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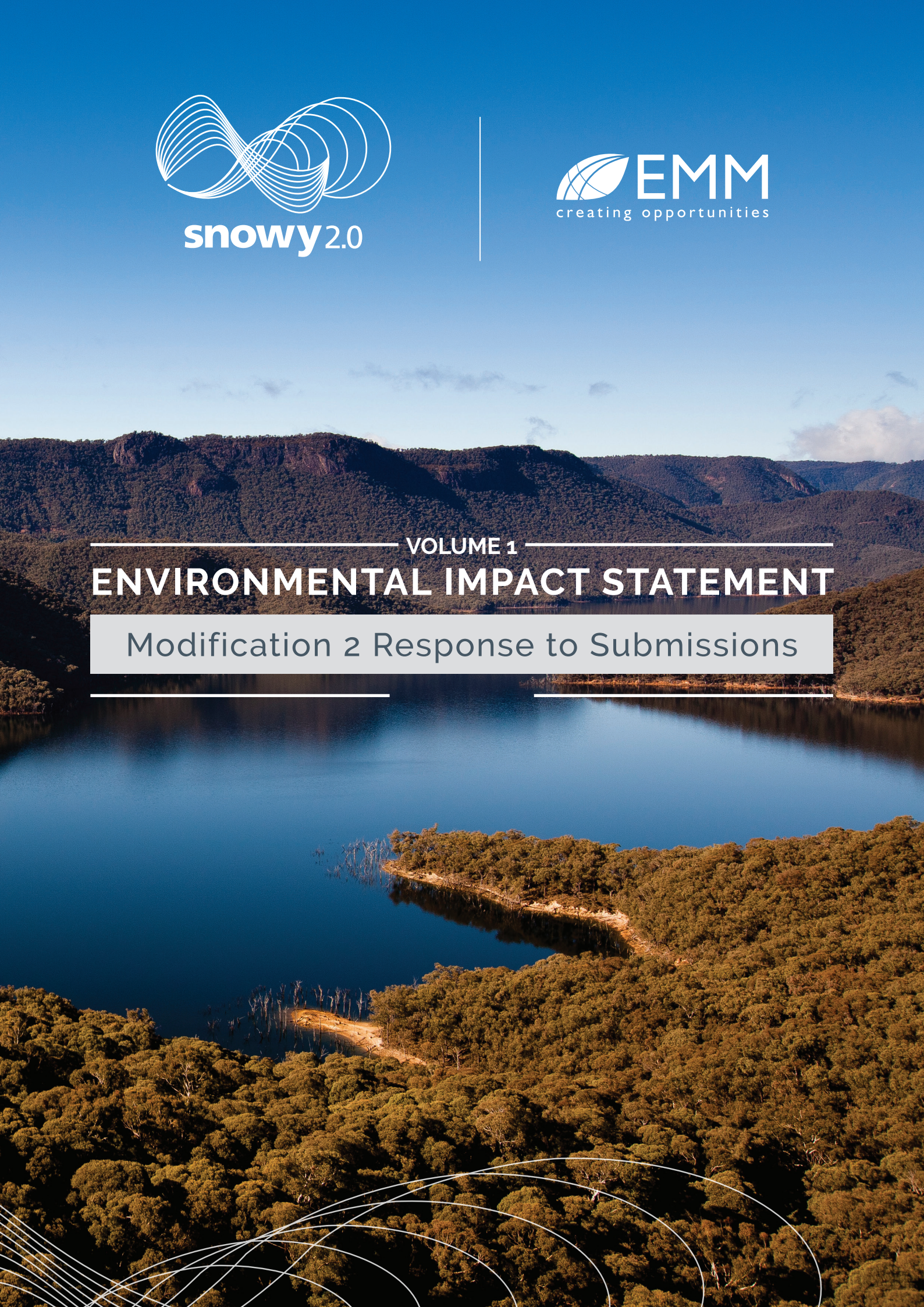

VOLUME 1

ENVIRONMENTAL IMPACT STATEMENT

Modification 2 Response to Submissions

Snowy 2.0 Exploratory Works Modification 2

Response to Submissions Report

Prepared for Snowy Hydro Limited
January 2020

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Snowy 2.0 Exploratory Works Modification 2

Response to Submissions Report

Report Number

J17188 RP104

Client

Snowy Hydro Limited

Date

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Version

v2 Final

Prepared by	**Approved by**
	
Lawrence Wallis	**Duncan Peake**
Senior Environmental Scientist	Director
10 January 2020	10 January 2020

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1 Introduction

1.1 Snowy 2.0

Snowy Hydro Limited (Snowy Hydro) owns and operates the Snowy Mountains Hydro-electric Scheme (Snowy Scheme), a large and complex water storage and diversion scheme in the Australian Alps in southern New South Wales (NSW). Snowy Hydro is the proponent for Snowy 2.0, an expansion of the Snowy Scheme that will increase its generation capacity by almost 50%, providing an additional 2,000 megawatts (MW) generating capacity, and making approximately 350,000 megawatt hours (MWh) (175 hours of energy storage) available to the National Electricity Market (NEM).

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

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

1.2 Exploratory Works

Snowy Hydro obtained approval to carry out Exploratory Works for Snowy 2.0 on 7 February 2019. The primary purpose of Exploratory Works is to gain a greater understanding of the rock conditions at the proposed location of the underground power station for Snowy 2.0. An exploratory tunnel is the key element proposed to gain this critical information for design development.

1.3 Modification 1

An application for a modification to the Exploratory Works was submitted to the NSW Department of Planning, Industry and Environment (DPIE) in June 2019. Modification 1 sought approval to establish a substation at Lobs Hole for construction power supply and to undertake additional geotechnical investigations. Modification 1 was approved on 2 December 2019.

1.4 Modification 2

Since the original Exploratory Works EIS was developed, the design and construction contractor, Future Generation Joint Venture (FGJV) has been engaged by Snowy Hydro and a period of design development has led to changes in the tunnelling method and transport strategy providing for improvements to the delivery of Exploratory Works. The proposed modification reflects project changes and requirements identified by FGJV.

Modification 2 will enhance the outcomes of Exploratory Works. The proposed modification will contribute to the aims of Exploratory Works by providing the following benefits:

- improve worker safety during construction;
- reduce environmental impact of blasting and dredging;
- improve schedule and increase reliability of tunnelling;

- improve constructability through standardising construction processes and reducing the handling of materials; and
- optimise cost.

The Modification 2 assessment report was exhibited from 7 to 21 November 2019 and considered the following scope of works:

- revision of the exploratory tunnelling method from drill and blast to predominantly tunnel boring machine (TBM) method;
- road upgrades for transport and delivery of TBM equipment and materials required for tunnelling;
- vegetation trimming, and selective tree lopping/removal on Lobs Hole Ravine Road (South) to provide adequate clearance for transport of the maximum TBM load;
- improved access and egress to Lobs Hole via Lobs Hole Ravine Road (North);
- relocation of Middle Bay Barge ramp to significantly reduce dredging area required for its establishment;
- increase Lobs Hole accommodation camp capacity from 152 personnel to up to 250 (the additional accommodation would be an additional storey to the existing camp within the currently proposed footprint);
- additional diesel storage capacity for the TBM until the Lob Hole Substation construction power is available;
- additional diesel generators to provide power supply to the TBM prior to Lobs Hole substation commissioning; and
- revision of the transport strategy to reduce the use of barging for delivery of materials to site.

1.5 Purpose and structure of this report

This response to submissions (RtS) report has been prepared in accordance with the draft *Environmental Impact Assessment Guidance Series Responding to Submissions* June 2017 (Department of Planning and Environment 2017). The purpose of the document is to consider and respond to submissions made in relation to the Modification 2 assessment report by various state and local government agencies, special interest groups and the public.

This report also presents findings of additional environmental assessment in response to submissions received and proposed mitigation measures.

This report follows the below structure:

- introduction;
- analysis of submissions;
- actions taken since exhibition;
- response to submissions;
- updated mitigation measures; and

- updated evaluation and conclusions.

This report also presents a submissions summary register in Appendix A, a register of submitters in Appendix B, an excavated material management flow chart in Appendix C and a biodiversity offset report in Appendix D.

1.6 Changes to design since public exhibition

Following public exhibition of the Modification 2 assessment report, several improvements have been designed and adopted by Snowy Hydro. These improvements include changes to the design and/or management of Exploratory Works and have been developed in response to feedback from government and community stakeholders, as well as the Future Generation Joint Venture contracted to construct Exploratory Works. The key project improvements are summarised as follows:

- Removal of approved borehole BH5205 and replacement with BH5203, to be located on a previously disturbed drill pad and access road off the Marica Track.

- Clarification of the proposed height for vegetation trimming on Lobs Hole Ravine Road South.

- Development of a protocol for post-approval vegetation removal in consultation with DPIE Biodiversity and Conservation Division (BCD).

2 Analysis of submissions received

2.1 Exhibition details

The Modification 2 assessment report was publicly exhibited from 7 November to 21 November 2019. Hard copies of the Modification 2 assessment report and USBs providing electronic copies were exhibited at Snowy Monaro Regional Council's (SMRC) Cooma offices, the Cooma library, Talbingo supermarket and Snowy Valleys Council office in Tumut. The Modification 2 assessment report was also available for review on DPIE's Major Projects website. The Modification 2 project page on the DPIE Major Projects Portal is accessible at the following location:

https://www.planningportal.nsw.gov.au/major-projects/project/25741

2.2 Submissions summary

Following public exhibition of the Modification 2 assessment report, 27 submissions were received. Two submissions were received from special interest groups (Inland Rivers Network and National Parks Association of NSW) and 19 were from individual community members, predominantly from either residents or frequent visitors to Talbingo. One submission was received from SMRC and five were from NSW government agencies.

A breakdown of the submissions received is provided in Table 2.1.

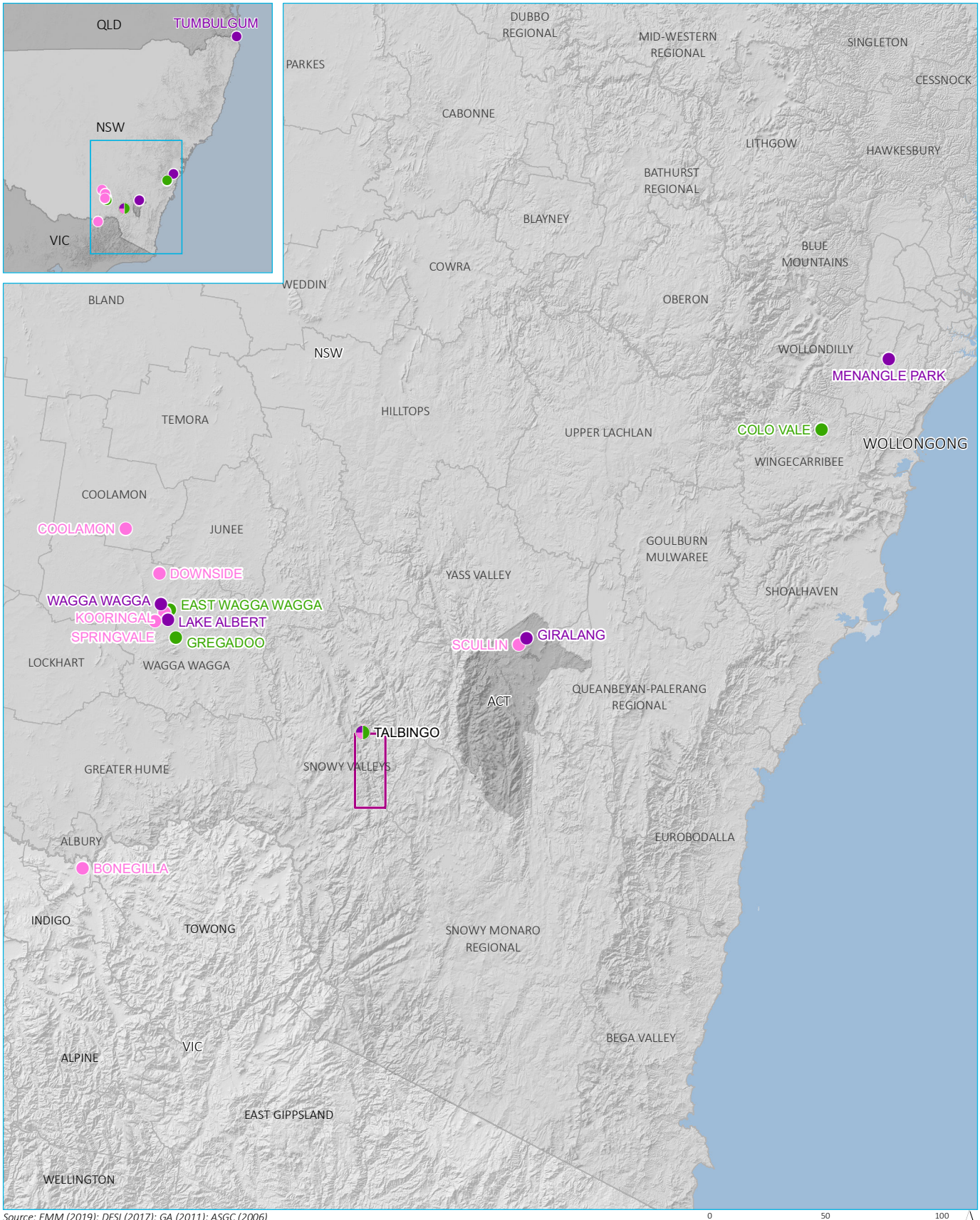
Table 2.1 Summary of submissions received

Submission category	Object	Support	Comment	Total
Individual community member	6	6	7	**19**
Special interest group	2			**2**
State government			5	**5**
Local government (SMRC)			1	**1**
Total	**8**	**6**	**13**	**27**

The following NSW Government agencies provided submissions:

- SMRC;
- Heritage Council of NSW;
- DPIE Biodiversity and Conservation Division and NPWS;
- NSW Environment Protection Authority;
- Transport for NSW; and
- Department of Primary Industries.

The locations of community submissions received is provided in Figure 2.1.



Source: EMM (2019); DFSI (2017); GA (2011); ASGC (2006)

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KEY

Submission type

- Objects (6)
- Supports (6)
- Comments (7)
- Local government area
- Exploratory Works project area

Location of community submissions

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1

snowy2.0

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2.3 Response methodology

All submissions received were collated and categorised based on who they were from, in accordance with the following categories:

- individual community member;
- special interest group; and
- local and state government agencies.

The submissions were reviewed, and the key matters raised in each submission identified. Matters raised in each submission were categorised by theme. The themes identified through the review of key matters were:

- Talbingo recreational area;
- transport;
- community engagement;
- KNP;
- approvals process;
- strategic justification;
- tunnelling;
- excavated material management;
- air quality
- heritage; and
- biodiversity.

Responses were prepared to each matter by Snowy Hydro and EMM, with input from technical specialists who prepared the relevant impact assessment for the EIS. The study team was the same team that prepared the Modification 2 assessment report.

2.3.1 Submissions in objection

Eight submissions objected to Modification 2. This comprised six submissions from individuals and two submissions from special interest groups. Frequency of matters raised in objecting submissions is provided in Table 2.2.

Matters raised in submissions in objection mainly related to the Talbingo recreational area. Additional matters raised in objecting submissions included impacts to KNP, air quality, transport, tunnelling and the approval process. Submissions were also received on matters beyond the scope of Modification 2, primarily relating to the merits and impacts of the Main Works application.

Table 2.2 Summary of matters raised in objecting submissions

Aspect	Quantity	Percentage (%)
Talbingo recreational area	4	50%
Impacts to KNP	1	12.5%
Air quality	1	12.5%
Transport strategy	1	12.5%
Tunnelling method	1	12.5%
Approval process	1	12.5%
Public exhibition	1	12.5%
Main Works application	3	37.5%

2.3.2 Government

A summary of the matters raised in submissions from government agencies is provided in Table 2.3.

Table 2.3 Summary of matters raised in government submissions

Aspect	Quantity	Percentage (%)
Biodiversity	1	17%
Heritage	1	17%
Excavated material management	3	50%
Transport	2	33%

2.3.3 Special interest groups

Two special interest group submission were received. Issues raised included the strategic justification, impacts to the KNP, air quality, transport strategy and the approval process. Submissions were also received on matters beyond the scope of Modification 2, primarily relating to the Main Works application.

2.3.4 Individual community members

A summary of the matters raised in community submissions is provided in Table 2.4.

Table 2.4 Summary of matters raised in community submissions

Aspect	Quantity	Percentage (%)
Talbingo recreational area	16	84.2%
Approvals process	2	10.5%
Tunnelling	1	5.2%
Public exhibition	2	10.5%

In total 19 individual community member submissions, primarily from Talbingo, were received by DPIE following the public exhibition of the Modification 2 assessment report. Many of the submissions received raised concerns about impacts to recreational users of Talbingo Reservoir. Other matters raised in the community submissions included the approvals process, public exhibition and the tunnelling method. Submissions were also received on matters beyond the scope of Modification 2, primarily relating to the Main Works application. The matters raised in community submissions are further detailed in Chapter 6.

3 Actions taken since exhibition

3.1 Project improvements

3.1.1 Overview of design changes

Following public exhibition of the Modification 2 assessment report, feedback from government and community stakeholders, and the design and construct contractors has been considered and several project improvements have been identified. The proposed project improvements involve design changes for the purposes of:

- further minimising environmental impacts;
- improving the constructability of Exploratory Works; and
- meeting stakeholder expectations for the project.

This section provides details of the proposed minor amendments to the Modification 2 proposal. The key project improvements are:

- Removal of approved borehole BH5205 and replacement with BH5203, to be located on a previously disturbed drill pad and access road off the Marica Track;
- Clarification of the proposed height for vegetation trimming on Lobs Hole Ravine Road South; and
- Development of a protocol for post-approval vegetation removal in consultation with BCD.

