-2);<br>• The line-point intercept method will be used at 1 m intervals along each 50 m transect;<br>• At each 1 m interval (starting from 1 m), the cover of weed species will be measured, using a straight rod. Any intercepts or “hits” of a weed species on the rod will be recorded as present (with one being the upper limit for each stratum at each point). No intercepts of weed species at each stratum records a zero;<br>• As data is collected for a total of 50 intervals along each transect, the cover (%) of weeds for each ground stratum (exotic shrubs <1 m, exotic grasses and exotic ground cover) is calculated by diving the number of hits by 50, then multiplying it by 100;<br>• An estimate of weed cover (% see Specht) for exotic canopy species and exotic mid storey species is to be calculated every 5 m along each 50 m transect;<br>• As data is collected for a total of 10 intervals along each transect, the cover (%) of mid storey and canopy weeds is calculated by determining the average of cover at each interval;<br>• For the baseline monitoring event, it is necessary to install permanent markers (e.g. star picket marked/flagged with monitoring location name) and to also record the coordinates of each monitoring location, in order to relocate for subsequent monitoring events; and<br>• Data will be collected via the proforma included as Appendix A of Appendix F (this Appendix) . |

| Location |
|---|

- Adjacent to project roads (Lobs Hole Ravine Road and Mine Trail Road, as indicated in Figure 5.1);
- Adjacent to accommodation camp; and
- Adjacent to construction compounds.

| Timing, effort and frequency |
|---|

Weed cover monitoring will occur once prior to construction (January 2019), annually during construction (Spring) and bi-annually (Spring and Autumn) post construction.

| Data analysis |
|---|

Transect data to be kept in a spreadsheet to determine any changes in the cover (%) of weeds at each transect location between monitoring periods.

| Triggers for adaptive management |
|---|

New occurrence of weeds within proximity to project roads and key project infrastructure, where previously not recorded. A significant increase in weed cover, being greater than 10%.

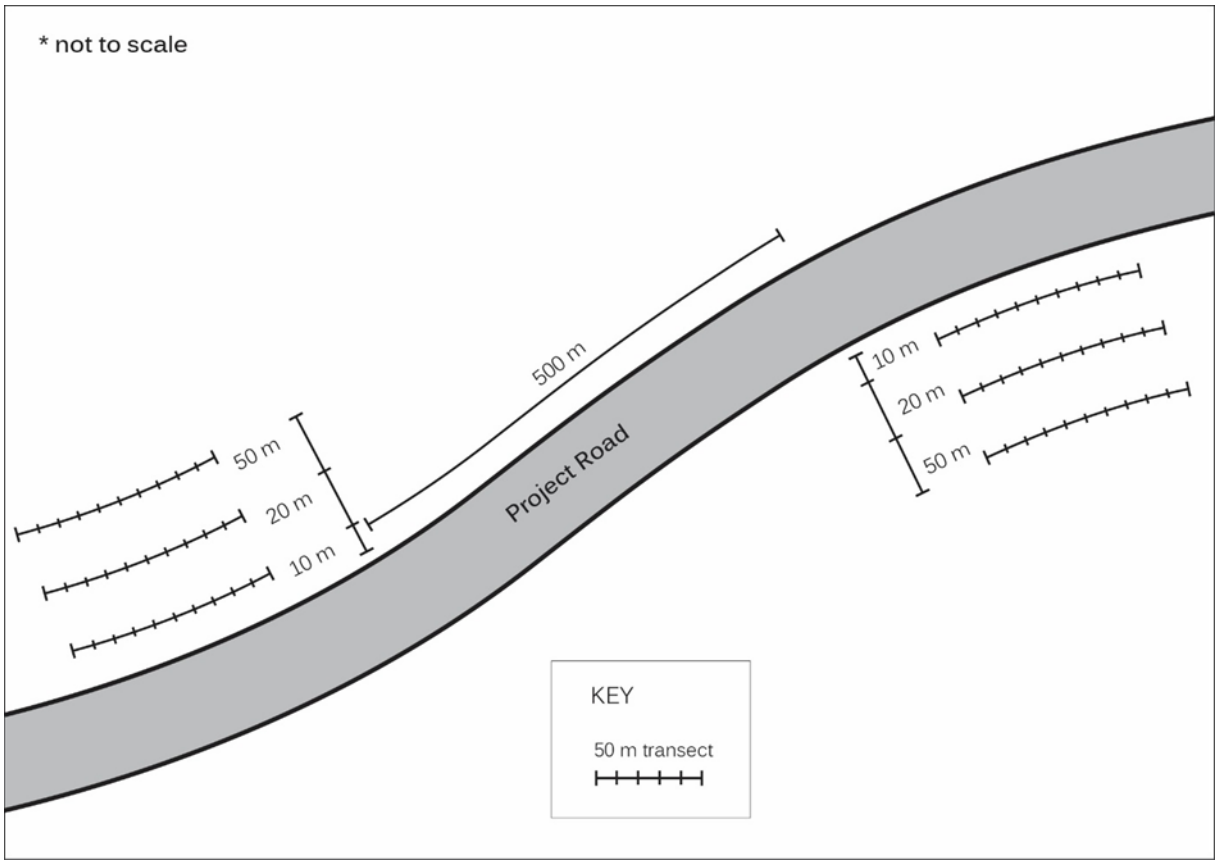



Figure 5-2: Weed cover monitoring – transect setup

## 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 5-4.

**Table 5-4: Phytophthora presence/absence monitoring**

| Objective |
|---|
| 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. |
| **Sampling units** |
| Soil sampling |
| **Method** |
| *Soil sampling*<br>Soil sampling will occur in key areas such as at vehicle washdown (to ensure that hygiene measures are effective) and around key infrastructure areas and roads where there is movement of vehicles and machinery and will include, at each monitoring location:<br>• use a sterile garden trowel to scrape away surface leaf litter;<br>• dig a small hole, collect a small amount of soil and living plant roots;<br>• place them into a new, thick zip-lock plastic bag;<br>• the hole does not need to be any deeper than 10 cm and you only need 100-250 grams of soils;<br>• label the bag with date, monitoring site code and sample number e.g. 19/12/18, Washdown01, North;<br>• place into a second bag to prevent cross contamination and as a safeguard against breakage;<br>• store soil samples in a cool, dark place and dispatch for analysis as practicable after sampling;<br>• after each sample, scrub your hands and the trowel thoroughly with methylated spirits to disinfect them and prevent cross-contamination of samples; and<br>• send samples to a suitable laboratory to analyse for *Phytophthora.* |
| **Location** |
| • Vehicle washdown stations;<br>• Around key infrastructure areas;<br>• Project roadsides; and<br>• Locations to be established during first monitoring event. |
| **Timing, effort and frequency** |
| Frequency will comprise four monitoring events per year (quarterly) during pre-construction, an annual event (Spring) during construction and bi-annually (Spring and Autumn) during post-construction phases, commencing prior to construction in January 2019. |
| **Data analysis** |
| Monitoring data (laboratory results) for each monitoring location to be kept in a spreadsheet with additional results added after each monitoring program. |
| **Triggers for adaptive management** |
| A soil sample returns a positive result for *Phytophthora.* |

#### 5.1.4. Weed Presence / Absence and Cover Monitoring for Geotechnical Works (Modification 1)

Given the short term nature of the geotechnical works, long term weed presence and absence and cover monitoring as detailed above is not proposed. Weed mapping will be completed as part of the pre clearing procedure (Appendix C) and ongoing monitoring of the drill pads will be undertaken as part of the monitoring of reinstatement of the drilling pads. Weed control activities will be informed and scheduled by the monitoring of the reinstatement of the drilling pads.

## 5.2. Other Monitoring

### 5.2.1. Dieback

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 OEH 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 Eucalypt 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 OEH 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 (the proformas in Appendix A include prompts to record any dieback noted) this monitoring program will be reviewed to include monitoring for dieback (mapping, soil testing, using indicator species) and adaptive management measure implemented if required.

## 5.3. Detailed Feral Herbivore and Predator Mitigation Measures

### 5.3.1. Feral herbivore and predator prevention

To minimise the risk of increased predator activity, the following controls will be implemented for the Project:

- waste will be stored appropriately in inaccessible bins and disposed off-site; no waste will be left outside in open areas accessible to feral animals; and
- a predator control program will be implemented, in conjunction with OEH and NPWS, to control feral animals.

### 5.3.2. Feral herbivore and predator control

Future Gen and Snowy Hydro will work with NPWS to co-ordinate NPWS control programs, so they can continue to be carried out and concurrently work with NPWS to conduct irregular controls which align with current NPWS methodology.

Currently annual control programs that NPWS carries out within the KNP to reduce the environmental impact of some pests is addressed in Table 5-5 below.

**Table 5-5: Feral herbivore control and management measures in Snowy Region National Parks**

| Animal | Priority for Control | Current NPWS Control | Exploratory Works |
|---|---|---|---|
| Red fox/wild dogs | Fox control and monitoring programs associated with the Fox TAP mountain pygmy possum and broad-toothed rat sites are a critical priority | Integrated control is essential. 1080 baiting,<br>Soft-jaw trapping,<br>M44 ejectors,<br>Opportunistic shooting and cage trapping. | Control to meet the requirements of the NPWS Regional Pest Management strategy 2012 - 2017<br>Control methods will comply with the NSW DPI Vertebrate Pest Control Manual and the DEH and DPI<br>Model Code of Practice for the Humane Control of Foxes and related standard operating procedures. |
| Feral cat | Due to the limitations imposed by current techniques, feral cat control is unfeasible over large areas.<br>Locations where feral cat control may occur include complementary programs at Fox TAP sites (critical priority) or in recreational areas (such as in Kosciuszko National Park resorts) (medium priority). | Opportunistic shooting<br>Cage trapping or soft-jaw trapping, | Control to meet the requirements of the NPWS Regional Pest Management strategy 2012 - 2017<br>Comply with the DEH and DPI Model Code of Practice for the Humane Control of Feral Cats and related standard operating procedures. |
| Rabbits | Critical priority:<br>Feral rabbit populations that have potential impact on threatened species or communities are of and will be investigated, and control programs implemented where necessary and feasible.<br>New or developing occurrences of a highly invasive species are also of critical priority.<br>Medium priority<br>Feral rabbit populations which occur in the vicinity of a variety of Kosciuszko National Park historic huts and precincts and in the vicinity of Aboriginal artefact scatters.<br>Feral rabbit populations which occur in wilderness areas and the Kosciuszko National Park management units | Cooperative control is essential for effective feral rabbit control.<br>Baiting (1080 or Pindone), warren fumigation (phosphine or CO2),<br>Opportunistic shooting, warren destruction or direct infection of a population with a biological control (such as rabbit calicivirus disease or myxomatosis). | Control to meet the requirements of the NPWS Regional Pest Management strategy 2012 - 2017<br>Control methods will comply with the NSW DPI Vertebrate Pest Control Manual and the DEH and DPI Model Code of Practice for the Humane Control of Rabbits and related standard operating procedures. |
| Feral deer (sambar) | Feral deer populations that have potential impact on threatened species or communities are of critical priority and will be investigated, and control programs implemented where necessary and feasible. New | Cooperative control is essential for effective feral deer control across the landscape.<br>Control methods will include opportunistic shooting or specific shooting operations | Control to meet the requirements of the NPWS Regional Pest Management strategy 2012 - 2017<br>Control methods will comply with the DEH and DPI Standard Operating |

| Animal | Priority for Control | Current NPWS Control | Exploratory Works |
|---|---|---|---|
| | or developing occurrences of a highly invasive species are of critical priority.<br>Feral deer populations also occur in wilderness areas and the Kosciuszko National Park management units and are of medium priority. | targeting identified feral deer populations. | Procedures for the Ground Shooting of Feral Deer and the Feral Animal Aerial Shooting Team Guidelines. |

## 5.4. Feral Herbivore and Predator Monitoring

A Biodiversity Monitoring Program has been developed for addressing all terrestrial biodiversity monitoring aspects. The Biodiversity Monitoring Program addresses all monitoring requirements for weeds, feral animal predators and herbivores. The details of the monitoring is detailed below and within the Biodiversity Monitoring Program.

To minimise the risk of increased predator activity, the following controls will be implemented for the Project:

- a monitoring program will be implemented using remote cameras to monitor feral animal activity (this program);
- remote cameras will be placed along Lobs Hole Ravine Road (north and south) and Mines Trail to monitor feral animal movements (this program); and
- a predator control program will be implemented, in conjunction with OEH and NPWS, to control feral animals.

### 5.4.1. Feral herbivore monitoring program

Baseline conditions

Remote camera surveys, spotlighting and opportunistic sightings undertaken for the Snowy 2.0 Exploratory Works, Biodiversity Development Assessment Report (EMM 2018) recorded the following feral herbivores within the Project area:

- Horse (*Equus caballus*);
- Sambar (*Cervus unicolor*); and
- Rabbit (*Oryctolagus cuniculus*)

The feral herbivore records were not limited to any one habitat type within the Project area and it is possible that they occur across the Project area.