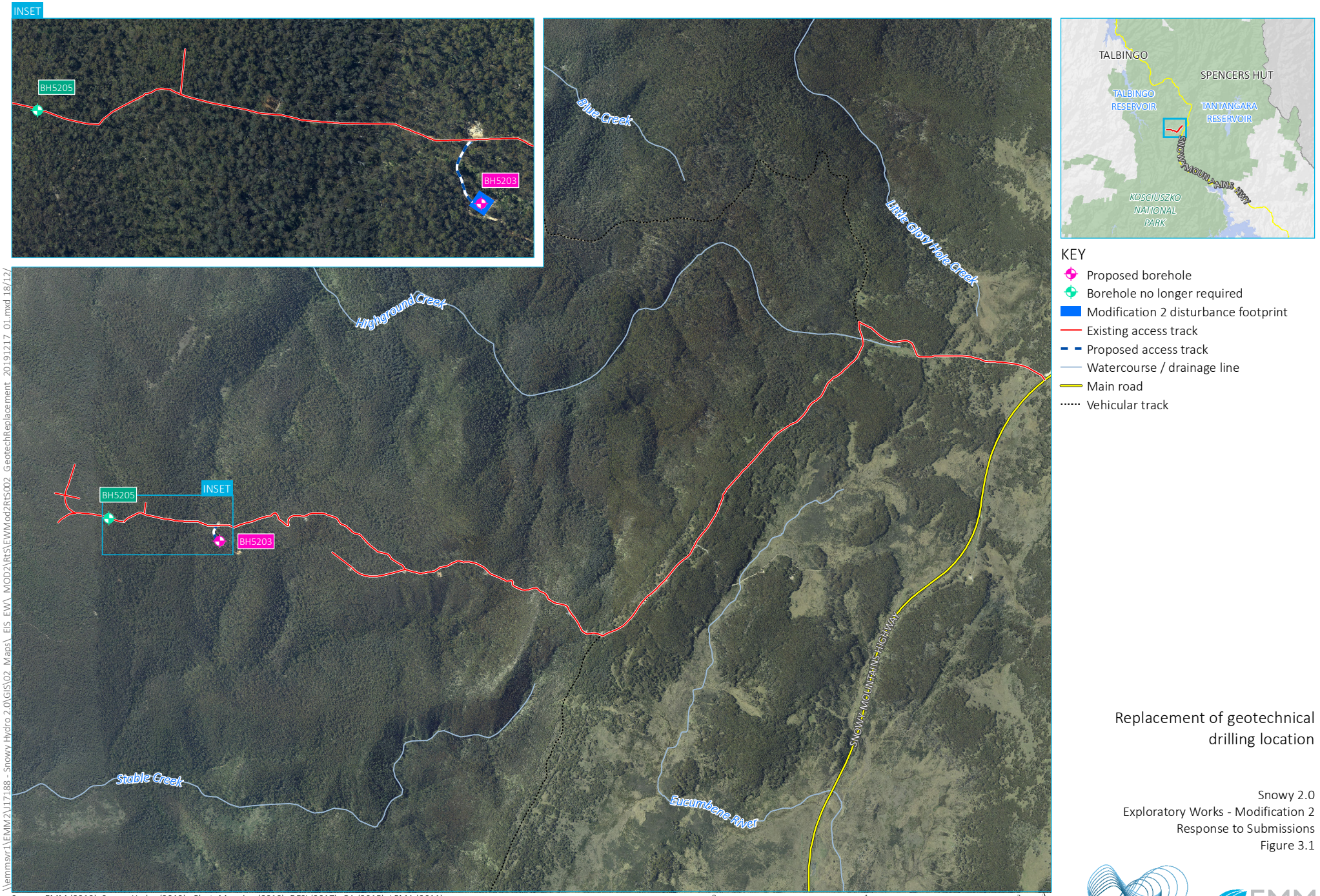
3.1.2 Replacement of geotechnical drilling location

Due to development in design of the Inclined Pressure Shaft (IPS) and the shift of the shaft alignment to the south, Future Generation Joint Venture has identified an area it would like additional geological information. To get this new geological information proposed to drill a borehole BH5203 at the location of a former drill pad (BH5113), utilising an existing access track corridor. The proposed additional geotechnical drilling site and access track will result in an increase to the Exploratory Works disturbance footprint of 0.13 ha. This increase, however, is entirely within an area that was previously impacted as part of the Feasibility Study geotechnical investigations as recently as April 2019. The re-instatement of this access track and borehole is considered to be an improvement in the overall level of impacts.

To offset the proposed new borehole, a previously approved drilling location (borehole BH5205) has been removed from the scope as it is no longer required at this stage. The removal of the previously approved geotechnical drilling site BH5205 will reduce the disturbance footprint of the Exploratory Works by 0.06 ha.

The proposed replacement of one geotechnical drilling location will thereby result in an overall increase to the Exploratory Works disturbance footprint of only 0.07 ha. An assessment of the potential impacts of the proposed borehole and access track is provided in Section 3.2.

The location of the existing approved borehole to be removed from scope (BH5205) and the location of the replacement borehole (BH5203) are shown in Figure 3.1.



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

Replacement of geotechnical drilling location

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 3.1

snowy 2.0

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Geotechnical investigations will involve the following:

- mobilisation to site;
- reinstatement of drill pad and access track;
- borehole drilling to an approximate depth of 500 m below ground level;
- demobilisation and reinstatement of the drilling pads and boreholes following completion of works.

i Track and pad reinstatement

The location of the proposed borehole BH5203 has been strategically selected to utilise the previously disturbed footprint of the former borehole BH5113 and associated access track. Whilst the site will be primarily accessed using the Marica Track, a previously rehabilitated spur track will be re-established over a distance of approximately 100 m from the Marica Track to the drill pad site. Photograph 3.1 below shows the spur track from the Marica Track prior to rehabilitation which was completed in March / April 2019.

Photograph 3.1 View from the Marica Track toward the proposed BH5203 drill pad

Similarly, the drill pad site of the former borehole BH5113 will need to be cleared of rehabilitate plantings and mulch to re-establish the drill pad site for BH5203. Minor earthworks may also be required to make the drill pad site suitable for the location and orientation of the drill rig. Photograph 3.2 below shows the site of the former BH5113 drill pad site during drilling operations and Photograph 3.3 shows the same site post-rehabilitation in March/ April 2019.

Photograph 3.2 Drilling operations on the former BH5113 drill pad

Photograph 3.3 Rehabilitation of the former BH5113 drill pad (April 2019)

Given the relatively recent rehabilitation efforts of both the spur access track and the former drill pad site of borehole BH5113, it is anticipated that vegetation clearing requirements will be minimal. All existing ground cover and timber / branches used during the rehabilitation efforts will be pushed to the side and retained for later reinstatement as required during the future rehabilitation of the site. Clearing of established vegetation is not anticipated for either the spur access track or the drill pad site for BH5203.

Site establishment of the spur access track and drill pad site for BH5203 will be undertaken as follows:

- pre-establishment vegetation inspections by ecologists;
- installation of site delineation/webbing, inclusive of sediments control measures along the tracks and around the drill pad sites;
- removal of surface cover and woody debris / branches, to be pushed to the edges of the access track and drill pad sites for later use during site rehabilitation; and
- placement of geofabric, track mats and gravel at track depression to maintain safe access and minimise impact on gully soils.

ii Mobilisation

The proposed BH5203 geotechnical drilling location will be accessed using the existing Marica Track, and a previously disturbed spur track which was rehabilitated in April 2019.

The process for mobilising equipment to site will be as follows:

- Drill rigs and other large equipment will be transported to the Snowy Mountain Highway lay down area (and Marica Track intersection) where they will be tracked or driven into site using existing access tracks that have been previously utilised for Snowy 2.0 Feasibility stage geotechnical investigation activities; and
- Vehicle hygiene checks will be undertaken for all new plant, machinery and vehicles prior to accessing site for the first time.

iii Drill pad and access track establishment

Following removal of rehabilitation efforts, establishment of the access track and drill pad site will involve:

- installation of swale and/or cut off drains (using skid steer loader or similar) to prevent overland water flow across the track/site and install erosion and sediment controls;
- where required, minor earthworks to level the track or pad to a suitable gradient;
- where required, placement of geofabric and use of compacted imported aggregate material to create a stable track or drill pad. This stabilisation of the ground is of particular importance for the active drilling area within the drilling pads to ensure the stability of the drill rig;
- for the drill pad site, placement on site of drill support equipment including water tanks, mud tanks, spill kits, lighting, mobile generator and other equipment as necessary; and
- set up of drill rig and drilling equipment.

The drill pad and surrounding work area will be maintained for the duration of drilling work as required. A drainage sump may also be installed at the lowest point of the site (to capture excess drill fluid) if required.

An example of a typical layout of a typical drill pad site is shown below in Figure 3.2.

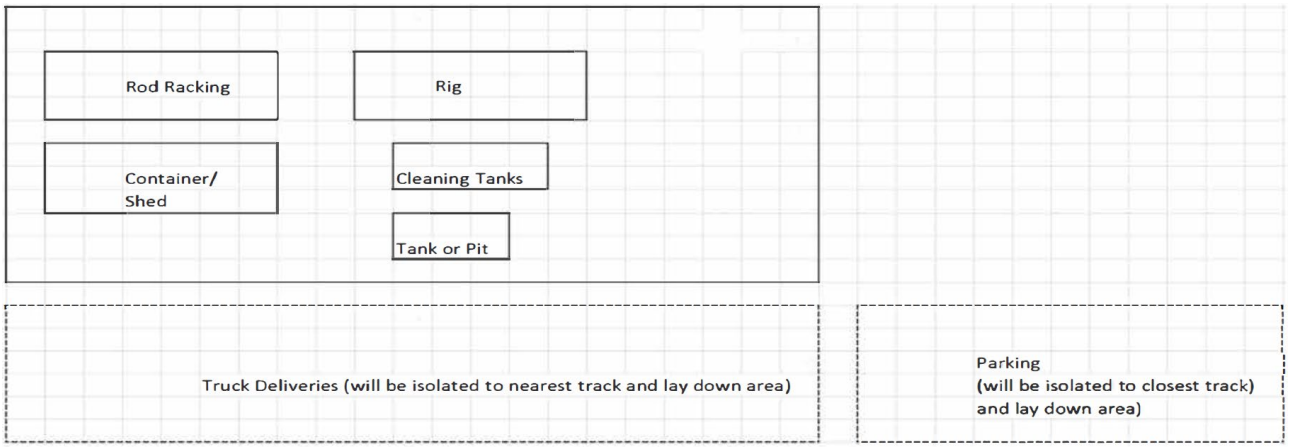


Figure 3.2 Typical drill pad layout

iv Borehole drilling

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

- drilling of boreholes using auger and rotary wash bore drilling techniques through soils and weathered rock followed by coring, to a maximum depth of approximately 500 m;
- rock core drilling using triple tube diamond coring techniques to the nominated target depth;
- containment of excess drilling fluids and cuttings in re-circulation tanks, excess fluids will be stored in portable containers and disposed of to an NSW Environment Protection Authority (EPA) licenced facility;
- in situ permeability testing using water pressure tests other downhole testing as required;
- clean water flushing of boreholes upon reaching target depths;
- downhole borehole survey using acoustic teleview cameras and instruments Survey of the as-built borehole location using GPS or suitable survey techniques;
- install of downhole monitoring instrument, for example vibrating wire piezometers and/or standpipes;
- grout of borehole upon completion of in-situ testing or downhole install; and
- ongoing maintenance of the equipment and site as required.

A typical drill rig is shown in Photograph 3.2 above, showing the active drill rig at the former borehole BH5113. A typical drill rig pad layout and cross section is shown in Figure 3.2 and Figure 3.3 below.

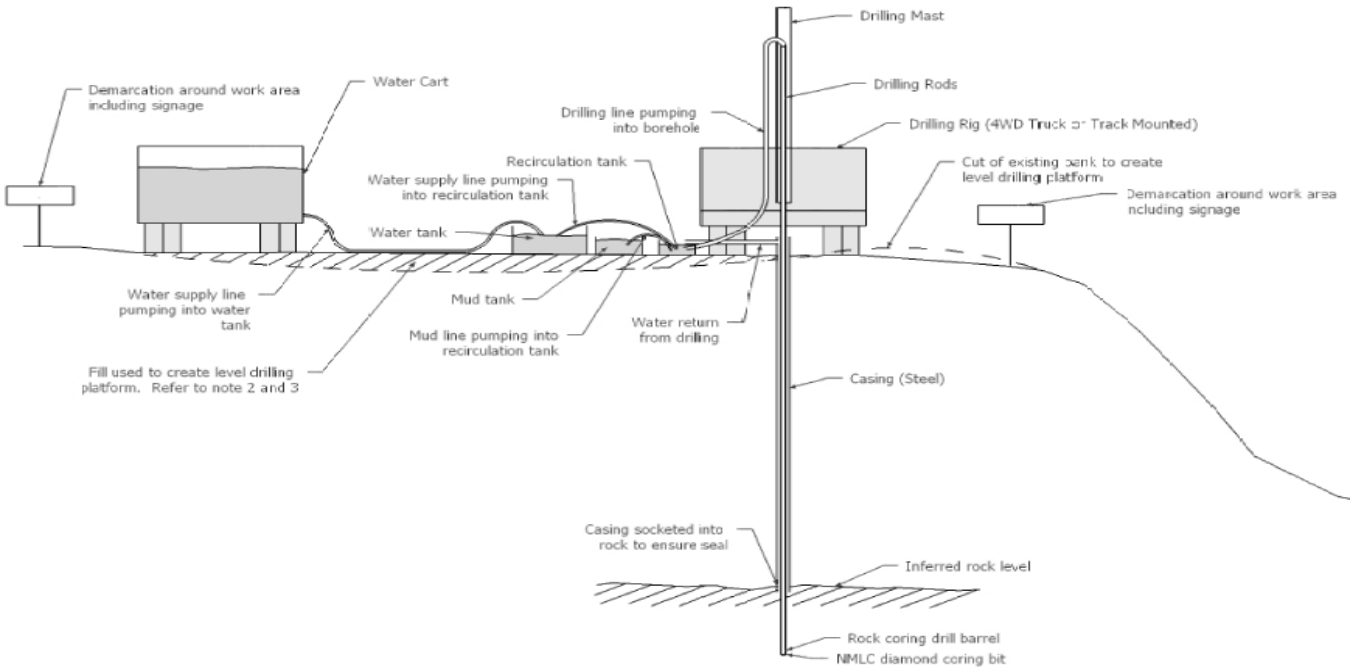


Figure 3.3 Typical drill site set up - cross section

v Ancillary activities

Ancillary activities will be consistent with the activities detailed in in accordance with the Modification 1 Assessment Report. In summary, this includes the following:

- daily mobilisation of site crew (drillers, geotechnical engineer etc) as well as delivery of materials as may be required;
- removal of drill core logs (contained in in light steel core trays), intermediate bulk containers (IBCs) and other equipment may also be undertaken as required on a daily basis;
- all laydown areas will be established within existing disturbed areas and will make use of existing laydown areas and access tracks that were previously used during the feasibility stage geotechnical investigations;
- water supply infrastructure including pumps, tanks and overland piping may also be established within laydown areas, access tracks and proposed drill sites for borehole drilling water supply; and
- all ancillary activities will be undertaken within existing disturbed areas and no vegetation clearance or ground disturbance will be required.

vi Site demobilisation and reinstatement at completion of works

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

- decommissioning of all equipment from the boreholes and drill pad locations;

- demobilisation of all equipment from site using temporary access tracks; and
- visual inspection by work crew to ensure that no materials associated with the drilling activities have been left at the drill pads.

Snowy Hydro proposes to retain the option of installing monitoring equipment in any of the boreholes for ongoing groundwater monitoring purposes. This may occur sometime in the future following the decommissioning activities.

Rehabilitation of the site will be consistent with the process and procedures detailed in the approved Modification 1 Assessment Report. In summary, this will include the following:

- Successful rehabilitation is based on the principle of "No Bare Ground" after rehabilitation works have been carried out;
- Implementation of strict vehicle hygiene protocol, such as washing down of equipment and vehicle wash bays before entering KNP and cleaning of boots prior to entering the sites;
- Rehabilitation will aim to use existing ecological resources at the sites and to minimise the use of additional materials such as seed, tubestock and mulch. This approach to rehabilitation was used throughout the Feasibility stage geotechnical investigation program and has been undertaken successfully to date;
- Following completion of all site activities, a visual inspection of the site by Snowy Hydro and NPWS personnel will be undertaken to ensure that the location of the drilling activities has been reinstated to an acceptable standard.

3.1.3 Implementation of vegetation trimming on Lobs Hole Ravine Road South

Further detailed design has identified that the proposed vegetation trimming height of 1.1 m may not achieve adequate clearance for safe access in some sections for the vehicle transporting the TBM. This is due to the need to provide safe separation between the TBM load and surrounding vegetation where the grade of the road will lead to some variation in the height of the trailer relative to the surrounding vegetation. That is, there are likely to be instances where the horizontal alignment or cross fall of the road results in the height of the trailer being less than 1.1 m, particularly on the inside corner of bends. This would result in potential obstructions for safe access for the vehicle transporting the TBM.

It is expected that the majority of the vegetation trimming will occur at or above 1.1 m height, however there are likely to be some instances where vegetation may require trimming below 1.1 m to provide for safe access for the vehicle transporting the TBM. The site specific vegetation trimming will need to be determined on-site prior to transport of the TBM.

To minimise any impacts to biodiversity and threatened species, a protocol for post-approval vegetation removal will be developed and included in the biodiversity management plan required under Schedule 3 Condition 6. This will include measures to manage any vegetation trimming below 1.1 m. This will outline measures to consult with BCD regarding any areas of vegetation trimming below 1.1 m within potential Smoky Mouse habitat.

3.1.4 Post-approval vegetation removal management

Experience with the implementation of Exploratory Works to date has highlighted the need for a process to assess and manage critical vegetation removal as part of the project's post-approval environmental management to provide for a safe working environment. A key issue requiring critical vegetation removal is the potential for dangerous trees to impact on the safety of the Exploratory Works construction workforce and vehicular access. Given the proximity of large forested areas to the project construction areas and access roads, it is expected that instances of individual trees posing safety risks will continue to arise throughout the construction period.

Similarly, as outlined in Section 3.1.3 above, the proposed vegetation trimming on Lobs Hole Ravine Road South may require some minor additional trimming below the nominated height of 1.1 m where site specific conditions require unexpected changes to the trimming height. The sensitivity of the surrounding environment to Exploratory Works is acknowledged and therefore, it is proposed that a protocol for post-approval vegetation removal is developed as part of the biodiversity management plan to provide for a safe working environment. This protocol will apply to critical vegetation removal only, where:

- vegetation removal is critical and unavoidable;
- the impacts of the vegetation removal are not considered to be significant; and
- the use of the post-approval protocol is agreed by BCD in each instance.

The protocol for post-approval vegetation removal will involve:

- preparation of a biodiversity assessment that provides:
  - a revised biodiversity development assessment report (BDAR); or
  - a report summarising the information required to revise the BDAR.
- assessment of impacts to native vegetation, threatened species and ecosystems;
- identification of any additional site specific mitigations required for the vegetation removal; and
- update to the biodiversity offsets required for the Exploratory Works.

3.2 Assessment of impacts from project changes

3.2.1 Replacement of geotechnical drilling location

i Biodiversity

The proposed change in geotechnical drilling location and required access track will result in minor changes to the disturbance footprint. As previously mentioned this will result in an overall increase of 0.07 ha to the disturbance footprint.

The biodiversity impacts of this change have been assessed in the biodiversity report provided in Appendix C.

The proposed changes to the disturbance footprint and vegetation clearing will result in the following impacts from Modification 2:

- a reduction of 0.06 ha vegetation clearance to PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion;

- an increase of 0.13 ha of vegetation clearance to PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion; and

- an overall increase in impacts to potential Smoky Mouse habitat of 0.07 ha.

This will result in a cumulative impact of 1.90 ha of vegetation clearance impacts to potential Smoky Mouse habitat as a result of the Exploratory Works and modifications.

The biodiversity offset requirements have been revised to reflect the proposed changes to Modification 2 and are provided in Appendix C.

ii Heritage

The potential for ground disturbance associated with the geotechnical drilling to impact Aboriginal and historic heritage items was assessed and is provided in this section.

a Existing environment

The Marica (M) area was subject to comprehensive field survey by NSW Archaeology between October 2017 and January 2019 as part of the Exploratory Works and Main Works EIS investigations. The proposed borehole and access track are located within NSW Archaeology survey unit MSU6 described as undulating ridge crest, heavily wooded with conglomerate geology and an abundance of water worn cobbles and pebbles (NSW Archaeology 2019, p. 130). No previously recorded Aboriginal sites were present in the Marica survey area and no Aboriginal sites were recorded during the field assessments. MSU6 was assessed to be of negligible cultural heritage significance with negligible predicted artefact density (NSW Archaeology 2019, p. 501).

The proposed borehole drilling pad and access track have been impacted as part of the previous geotechnical program but have since been rehabilitated. As such the proposed disturbance footprint has been wholly disturbed by prior clearance and drilling activities.

b Register searches

NSW Archaeology completed a search of the Aboriginal Heritage Information System (AHIMS) database on 5 April 2019 which covers the entire Snowy 2.0 Main Works project area, and includes the sites recorded as part of the Exploratory Works and Main Works ACHARs (NSW Archaeology 2018, 2019).

No AHIMS sites are registered within the disturbance footprint of the proposed borehole or access track. The closest site is approximately 2.5 km south-east from the proposed borehole location. The site is AHIMS site number 56-6-0508 and is identified as an open artefact scatter.

A search was conducted for historical sites in the area. There are no sites within the vicinity of the proposed borehole and access track. The closest site identified as part of the NSW Archaeology survey effort is located approximately 1.4 km east of the proposed borehole.

Table 3.1 provides the search results for historical sites related to the proposed borehole location.

Table 3.1 Historical register search for the project area

Register	Register listing
National Heritage List (NHL)	'Australian Alps National Parks and Reserves' and the 'Snowy Mountains Scheme'
Commonwealth Heritage List (CHL)	Nil
State Heritage Register (SHR)	Nil
Section 170 Registers	Nil
Kosciuszko Huts Association (KHA)	Nil
Tumut Local Environmental Plan 2012 (Schedule 5)*	Nil
Tumbarumba Local Environmental Plan 2010 (Schedule 5)*	Nil

* Notes: Snowy Valleys Council Local Government Area (LGA) is still operating with the former Tumbarumba Shire Council and Tumut Shire Council Local Environmental Plans (LEPs) and Development Control Plans (DCPs).

c Impact assessment

No AHIMS registered sites will be impacted by the proposed activity. The closest registered Aboriginal site (AHIMS site number 56-6-0508) and is approximately 2.5 km south-east from proposed borehole location. The survey unit covering the proposed borehole location (MSU6) was noted to be of negligible cultural heritage significance with negligible predicted artefact density (NSW Archaeology 2019, p. 501). Additionally, the proposed activity will be contained within an area previously disturbed by clearance and drilling activities as part of the Feasibility Study geotechnical program.

It is therefore assessed that there will be no impact on known or previously recorded Aboriginal sites and impacts to unknown Aboriginal objects are unlikely as a result of the proposed activity.

There are no heritage items within the project area listed on the World Heritage List, Commonwealth Heritage List, State Heritage Register, or local government heritage schedules. The 'Australian Alps National Parks and Reserves' and the 'Snowy Mountains Scheme' are two listed places on the National Heritage List. No impacts to national heritage values will occur as a result of the proposed activity due to their minor nature.

d Conclusions and recommendations

No further investigation or assessment is required for the proposed works. Notwithstanding, unexpected finds protocols still apply for the proposed activity.

iii Water

The impacts to water from the proposed replacement geotechnical drilling location are expected to be consistent with the impacts of the existing geotechnical drilling program at Marica that is approved under Modification 1. Impacts to water will therefore be managed in accordance with the existing management measures and controls required under the existing Exploratory Works approval.

iv Traffic

The proposed change to geotechnical drilling location will not require any additional traffic movements or use of access tracks that were not previously proposed as part of the Modification 1 geotechnical drilling works. The replacement of the geotechnical drilling location will have no impacts on traffic and transport.

v Noise and vibration

Noise and vibration impacts of the proposed geotechnical drilling are expected to remain consistent with the acceptable level of impacts predicted for the geotechnical drilling works approved as part of Modification 1.

3.2.2 Change to vegetation trimming height on Lobs Hole Ravine Road South

The proposed change in vegetation trimming height is not expected to result in any significant impacts. The area of vegetation trimming outlined in the Modification 2 Assessment Report (0.4 ha) remains unchanged and the proposed process for managing instances of trimming below 1.1 m will ensure impacts to habitat for key threatened species are minimised and managed in consultation with BCD. The primary reason for avoiding impacts to the vegetation below 1.1 m is to minimise and manage impacts to habitat for Smoky Mouse.

It is expected that individual instances of vegetation trimming below 1.1 m will not have a significant impact on potential habitat for Smoky Mouse. Surveys undertaken for Snowy 2.0 have shown that the Smoky Mouse is positively correlated with habitat complexity at ground level, including large logs and coarse woody debris. As clearing will occur on average only for 1.2 m either side of the existing disturbed area, and any removed vegetation (including logs and coarse woody debris) will be placed in the surrounding vegetation where practical, it is deemed that impacts to Smoky Mouse will be avoided and minimised.

3.3 Stakeholder engagement

Stakeholder engagement commenced on the broader Snowy 2.0 before the scoping phase for the Exploratory Works. Stakeholder engagement has been led by Snowy Hydro with the support of FGJV, EMM and technical specialists where required.

As detailed in the Modification 2 assessment report, Snowy Hydro consulted with local government and state government stakeholders prior to lodging the Modification 2 application.

Given no further changes to the scope of Modification 2 are contemplated, no additional stakeholder engagement specific to Modification 2 has occurred following public exhibition.

4 Response to government submissions

4.1 Overview of government submissions

Reponses to the issues raised by the six government submissions received during the public exhibition period for the Modification 2 assessment report are provided in the following subsections. Comments from the government agencies are presented verbatim within text boxes, with each respective comment followed directly with a response.

4.2 SMRC

SMRC's submission supports Modification 2 and provides commentary on the proposed roundabout upgrades in Cooma central business district (CBD), which are addressed in the section.

Snowy Monaro Regional Council (SMRC) strongly supports the Snowy 2.0 project and would like to acknowledge the efforts made by Snowy Hydro Limited (SHL) to engage with Council and impacted communities during the formative stages of the project.

SMRC supports the proposal for alterations to be made to the roundabouts in the Cooma CBD and recognises the importance of necessary improvements along major freight routes.

SMRC notes the requirement for the proposed upgrades to suit the OSOM movements for the project and encourages that discussions be held between SMRC and SHL to finalise the upgrade design. It is considered that RMS should also be involved in this process.

Snowy Hydro is committed to high quality engagement with government and community stakeholders. SMRC's interest in the Cooma roundabout upgrades is acknowledged and further consultation will be taken with SMRC and NSW Roads and Maritime Services (RMS) to finalise the upgrade designs.

4.3 Heritage Council of NSW

The areas relevant to the Exploratory Works program will not directly impact any State Heritage Register listed items, although a number exist in surrounding areas. However, several sites of Historical archaeological significance were previously identified, and conditions of consent were advised to manage disturbance of these sites. The modification as assessed by EMM (October 2019) in Chapter 6 indicates most of the change involves works into and around Lobs Hole, which includes several historical archaeological sites linked to the former mining complex and township of Ravine. The Assessment argues that works would be unlikely to impact any further sites than those previously assessed for earlier iterations of the Snowy 2.0 Exploratory Works project. The existing conditions of approval are adequate to manage disturbance to significant archaeological sites by this project.

This comment is consistent with the findings of the Modification 2 assessment report.

The commitment to avoiding disturbance to two significant archaeological sites at Lobs Hole known as the Washington Hotel and the Ravine Cemetery, under the Snowy 2.0 Main Works (SSI 9687) is noted. It is anticipated that the Exploratory Works program will endeavour to protect these items throughout the project to ensure this outcome is achieved.

The Washington Hotel was identified as an historic heritage item for avoidance in the Exploratory Works EIS. The Exploratory Works conditions of approval require avoidance of the Washington Hotel and the historic heritage management plan (HHMP) implemented for the Exploratory Works reflects this.

The Ravine Cemetery was also identified as an historic heritage item for avoidance in the Main Works EIS. The Exploratory Works disturbance footprint (inclusive of Modification 2) falls outside the Ravine Cemetery. Impacts to the Ravine Cemetery will therefore be avoided throughout Exploratory Works.

4.4 DPIE Biodiversity and Conservation Division and National Parks and Wildlife Service

I refer to your notification dated 5 November 2019 seeking comment for the Snowy 2.0 Exploratory Works Modification 2 located in Kosciuszko National Park (KNP), within the Snowy Valleys and Snowy Monaro local government areas. The Biodiversity and Conservation Division (BCD) and National Parks and Wildlife Service (NPWS) of the Department of Planning, Industry and Environment ('the Department') have reviewed the exhibited Modification and supporting technical reports.

Significant concerns are held by BCD and NPWS regarding the proposal. Our advice is provided in Attachment A. In summary, the key issues requiring continued discussion and resolution prior to final consideration of the proposal are:

- *composition of spoil from the tunnel boring process and the impacts on terrestrial and aquatic values*
- *disposal of spoil, subaqueously or on land within Kosciuszko National Park*
- *cumulative impact to Smoky Mouse habitat*
- *details about vegetation trimming and associated mitigation measures for avoiding disturbance to Smoky Mouse habitat*
- *completion of surveys for the Biodiversity Development Assessment Report.*

The Modification as proposed will require all existing management plans to be updated to reflect the new works. We request that all plans required as a Condition of Approval that relate to BCD and NPWS matters are developed in consultation with the Department to ensure the identified issues are adequately addressed.

The comments received from DPIE BCD and NPWS are acknowledged and detailed responses to the matters raised are provided in the Sections (i) and (iv) below.

Should Modification 2 be approved, the Exploratory Works management plans will be reviewed and updated to reflect Modification 2 as required.

DPIE BCD and NPWS will be consulted regarding the revision of the management plans in accordance with the conditions of approval.

4.4.1 Excavated material management

Modification Report section 3.2 identifies a change in methodology from drill and blast to the use of a tunnel boring machine.

Recommended actions:

- *Clarify the extent of difference in the composition of the spoil generated by the two methodologies.*
- *Undertake a full environmental assessment of potential ground and surface water impacts resulting from the change in methodology.*
- *Undertake a full environmental assessment of potential terrestrial and aquatic impacts resulting from the change in methodology.*
- *Undertake a full assessment of potential water quality impacts to Talbingo Reservoir resulting from the changed spoil composition and approved sub aqueous placement.*
- *Recommended condition of consent*
- *Tunnelling works are not to commence until a Subaqueous Emplacement Management Plan is prepared in consultation with EPA and completed to the satisfaction of the Planning Secretary and NPWS*

The existing conditions of approval provide adequate management and mitigation measures to manage the potential impacts of excavated material generated by the proposed TBM tunnelling method.

The concerns of DPIE BCD and NPWS regarding the potential impacts arising from the changed excavated material composition are acknowledged.

Revision of the exploratory tunnelling method from drill and blast to predominantly TBM method will result in a change to particle size distribution – essentially this excavated material will be finer in composition, with other excavated material characteristics essentially unchanged. While the excavated material generated by the TBM tunnelling method will be finer in particle size distribution compared to the drill and blast material, the existing management measures proposed to minimise and mitigate potential impacts, of both on-land and subaqueous emplacement of this material, are considered to remain suitable.

An assessment of potential impacts and management measures proposed for emplacement of the excavated material generated by the TBM tunnelling are outlined in the sections below.

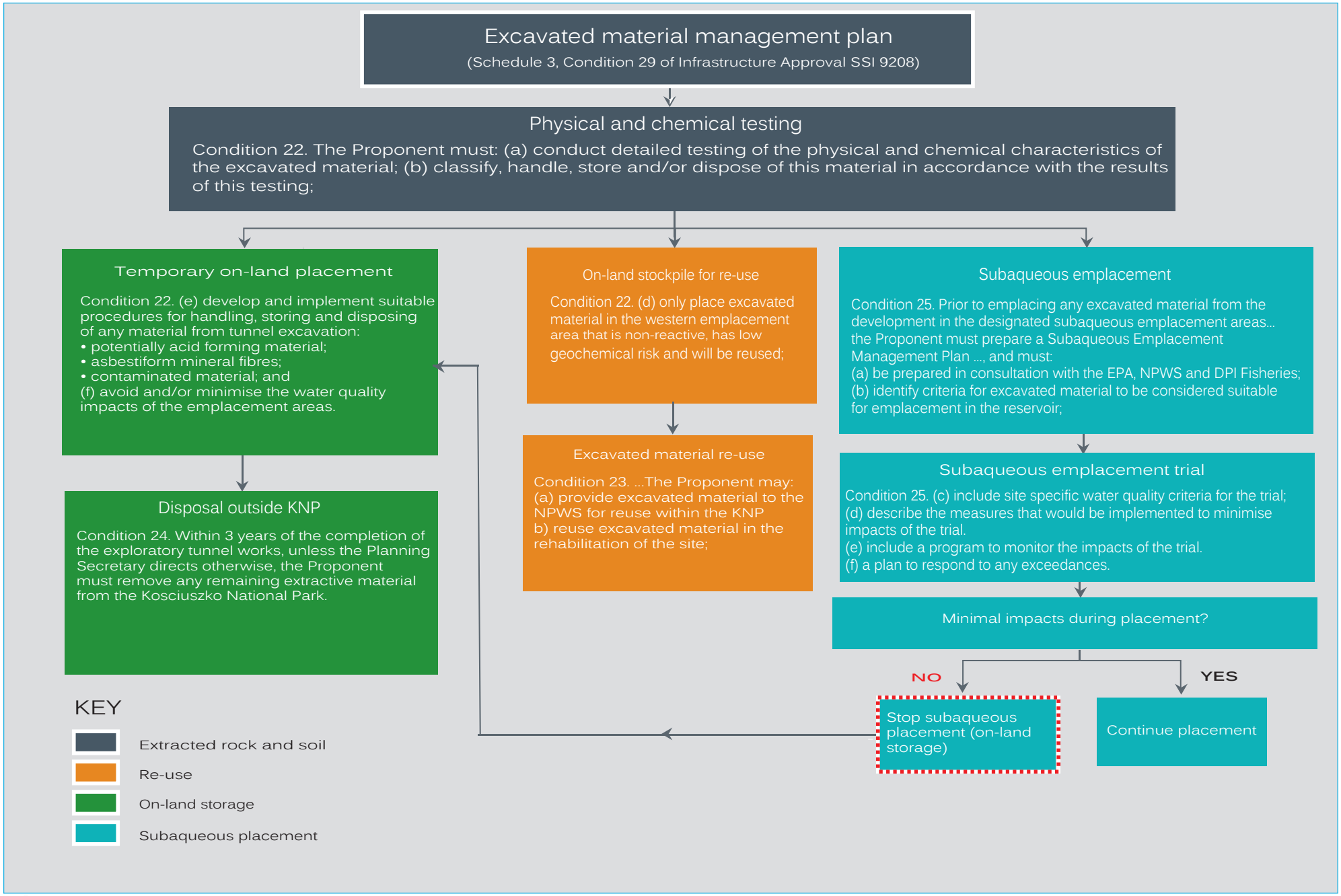
i Approved process for excavated material management

The current conditions of approval provide mechanisms and processes to safely manage excavated material in consideration of its characteristics and potential effects on the surrounding environment. These measures will be implemented from when the material is generated through to its disposal and apply to both drill and blast and, should it be approved, TBM tunnelling methods.

Once material has been excavated from the exploratory tunnel, it is subject to testing of its physical and chemical characteristics. The conditions of approval then require this material to be then classified, handled, stored and/or disposed of in accordance with the results of this testing. This means that the material will either be re-used, placed on land or placed subaqueously within Talbingo Reservoir as part of a trial program. A flow chart showing the approved process for excavated rock management and the relevant conditions of consent is provided in Figure 4.1.

The existing conditions of approval provide strict controls and processes for excavated material emplacement and its management. This process is outlined in the flow chart provided in Figure 4.1 and also in the corresponding conditions of approval, Schedule 3, Condition 22 and 23 which state:

> 22. The Proponent must:
>
> (a) conduct detailed testing of the physical and chemical characteristics of the excavated material;
>
> (b) classify, handle, store and/or dispose of this material in accordance with the results of this testing;
>
> (c) not place dredge material in the eastern and western emplacement areas;
>
> (d) only place excavated material in the western emplacement area that is non-reactive, has low geochemical risk and will be reused;
>
> (e) develop and implement suitable procedures for handling, storing and disposing of any material from tunnel excavation:
>
> - potentially acid forming material;
> - asbestiform mineral fibres;
> - contaminated material; and
>
> (f) avoid and/or minimise the water quality impacts of the emplacement areas.
>
> 23. Subject to obtaining the further approvals required under this approval, the Proponent may: (a) provide excavated material to the NPWS for reuse within the Kosciuszko National Park; (b) reuse excavated material in the rehabilitation of the site; (c) place excavated material in the designated subaqueous emplacement areas; and (d) return the excavated material to the exploratory tunnel.



snowy 2.0

EMM creating opportunities

Excavated rock management flow chart

Snowy 2.0
Response to Submissions
Modification 2

Figure 4.1

ii Disposal outside KNP

In the event that either the material is unsuitable for subaqueous disposal or the proposed methods for disposal of excavated material are found to be unsuitable for permanent placement, either within the reservoir or on-land, all excavated material would be removed from the KNP at the completion of the Exploratory Works. The conditions of approval provide a mechanism for the removal of excavated material from KNP if material through initial testing deems it unsuitable or the subaqueous spoil trial identifies unacceptable impacts of in-reservoir placement of excavated material. This requirement is outlined in Schedule 3, Condition 24 of the approval and states:

> 24. Within 3 years of the completion of the exploratory tunnel works, unless the Planning Secretary directs otherwise, the Proponent must remove any remaining extractive material from the Kosciuszko National Park.

iii Impacts to emplacement methods

As outlined in the Exploratory Works EIS, subject to geochemical testing of the rock material, excavated rock will either be re-used, placed on land or placed subaqueously within Talbingo Reservoir. The change in excavated material composition arising from the change to tunnelling method will have no consequence for the requirements for material identified as suitable for re-use. Therefore, no impacts are expected arising from the material for re-use. An assessment of potential impacts to water and biodiversity due to the subaqueous and on-land placement of excavated material generated by TBM tunnelling is provided in the sections below.

iv Subaqueous emplacement

As outlined in the Exploratory Works EIS and the conditions of approval, following identification of suitable material through testing of the physical and chemical characteristics, the subaqueous emplacement of excavated material would be subject to an initial trial program of up to 50,000 m^3 of excavated material. A Subaqueous Emplacement Management Plan will be prepared prior to commencement of these activities. Importantly and as required under the conditions of approval, this plan will identify criteria for excavated material considered suitable for placement within the reservoir. The testing of the material's physical and chemical characteristics and its potential effects on water quality and aquatic habitat within the reservoir will be considered in the development of this criteria.