**Mitigation measures**

To minimise the risk of increased feral herbivore activity, the following controls will be implemented for the Project:

- a monitoring program will be implemented using remote cameras to monitor feral herbivore activity (this program); and
- remote cameras will be placed along Lobs Hole Ravine Road (north and south) and Mines Trail to monitor feral herbivore movements (this program).

### Monitoring objectives

The overarching monitoring objective for feral herbivores is to document changes in occupation (presence/absence) and abundance within proximity to the Project, arising from increased human activity associated with the Project and to inform the location and extent of controls, specifically:

- to determine occupancy and abundance along project roads and adjacent to key project infrastructure; and
- to determine occupancy and abundance on the upper sections of Lobs Hole Ravine Road (in Smoky Mouse habitat).

### Monitoring parameters

To determine if the mitigation measures put into place effectively mitigate indirect impacts associated with feral herbivores, the following parameters will be monitored:

- presence/absence; and
- abundance.

### Presence/absence monitoring

The monitoring of feral herbivore presence/absence will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 5-6.

**Table 5-6: Feral herbivore presence/absence monitoring**

| Objective |
|---|
| To determine feral herbivore (rabbit) presence/absence within proximity to the project and document any changes arising from increased human activity as a result of the project and to inform location and extent of controls. |
| **Sampling units** |
| Remote camera monitoring along project roads and adjacent to key infrastructure. |
| **Method** |
| Remote camera monitoring<br>• Remote cameras will be placed at locations adjacent to project roads and around key infrastructure areas;<br>• A pair of cameras will be placed at 500 m intervals along the project roads (perpendicular to the roads with each pair of cameras placed on alternate sides of the road) as well as at project infrastructure;<br>• For each pair, one camera will be placed adjacent to the road or infrastructure at 20 m and one will be placed distant to the road or infrastructure at 120 m, as shown in Figure 5-3;<br>• Cameras to be attached to a tree or stake and positioned approximately 1 m above ground;<br>• The cameras are to be unbaited, as this is more suitable for long term monitoring;<br>• Micro siting or otherwise 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;<br>• Cameras are placed out for one month (30 days) per monitoring period; and<br>• Coordinates to be recorded at each camera location, in order to repeat the method during each subsequent monitoring event. |
| **Location** |
| • Adjacent to project roads (Lobs Hole Ravine Road and Mine Trail Road, as indicated in Figure 5-5);<br>• Adjacent to accommodation camp; and |

- Adjacent to construction compounds.

**Timing, effort and frequency**

- Monitoring frequency will be undertaken as follows: one monitoring event pre-construction will be undertaken in January 2019, during construction one monitoring event per year (Spring or Autumn) lasting 10 days will be undertaken, post construction four monitoring events per year (quarterly) will be undertaken with each event lasting 30 days.

**Data analysis**

- Data to be kept in a spreadsheet to determine presence/absence at monitoring locations between monitoring periods;
- Data trends are to be analysed by a suitably qualified person ecologist in order to determine occupancy.

**Triggers for adaptive management**

A statistically significant increase in the number of sites at which feral herbivores recorded over consecutive monitoring periods or years.

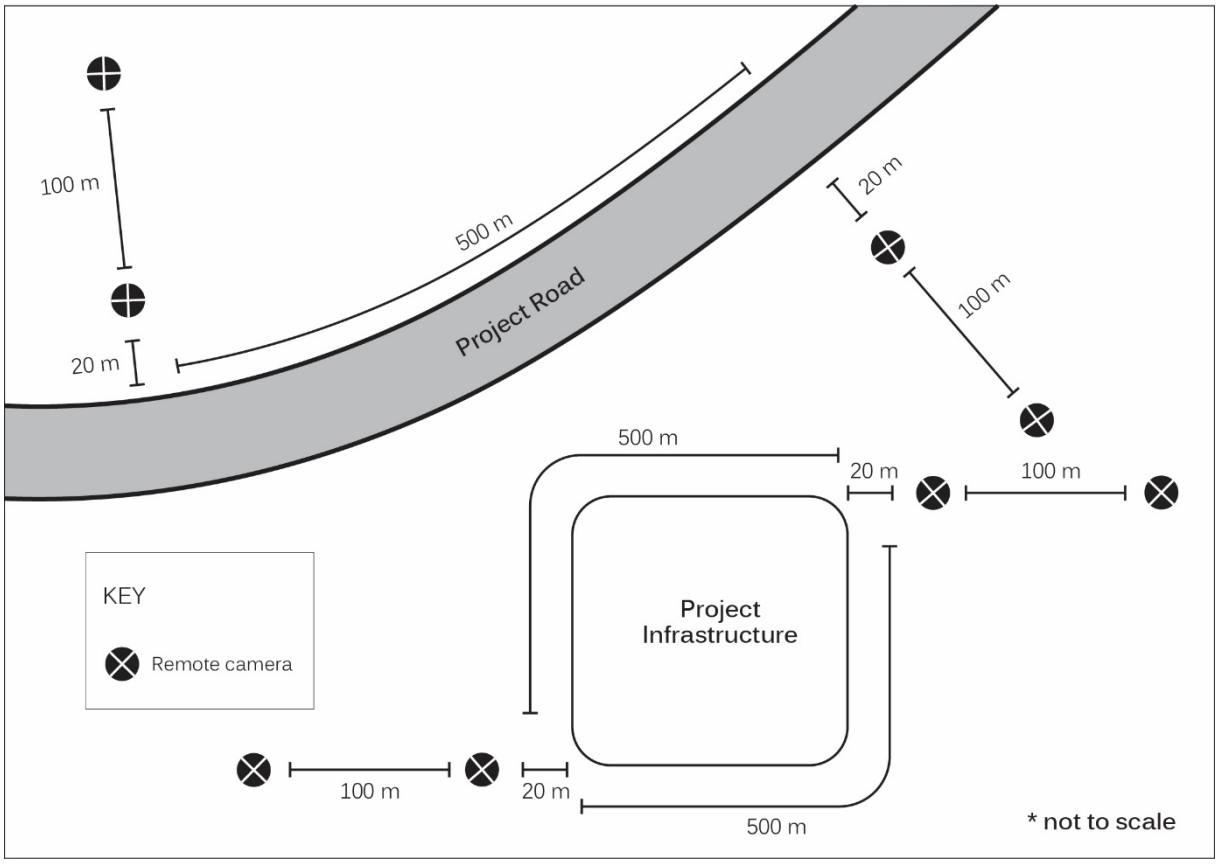



**Figure 5-3: Feral herbivore presence/absence monitoring - remote camera setup**


Figure 5-4: Feral herbivore presence/absence monitoring - indicative locations

## Abundance monitoring

The monitoring of feral herbivore abundance will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 5-7.

**Table 5-7: Feral herbivore abundance monitoring**

| Objective |
|---|
| To determine feral herbivore (Horse and Rabbit) abundance within proximity to the project and document any changes arising from increased human activity as a result of the project and to inform location and extent of controls. |
| **Sampling units** |
| Spotlight counts along project roads and adjacent to key infrastructure (vehicle and walked). |
| **Method** |
| Vehicle spotlight counts<br>• A 4WD vehicle with one driver and an observer using a handheld spotlight (100 W – 12 V narrow beam);<br>• Start approximately half an hour after sunset from an established start point;<br>• One person drives and the other counts animals;<br>• Drive at a constant slow speed (10-15 km/h) along all project roads (Lobs Hole Ravine Road and Mine Trail Road);<br>• Observer scans a 90° arc ahead of the vehicle with a spotlight and count animals seen within 50 m on either side (a handheld tally counter is effective when the rabbit occurs in high numbers);<br>• Every 1 km record the tally on a standardised spotlight count sheet (see proforma in Appendix B of Biodiversity Management Plan);<br>• Repeat the count on three more consecutive nights of similar weather; and<br>• On subsequent counts, start the same time as the first count, use the same route (distance and direction), vehicle, speed, spotlight and people.<br>Walked spotlight counts<br>• Establish transect paths around key infrastructure;<br>• Start approximately half an hour after sunset from an established start point;<br>• Two people using two hand-held spotlights of the same power, with observers counting only one side each in a 90° arc ahead of them;<br>• Walk at an easy constant walking pace;<br>• Count animals seen within 50 m;<br>• Every 0.5 km record the tally on a standardised spotlight count sheet (see proforma in Appendix B of Biodiversity Management Plan);<br>• Repeat the count on three more consecutive nights of similar weather;<br>• On subsequent counts, start the same time as the first count, use the same route (distance and direction), vehicle, speed, spotlight and people; and<br>• After completion of the survey determine the average of counts and divide them by the length of the transect to get a simple index of abundance (animals/km); and<br>• Use a GPS to help maintain your path. |
| **Location** |
| • Vehicle spotlight counts: Lobbs Hole Ravine Road and Mine Trail Road (Figure 5-5); and<br>• Walked spotlight counts: around key infrastructure areas (Figure 5-5). |
| **Timing, effort and frequency** |

- Frequency will be one monitoring event pre-construction in January 2019, one monitoring event per year (Spring or Autumn) lasting 10 days during construction and four monitoring events per year (quarterly) post construction (with one monitoring event defined as four nights)

**Data analysis**

After completion of each monitoring event at each location determine the average 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.

**Triggers for adaptive management**

A statistically significant increase in the number of feral herbivores per km, over multiple consecutive monitoring periods or years.


Figure 5-5: Feral herbivore abundance monitoring indicative locations

**Limitations of abundance monitoring**

Night-time counting using spotlights, either on foot or from vehicles, has been used for many years to survey animal species such as the Rabbit (Mitchell & Balogh 2007a). This is mainly because spotlighting is easy to do and can cover large areas in a relatively short time. Spotlighting can sample different vegetation types and compare them under similar conditions within a site (i.e. season, time, weather). Simple indexes of abundance can be produced from these counts. Examples are the number of animals seen per kilometre travelled.

However, indices created from spotlighting counts have bias caused by difference between observers and also in visibility, or 'sightability', which can change with vegetation density and animal behaviour (Mitchell & Balogh 2007a). This monitoring method is also unsuitable in high wind or rain conditions, as these affect rabbit behaviour (Ballinger & Morgan 2002, cited in Mitchell & Balogh 2007a). Other sources of potential variation include the time of night that the survey is done, seasonal variations in animal behaviour and abundance, and the use of roads as transects (vegetation types will not be surveyed evenly) (Mitchell & Balogh 2007a). Despite these shortcomings, spotlighting has been found to be a reliable means of monitoring relative population size in rabbits (Mitchell & Balogh 2007a). For example, in New Zealand, spotlighting along fixed transects has become the standard method used by regional councils and the Ministry of agriculture and Fisheries to assess Rabbit populations (Fletcher et al. 1999, as cited in Mitchell & Balogh 2007a). However, there has been little standardisation of the technique, thus creating difficulties with comparisons between studies.

### 5.4.2. Feral predator monitoring program

**Baseline conditions**

Remote camera surveys undertaken for the Snowy 2.0 Exploratory Works, Biodiversity Development Assessment Report (EMM 2018) recorded the following feral predators within the Project area:

- Cat (*Felis catus*);
- Dingo/domestic dog (*Canis lupus*); and
- Fox (*Vulpes vulpes*).

The feral predator records were not limited to any one habitat type within the Project area and it is possible that they occur across the Project area.

**Mitigation measures**

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 feral predators has consequent impacts on native animals. Predation by feral Cats and Red Foxes are listed as key threatening processes under the BC Act and EPBC Act (NPWS 2001, DEWHA 2008, DoE 2015) with impacts from feral Cats also listed as a key threat to the Smoky Mouse (Menkhorst and Broome 2008a, 2008b).

To minimise the risk of increased predator activity, the following controls will be implemented for the Project:

- waste will be stored appropriately in inaccessible bins and disposed off-site; no waste will be left outside in open areas accessible to feral animals;
- a monitoring program will be implemented using remote cameras to monitor feral animal activity (this program);
- remote cameras will be placed along Lobs Hole Ravine Road (north and south) and Mines Trail to monitor feral animal movements (this program); and

- a predator control program will be implemented, in conjunction with OEH and NPWS, to control feral animals.

**Monitoring objectives**

The overarching monitoring objective for feral predators is to document changes in occupation (presence/absence) and abundance within proximity to the Project, arising from increased human activity associated with the Project and to inform the location and extent of controls, specifically:

- to determine occupancy and abundance along project roads and adjacent to key project infrastructure; and
- to determine occupancy and abundance on the upper sections of Lobs Hole Ravine Road (in Smoky Mouse habitat).

### 5.4.3. Monitoring parameters

To determine if the mitigation measures put into place effectively mitigate indirect impacts associated with feral predators, the following parameters will be monitored:

- presence/absence; and
- abundance.