The change in tunnelling method from drill and blast to TBM does not change this process as outlined in the conditions of approval.

The Subaqueous Emplacement Management Plan will be prepared in consultation with EPA, NPWS and DPI Fisheries. Schedule 3, Condition 25 requires the following:

Prior to emplacing any excavated material from the development in the designated subaqueous emplacement areas in the Talbingo Reservoir, the Proponent must prepare a Subaqueous Emplacement Management Plan for the development to the satisfaction of the Planning Secretary. The plan is to focus initially on the proposed trial of emplacing up to 50,000m^3 of excavated material into the designated subaqueous emplacement area in Plain Creek Bay, and must:

> (a) be prepared in consultation with the EPA, NPWS and DPI Fisheries;
>
> (b) identify criteria for excavated material to be considered suitable for emplacement in the reservoir;
>
> (c) include site specific water quality criteria for the trial;
>
> (d) describe the measures that would be implemented to:
>
> - minimise the water quality impacts of the trial;

- minimise the aquatic habitat and species impacts of the trial; and

- stabilise the emplaced material within the subaqueous emplacement area;

(e) include a program to monitor the impacts of the trial on water quality, aquatic habitat and species and the bed of the reservoir in the subaqueous emplacement areas; and

(f) a plan to respond to any exceedances of the surface water trigger levels and/or assessment criteria and mitigate and/or offset any adverse surface water impacts of the development.

The management measures outlined in this condition of approval provide suitable monitoring, management and controls to minimise potential impacts arising from subaqueous placement whilst allowing for uncertainty regarding the composition of the excavated material. The proposed trial provides a program incorporating suitable environmental controls for the subaqueous placement of excavated material and outlines a process to ensure impacts to water quality and aquatic habitat and species remain within appropriate levels.

The development of the Subaqueous Emplacement Management Plan and the implementation of the strict controls of the subaqueous emplacement trial are therefore expected to be unaffected by potential changes to the composition of excavated material arising from the change to TBM tunnelling method. Government agencies as required by the conditions of approval will be consulted through the preparation of the Subaqueous Emplacement Management Plan.

v Temporary on-land emplacement

The temporary on-land emplacement areas required for the management of excavated rock generated by the proposed change in tunnelling method to include TBM remain consistent with the existing emplacement area designs and footprints approved for the Exploratory Works. Therefore, no additional direct impacts to terrestrial or aquatic ecology are expected.

a Emplacement design and construction

An assessment of the change to excavated material composition to the design and construction of the on land emplacement areas is provided in the section below

Modification 2 proposes the use of both tunnel boring machines (TBM) and drill and blast methodology during tunnelling of the Exploratory Works project. Drill and blast processes will be used until the TBM can be established and operated on site, and to excavate smaller areas of the tunnel which cannot be accessed by the TBM.

Due to the two distinct methods of excavation applied, the particle size distribution (PSD) of excavated material produced from the tunnelling processes will vary.

The TBM excavation process (discs mounted on the cutterhead) typically creates a smaller PSD, which can be affected by rock type, distance between the discs and force applied by the TBM. Regardless, the excavated rock produced is one which is much more uniform in size, varying from approximately 0 mm–75mm in size.

In comparison drill and blast excavated rock can vary between 20mm–over 1000 mm in size (as shown in Figure 4.2). The PSD for drill and blast excavated rock can also depend on various factors such as the geology, borehole diameter, drill pattern and blast charge used.

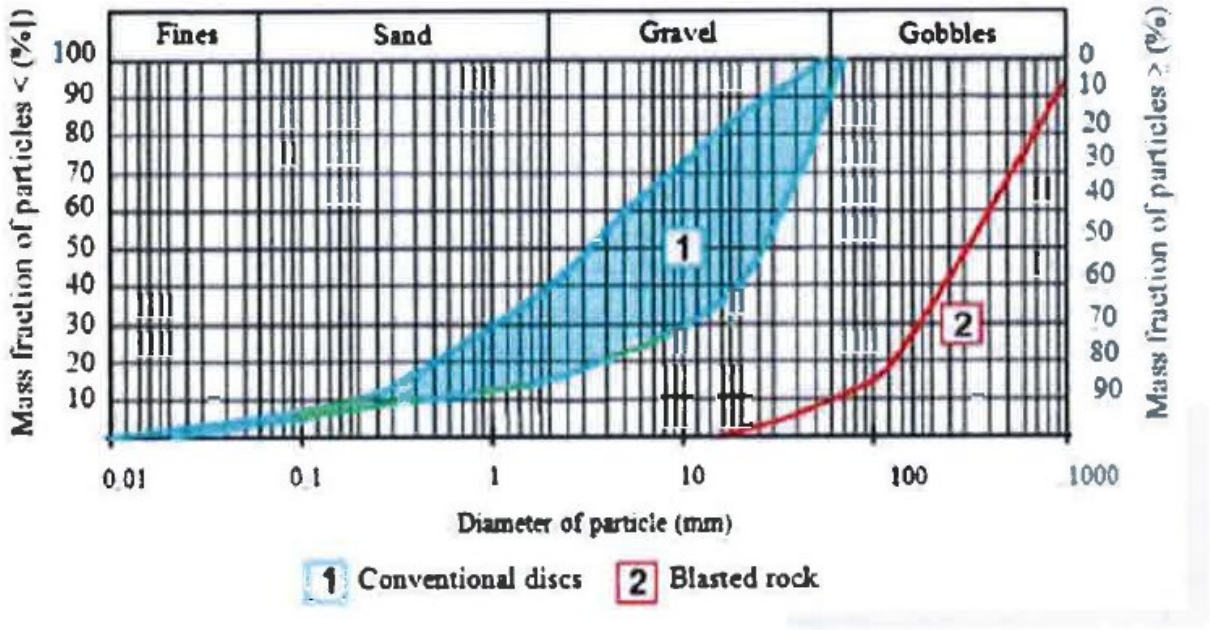


Figure 4.2 Particle size distribution for TBM and blasted rock (ITA 2019)

The uniformity of the TBM produced rock will provide a much more consistent particle size which will assist in managing the emplacement area.

This consistency in PSD produced from the TBMs will:

- improve compaction rates in the emplacement areas;
- improve the ability to treat any potential acid forming material encountered during tunnelling;
- provide increased opportunities for reuse of the material in areas of fill or construction processes;
- have a reduced bulking factor (or available air space), resulting in a slightly reduced volume of material compared to that which would be reduced by a drill and blast process.

Not all material placed in the eastern and western emplacement areas will be from the TBMs. Other excavated rock and soils sent to the emplacement areas will come from general earthworks at the accommodation camp (~90000 m^3) and roadworks (~80,000 m^3)

The Exploratory Works EIS estimated that 750,000 m^3 of bulked materials will be excavated. As the emplacement areas are being designed with a capacity of approximately 1,000,000 m^3, there will be no change made to the design of the size of the eastern or western emplacement areas.

b Management of potentially acid forming material

As noted in the Exploratory Works Excavated Material Management Plan, two samples collected at the proposed depth of the exploratory tunnel are potentially acid forming (PAF) with an acid forming potential of between 4.6–6.3 kg H_2SO_4/t. It should be noted however, that the other rock samples obtained had excess acid neutralising capacity (ANC) and are classified as acid consuming (AC). As such there is potential that any acidity produced by PAF rock is consumed by the AC rock.

Geochemical sampling and pre-classification will occur regardless of the tunnelling method used as detailed within the Stage 2 Excavated Material Management Plan. This includes analysing samples for acid producing potential and acid neutralising capacity and comparing the difference to determine the non-acid producing potential (NAPP) (Table 4.1).

Table 4.1 PAF classification criteria

Classification	NAPP (kg H_2SO_4/t)	NAG pH	ANC:MPA Ratio
Potentially acid-forming	>10	<4.5	<2
Potentially acid-forming – low capacity (PAF-LC)	0 to 10	<4.5	<2
Uncertain	Positive	≥4.5	<2
	Negative	<4.5	-
Non-acid forming (NAF)	Negative	≥4.5	≥2
Acid consuming material (ACM)	Less than -100	≥4.5	>2

Notes: Samples that fall outside of the above criteria are also classified as uncertain (eg >1%S)
Samples with 0.1% or less are classified as barren

Excavated spoil confirmed as containing PAF material will be diverted to the eastern emplacement area where it will be tested and thoroughly blended with acid neutralising rock (ie limestone) to create a neutral spoil mass. The volume of ANC material in each layer will be determined stoichiometrically so that the maximum potential acidity from the overlying layer of spoil and sediment is treated.

The rate of application of acid neutralising rock will depend on the results received. Regardless of the tunnelling method used, the results and therefore application rates of ANC will not be known until excavation occurs and sample results are received. As outlined within the Excavated Material Management Plan, if required, other acid neutralising material such as lime will be used to neutralise the excavated material.

Therefore, though the application rate of ANC or lime may change based on the results of the samples received, the process for the treatment and management of PAF material remains identical regardless of the tunnelling methodology used on the project.

c Surface water impacts

An assessment of impacts to surface water arising from the on-land emplacement of TBM excavated material is provided below.

Revision of the exploratory tunnelling method from drill and blast to predominantly TBM method will result in a change to particle size distribution - essentially this excavated material will be finer in composition, with other excavated material characteristics essentially unchanged.

Unmanaged, a finer excavated material potentially presents a risk of surface water quality impacts resulting from land-based emplacement due primarily to:

- Potential for instability/erosion: Risk to water quality from emplaced excavated material being eroded and transported downstream.

- Potential for acid rock drainage (ARD) due to the increased surface area of potentially acid forming rock (PAF), and related geochemical risks. Risk to water quality in this case results from release or discharge of seepage that accumulates in the emplacement.

The water management approach for temporary land based excavated material emplacement that was presented in the Exploratory Works EIS involves:

- Characterisation of excavated material into lower and higher geochemical risk materials.
- Placement of lower risk materials into an emplacement area with controls focused on surface stabilisation and minimising erosion potential.
- Placement of higher risk materials into an emplacement area with controls addressing surface stabilisation and minimising erosion potential, but also managing ARD risks through:
    - the selective placement of PAF material with acid consuming materials (either in-situ or imported); and
    - capture of all seepage, to be irrigated back to the emplacement to promote evaporative losses or treated in the process water treatment plant prior to discharge to Talbingo Reservoir.
- Establishment of clean water diversion measures around all emplacement areas.
- Comprehensive water monitoring including sites upstream, within and downstream of the emplacement areas.

This approach is considered suitable to manage excavated material from either drill and blast or TBM methods.

On this basis, the currently approved management measures associated with the temporary land storage of excavated materials is considered suitable to minimise and manage potential water quality impacts from stored materials generated from the tunnel using the proposed change in method to TBM. No additional management measures are required.

vi Dredge material

Modification Report section 6.2.1 (page 51), states "dredge spoil from Modification 2 barge ramp construction- will be placed within the designated subaqueous spoil placement area at Ravine Bay/Middle Bay." NPWS understands initial sampling of this material identified the presence of some heavy metals. NPWS also understands there is uncertainty regarding subaqueous spoil placement within Talbingo Reservoir as part of the Main Works EIS assessment.

Recommended condition of consent

Dredge material from Talbingo Reservoir is to not be temporarily or permanently stored on land in KNP

Schedule 3, Condition 22 of the existing Exploratory Works approval requires that:

> The Proponent must:
>
> … (c) not place dredge material in the eastern and western emplacement areas; …

Accordingly dredge material from Talbingo Reservoir will not be placed in the eastern and western emplacement areas. Modification 2 proposes no change to this requirement.

A dredge management plan will also be prepared in accordance with Schedule 3, Condition 34(d) prior to any dredging activities and in consultation with relevant agencies.

vii Heritage

The commitment to update the current Aboriginal Heritage Management Plan under section 7.2 and Table 7.1 (page 83) is noted.

Recommended actions

All operational maps and plans must also be reviewed and updated to ensure the new boundaries of works are consistent with the proposed modification changes. All older versions of operational maps and plans should be removed from circulation to ensure there are no inadvertent impacts to Aboriginal cultural heritage values due to any out-of-date mapping.

The Aboriginal Heritage Management Plan will be updated to reflect proposed works and the disturbance footprint as modified.

viii Biodiversity

Biodiversity

The Department acknowledges that considerable effort has been made to reduce disturbance and supports measures for avoiding impacts to threatened fauna habitat.

The residual impacts requiring offsets include 0.93 ha of Eastern Pygmy-possum habitat and 0.06 ha of Smoky Mouse habitat and direct impacts to 1.62 ha of native vegetation consisting of six plant community types. The resulting credit requirement is 32 species credits and 36 ecosystem credits.

An additional area of 0.38 ha of native vegetation will be trimmed to 1.1 m high, including lopping or removal of any trees present. The Department understands that these trees require further assessment for breeding or roosting habitat of hollow-dependent threatened fauna.

This comment is noted. Additional assessment of tree removal and trimming is provided in the Biodiversity Offsets Report provided in Appendix C.

Native vegetation trimming and tree removal

Modification Report Section 3.3.2 (page 21) states "to minimise impacts to potential Smoky Mouse habitat it is proposed to trim vegetation and selectively remove trees as required along some sections of the upper sections of Lobs Hole Ravine Road. Vegetation removal will occur at- a width of 7.4 m and 1.1 m height for the extent of upper Lobs Hole Ravine Road."

BDAR Section 2.4.2 lacks specific detail about trimming and tree removal along Lobs Hole Ravine Road south to enable transport of the tunnel boring machine. It is unclear how trimming to 1.1 m height and removal of trees will occur without impact to Smoky Mouse habitat.

Modification Report Section 3.3.4iii (page 27) identifies the removal of dangerous trees along Lobs Hole Ravine Road north. NPWS understand that a full tree risk assessment (not included as part of Modification 2) has been conducted.

The BDAR should identify specific mitigation measures for the residual impacts being assessed. Impact mitigation measures in Table 7.1 (pages 97-99) rely on general reference to pre-clearing and vegetation clearing protocols in the EMM (2019) Biodiversity Management Plan (BMP) to mitigate impacts on threatened species habitat from trimming and tree removal.

The Department understands that the EMM BMP has been superseded by construction BMPs developed for Exploratory Works Stage 1 by Leed (approved in May 2019) and Stage 2 by Future Generation (approved in August 2019).

Recommended actions

- *Describe in detail the techniques and equipment to be used for vegetation and tree removal, including trimming to 1.1 m*
- *Clarify the extent of dangerous trees identified for removal along Lobs Hole Ravine Road (north) and ensure they are included in the biodiversity assessment*
- *Clarify the impact and the exact number of trees required to be trimmed and or removed completely along Lobs Hole Ravine Road*
- *Specify the 'pre-clearance process' and 'clearing procedures' for mitigating impacts of Modification 2 due to removal of vegetation and threatened species habitat and indirect impacts due to trimming of native vegetation and selective tree lopping and removal, including:*

- *best practice tree trimming to minimise long-term impact to threatened species habitat due to subsequent tree death*
- *determining whether a tree is lopped or removed, such as proportion of canopy removal that triggers complete tree removal*
- *minimising damage to understorey vegetation*
- *delineation of area to be trimmed to 1.1 m*
- *monitoring and reporting procedures for tree removal by licensed wildlife handlers and qualified ecologists.*

Recommended condition of consent

Procedures for tree· removal and vegetation trimming must ensure that damage to surrounding vegetation is avoided.

A detailed response to this matter is provided in Appendix C.

Threatened species and targeted survey methods

The northern section of Lobs Hole Ravine Road did not have targeted threatened species survey due to timing. BOAR Section 6.3.3 (page 60) states that "where required, additional pre-clearance surveys will be completed within this area before construction works are undertaken", and the results are to be addressed in the response to submissions (RTS).

The BAM requires the assessment results and credit requirements to be identified within the BOAR. The Department's strong preference is that a revised and complete BOAR be provided rather than parts of the assessment being presented in the RTS.

The use of upper-storey vegetation by Smoky Mouse, including tree hollows, is not well understood. Any habitat element within the relevant plant community types may be utilised by Smoky Mouse, including trees.

Recommended actions

- *Clarify the location of potential habitat that has not been surveyed for each species in Table 6.4*
- *Explain the process for determining where a survey will be required*
- *After clarifying the trees to be removed, update the BDAR to consider the potential impact of tree canopy removal on Smoky Mouse and hollow-dependent fauna, including Gang Gang Cockatoo*

After pre-clearing surveys have been completed during the correct months, provide a revised and complete BDAR Smoky Mouse

A detailed response to this matter is provided in Appendix C.

Smoky Mouse

The assessment identified that 0.06 ha of Smoky Mouse habitat will be impacted by Modification 2. The Department is concerned with the incremental nature of how impacts to Smoky Mouse are being considered. The Exploratory Works EIS, including the original approval plus Modification 1 and 2, and then Main Works impacts in the same location will result in an increasing cumulative impact that makes it difficult to contextualise for individual assessments. In the absence of an overall assessment, we request an updated summary of cumulative impact to Smoky Mouse habitat with each separate development application.

It is essential that the mitigation measures described in the EMM BMP (2019), as mentioned in BDAR Section 7.2.4 (page 95) will continue to be implemented to reduce the potential of vehicle strike on Smoky Mouse.

Recommended actions:

- *Include a table of incremental loss of Smoky Mouse habitat for all Snowy 2.0-related projects and modifications, including trimming*

Ensure current measures to reduce potential vehicle strike continue to be implemented through Biodiversity Management Plans developed for Exploratory Works modifications and future Snowy 2.0 projects

Section 7.3.2 of the Exploratory Works Modification 2 BDAR (EMM 2019b) outlines the cumulative loss of Smoky Mouse habitat for all Exploratory Works projects, being 1.83 ha. As a result of design changes since exhibition, an additional 0.13 ha of Smoky Mouse habitat will be impacted and a reduction of 0.06 ha of Smoky Mouse habitat. Therefore, the cumulative loss of Smoky Mouse habitat for all Exploratory Works projects will be 1.90 ha.

Current measures in place to reduce the potential vehicle strike as outlined in the BMP (EMM 2019a) will continue to be implemented in the additional Modification 2 areas. The proposed restriction on night-time movements along Lobs Hole Ravine Road South will be maintained.

Regent Honeyeater

Regent Honeyeaters have recently been recorded flying over Lobs Hole.

Recommended action:

Include a protocol for stopping work if Regent Honeyeaters are sighted and observed to be foraging or breeding within the project area. An appropriately experienced ecologist is to determine whether Regent Honeyeaters are using the plant community type being impacted. Work should not to recommence in that vegetation type until the breeding or foraging period is complete.

The biodiversity management plan prepared in accordance with Schedule 3, Condition 6 of the Exploratory Works infrastructure approval includes an unexpected threatened species find procedure. This procedure is applicable to all activities that have the potential to impact any threatened flora and fauna, including the Regent Honeyeater.

Mitigation measures

Section 2.4.2 (page 14) describes maintenance works within the existing road and disturbed area along Lobs Hole Ravine Road north.

Recommended action:

Include a mitigation measure stating that spoil and sediment resulting from clearing of existing culverts and temporary removal of roll-overs must not to be pushed or piled into native vegetation.

The disturbance footprint assessed in the Modification 2 assessment report represents the extent of impacts from the proposed works including management of any excavated material. The excavated material resulting from road upgrades to Lobs Hole Ravine Road North will be managed in accordance with the Excavated Material Management Plan which provides suitable measures for the characterisation and management of this material.

Additional mitigation measures to minimise the impacts of clearing of culverts on native vegetation are outlined in Appendix C.

4.5 Environment Protection Authority

I refer to your correspondence dated 2 November 2019, requesting advice from the NSW Environment Protection Authority's ("EPA") on Snowy 2.0 Exploratory Works Modification 2 lodged with the Department of Planning, Industry and Environment ("OPIE").

The EPA understands the proposed modification includes amongst other things, altering the exploratory works tunnelling method from drill and blast to predominately tunnel boring machine ("TBM"). The EPA has reviewed the Modification 2 Assessment Report (EMM, October 2019) and provides the following comments for consideration by DPIE.

Although the assessment report describes a change in tunnelling methodology, it does not fully the describe the changes in the physical and chemical properties of the resultant excavated material. Furthermore, the report references storage, management and disposal of the excavated material, including an initial trial program of rock emplacement within Talbingo Reservoir of up to 50,000 m3. The report does not however provide sufficient information to robustly quantify or assess the environmental impacts of the proposed changes, particularly in relation to the proposed trial subaqueous rock emplacement program.

As a result, the environmental impacts arising from the management and disposal of excavated material proposed in the assessment report are not able to be determined. The EPA recommends that additional information be requested from the proponent so that the potential impacts of excavated material storage and disposal can be thoroughly assessed.

Information is provided in Section 4.4.1 above which responds to matters raised related to excavated material management.

4.6 Transport for NSW

In TfNSW's submission, recognition and support is given to the continued willingness of the applicant and their consultants to work with TfNSW and SMRC to ensure potential impacts are adequately mitigated. Matters raised by TfNSW are addressed in the sections below.

Traffic movements:
TfNSW notes that the information provided details that there will be no changes to previously forecast traffic movements along the Snowy Mountains Highway as part of the exploratory works approval (i.e. those forecast submitted as part of Modification 1 to SSI 9208) as a consequence of this modification. No supporting justification for this position has been provided noting the increase in size of the onsite accommodation camp (from 152 to 250) and the revision of the approved transport strategy to reduce the use of barges and therefore require all materials and equipment required for Exploratory Works to be delivered by road.

TfNSW seeks some additional clarification in relation to the above.

The traffic volumes predicted and assessed for the approved Exploratory Works (including traffic volume increases under Modification 1) were based on a conservative estimate of the project construction traffic. Further detailed design and project planning has confirmed that the construction traffic required to complete the Exploratory Works as proposed under Modification 2 remain within the approved peak hourly and daily construction traffic volumes.

The matters raised by Transport for NSW regarding the increased capacity of the onsite accommodation camp and revised transport strategy will not increase the project construction traffic volumes beyond what was previously assessed and approved under Modification 1. The proposed changes to the transport strategy and the accommodation camp capacity are expected to result in minimal changes only to the predicted construction traffic volumes. The efficiencies gained through other aspects of the project planning and the conservative estimates used in the previous traffic impact assessment mean that the resulting traffic volumes will not exceed those previously assessed and approved.

Concrete Segment Sourcing Information
TfNSW notes tunnelling is planned to commence in August 2020. Noting the approval and construction time for the proposed segment factory in Cooma (SSI 10034) details are requested on where the segments will be sourced if they are required in advance of the construction and operation of the segment factory in Cooma. Specifically, details on the number of segments that will be required in advance of the factories operation, details on the route that will be taken to deliver the segments to the project site, details on the type of vehicles to be used, (including their size and their associated carrying capacity), a vehicle movement plan for the transport of the concrete segments that addresses heavy vehicle movements during peak holiday periods, etc.
TfNSW requests this issue be addressed.

Tunnel segments required for the Exploratory Works are expected to be entirely sourced from the proposed Segment Factory subject to application number SSI-10034 which is currently being assessed by DPIE. Should an alternative source for tunnel segments be required for the Exploratory Works, the potential for traffic and transport impacts will be assessed and approval sought as required.

Impact on journey times and identification of appropriate measures
TfNSW notes that no assessment of the impact of the submitted modification on journey times for motorists along the classified road network has been undertaken or appropriate measures identified to minimise delays and to ensure road users are kept well informed of the increased traffic and changes driving experience (e.g. slow vehicle turn out bays, electronic variable message signage at key locations on the road network, etc).

TfNSW requests this issue be addressed.

The proposed modification is not expected to result in significant impacts to journey times. Modification 2 will not result in any exceedances of the peak daily or hourly traffic volumes previously assessed and approved. Snowy Hydro continues to consult closely with TfNSW and RMS regarding the impacts to journey times associated with the broader Snowy 2.0 including the proposed Main Works and the Segment Factory.

Snowy Hydro has been working in consultation with TfNSW and RMS to develop an arrangement consisting of several turn out bays placed in strategic locations along the Snowy Mountains Highway. It is anticipated that approximately four slow vehicle turn-out bays will be constructed on the northbound route to site, and two new turnout bays constructed on the southbound route along the highway. The specific locations of these will be determined by TfNSW to ensure that they are effective in mitigating the impacts of project traffic on public users. These turn-out bays will be managed by TfNSW, including approvals and construction. It is expected that these works will be completed by the start of the winter months, 2020.

The following management measures are also being considered in consultation with TfNSW and RMS to minimise impact on journey times for motorists:

- communications and variable messaging signs will be used to warn drivers in addition to potential radio etc; and

- there is a sub working group with TfNSW that is working specifically on OSOM [oversize overmass vehicle] and communication strategy which will drive ultimate design approach.

Impact on existing intersections and identification of appropriate upgrades

Intersection	***Proposed Upgrade*** *(as detailed in the Modification 2 Assessment Report – 17 October 2019)*	***TfNSW Comments***
Monaro Highway/Sharp Street and its intersection with Bombala Street.	*Alterations to the existing roundabout to enable OSOM vehicle movements.*	*As has been advised by TfNSW in its submissions for both SSI 9687 (Snowy 2.0 Main Works) and SSI 10034 (Snowy 2.0 Segment Factory) it is concerned with the impact the development, as a whole, will have on the existing operation of the intersection as well as the impacts of increased heavy vehicle traffic on pedestrian movements across Sharp Street at this location. Noting the above and the high level concept designs that have been submitted as part of this modification, TfNSW is concerned with the changes/options that have proposed. Specifically:* *- The concept designs provided contain insufficient detail to enable an assessment to be undertaken. Refer to additional comments under the heading 'Strategic/Concept Designs' below.* *- No swept path plans have been provided to demonstrate that vehicles associated with this SSI application (e.g. largest load size) can undertake a manoeuvre through the altered roundabout. It is also unclear if the existing splitter islands will create an issue for the largest vehicle;* *- Additional details are required for Concept 03 design to demonstrate that installing of movable planters to provide greenery will not impact on sight lines for the roundabout;* *- Reducing the height of the roundabouts central island at the intersections in Cooma to make them traversable for the OSOM vehicles would provide the opportunity for smaller vehicle to drive over them without slowing down to negotiate the roundabout correctly; and* *- An environmental assessment for the upgrade to the existing treatment is required Refer to additional comments under the heading 'Environmental Impacts' below.*
Monaro Highway/Sharp Street and its intersection with Vale Street	*Alterations to the existing roundabout to enable OSOM vehicle movements.*	*As detailed above TfNSW is concerned with the changes/options that have proposed and seeks the submission of additional information to address swept paths, sight lines and the concerns raised about reducing the height of the roundabouts central median island. A concept design and associated environmental assessment for the changes to the existing treatment is required. Refer to additional comments under the headings 'Strategic/Concept Designs' and 'Environmental Impacts' below.*

Snowy Mountains Highway with Lobs Hole Ravine Road (North)	*Nil*	*TfNSW is concerned with the anticipated vehicle movements from the Snowy Mountains Highway into Lobs Hole Ravine Road (North) and believes that an appropriate treatment has not been identified at this intersection (e.g. BAL treatment in accordance with Figure 8.2 Austroads Guide to Road Design Part 4A as well as sealing for a minimum of 20m into Lobs Hole Ravine Road (North) to prevent the transfer of gravel/mud onto the Snowy Mountains Highway). A concept design and associated environmental assessment for the upgrade to the existing treatment is required. Refer to additional comments under the headings 'Strategic/Concept Designs' and 'Environmental Impacts' below.*
TfNSW requests the submission of additional information to address above comments.		

Cooma roundabouts

Snowy Hydro has been working with TfNSW and RMS in relation to the external road and intersection upgrades required for the Snowy 2.0 project generally, including Exploratory Works, Main Works and the Segment Factory.

The detailed designs for the proposed Cooma roundabout upgrades are yet to be finalised, with the preferred strategic/concept design to be selected based on further detailed design and project planning.

Indicative swept path diagrams are provided in Figure 4.3 and Figure 4.4 below which show the indicative path of the largest OSOM vehicle movement through the two intersections.

The concept designs provided in Appendix B of the Modification 2 Assessment Report are reproduced in Figure 4.5–4.8 below and provide options for the roundabout upgrades to enable OSOM vehicles to safely traverse the intersections.

The indicative swept path assessment provided in Figure 4.3 and Figure 4.4 shows that some modifications would be required for the roundabouts, refuge islands and street signage.

The final treatment selected for the roundabout upgrades will depend on the vehicle used for the maximum OSOM movements. The proposed treatment will seek to minimise changes to the existing roundabout where practical with the design modified based on the vehicle selected for the maximum oversize movements. The proposed options for roundabout upgrades will allow OSOM movement to pass over the roundabout and maintain the existing roundabout size and kerb consistent with existing conditions for large vehicles. Some existing fixed signage may need to be replaced with removable signs to allow them to be taken down for oversized movements. The existing kerb is expected to be used and will prevent local traffic from running over the roundabout. If required, OSOM movements may use sandbags or similar to reduce impacts to the kerbs.

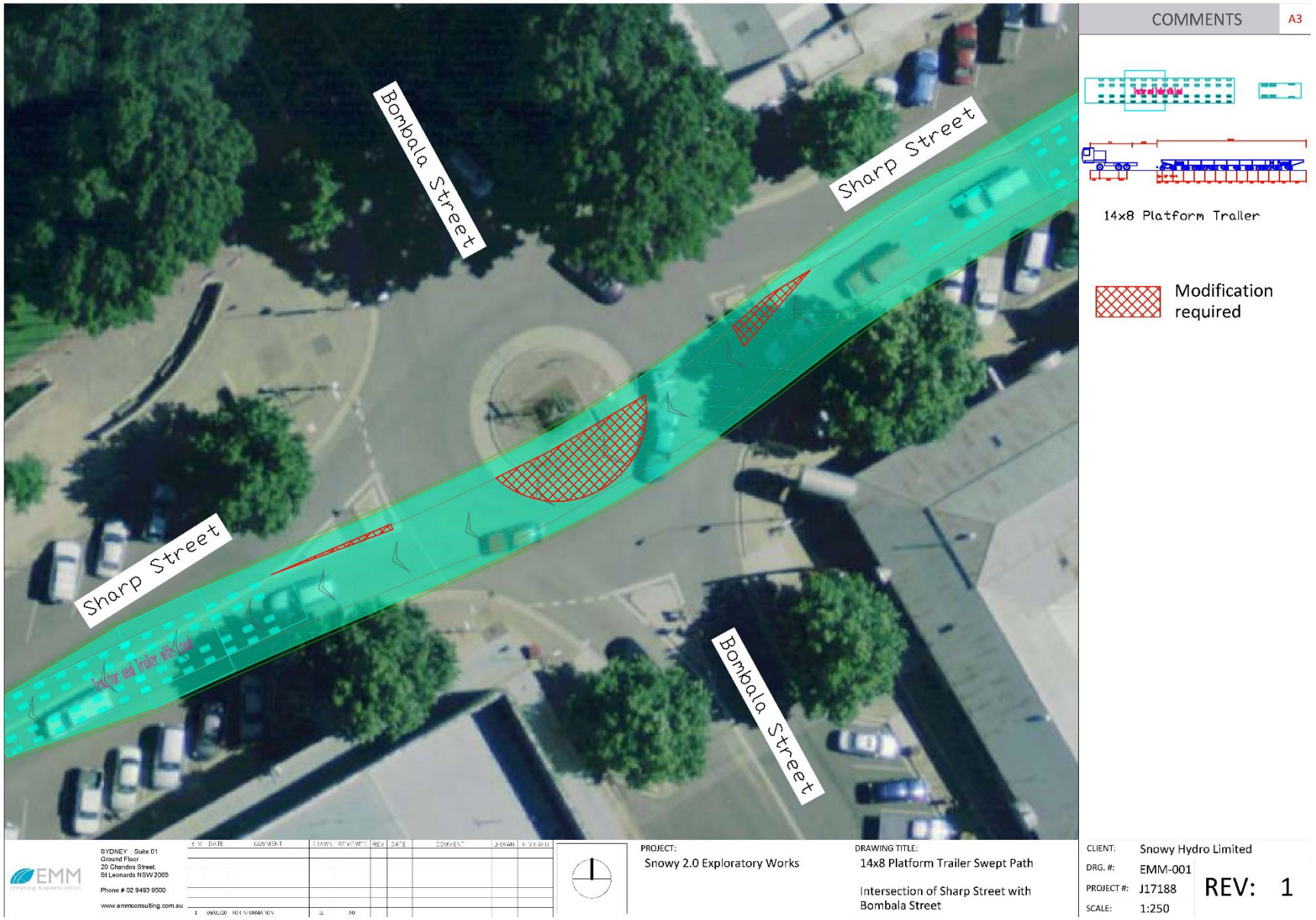


Figure 4.3 **Indicative swept path for Monaro Highway/Sharp Street and its intersection with Bombala Street**

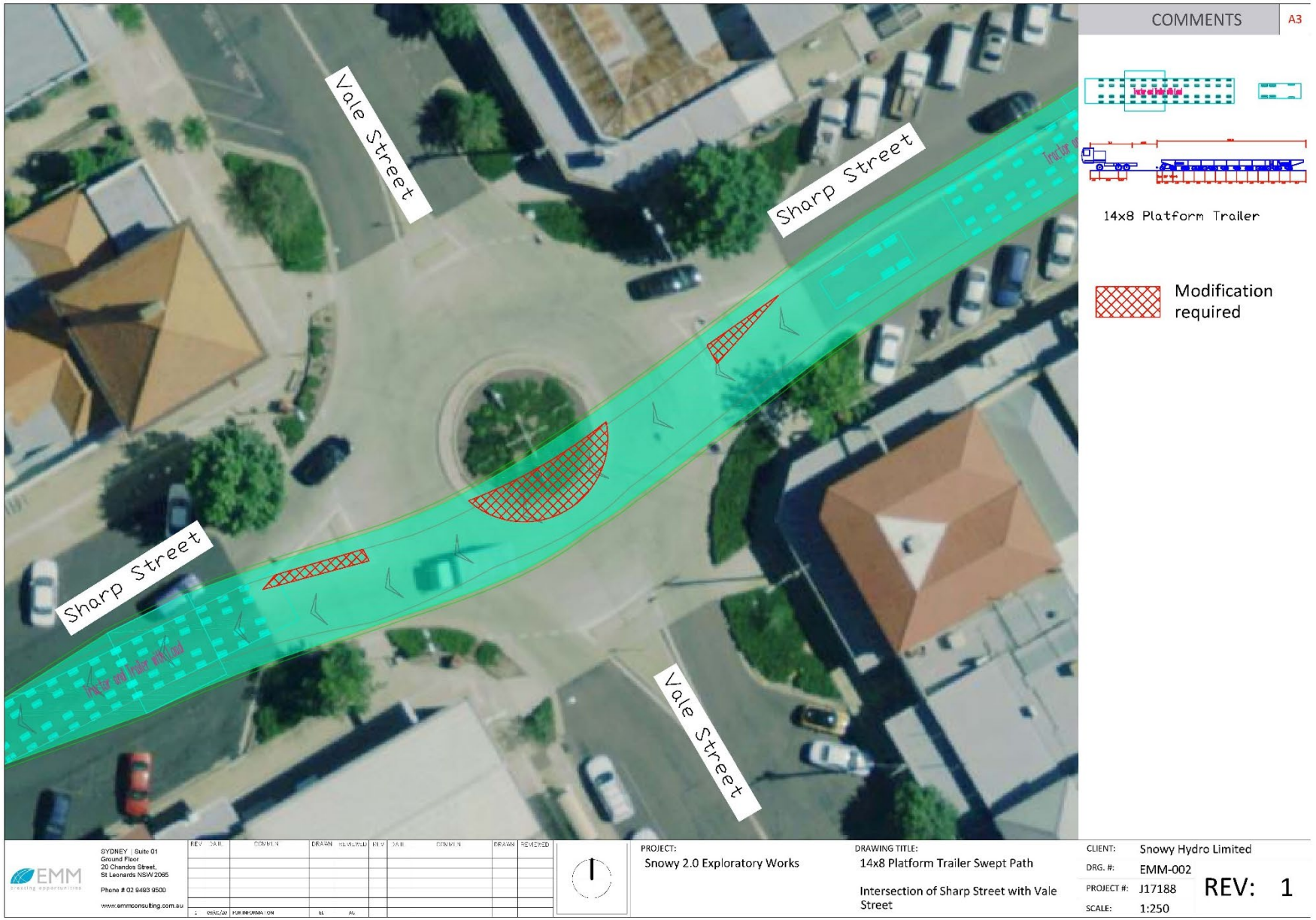
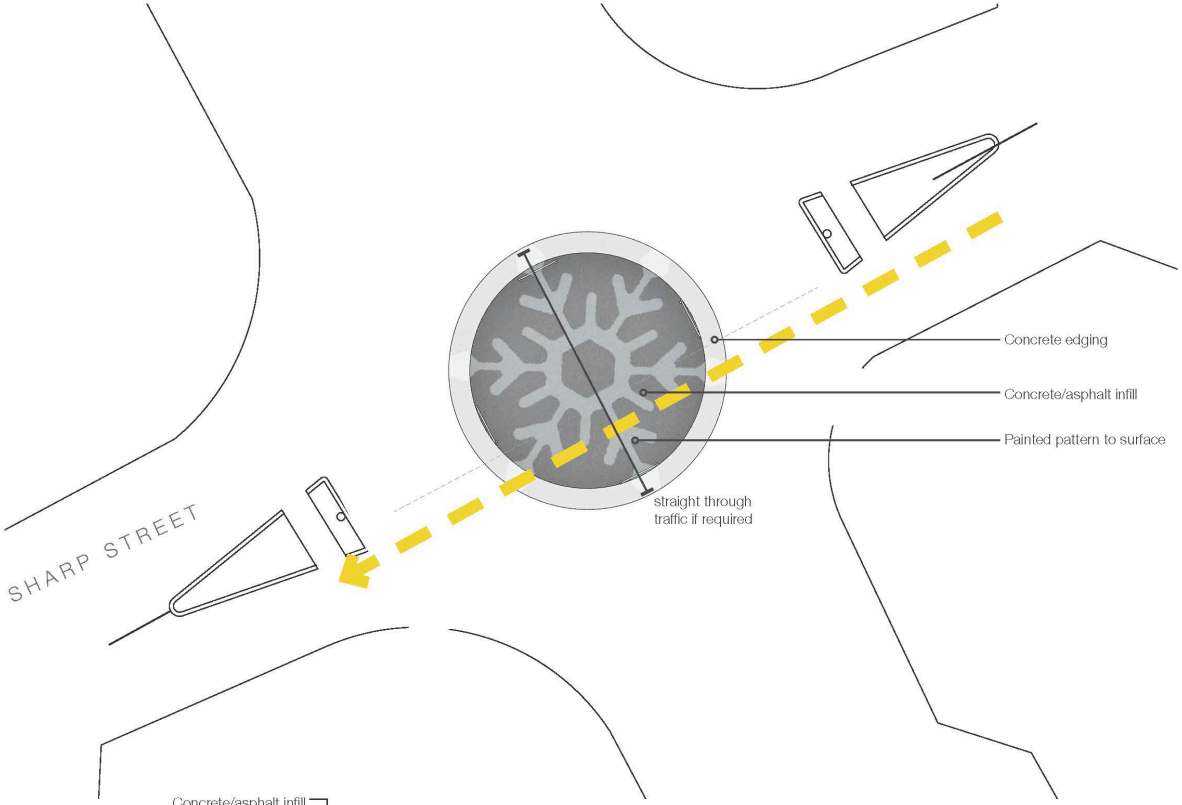