**Presence/absence monitoring**

The monitoring of feral predator presence/absence will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 5-8.

Table 5-8: Feral predator presence/absence monitoring

| Objective |
|---|
| To determine feral predator presence/absence within proximity to the project and document any changes arising from increased human activity as a result of the project and to inform location and extent of controls. |
| **Sampling units** |
| Remote camera monitoring along project roads and adjacent to key infrastructure. |
| **Method** |
| Remote camera monitoring<br>• Remote cameras will be placed at locations adjacent to project roads and around key infrastructure areas;<br>• A camera will be placed at 500 m intervals along the project roads (placed to view across the road) as well as at project infrastructure, as shown in Figure 5-6;<br>• Cameras to be attached to a tree or stake and positioned approximately 1 m above ground. Cameras will be baited and left in place continuously for the month<br>• Cameras are placed out for one month per monitoring period;<br>• Cameras to be placed at a 45-degree angle to the road; and<br>• Coordinates to be recorded at each camera location, in order to repeat the method during each subsequent monitoring event. |
| **Location** |
| • Adjacent to project roads;<br>• Adjacent to accommodation camp; and<br>• Adjacent to construction compounds (Figure 5-7). |
| **Timing, effort and frequency** |

- Frequency will be one monitoring event pre construction in January 2019, one monitoring event per year (Spring or Autumn) lasting 10 days during construction and four monitoring events per year (quarterly) post construction (with one monitoring event lasting 30 days).

**Data analysis**

- Animals captured on digital images are to be identified by a suitable Ecologist and with reference to field guides and species experts, if required;
- Data to be kept in a spreadsheet to determine presence/absence at monitoring locations between monitoring periods; and
- Occupancy is commonly used as a metric for estimating species' occurrence and is a function of abundance (MacKenzie et al 2003; O'Connell and Bailey 2011) as it concerns the probability of a particular animal being in a given site or patch. This method can be misused by only reporting on detection sites and ignoring non-detection sites, thereby failing to calculate the detection probability (O'Connell and Bailey 2011), therefore
- Data trends are to be analysed by a suitably qualified person (e.g. biometrician), in order to determine occupancy. Software programs can also be used for calculating occupancy.

**Triggers for adaptive management**

Statistically significant increase in the occurrence of feral predators observed across multiple monitoring periods and years.

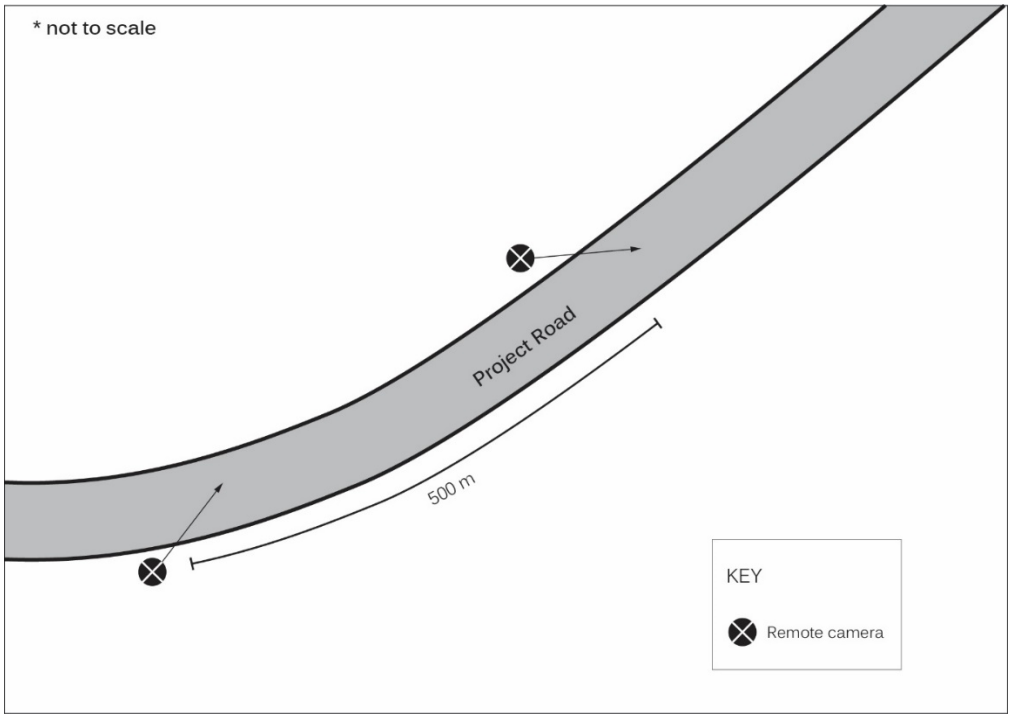



Figure 5-6: Feral predator presence/absence monitoring - remote camera setup


Figure 5-7: Feral predator presence/absence monitoring indicative locations

## Abundance monitoring

The monitoring of feral predator abundance will be undertaken by a suitably qualified ecologist (s) and will be undertaken as detailed in Table 5-9.

**Table 5-9: Feral predator abundance monitoring**

| Objective |
|---|
| To determine feral predator (fox and cat) abundance within proximity to the project and document any changes arising from increased human activity as a result of the project and to inform location and extent of controls. |
| **Sampling units** |
| Spotlight counts along project roads and adjacent to key infrastructure (vehicle and walked). |
| **Method** |
| Vehicle spotlight counts<br>• A 4WD vehicle with one driver and an observer using a handheld spotlight (100 W – 12 V narrow beam);<br>• Start approximately half an hour after sunset from an established start point;<br>• One person drives and the other counts animals;<br>• Drive at a constant slow speed (10-15 km/h) along all project roads (Lobs Hole Ravine Road and Mine Trail Road);<br>• Observer scans a 90° arc ahead of the vehicle with a spotlight and count animals seen within 50 m on either side;<br>• Every 1 km record the tally on a standardised spotlight count sheet (see proforma in Biodiversity Management Plan Appendix B);<br>• Repeat the count on three more consecutive nights of similar weather; and<br>• On subsequent counts, start the same time as the first count, use the same route (distance and direction), vehicle, speed, spotlight and people.<br>Walked spotlight counts<br>• Establish transect paths around key infrastructure;<br>• Start approximately half an hour after sunset from an established start point;<br>• Two people using two hand-held spotlights of the same power, with observers counting only one side each in a 90° arc ahead of them;<br>• Walk at an easy constant walking pace;<br>• Count animals seen within 50 m;<br>• Every 0.5 km record the tally on a standardised spotlight count sheet (see proforma in Appendix B of Biodiversity Management Plan);<br>• Repeat the count on three more consecutive nights of similar weather;<br>• On subsequent counts, start the same time as the first count, use the same route (distance and direction), vehicle, speed, spotlight and people; and<br>• After completion of the survey determine the average of counts and divide them by the length of the transect to get a simple index of abundance (animals/km); and<br>• Use a GPS to help maintain your path. |
| **Location** |
| • Vehicle spotlight counts: Lobes Hole Ravine Road and Mine Trail Road; and<br>• Walked spotlight counts: around key infrastructure areas (Figure 5-8). |

**Timing, effort and frequency**

- Frequency will be one monitoring event pre construction in January 2019, one monitoring event per year (Spring or Autumn) lasting 10 days during construction and four monitoring events per year (quarterly) post construction (with one monitoring event lasting 30 days).

**Data analysis**

After completion of each monitoring event at each location determine the average of counts (foxes and cats) 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.

**Triggers for adaptive management**

A statistically significant increase in the number of feral predators per km, over multiple consecutive monitoring periods or years.

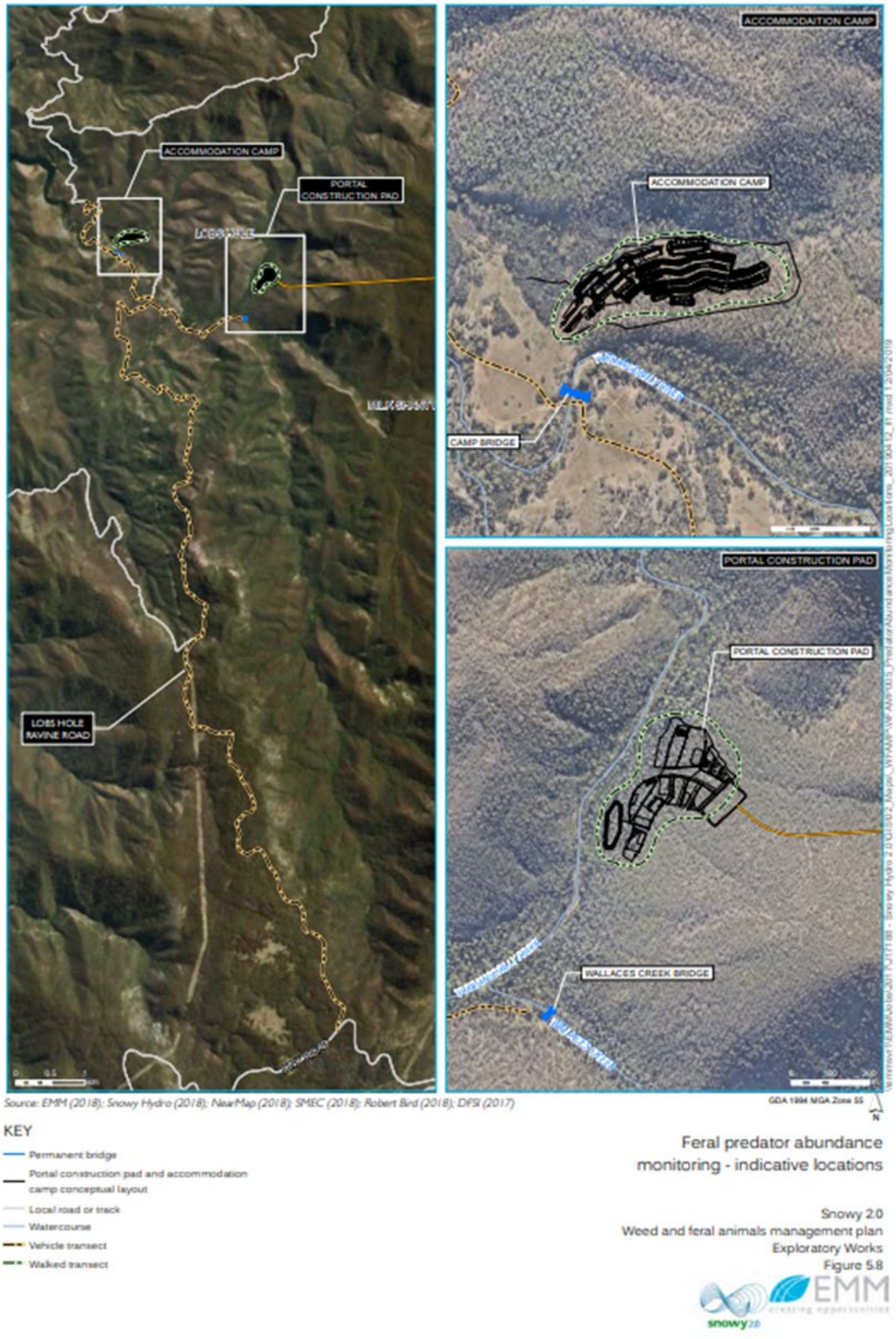



Figure 5-8: Feral predator abundance monitoring

### 5.4.4. Limitations of abundance monitoring

Night-time counting using spotlights has been used for many years to survey foxes (Mitchell & Balogh 2007b) and simple indexes of abundance can be produced from these counts, such as the number of animals seen per kilometre travelled. However, indexes created from spotlighting counts have bias caused by the use of different observers or changes in visibility or sightability due to vegetation density (Mitchell & Balogh 2007b) other sources of potential variation include the time of night that the survey is undertaken and seasonal variations in animal behaviour and abundance. The use of roads as transects means vegetation types may not be surveyed evenly (Mitchell & Balogh 2007a). Where fox density is low, spotlighting may fail to detect their presence, and as a result, spotlighting tends to underestimate fox numbers (Mitchell & Balogh 2007b).

Despite these shortcomings, spotlighting has been extensively used in Australia, and is considered a practical tool for monitoring the relative size of the fox population, especially where the habitat is open grassland or open woodland where trees are sparse (Mitchell & Balogh 2007b). Sharp et al. (2001) (as cited in Mitchell & Balogh 2007b) suggested that spotlight counts can accurately indicate fluctuations in fox population size but may not be able to detect small changes in abundance.