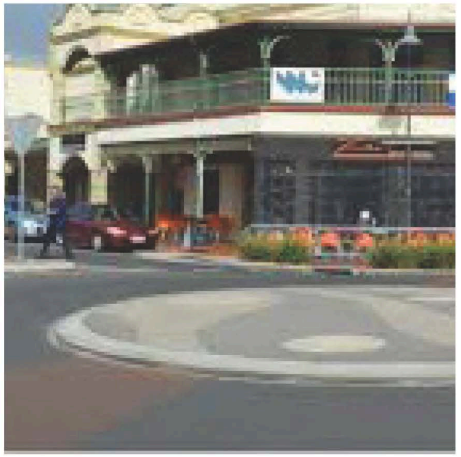
Figure 4.4 Indicative swept path for Monaro Highway/Sharp Street and its intersection with Vale Street



CONCEPT 01 KEY IDEAS

- Option developed to allow Oversized vehicle movement to pass over roundabout and utilise hardstand area as shown
- Retain definition of roundabout to match existing size and conditions for vehicle movements
- Existing roundabout size and kerb to remain matching current conditions for large vehicles
- Some existing signage may need to be re-placed with removable signs to allow them to be taken down for oversized movement
- Provide patterning to create interest

Precedent image: patterned concrete roundabout



Concept 01: Patterned concrete

Sharp Street, Cooma

Date Issued: 28.05.2019| Revision: 1
SMEC Project Reference: Snowy2.0 | Drawing: LC-01
Drawn by: N. Lamb

NTS

Figure 4.5 Cooma roundabout upgrades – Concept 01 – patterned concrete

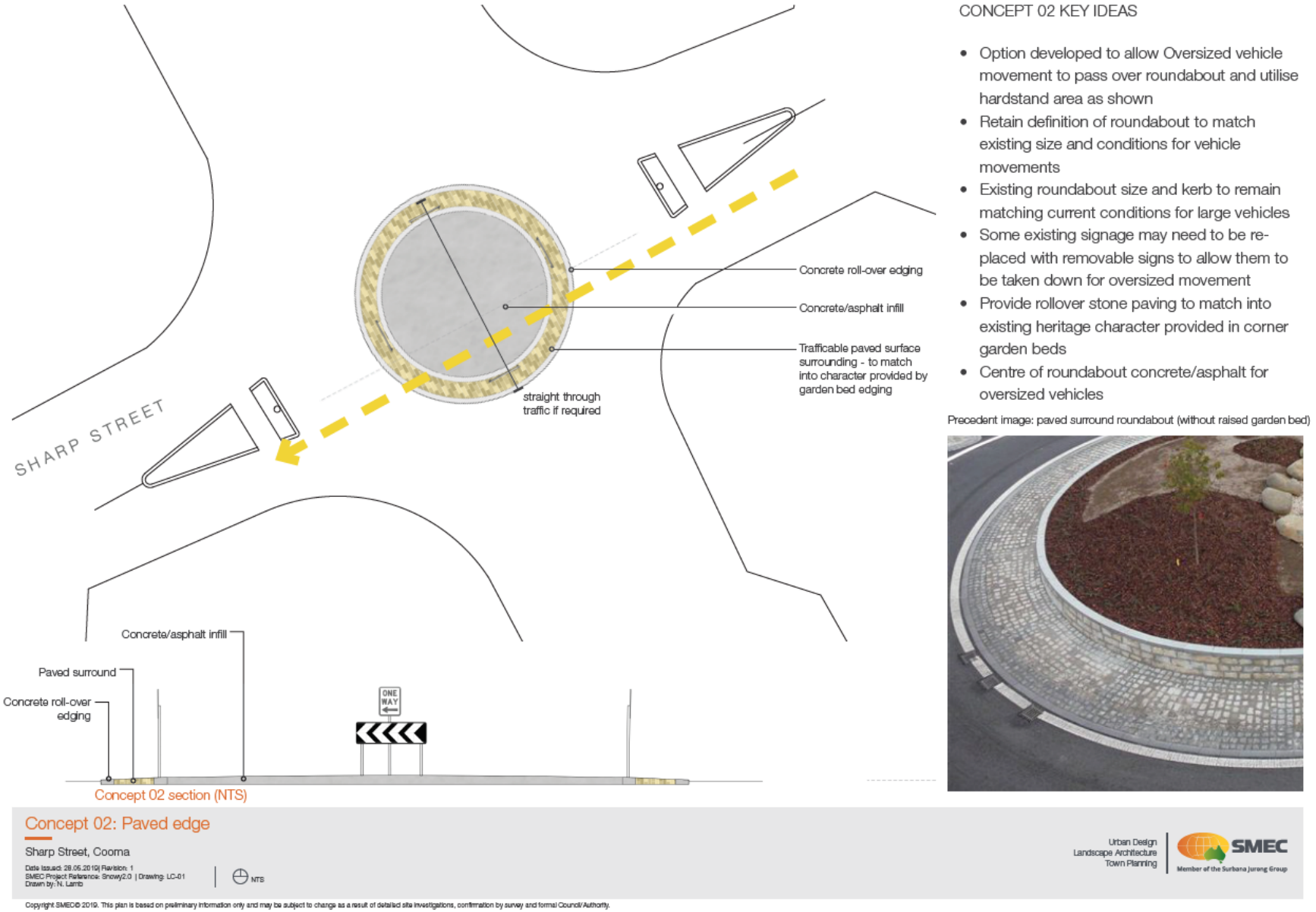


Figure 4.6 Cooma roundabout upgrades – Concept 02 – paved edge

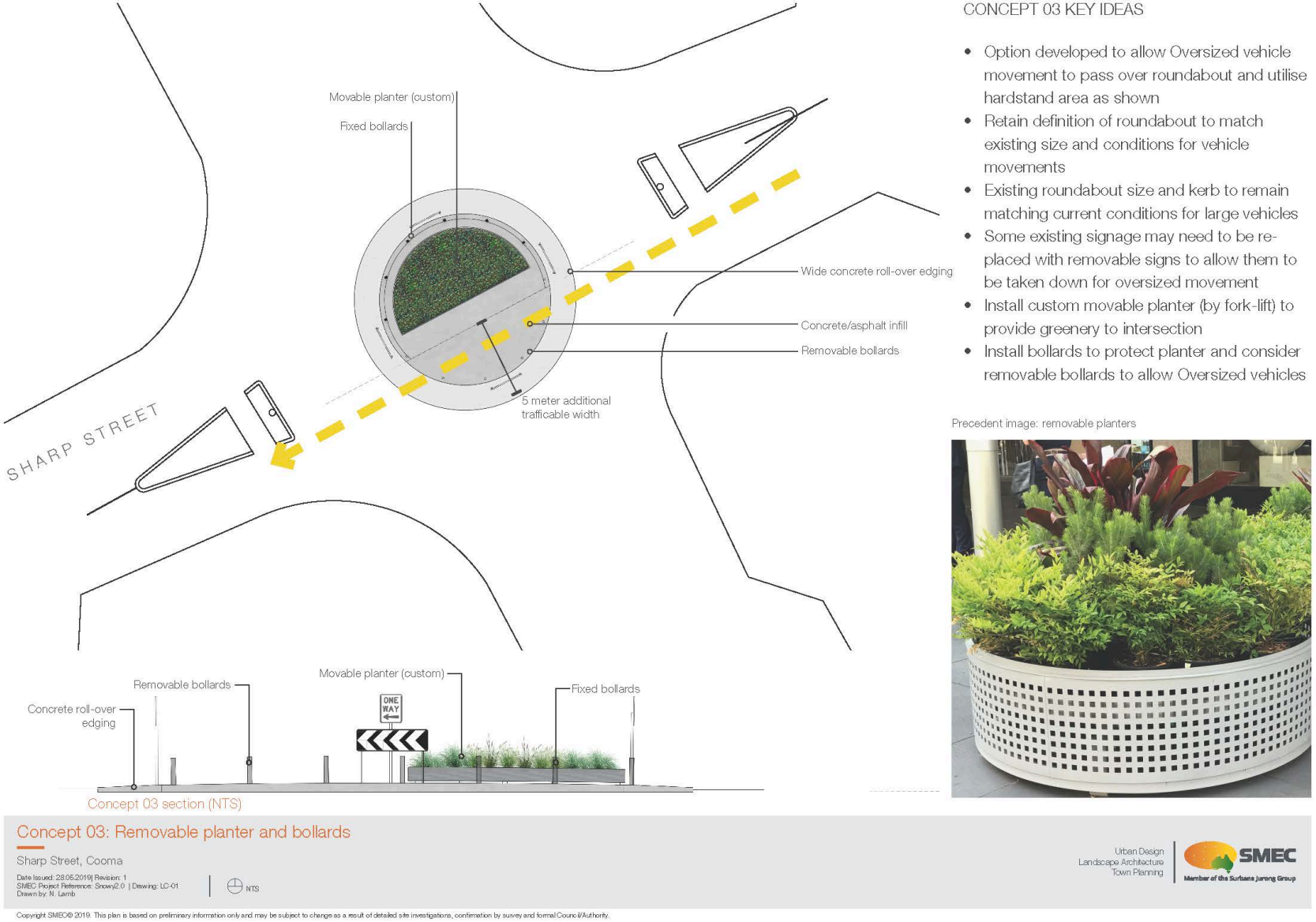


Figure 4.7 Cooma roundabout upgrades – Concept 03 – removable planter and bollards

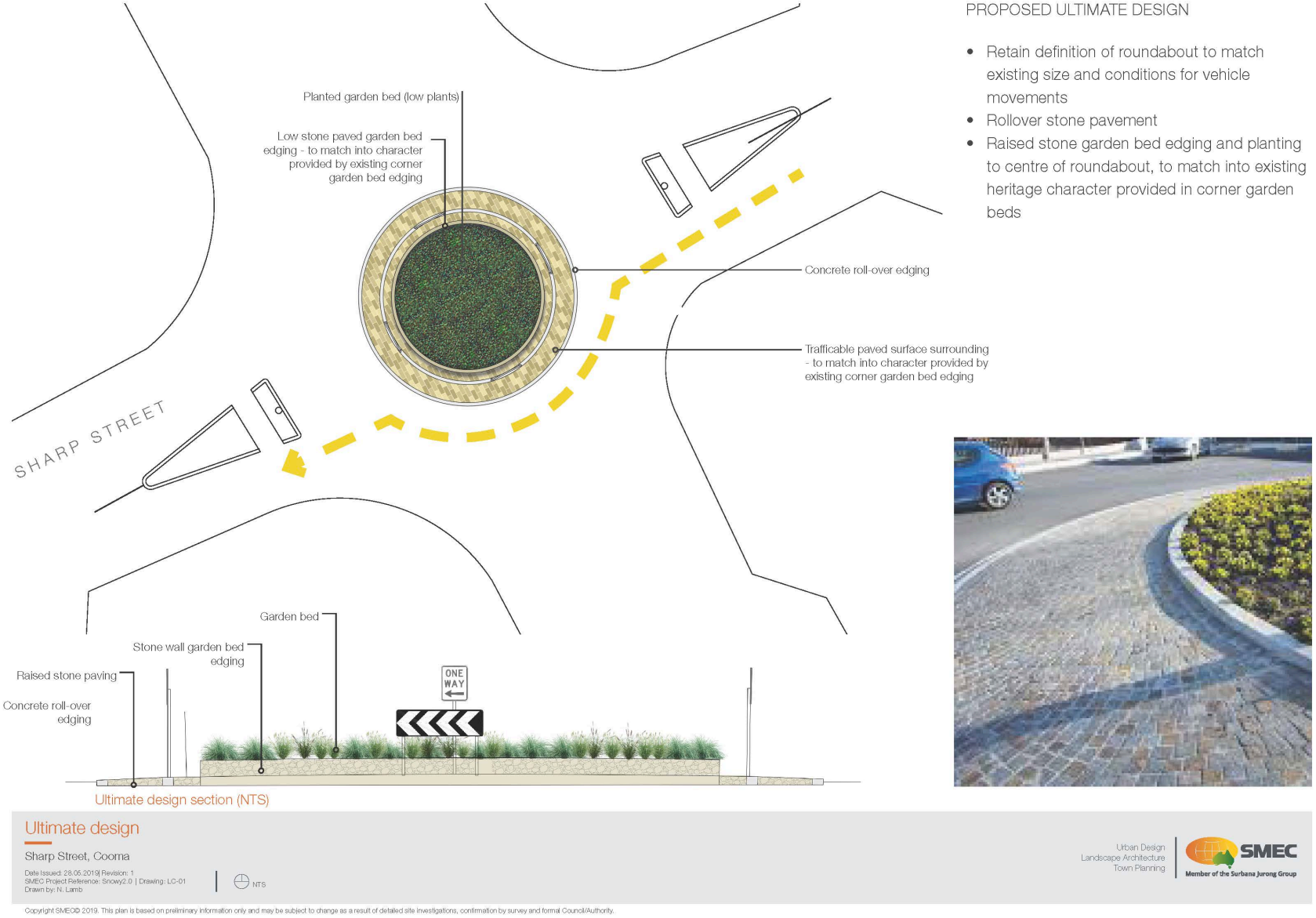


Figure 4.8 Cooma roundabout upgrades – Ultimate design

Similarly, modifications to the garden beds are under consideration with final changes to be agreed with TfNSW and SMRC. Any removable planters or changes to the roundabout will be designed to minimise any impacts to sight lines for the roundabouts. Any reductions in height to the roundabouts will be discussed with TfNSW prior to construction and will consider impacts to existing traffic conditions. Removable features such as planters and bollards may be implemented where required to maintain the safety of the roundabout and minimise any changes to its function.

The proposed roundabout upgrades will be undertaken entirely within the existing roadway and are expected to have negligible environmental impacts which will be suitably managed by standard environmental management and traffic control measures during its construction.

Lobs Hole Ravine Road North

With regards to the TfNSW comments regarding the intersection of Snowy Mountains Highway with Lobs Hole Ravine Road North, an assessment of this intersection was completed as part of the Modification 2 assessment report which found that the existing intersection is suitable for the proposed use.

The Modification 2 assessment identified that the intersection would typically be used by light vehicles exiting Lobs Hole Ravine Road North. It is not anticipated that many if any vehicles will enter this road from the Snowy Mountains Highway as the intersection will be used primarily to exit rather than enter Lobs Hole Ravine Road North. The proposed use of this intersection primarily as an exit removes the requirement for the minimum intersection type of a basic right turn treatment requested by TfNSW.

As described in the Modification 2 Assessment Report, the proposed peak hour volumes are low with 33 light vehicles and a potential one off event of 66 light vehicles. The analysis provided in the Modification 2 assessment report found that the intersection would operate well within a simple T-junction intersection layout, as per the existing layout, with minimal delays and queuing even with the one-off maximum event. The intersection was also found to provide suitable sight distances for heavy vehicles travelling on the Snowy Mountains Highway. Given that the proposed use of this intersection is for relatively low traffic volumes of light vehicles, sealing the road is not planned at this stage.

Strategic/Concept Designs
The high level concept designs that have been provided as part of this current application do not contain sufficient information to enable TfNSW to undertake an adequate assessment of any proposed upgrade works (e.g. works required to existing roundabouts in Cooma). TfNSW request that more detailed strategic/concept designs be submitted.

These should clarify the scope of works, demonstrate the works can be constructed within the road reserve and allow the consent authority to consider any impacts of the works as part of their assessment. The concept design must be to scale, identify legal property boundaries (inclusive of road reserve boundaries), detail existing lane widths, proposed lane widths, new/proposed works, lane lengths and demonstrate the works will comply with the applicable requirements of Austroads Guide to Road Design and associated technical directions. A turning path plan for the largest load size would also have to be provided for each of the roundabouts and intersection works at Lobs Hole Ravine Road (North).

This comment is addressed in the sections above regarding the Cooma roundabouts and Lobs Hole Ravine Road North.

Environmental Impacts
Noting the comments above any road infrastructure upgrade works that are being proposed as part of the current application will need to give consideration/undertake an assessment of the environmental impacts of the proposed works. Refer to Attachment 1 for additional details.

TfNSW requests that this information be provided.

Environmental impacts of all road upgrade works were considered and addressed in the Modification 2 Assessment Report. As mentioned above, the proposed roundabout upgrades at the intersections of Sharp Street with Vale Street and Bombala Street are expected to have negligible environmental impacts which will be suitably managed by standard environmental management and traffic control measures during its construction.

Accommodation Camp
No details have been provided on how the increased number of workers being housed in the accommodation camp will be transported to and from the camps at the commencement and end of their shifts as well as details on how works will be transported from the accommodation camps to works sites.

TfNSW requests that this information be provided.

Worker transport to and from the accommodation camp at the start and end of their shifts will be consistent with the worker transport described in the Exploratory Works EIS. That is, workers will be driven to and from site by bus. As described in the response to the comment regarding traffic movements above, this is not expected to result in an increase to traffic volumes above the previously predicted and approved peak daily and peak hourly traffic during construction.

Transport of workers between the accommodation camp to the work sites will be entirely within the Exploratory Works internal road network and will not require any access to the external road network.

Heavy Vehicle Salvage
No details on how heavy vehicle salvage, if required, will be dealt with so as to minimise impacts on the state road network (e.g. plans/protocols, how road users will be kept informed, etc).

TfNSW requests that this information be provided.

Facility for heavy vehicle haulage salvage will be provided by the project to minimise impacts on the road network. This includes provision of salvage vehicle at critical location and times of the project along with associated road user communications and traffic management/controls.

4.7 Department of Primary Industries

DPI has reviewed the proposal and has identified the following issues.
The Modification 2 Assessment Report does not include any details on the management of the spoil that is to be produced from the tunnel boring machine (TBM) for the exploratory works tunnel, DPI has concerns regarding the disposal of this material and potential impacts on water quality and the aquatic ecosystem.
The approval granted for the exploratory works includes a trial disposal of the spoil material from the exploratory tunnel, however this approval and the assessment behind it was developed around spoil produced from drill and blast operations rather than TBM. DPI objects to the subaqueous disposal of any TBM material from the exploratory works without further assessment regarding the impacts of the subaqueous disposal of such mater and the potential impact on water quality, aquatic species particularly Murray Crayfish.

Information is provided in Section 4.4.1 above which responds to matters raised related to excavated material management.

5 Response to special interest group submissions

5.1 Overview of special interest group submissions

As discussed in Section 2.3.3, the most commonly raised themes in the special interest group submission included impacts to the KNP, air quality, transport and the approval process. Submissions were also received on matters beyond the scope of Modification 2, primarily relating to the main works application.

This section summarises the special interest group submission and provides responses.

5.2 Main Works application

As previously mentioned, the special interest group submissions raised matters beyond the scope of the application for Modification 2. These submissions raised matters related to the Main Works application including concerns about the strategic justification for the Snowy 2.0 Main Works as well as the impacts of the Main Works within KNP including biodiversity, water and recreational impacts. All matters raised in submissions on Modification 2 regarding the Main Works application have been raised in submissions received through the public exhibition of the Main Works EIS. These matters will therefore be addressed in the RTS to Main Works. Notwithstanding this, preliminary responses are provided in the section below regarding comments on the strategic justification for the overall Snowy 2.0.

5.3 Approvals process

One submission raised concerns that a staged approvals process is not appropriate for Snowy 2.0. This submission argued that the cumulative impacts of the previous and future planning applications for Snowy 2.0 are unclear due to the staged approval process. This submission stated that:

"The staged assessment process for Snowy 2.0 invites the 'death of a thousand cuts' and obscures the true scale and impact of the project on the Park."

In NSW staged applications for State significant infrastructure (SSI) projects are common practice and consistent with the requirements for SSI stated in Division 5.2 of the EP&A Act. On 7 March 2018 the NSW Minister for Planning declared Snowy 2.0 to be CSSI and thereby confirmed the SSI application process as a permissible approval pathway for Snowy 2.0. As a component of Snowy 2.0, the Exploratory Works is declared to be CSSI for the purposes of the EP&A Act.

Modification 2 relates to the first stage of Snowy 2.0 (Exploratory Works) with later stages of the project to be assessed in separate applications in accordance with Division 5.2 of the EP&A Act.

Subsequent stages of Snowy 2.0 must assess the cumulative impacts of the project.

5.4 Strategic justification

Matters regarding the strategic benefits of the overall Snowy 2.0 project are most directly related to the works proposed under the Main Works application. Accordingly, matters regarding the strategic justification and benefits to the NEM of Snowy 2.0 will be responded to in detail in the Main Works response to submissions.

As the strategic benefits of Snowy 2.0 to the NEM are an aspect of the justification for the Exploratory Works and Modification 2, a preliminary response to the NPA's claims that the benefits of Snowy 2.0 to the NEM are overstated is provided in the section below.

Strategic justification and benefits to the NEM

The submission received from the NPA challenged the strategic need for a pumped hydro project within KNP. Key comments and concerns included claims:

- The submission argued that the project will provide minimal contribution to renewable energy and that the benefits of the project within the National Electricity Market are overstated in the Main Works EIS.
- This submission challenged the storage capacity of Snowy 2.0. The NPA submission argued that the practical capacity of the scheme is less than 350 GWh. The volume of Tantangara Reservoir's active storage cannot be contained within Talbingo Reservoir, thereby necessitating releases into Jounama and Blowering and losing effective storage to other parts of the Snowy Scheme. This submission also stated that Snowy 2.0 is not a true closed system due to requirements for downstream releases.
- The submission also argued that alternative energy storage technologies provide more appropriate solutions to the energy storage requirements of the NEM. The submission argued that the proposed technology would be inefficient as Snowy 2.0 will be a net consumer of electricity in the short term (including coal-fired electricity), not a generator, and result in significant net losses via pumping and transmission.

Benefits to the NEM and capacity of Snowy 2.0

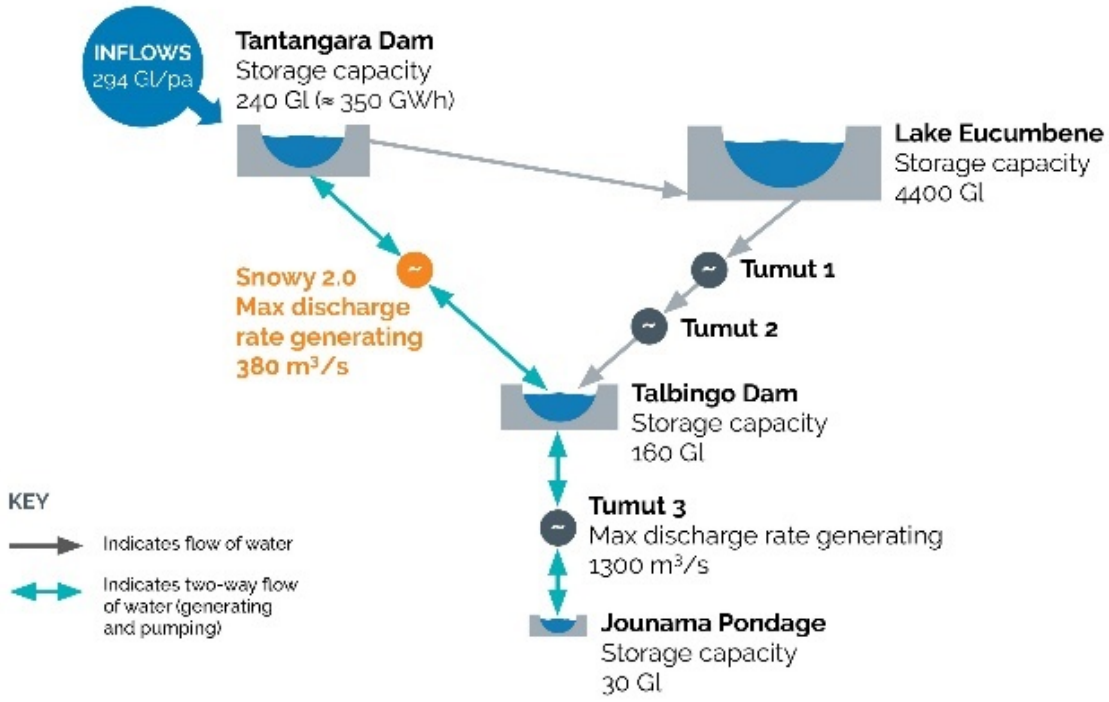
Snowy 2.0 will add 2,000 MW and 350,000 MWh of pumped hydro storage. The 2,000 MW of capacity, and the 350,000 MWh stored in Tantangara Reservoir, individually and together constitute the two key capabilities of Snowy 2.0. While the NPA submission and supporting report implicitly accept the 2,000 MW capacity, it ignores the fact that this is one of Snowy 2.0's critical capabilities. It is critical for keeping the lights on in the NEM. 2,000 MW of reliable, on-call capacity backs several of Snowy 2.0's revenue sources, including the $300/MWh cap contracts that have been a mainstay of Snowy Hydro's role in the market since the beginning of the NEM. This "capacity value" is simply ignored. The report appears to concede that Tantangara Dam has the storage capacity to provide 350,000 MWh, using the Snowy 2.0 generating assets, but claims that downstream hydraulic constraints in Talbingo, Jounama and Blowering dams limit that capacity. This is quite simply wrong. The following errors have been made in the analysis:

- Because it has a much higher elevation, Snowy 2.0 passes through water at a much lower rate when operating at full capacity than Tumut 3 Power Station (T3). In fact, one third of T3, that is 2 of the 6 units, is able to pass all the water that Snowy 2.0 passes when generating at its full 2000 MW capacity. Given this simple fact, Snowy 2.0's ability to generate at full capacity at 2000 MW for 175 hours will never be constrained by the operating level of Talbingo Dam because Snowy Hydro is able to pass water out of Talbingo Dam much more quickly than it flows into it.

- Talbingo Dam level does not "almost always" operate at close to full. The 'active storage' of Talbingo Dam is only the top 9 m of a dam that is up to 140 m deep in places. This 9 m constitutes the 160 GL of 'active storage'. Accordingly, if the water level in Talbingo is only 4 m below Full Supply Level, and appears close to full, its active storage is actually half-empty.

- The active storage in Talbingo is also augmented by the 30GL active storage in Jounama (from which Snowy Hydro can also pump water), which means there is 190 GL of active storage in the lower dams, which is 80% of the 240 GL storage of Tantangara. So, as a closed cycle system, Snowy 2.0 can operate at 80% of its full capacity.

- However, of course, Snowy 2.0 will not operate in isolation, and one of the significant advantages of adding Snowy 2.0 to the existing Snowy Scheme is that Tantangara and Talbingo dams both operate as part of an integrated portfolio of 16 dams, with water capable of being stored in multiple places throughout the Scheme. In particular, both are connected to Eucumbene Dam, which has 4,400 GL of storage capacity. There are in fact three ways to recharge Tantangara Dam: natural inflows, which average 294 GL/annum; water passed into Talbingo from Snowy 2.0 and then pumped back up (190GL); and water passed into Talbingo from Eucumbene through the existing Tumut 1 and Tumut 2 Power Stations. Accordingly, there is no question that Tantangara can be fully recharged.



Consideration of alternative technology

Snowy Hydro's approach has always been to conduct a series of economic tests at milestone points or gates - this started with the Snowy 2.0 Feasibility Study and was confirmed at Final Investment Decision in December 2018. This has been done using a consistent and transparent methodology by conducting a NEM-wide review of the market "with and without Snowy 2.0". This is the most objective method. All these results, analysis and commentary can be found on the Snowy Hydro website. Detractors should be clear about what basis their beliefs have in long-term NEM modelling. The key point is that there is no single, dominant "best" alternative. The strength of the NEM in the past has been its diversity of generating sources. To maximise competition and minimise consumer costs, future NEM developments should include all economic generating sources. In an optimal NEM, the balance between coal, gas, wind, solar, hydro and other sources is determined by effective competition. Snowy Hydro agrees with AEMO's assessment that the NEM requires greater storage capacity than Snowy 2.0 can provide:

- Large-scale batteries have a role in the NEM (frequency control for example) however they suffer from prohibitive cost to provide the same products and service that Snowy 2.0 provides. There is no evidence that batteries will ever be economic.

- Demand management for industrial customers may play some role, but this is yet to be proven. Snowy Hydro has chosen to invest based on the best information available, not baseless aspirations. The re-orienting of VRE was included in the MJA modelling but found to have limited impact.

- Gas and diesel asset planting has been available to NEM participants as an investment option for decades. Snowy Hydro owns them. Snowy Hydro continues to believe in a NEM that invites competition without a particular fuel source receiving preferential regulatory treatment.

Snowy Hydro absolutely relies on a well-functioning and competitive NEM.

Impacts to the KNP

The NPA submission objected to the project's location within KNP. The submission argued that the overall Snowy 2.0 project is inconsistent with the National Park designation and the values for which it has been listed for conservation and protection under the *National Parks and Wildlife Act 1974*.

As discussed in Section 4.2.2 of the Modification 2 assessment report, Part 6, Section 37(2) of the *Snowy Hydro Corporatisation Act 1997* (SHC Act) entitles Snowy Hydro to the grant of a lease, licence, easement or right of way over KNP, for the purposes of the existing Snowy Scheme development. The Snowy Park Lease was granted in 2002 and has a term of 75 years. Section 41(5) of the SHC Act provides that development that is for a purpose for which a lease has been granted under Part 6 of the Act, is taken to be authorised under the NPW Act.

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

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

The amendment to the SHC Act and subsequent Snowy Park Lease together with management plans and the Minister's approval provides a regulatory framework that permits the Exploratory Works (and any modification to the Exploratory Works) to be carried out within the KNP.

Snowy Hydro is committed to maintaining its excellent environmental track record of work within the KNP. The environmental management framework that will govern the avoidance, minimisation and management of impacts during the Exploratory Works has been set out to ensure responsibilities and accountabilities for environmental performance are clear.

Snowy Hydro's consultation with key stakeholders and the community is ongoing. Working together with NPWS is fundamental to achieving long term management objectives and has been important in the development of Exploratory Works. Snowy Hydro has set out in its commitments, the ability for the Exploratory Works to be reversible (ie decommissioned and suitably rehabilitated) should unacceptable impacts occur or if Snowy 2.0 does not proceed. Snowy Hydro has also been working with NPWS to develop appropriate offsets for biodiversity and recreational uses, for predicted impacts.

5.5 Transport strategy

Changed transport strategy

The NPA submission objected to the proposed change to the transport strategy. The submission argued that the proposed change to road traffic as the primary method of delivering materials and equipment to site would result in significant impacts to the KNP. The NPA submission states:

"The proposed shift to increased reliance on road transport involves:

- upgrading the two Lobs Hole Ravine access tracks over some 40 kms
- widening the tracks to accommodate oversized loads up to 7m wide

- extensive track side vegetation clearance
- substantial cuttings and civil works along steep sections of the tracks
- constructing dozens of passing bays along the tracks
- permanent damage and ongoing impacts on the roadside and verge environment
- increased animal roadkill and potential for pollution spills, rubbish, weeds, pests and pathogens."

This submission also challenged the justification for the proposed change to the transport strategy stating that the benefits to logistics, cost and safety outlined in the Modification 2 Assessment Report were incorrect or overstated.

The impacts of the proposed road upgrades required to facilitate the change to the transport strategy were assessed in the Modification 2 assessment report and suitable mitigation and management measures were identified. Significant efforts were made to minimise the impacts of the proposed road works and overall design of Modification 2. This resulted in only a minor amount of vegetation clearance of 1.62 ha being required for Modification 2. The biodiversity impacts of this vegetation clearance and impacts to threatened species habitat will be suitably offset, with a total of 36 ecosystem credits and 33 species credits are required to offset the residual biodiversity impacts of Modification 2.

A traffic and transport assessment was undertaken for the Modification 2 assessment report and found that there would be no changes to the forecast traffic movements along Snowy Mountains Highway or Link Road due to Modification 2. Changes to the traffic flows as a result of Modification 2 would be along Link Road, between Lobs Hole Ravine Road South and Snowy Mountains Highway, whereby the volume of light vehicles would reduce during periods of peak heavy vehicles movements, to improve efficiency within the worksite for heavy vehicles by allowing light vehicles to exit Lobs Hole via Lobs Hole Ravine Road (North).

Construction traffic volumes will also be reduced on Miles Franklin Drive and through Talbingo township due to the revision of the transport strategy and reduced use of barges.

As described in the Modification 2 assessment report Section 4.1.3 the revised transport strategy provides several benefits to the project including:

- **Worker safety and constructability –** The construction contractor, FGJV, identified road transport as being far more efficient than barge transport. Road transport of materials and equipment for the project will reduced double handling, reduce safety and environmental risks of transport over water and minimise risks associated with adverse weather. While some barge transport is still required for the installation of the marine communications cable and other in-reservoir construction such as the barge ramp at Middle Bay, the facilities and equipment required for these activities are significantly reduced compared to the infrastructure required for the ongoing transport of materials and equipment via Talbingo Reservoir.

- **Public safety –** The reduced barging would improve public safety outcomes by minimising the potential for interactions with the public recreational users of Talbingo Reservoir. It is incorrect to suggest that the change in transport strategy shifts public safety impacts to road users as barge transport to the project area would still require transport by road to the Talbingo spillway. As outlined in the Modification 2 assessment report the proposed works are expected to provide improvements to the Exploratory Works traffic impacts by reducing the volume of traffic travelling via Miles Franklin Drive and Talbingo township.

- **Logistics –** Aligning the transport strategy with the sources for construction materials that were identified to the east of the project area. The selection of construction material sources is an ongoing process that has progressed substantially since the construction contractor was engaged.

- **Cost –** The cost of the proposed barge infrastructure was found to be prohibitive for both Exploratory Works and Main Works.

5.6 Air quality and greenhouse gas

The NPA raised concerns regarding the proposed use of diesel generated electricity for the TBM prior to the establishment of the Lobs Hole substation. The submissions stated the following:

> "5. Additional Diesel Usage and CO2 Emissions
>
> Modification 2 proposes the use of an additional 4,320,000 litres (L) of diesel to generate electricity for the TBM until the proposed electricity substation is constructed (based on 24,000 L per day for 6 months). Table 6.8 provides an estimate of the CO2 emissions as 12,358 tonnes. This diesel is additional to the 8,690,000 L previously predicted for the duration of the Exploratory Works. In the context of the climate change abatement claims of the proponent it is remarkable that there is no formal assessment of the significance of the increased emissions.
>
> Recommendation:
>
> - That any approval to use a tunnel boring machine be conditional upon such use being solely supplied by grid electricity."