Similarly, spotlighting has been used for many years to survey feral cats (Mitchell & Balogh 2007c), because it allows large areas to be monitored fairly rapidly. Spotlighting can sample different vegetation types and compare them under similar conditions within a site. Indexes of abundance, such as the number of animals seen per kilometre, can be produced from the spotlight counts; however, indexes created using spotlighting counts should also be corrected for the bias. Where feral cat density is low, spotlighting may fail to detect their presence; therefore, under these conditions, spotlighting may underestimate feral cat numbers (Mitchell & Balogh 2007c). Despite these shortcomings, spotlighting has been used extensively in Australia, and is considered a practical tool for monitoring relative population abundance of feral cats also. Edwards et al. (2000) (as cited in Mitchell & Balogh 2007c) suggested that spotlight counts would improve in precision as the feral cat population size increased, but that they may not be able to detect small changes in abundance at low densities.

# 6. REPORTING AND REVIEW

## 6.1. Reporting Schedule

An annual report will be prepared that summarises all monitoring undertaken within the year, the results of the monitoring, and any adaptive management undertaken. The annual report is also an opportunity to summarise findings to feed into the annual review of the monitoring program, as explained in the following sections.

The detection of any new weed species or the identification of any declared Class 1 or Class 2 pests coming into flower will need to be reported to the client as soon as they are identified.

## 6.2. Compliance

Compliance with this WFMP monthly internal project reports and six monthly compliance reports to Snowy Hydro. The six-monthly reports will track compliance against the revised environmental management measures.

Reporting requirements and responsibilities are documented in the Sections 6 and 7 of the EMS.

## 6.3. Training

All site personnel will undergo site induction training relating to biodiversity including threatened species and habitat protection management issues.

The induction training will address elements related to biodiversity management including:

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

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

- clearing procedures;
- no-go zones;
- threatened species within the Project area;
- the unexpected finds procedure for threatened species;
- the procedures regarding management of weeds or pathogens.

Further details regarding the staff induction and training are outlined in Section 4 of the EMS.

# 7. WEED AND FERAL ANIMAL IDENTIFICATION

## 7.1. Most Significant Weed and Feral Animal Identification

| | |
|---|---|
|   |   |
| Blackberry | Boneseed |

| | |
|---|---|
|   |   |
| Gorse | Flax-leaf Broom |

| | |
|---|---|
|   |   |
| Fireweed | Ox-eye daisy |

| | |
|---|---|
|  |  |
|  |  |
| St Johns Wort | Sweet briar |

| | |
|---|---|
|  |  |
|  |  |
| Orange Hawkweed | Mouse-eared Hawkweed |


Rabbit


Feral cat


Fox

# APPENDIX A - WEED AND SEED FORM (HYGIENE DECLARATION)

# WEED AND SEED FORM (HYGIENE DECLARATION)

| 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)? | ☐ Yes | ☐ No | ☐ N/A |
| If travelling / delivered from outside the KNP to inside to the KNP has the equipment / building been disinfected? If so with what? ……..... | ☐ Yes | ☐ No | ☐ 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? | ☐ Yes | ☐ 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? | ☐ Yes | ☐ No |
| Name | | |
| Signature | | |

# WEED AND SEED FORM (HYGIENE DECLARATION)

| Date | |
|---|---|

## CLEANDOWN CHECKLIST

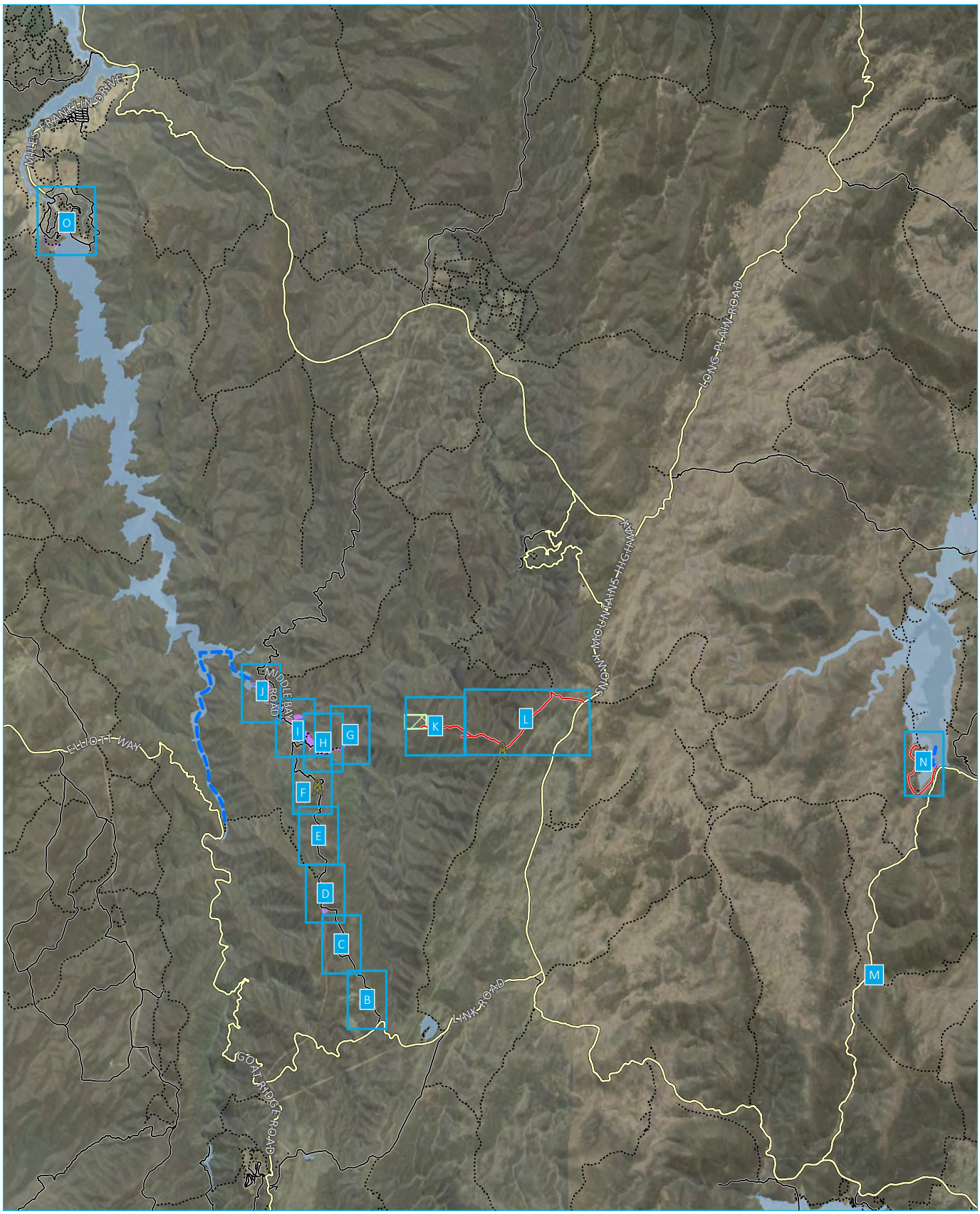
| LIGHT VEHICLES / TRUCKS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Interior** | ☐ Yes | ☐ No | ☐ N/A | **Tyre Rims** | ☐ Yes | ☐ No | ☐ N/A |
| **Engine Bay** | ☐ Yes | ☐ No | ☐ N/A | **Side Steps** | ☐ Yes | ☐ No | ☐ N/A |
| **Grill** | ☐ Yes | ☐ No | ☐ N/A | **Chassis** | ☐ Yes | ☐ No | ☐ N/A |
| **Radiator** | ☐ Yes | ☐ No | ☐ N/A | **Axels/Diffs** | ☐ Yes | ☐ No | ☐ N/A |
| **Wiper Recess** | ☐ Yes | ☐ No | ☐ N/A | **Suspension** | ☐ Yes | ☐ No | ☐ N/A |
| **Wheels & Spares** | ☐ Yes | ☐ No | ☐ N/A | **Fuel Tank Guard** | ☐ Yes | ☐ No | ☐ N/A |
| **Wheel Arches** | ☐ Yes | ☐ No | ☐ N/A | **Draw Bar** | ☐ Yes | ☐ No | ☐ N/A |
| **Mud Flaps** | ☐ Yes | ☐ No | ☐ N/A | **Toolboxes** | ☐ Yes | ☐ No | ☐ N/A |
| **Tray** | ☐ Yes | ☐ No | ☐ N/A | **Air Filters** | ☐ Yes | ☐ No | ☐ N/A |
| **EARTHMOVING EQUIPMENT (EXCAVATORS, ROLLERS, LOADERS, GRADERS ETC.)** | | | | | | | |
| **Interior** | | | | | | | |
| **Pedal Covers** | ☐ Yes | ☐ No | ☐ N/A | **Seat (incl. rubber shroud)** | ☐ Yes | ☐ No | ☐ N/A |
| **Joystick Control Housing** | ☐ Yes | ☐ No | ☐ N/A | **Ladder** | ☐ Yes | ☐ No | ☐ N/A |
| **Cabin Roof** | ☐ Yes | ☐ No | ☐ N/A | **Footsteps** | ☐ Yes | ☐ No | ☐ N/A |
| **Cabin Walls** | ☐ Yes | ☐ No | ☐ N/A | **Floor and Floor Mats** | ☐ Yes | ☐ No | ☐ N/A |
| **Air Conditioning Vents and Filter** | ☐ Yes | ☐ No | ☐ N/A | **Cabin Housing** | ☐ Yes | ☐ No | ☐ N/A |
| **Body and Engine Bay** | | | | | | | |
| **Air Filter and Air Filter Pre Cleaner** | ☐ Yes | ☐ No | ☐ N/A | **Engine Cover Rubbers** | ☐ Yes | ☐ No | ☐ N/A |
| **Engine Block** | ☐ Yes | ☐ No | ☐ N/A | **Engine Covers** | ☐ Yes | ☐ No | ☐ N/A |
| **Counterweights** | ☐ Yes | ☐ No | ☐ N/A | **Wiring Harnesses** | ☐ Yes | ☐ No | ☐ N/A |
| **Radiator** | ☐ Yes | ☐ No | ☐ N/A | **Hollow Support Structures and Rails** | ☐ Yes | ☐ No | ☐ N/A |
| **Radiator Shroud** | ☐ Yes | ☐ No | ☐ N/A | **Hydraulic Rams** | ☐ Yes | ☐ No | ☐ N/A |
| **Oil Cooler** | ☐ Yes | ☐ No | ☐ N/A | **Lights and Cavities** | ☐ Yes | ☐ No | ☐ N/A |
| **Belly Plates** | ☐ Yes | ☐ No | ☐ N/A | **Rear Plates** | ☐ Yes | ☐ No | ☐ N/A |
| **Tracks, Rollers, Drums, Tyres and Frames** | | | | | | | |
| **Rock Guards** | ☐ Yes | ☐ No | ☐ N/A | **Track Frames** | ☐ Yes | ☐ No | ☐ N/A |
| **Tracks** | ☐ Yes | ☐ No | ☐ N/A | **Wheel Arches** | ☐ Yes | ☐ No | ☐ N/A |
| **Rollers** | ☐ Yes | ☐ No | ☐ N/A | **Wheels and Tyres** | ☐ Yes | ☐ No | ☐ N/A |
| **Drive Motor** | ☐ Yes | ☐ No | ☐ N/A | **Roller Frames** | ☐ Yes | ☐ No | ☐ N/A |

# WEED AND SEED FORM (HYGIENE DECLARATION)

| Booms, Bucket, Blades, Rippers, Augers | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Blades** | ☐ Yes | ☐ No | ☐ N/A | **Boots** | ☐ Yes | ☐ No | ☐ N/A |
| **Ripper Support Frame** | ☐ Yes | ☐ No | ☐ N/A | **Teeth** | ☐ Yes | ☐ No | ☐ N/A |
| **Tines** | ☐ Yes | ☐ No | ☐ N/A | **Booms** | ☐ Yes | ☐ No | ☐ N/A |
| **Augers** | ☐ Yes | ☐ No | ☐ N/A | **Other** | ☒ Yes | ☐ No | ☐ N/A |
| **BUILDINGS** | | | | | | | |
| **Internal Floors** | ☐ Yes | ☐ No | ☐ N/A | **Shelves** | ☐ Yes | ☐ No | ☐ N/A |
| **Windows** | ☐ Yes | ☐ No | ☐ N/A | **Air condition units** | ☐ Yes | ☐ No | ☐ N/A |
| **Doors** | ☐ Yes | ☐ No | ☐ N/A | **Others (please list below)** | | | |
| **Walls** | ☐ Yes | ☐ No | ☐ N/A | **1)** | ☐ Yes | ☐ No | ☐ N/A |
| **Roof** | ☐ Yes | ☐ No | ☐ N/A | **2)** | ☐ Yes | ☐ No | ☐ N/A |
| **External Base (opposite side of the floor)** | ☐ Yes | ☐ No | ☐ N/A | **3)** | ☐ Yes | ☐ No | ☐ N/A |
| **Compartments / cubicles** | ☐ Yes | ☐ No | ☐ N/A | **4)** | ☐ Yes | ☐ No | ☐ N/A |

ATTACH PHOTOGRAPHS:

# APPENDIX G – EXPLORATORY WORKS – PROJECT BOUNDARY FIGURES




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

0 5 10 km

GDA 1994 MGA Zone 55

N

KEY

- Proposed temporary communications upgrade location
- Existing access track
- Boat access
- Main road
- Local road
- Vehicular track
- Map index
- EW approved construction footprint
- EW modification construction footprint (additional)
- Boreholes requiring on-site adjustment
- Waterbody

## Exploratory Works project boundary - overview

Snowy 2.0
Exploratory Works EIS
Modification 1
1 a

snowy 2.0

EMM creating opportunities

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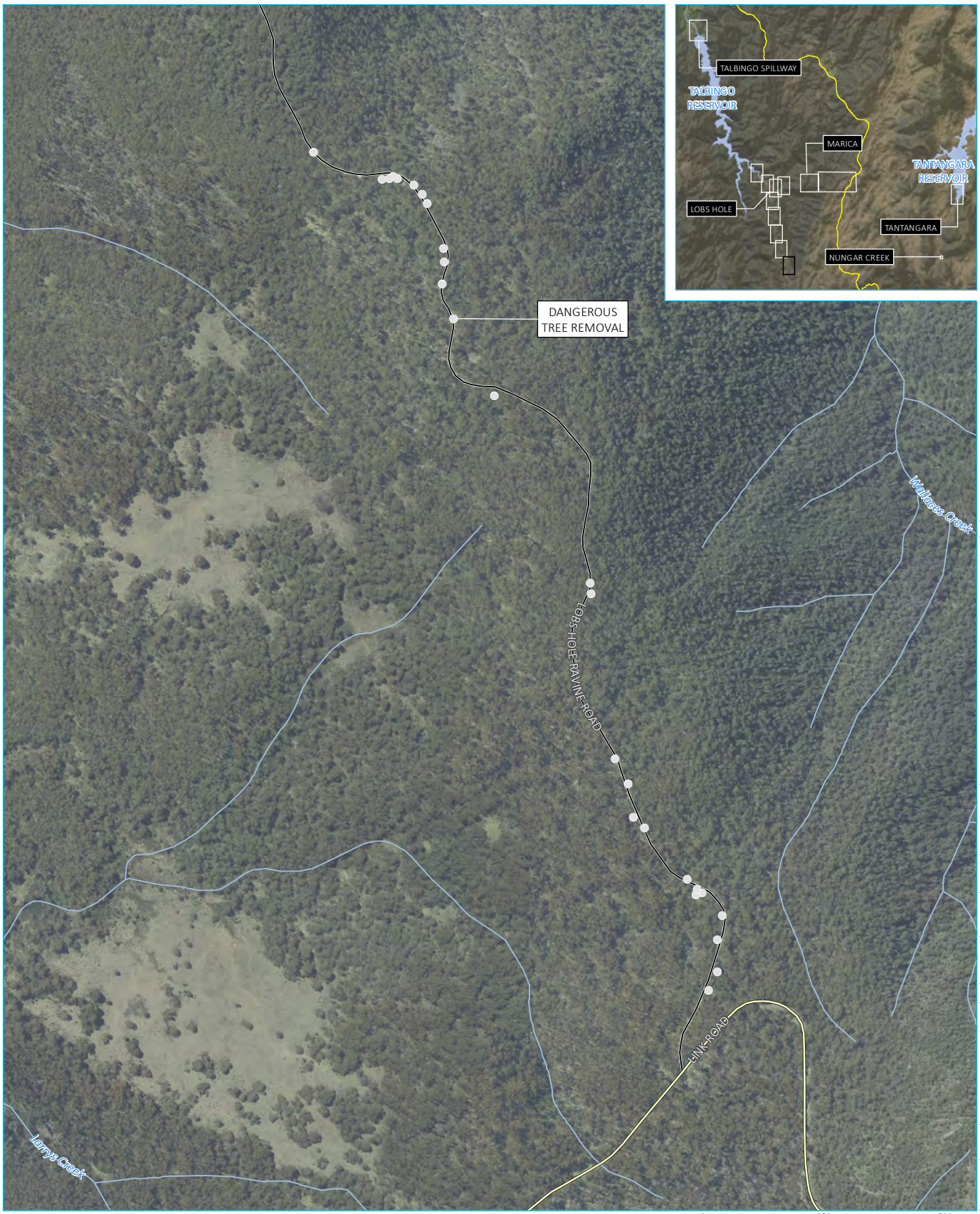


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 250 500 m

GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Main road
- Local road
- Watercourse/drainage line

Exploratory Works project boundary
- Lobs Hole Ravine Road (Upper) 1

Snowy 2.0
Exploratory Works EIS
Modification 1
1 b

snowy 2.0

EMM creating opportunities

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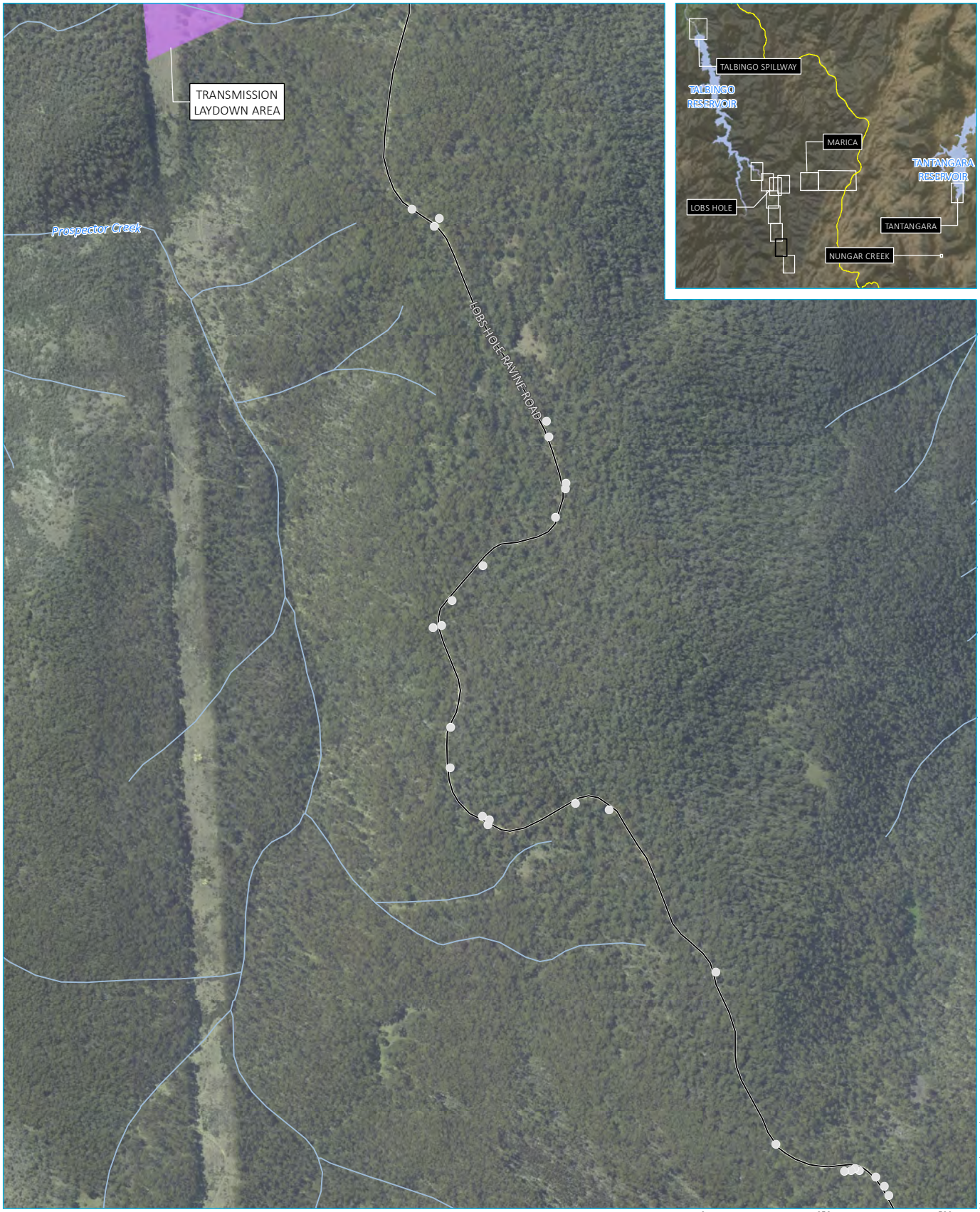


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

KEY

- Dangerous tree
- Local road
- Watercourse/drainage line
- EW approved construction footprint

0 250 500 m

GDA 1994 MGA Zone 55

N

Exploratory Works project boundary
- Lobs Hole Ravine Road (Upper) 2

Snowy 2.0
Exploratory Works EIS
Modification 1
1 c

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

0 250 500 m

GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Local road
- Vehicular track
- Watercourse/drainage line
- EW approved construction footprint
- EW modification construction footprint (additional)

Exploratory Works project boundary - Lobs Hole Ravine Road (Upper) 3

Snowy 2.0
Exploratory Works EIS
Modification 1
1 d

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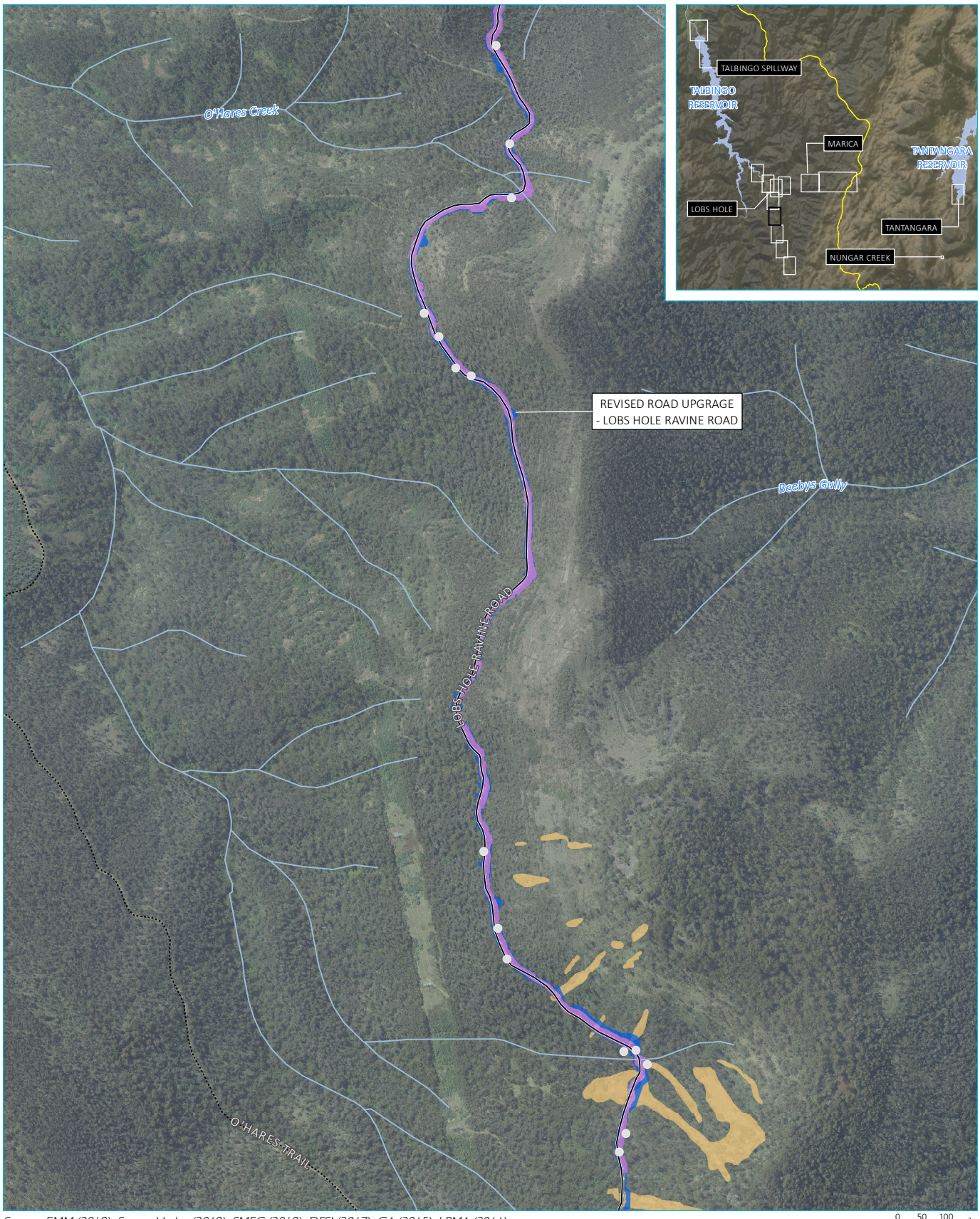


*Source: EMM (2019); Snowy Hydro (2019); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m

GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Local road
- Vehicular track
- Watercourse/drainage line
- EW approved construction footprint
- EW modification construction footprint (additional)
- Boulder stream

Exploratory Works project boundary
- Lobs Hole Ravine Road (Lower) 1

Snowy 2.0
Exploratory Works EIS
Modification 1
1 e

snowy 2.0

EMM creating opportunities

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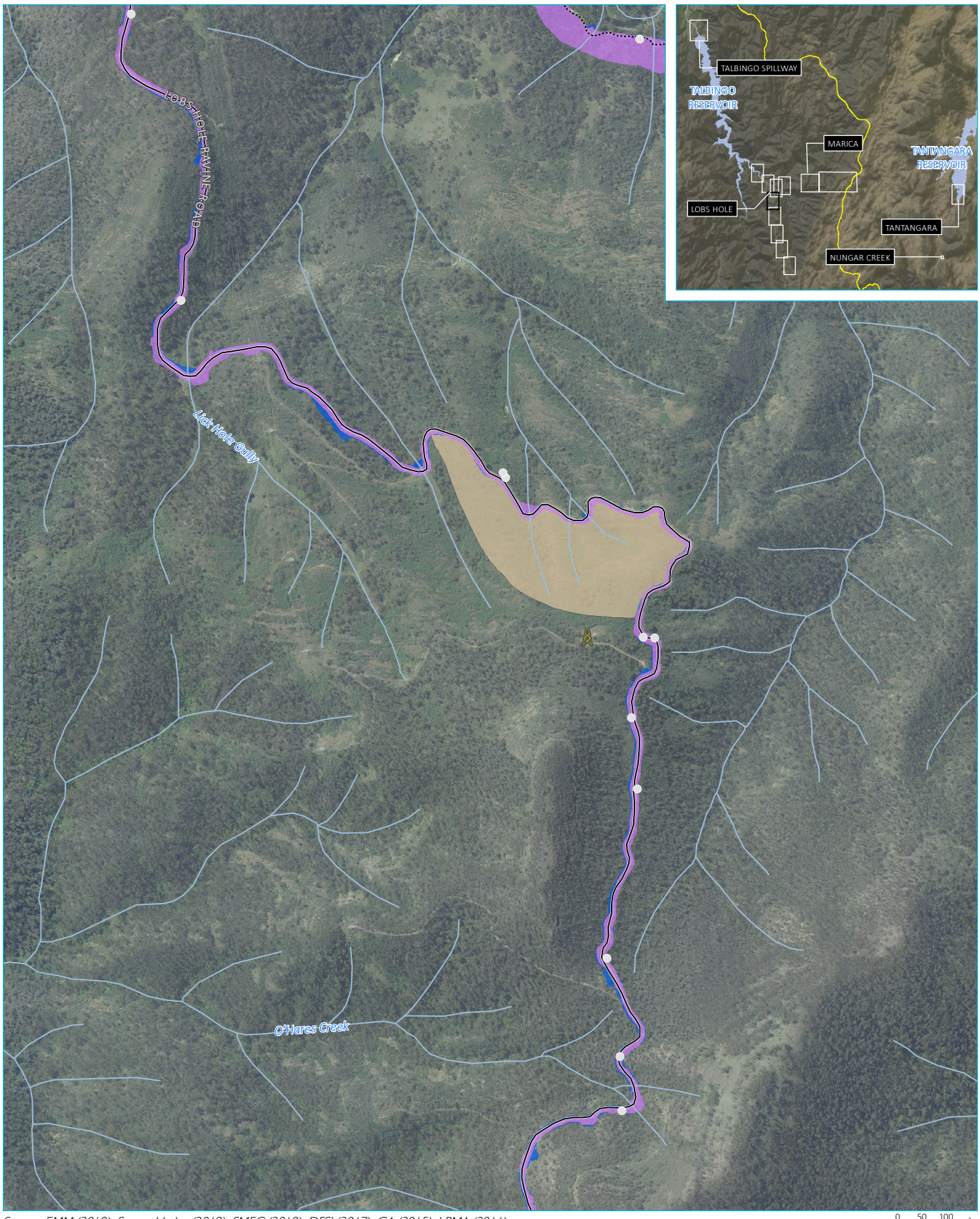


*Source: EMM (2019); Snowy Hydro (2019); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 50 100 m

GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Existing temporary communications
- Local road
- Vehicular track
- Watercourse/drainage line
- EW approved construction footprint
- EW modification construction footprint (additional)
- Fossil area

# Exploratory Works project boundary - Lobs Hole Ravine Road (Lower) 2

Snowy 2.0
Exploratory Works EIS
Modification 1
1 f

snowy 2.0

EMM creating opportunities

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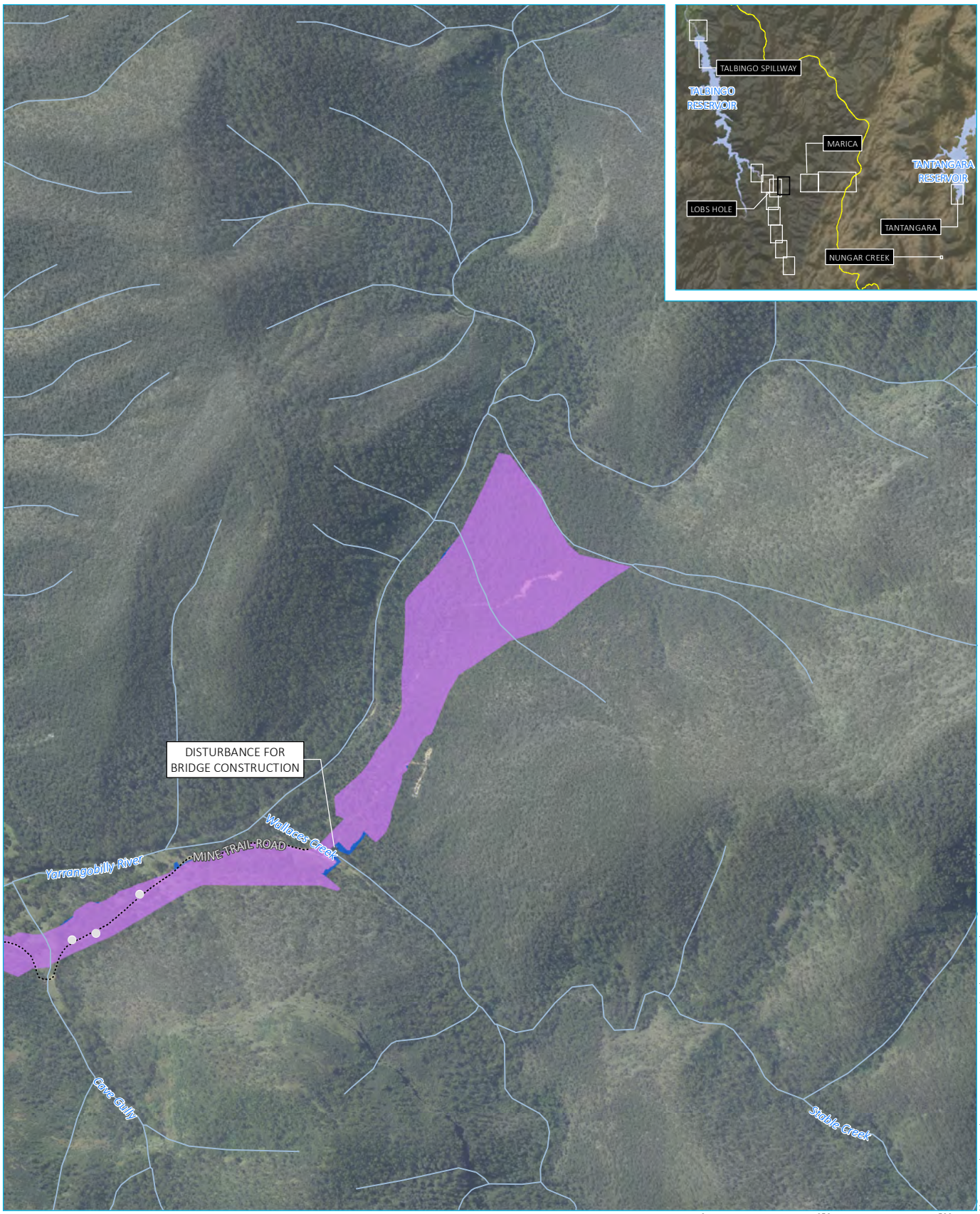


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 250 500 m

GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Vehicular track
- Watercourse/drainage line
- EW approved construction footprint
- EW modification construction footprint (additional)

Exploratory Works project boundary
- Mine Trail Road 1

Snowy 2.0
Exploratory Works EIS
Modification 1
1 g

snowy 2.0

EMM creating opportunities

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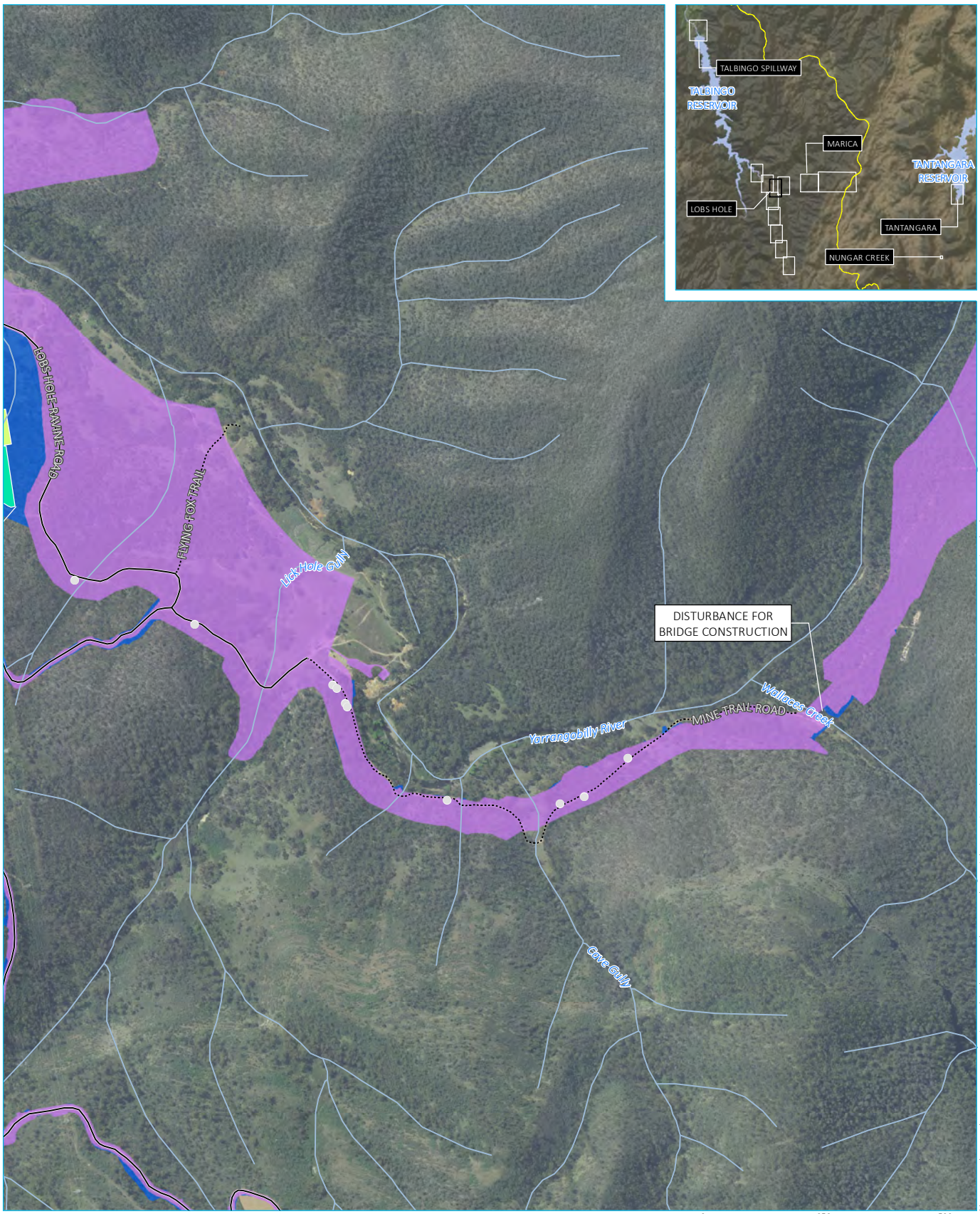


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 250 500 m

GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Local road
- Vehicular track
- Watercourse/drainage line
- EW approved construction footprint
- EW modification construction footprint (additional)
- Indicative laydown area
- Proposed substation
- Fossil area

Exploratory Works project boundary
- Mine Trail Road 2

Snowy 2.0
Exploratory Works EIS
Modification 1
1 h

snowy 2.0

EMM creating opportunities

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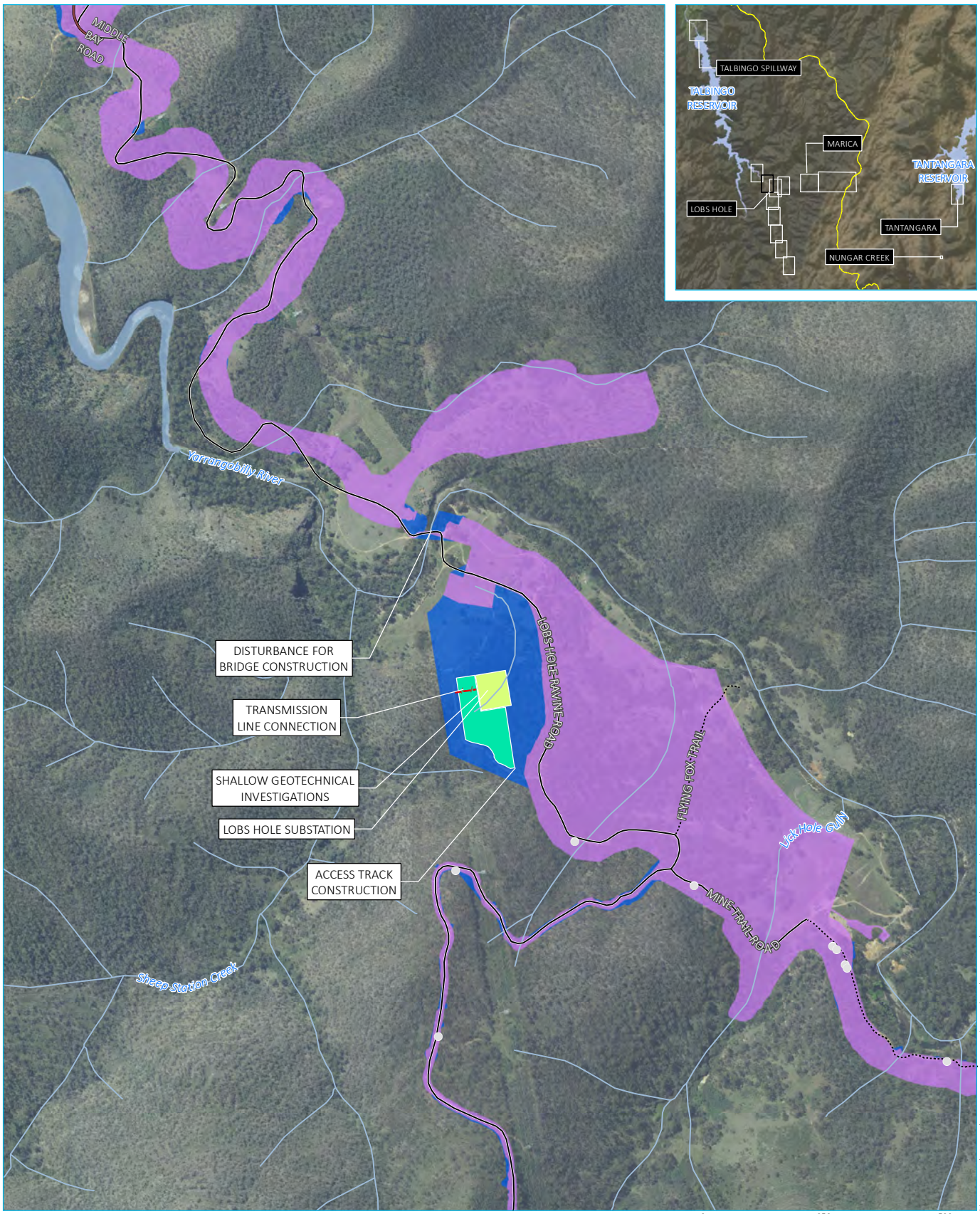



*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 250 500 m

GDA 1994 MGA Zone 55

N

KEY

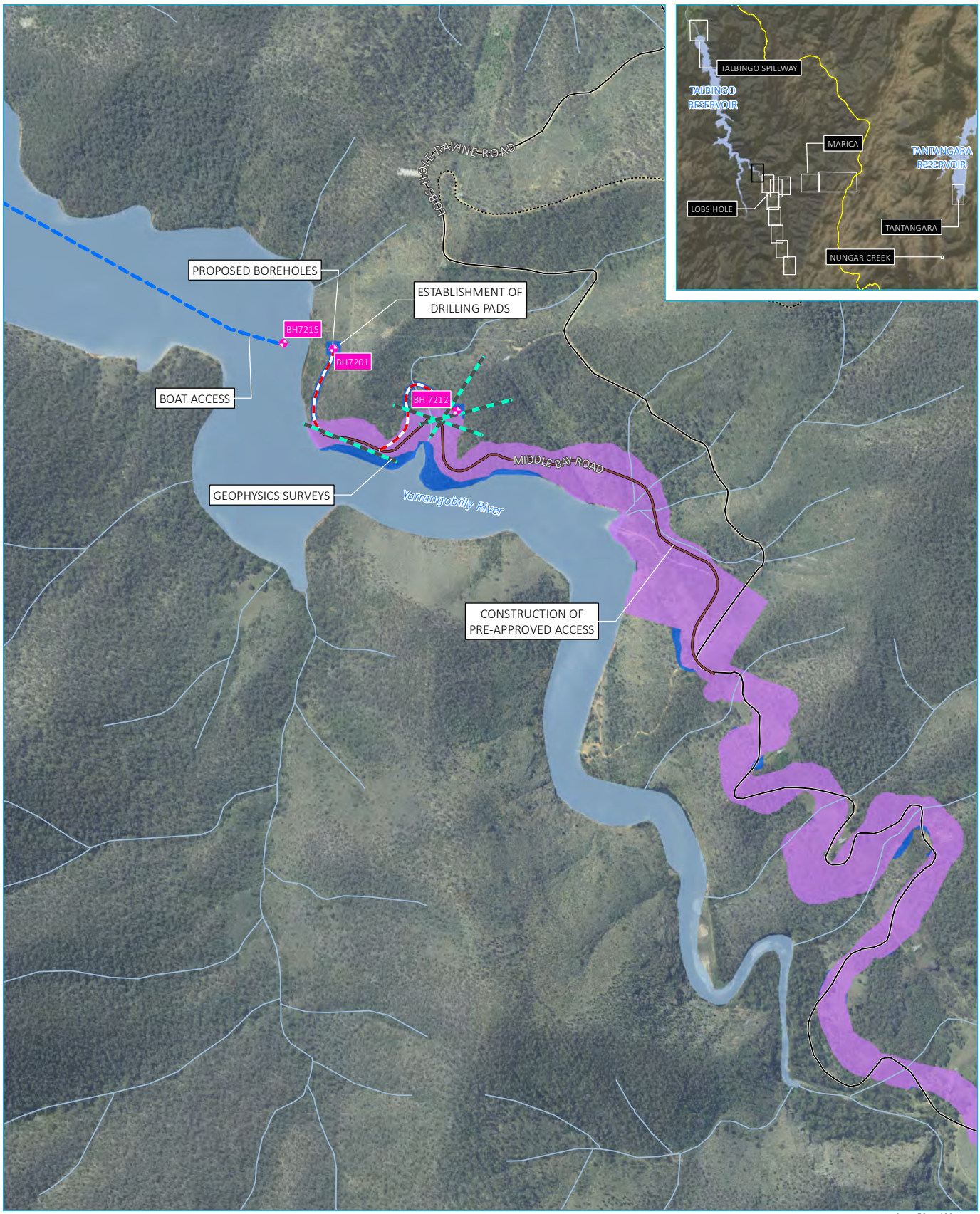
- Dangerous tree
- Approved EW access
- Transmission line connection
- Local road
- Vehicular track
- Watercourse/drainage line
- EW approved construction footprint
- EW modification construction footprint (additional)
- Indicative laydown area
- Proposed substation
- Waterbody

## Exploratory Works project boundary - Lobs Hole

Snowy 2.0
Exploratory Works EIS
Modification 1
1 i

snowy 2.0

EMM creating opportunities




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

0 50 100 m

GDA 1994 MGA Zone 55

N

KEY

- Proposed borehole
- Proposed geophysics
- Proposed access track
- Approved EW access
- Boat access
- Local road
- Vehicular track
- Watercourse/drainage line
- EW approved construction footprint
- EW modification construction footprint (additional)
- Waterbody

## Exploratory Works project boundary - Lobs Hole Ravine Road

Snowy 2.0
Exploratory Works EIS
Modification 1
1 j

snowy 2.0

EMM creating opportunities

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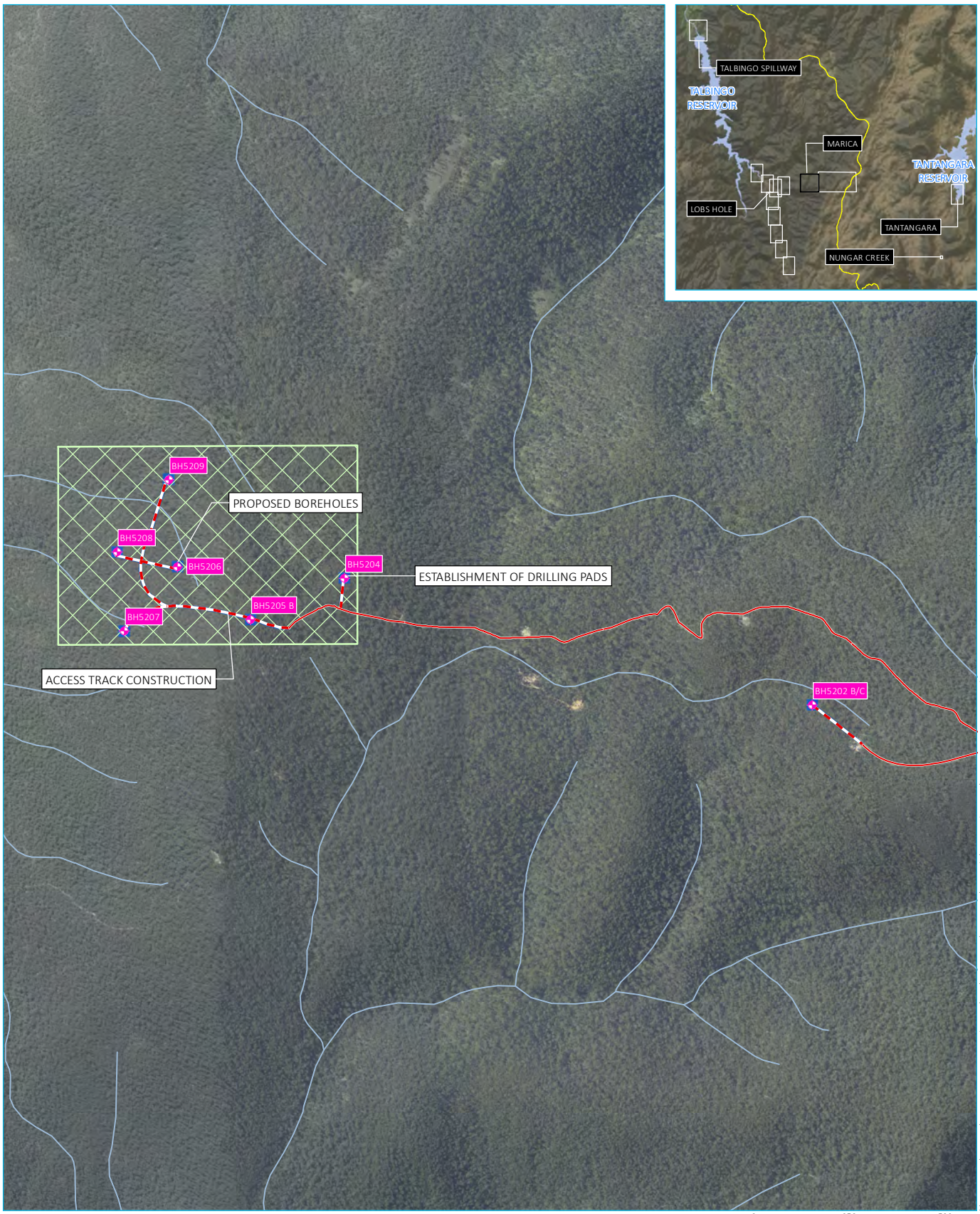


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 250 500 m

GDA 1994 MGA Zone 55

N

KEY

- Proposed borehole
- Existing access track
- Proposed access track
- Watercourse/drainage line
- EW modification construction footprint (additional)
- Boreholes requiring on-site adjustment

Exploratory Works project boundary - Marica 1

Snowy 2.0
Exploratory Works EIS
Modification 1
1 k

snowy 2.0

EMM creating opportunities

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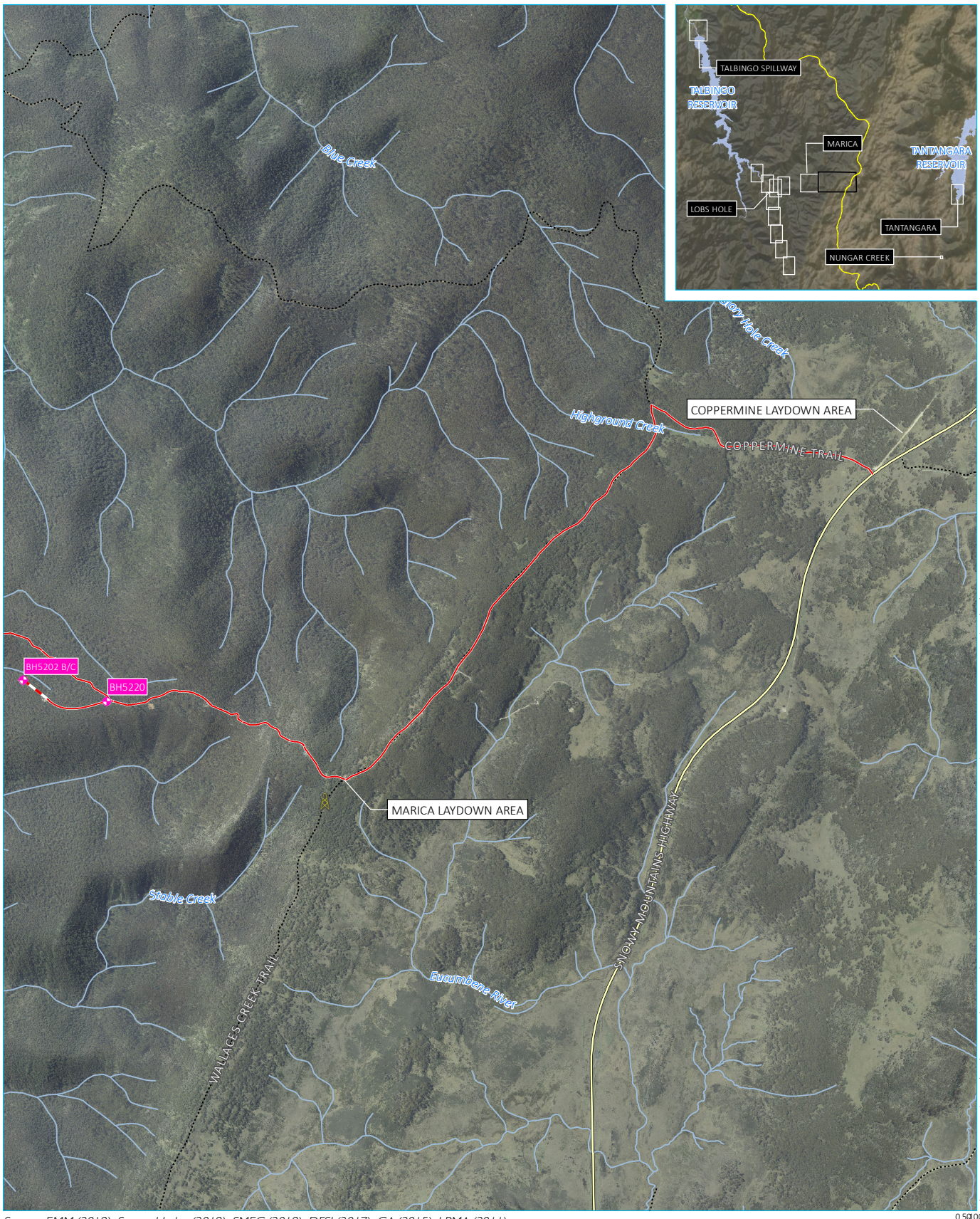


*Source: EMM (2019); Snowy Hydro (2019); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 5 10 km

GDA 1994 MGA Zone 55

N

KEY

- Proposed borehole
- Existing temporary communications
- Existing access track
- Proposed access track
- Main road
- Vehicular track
- Watercourse/drainage line
- EW modification construction footprint (additional)

Exploratory Works project boundary - Marica 2

Snowy 2.0
Exploratory Works EIS
Modification 1
1 I

snowy 2.0

EMM creating opportunities

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

0 50 100 m

GDA 1994 MGA Zone 55

N

KEY

- Proposed borehole
- Main road
- Watercourse/drainage line
- Proposed work area

Exploratory Works project boundary - Nungar Creek

Snowy 2.0
Exploratory Works EIS
Modification 1
1 m

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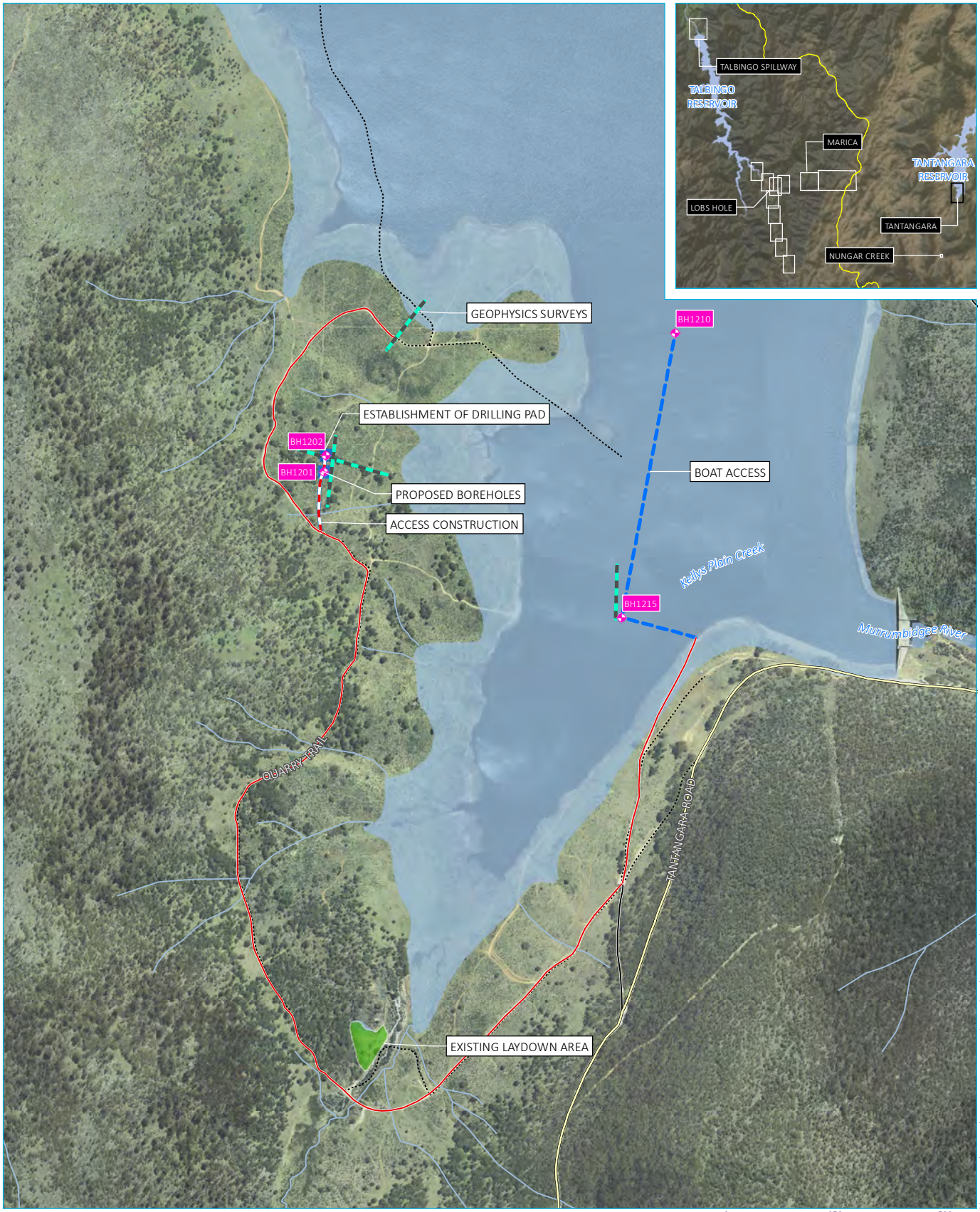


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 250 500 m

GDA 1994 MGA Zone 55

N

KEY

- Proposed borehole
- Proposed geophysics
- Existing access track
- Proposed access track
- Boat access
- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- EW modification construction footprint (additional)
- Existing laydown area
- Waterbody

## Exploratory Works project boundary - Tantangara Reservoir

Snowy 2.0
Exploratory Works EIS
Modification 1
1 n

snowy 2.0

EMM creating opportunities

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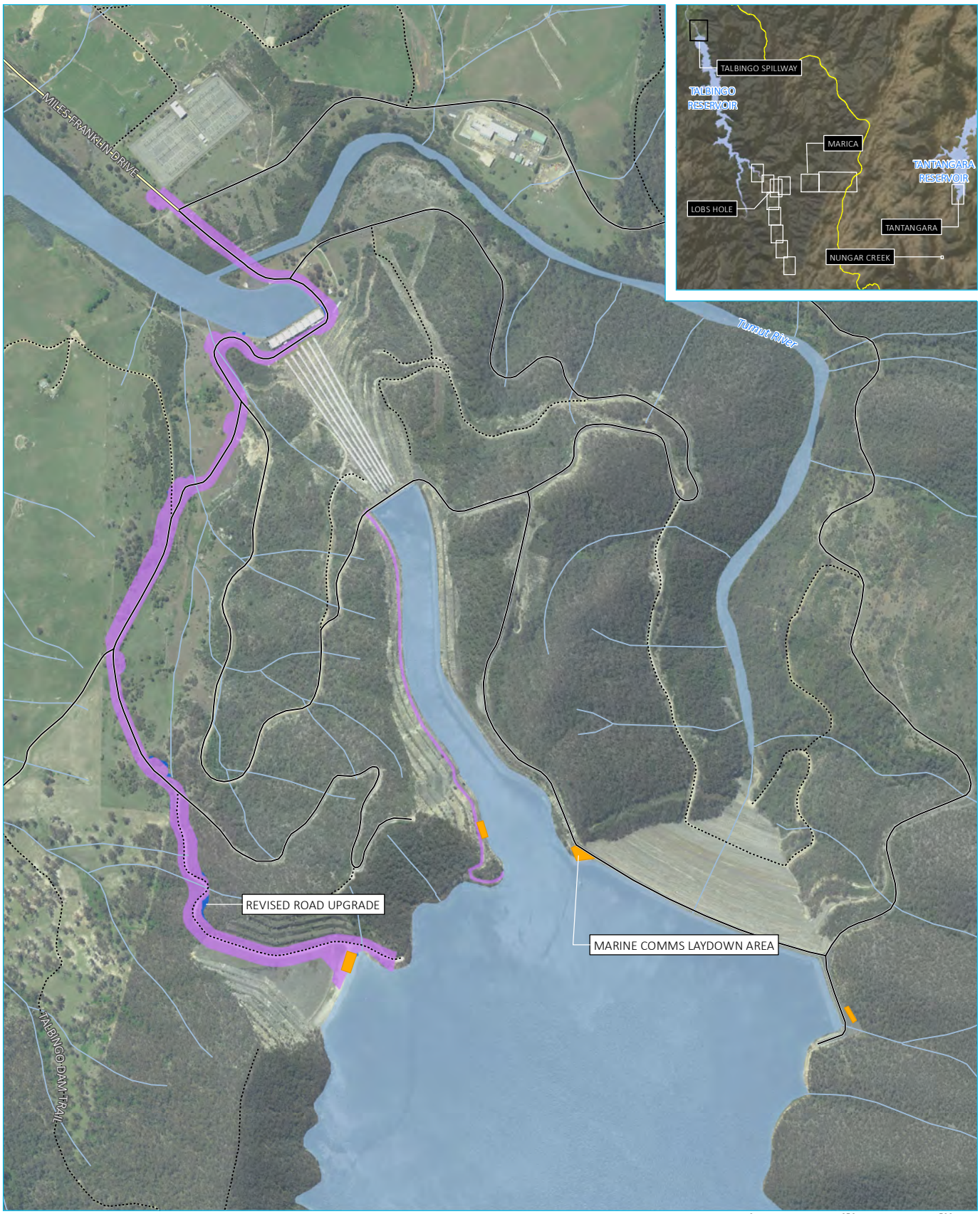


*Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)*

0 250 500 m

GDA 1994 MGA Zone 55

N

KEY

- Main road
- Local road
- Vehicular track
- Watercourse/drainage line
- EW approved construction footprint
- EW modification construction footprint (additional)
- Marine comms laydown (proposed)
- Waterbody

Exploratory Works project boundary
- Talbingo spillway

Snowy 2.0
Exploratory Works EIS
Modification 1
1 o

snowy 2.0

EMM creating opportunities

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