An assessment of the greenhouse gas emissions of Modification 2 was provided in Section 6.7.2 of the assessment report. The assessment found that Modification 2 would generate 12,358 tonnes of CO2 emissions. Although Modification 2 would increase GHG emissions by 19% compared to the predicted emissions for the approved Exploratory Works, when viewed in the context of NSW and national emissions, the increase remains minor. Furthermore, it is noted that the GHG emissions associated with explosive use would decrease for Modification 2, due to the revision of the tunnelling method from drill and blast to predominantly TBM.

6 Response to community submissions

6.1 Overview of community submissions

As discussed in Section 2.3.4, many of the community submissions received raised concerns about impacts to recreational users of Talbingo Reservoir. Other matters raised in the community submissions included the approvals process, public exhibition and the tunnelling method. Submissions were also received on matters beyond the scope of Modification 2, primarily relating to the Main Works application.

This section summarises community submissions received and provides Snowy Hydro's responses immediately below. The section is structured to present matters in order of how frequently they were raised by community submissions.

6.2 Talbingo recreational area

Several community submissions raised concerns regarding the proposed removal of Schedule 3, Condition 4 of the conditions of consent that requires Snowy Hydro to establish an enhanced Talbingo Recreational Area at the existing Talbingo boat ramp.

Submissions objected to the removal of this condition citing concerns about impacts to recreational users of Talbingo Reservoir and users of the Talbingo Spillway.

Some submissions stated that the proposed reduction in use of the Talbingo Spillway for barge transport was either misleading or unclear and argued that public access would still be restricted to an unacceptable degree. Several submissions raised concerns that the proposed changes to use of Talbingo Spillway are inconsistent with information previously provided to the community in Talbingo and were concerned that long-term closure of the spillway would occur without adequate mitigation of impacts to recreational users.

Some submissions argued that the temporary access requirements and barge infrastructure required would still result in an unacceptable level of impacts to recreational users of Talbingo Reservoir.

Modification 2 will change the Exploratory Works transport strategy such that long-term closure of the Talbingo Spillway would not be related to Snowy 2.0.

Modification 2 will significantly reduce the use of barge transport on Talbingo Reservoir during Exploratory Works. The only works where barge transport would require access using the Talbingo Spillway would be the installation of the marine communications cable and the establishment of the Middle Bay barge ramp. While barge transport may be used for the subaqueous emplacement of excavated material, the primary access for this work would use the newly established barge ramp at Middle Bay.

Any closure to the Talbingo Spillway as a result of Exploratory Works would be temporary only and would be clearly communicated to the community. The proposed temporary use of the Talbingo Spillway would be planned outside of peak use times and the local community would be notified prior to works commencing.

6.3 Project

Tunnelling method

One submission raised concern surrounding the tunnelling methodology proposed in Modification 2 and that it should remain as originally proposed

The tunnelling method proposed under Modification 2 uses a TBM. As outlined in Section 4.1.3 of the Modification 2 assessment report the key benefit of the change to tunnelling methods is that TBM tunnelling will reach the power station cavern location in a shorter time than what would be achieved using drill and blast methods. This will provide advanced geotechnical information needed for the design of critical elements of Snowy 2.0.

6.4 Approvals process

Public exhibition

Two submissions raised concerns surrounding the lack of accessibility to the Modification 2 Assessment Report. These submissions raised concerns that the Modification 2 Assessment Report was difficult to access during the public exhibition period and that the notification provided to the community was inadequate.

As described in Section 2.1, hard copies of the Modification 2 assessment report and USBs providing electronic copies were exhibited at SMRC's Cooma offices, the Cooma library, Talbingo supermarket and Snowy Valleys Council building in Tumut. The EIS was also available for review on DPIE's Major Projects website.

Every effort was made to provide suitable information for the public exhibition including the provision of hard copies and USBs for community members with minimal internet access.

Approvals process

One submission argued that the proposed Modification 2 could not reasonably be considered a modification to the existing approval and should be considered as a separate application requiring an EIS.

As outlined in Section 4.2.5 of the Modification 2 assessment report the proposed modification is sought in accordance with Section 5.25 of the EP&A Act. The definition of a modification is provided in this legislation as follows:

> **Modification** of an approval means changing the terms of the approval, including revoking or varying a condition of the approval or imposing an additional condition on the approval.

The proposed works are consistent with the meaning of 'modification' provided above. Consultation with DPIE to date has confirmed the suitability of the approval pathway for the Modification 2 application.

6.5 Stakeholder engagement

Level of engagement

One submission raised concerns that some community stakeholders had not been adequately engaged due to the short duration of the public exhibition and insufficient notification to the community.

The Modification 2 assessment report was publicly exhibited from 7 November to 21 November 2019. Hard copies of the Modification 2 assessment report and USBs providing electronic copies were exhibited at SMRC's Cooma offices, the Cooma library, Talbingo supermarket and Snowy Valleys Council building in Tumut. The EIS was also available for review on DPIE's Major Projects website. The public exhibition was in accordance with the general exhibition period for modification reports of 14 days.

Consultation for Modification 2 focused on engagement with key government agency stakeholders. It is acknowledged that the Talbingo community have raised concerns regarding changes to the Talbingo recreational area. These concerns are addressed in Section 6.2 above.

6.6 Main Works application

As previously mentioned, several submissions raised matters beyond the scope of the application for Modification 2. These submissions raised matters related to the Main Works application including concerns about the strategic justification for the Snowy 2.0 Main Works as well as the impacts of the Main Works within KNP including biodiversity, water and recreational impacts. All matters raised in submissions on Modification 2 regarding the Main Works application have been raised in submissions received through the public exhibition of the Main Works EIS. These matters will therefore be addressed in the RTS to Main Works.

7 Updated mitigation measures

Following public exhibition of the Modification 2 assessment report, revisions to the mitigation measures included in the assessment report have been identified. Mitigation measures have been revised in order to further minimise environmental impacts and meet expectations and requirements of stakeholders.

A complete and comprehensive list of updated mitigation measures is provided in the sections below.

7.1 Environmental mitigation measures to be removed

Modification 2 proposes to revise the transport strategy so that all materials and equipment required for Exploratory Works will be delivered using Lobs Hole Ravine Road (South) as the primary access road. It is proposed that Condition 45 be removed from Schedule 3 of the Exploratory Works infrastructure approval.

Similarly, it is proposed that Condition 4 be removed from Schedule 3 of the Exploratory Works infrastructure approval. Modification 2 proposes to significantly reduce barge transport and will no longer require the long-term closure of Talbingo Spillway as part of Snowy 2.0. This is expected to remove a significant impact of the Exploratory Works on recreational users of Talbingo Reservoir. It is proposed to remove the corresponding condition of approval.

7.2 Revised environmental management measures

Additional management and mitigation measures that will be implemented to avoid and minimise environmental impacts of the proposed modification are provided in Table 7.1 below.

Table 7.1 Revised environmental management measures

Reference	Impact	Environmental management measure	Revised environmental management measures
MOD2 – 001	Barge ramp establishment	The following measures will be implemented for barge ramp establishment works at Middle Bay: • all barge ramp construction and dredging works would be closely monitored and carried out according to the Dredge Management Plan, Surface Water Management Plan and Aquatic Habitat Management Plan; • appropriate methods and pre-dredge testing would be implemented to ensure that aquatic biota are not exposed to potentially harmful contaminants mobilised within the water column; and • removal and subsequent disposal of aquatic macrophytes would be undertaken according to the Dredge Management Plan and / or Waste Management Plan.	The following measures will be implemented for barge ramp establishment works at Middle Bay: • all barge ramp construction and dredging works would be closely monitored and carried out according to the Dredge Management Plan, Surface Water Management Plan and Aquatic Habitat Management Plan; • appropriate methods and pre-dredge testing would be implemented to that material is appropriately handled to minimise impacts to aquatic species and habitat; and removal and subsequent disposal of aquatic macrophytes would be undertaken according to the Dredge Management Plan and / or Waste Management Plan.
MOD2 – 002	Impacts to Aboriginal and historic heritage	The Exploratory Works Aboriginal heritage management plan (AHMP) and historical heritage management plan (HHMP) will be updated to account for the additional areas assessed for the proposed modification.	No change
MOD2 – 003	OSOM vehicle movements	For scheduled OSOM movements and associated road closures, a Transport Management Plans (TMP) will be prepared. The TMP will detail the date, duration, load details, driver detail, proposed route, emergency contact details, communication protocols, route surveys that include road width dimensions (pinch points) and procedures to mitigate the pinch point locations. The TMPs will be prepared, submitted and approved by the RMS, prior to the commencement of any deliveries in accordance with RMS 'high risk' OSOM movements. In addition, the TMPs will be prepared in consultation with relevant councils and emergency providers and include emergency contingency plans. Where required a Traffic Control Plans (TCP) for OSOM movements will also be obtained.	No change
MOD2 - 004	Emergency access	The Exploratory Works Bushfire Management Plan will be reviewed and, if required, updated to include the revised secondary access arrangements for Lobs Hole via Lobs Hole Ravine Road (North).	No change

Table 7.1 Revised environmental management measures

Reference	Impact	Environmental management measure	Revised environmental management measures
MOD2 - 005	Excavated material management		The Excavated Material Management Plan will be updated and the Subaqueous Emplacement Management Plan will be prepared to provide consideration to the management of excavated material generated by TBM tunnelling.
MOD2 - 006	Biodiversity management measures		The Biodiversity Management Plan will be updated to include: • procedures for dangerous tree removal and vegetation trimming; and • a protocol for post-approval vegetation removal.
REMM SEC06	Restricted access to Talbingo Reservoir for recreational users	Additional recreational facilities will be provided to mitigate the impacts of the closure of public access to the spillway and boat ramp. These include: • provision of two pontoons for the mooring of boats to the north of the boat ramp; • provision of 'beach' area immediately south of boat ramp; • provision a swimming pontoon off the 'beach' area; • provision of an exclusive swimming area around the 'beach' area; and • provision of picnic facilities and amenities at 'beach' area including picnic tables and BBQs.	Mitigation measure to be deleted

8 Updated evaluation and conclusions

The proposed modification will contribute to achieving the objectives of the Exploratory Works and is essential to the final design of Snowy 2.0. Modification 2 will enhance the outcomes of Exploratory Works.

The proposed modification will provide several benefits that contribute to the objectives of the Exploratory works. These include improving the schedule and reliability of tunnelling, improved worker safety, minimising environmental impacts from blasting and dredging and improving the efficiency and reliability of the construction transport strategy.

Snowy 2.0 is in the public interest as it will ultimately provide the ability to counteract the predicted shortfall in reliable electricity supply and generation capacity available in the NEM, as it transitions from a predominantly fossil fuel based market to a renewable one. It will provide a reliable, secure and relatively low cost and emission solution compared to other alternatives.

The proposed modification has been designed to avoid and minimise impacts where possible. The residual impacts have been identified and assessed. The key impacts of the proposed modification are associated with direct and indirect impacts from vegetation clearance and ground disturbance, such as loss of native habitat for threatened species, impacts to known heritage items and potential for impacts to water quality from construction activities.

The Modification 2 assessment report was publicly exhibited from 7 November to 21 November 2019. In response, a total of 25 submissions were received including 19 submissions from the community, five from NSW government agencies, one from SMRC and two from special interest groups. Of the 19 community submissions received seven were characterised as providing comments, six objected to the proposal and six indicated support.

The key issue raised in the community submissions on Modification 2 related to recreational impacts to users of Talbingo Reservoir and the condition of approval requiring the development of an enhanced Talbingo recreational area. Section 6.2 of this report provided clarification that Modification 2 will change the Exploratory Works transport strategy such that long-term closure of the Talbingo Spillway is not required as part of Snowy 2.0.

The five submissions from NSW government agencies provided comments on Modification 2. A key issue raised in three of the NSW government submissions related to the management of excavated material generated by TBM tunnelling. A detailed response to this concern was provided in Section 4.4. The existing conditions of approval and required processes to characterise the excavated material and prescribe appropriate management measures based on its characterisation are expected to be sufficient to manage the proposed change to tunnelling methods. Changes to excavated material composition and management requirements have been addressed in this report and the relevant environmental management plans will be updated and developed to reflect the changed tunnelling method. Other matters raised in government submissions included comments on the biodiversity and traffic assessment which have been addressed through the preparation of a biodiversity offset report provided in Appendix C and Section 4.6 respectively.

The two submissions received from special interest groups raised matters largely related to the merits and impacts of the Snowy 2.0 Main Works application. Some preliminary responses to the matters raised regarding the merits of the overall Snowy 2.0 project are provided in Chapter 5, however, matters relating to the Main Works application will be addressed in detail in the Main Works response to submissions.

The proposed modification is justified and in the public interest because:

- it will accelerate the detailed design for Snowy 2.0 by improving the schedule for exploratory tunnelling using TBM methods;
- it seeks to promote the management and conservation of resources, while also permitting appropriate development to occur which is in line with the objects of the EP&A Act;

- Snowy 2.0 will provide long term reliable energy, environmental and economic benefits;
- the design of the proposed modification has been an iterative design and environmental assessment process to ensure impacts have been avoided and minimised as much as possible.
- the environmental impact assessment has identified that residual impacts can be appropriately managed;
- consultation with NPWS, DPIE and other key stakeholders has been undertaken to ensure appropriate management objectives are identified for the proposed works; and
- Snowy Hydro has committed to the long-term environmental management and rehabilitation of impacted sites, including removal, decommissioning and rehabilitation if needed. Therefore, should Snowy 2.0 Main Works not proceed, long term negative environmental issues can be reasonably avoided.

Glossary

Term	Meaning
Access road upgrade	Upgrade works (realignment, widening or no widening) of existing access roads
Access road extension	A new access road that is an extension of an existing access road
Accommodation camp	Area used for temporary housing and facilities for construction personnel
Avoidance footprint	Exploratory Works areas excluded from clearing and ground disturbance due to sensitive environmental constraints
Barge access infrastructure	A ramp and associated facilities to allow the loading and unloading of barge(s) on Talbingo Reservoir
Base-load	Represents the minimum continuous level of energy demand in a grid system
Camp Bridge	The permanent bridge structure across Yarrangobilly River
Communications cable	Fibre optic communications cable in Talbingo Reservoir
Disturbance footprint	The area subject to clearing and ground disturbance
Exploratory tunnel	A 3.1 km tunnel to the cavern of the proposed Machine Hall for the purposes of understanding geotechnical and underground conditions
Exploratory Works	A program of exploratory works for Snowy 2.0, as more fully described in the EIS for Application No. SSI 9208 and approved by the Minister on 7 February 2019 subject of this EIS and as described in Section 2
Firming generation/capacity	Energy available within the network to respond to demand when other energy sources, such as intermittent renewables are not operating (due to low wind or low sunlight)
Hydro-electric	Generation of electricity using flowing water (typically from a reservoir held behind a dam or barrage) to drive a turbine which powers a generator
Kosciuszko National Park	A National Park protected under the NSW *National Parks and Wildlife Act 1974* and managed by NSW National Parks and Wildlife Service. It covers an area of 673,543 hectares and forms part of Australia's only Alpine area
Lobs Hole	A former settlement location within Kosciuszko National Park, and primary location of Exploratory Works
Lobs Hole Mine	The site of a former copper mine circa 1908, located at Lobs Hole
Lobs Hole Road	The road at Lobs Hole, not the main access down to Lobs Hole
Lobs Hole Ravine Road South	The main access road to Lobs Hole
Lobs Hole Ravine Road North	The section of Lobs Hole Ravine Road between Lobs Hole and the Snowy Mountains Highway to the north.
Lower Lobs Hole Ravine Road	The section of Lobs Hole Ravine Road from Link Road to where it crosses the transmission easement
Middle Bay barge ramp	Location of barge access infrastructure at the southern end of Talbingo Reservoir
Middle Bay Road	The access road from the accommodation camp to the Middle Bay barge ramp. An extension to Middle Bay Road is proposed as part of Exploratory Works
Miles Franklin Drive	Existing road leading to Spillway Road, for access to the Talbingo barge ramp
Mine Trail Road	The access road from the intersection with Lower Lobs Hole Ravine Road and the portal construction pad. An extension to Mine Trail Road is proposed as part of Exploratory Works
On land rock emplacement area	The locations for rock emplacement at Lobs Hole being the western emplacement area and the eastern emplacement area
Permanent bridge	The permanent bridge crossings comprising Wallace Creek Bridge and Camp Bridge
Portal	Location of surface connection with the exploratory tunnel
Portal construction pad	Area used for construction for the exploratory tunnel and portal, including ancillary facilities, laydown and storage, and environmental controls

Term	Meaning
Power station	An industrial facility for the generation of electric power
Project area	The area required to access and build project infrastructure, including surface and tunnel components of the project
Snowy 2.0	A pumped hydro-electric expansion of the Snowy Scheme that will link the two existing reservoirs of Tantangara and Talbingo through underground tunnels, and include a new underground power station with pumping capabilities
Spillway Road	The access road to Talbingo barge ramp
Talbingo barge ramp	Location of barge access infrastructure at the northern end of Talbingo Reservoir
Talbingo Spillway	Structure used to provide the controlled release of flows from Talbingo Dam into the reservoir
Temporary bridge	A temporary structure or causeway across a watercourse to allow construction of permanent bridges
Tumut 2 power station	Underground power station south of Talbingo Reservoir
Tumut 3 power station	Power station at the northern end of Talbingo Reservoir
Upper Lobs Hole Ravine Road	The section of Lobs Hole Ravine Road from where it crosses the transmission easement to Lobs Hole
Wallaces Creek Bridge	The permanent bridge structure across Wallaces Creek
Water services pipeline	Utility pipeline for Exploratory Works providing water supply and wastewater discharge between accommodation camp, portal construction pad and Talbingo Reservoir

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APPENDIX A

SUBMISSIONS REGISTER

Appendix A

Submissions register

					Heritage		Project		Biology		Social	Other	Mitigation	Transport				Engagement	Beyond scope	Process		Merits	
Submitter	Reference number	Location	Group	View	General comment	Aboriginal heritage	Tunnelling	Excavated rock placement	Threatened fauna impacts	Adequacy of assessment/survey	Talbingo Recreational Area	Air	Construction environmental management	Public safety	Changed transport strategy	Intersection upgrades	Traffic and transport assessment	Insufficient level of engagement	Main works application	Public exhibition	Piecemeal approvals	Development in KNP	Strategic justification (benefits to the NEM)
Heritage Council of NSW	SG001		State government	Comment	1																		
NSW Environmental Protection Authority	SG002		State government	Comment				1															
Office of Environment and Heritage	SG003		State government	Comment		1		1	1	1			1										
Transport for NSW	SG004		State government	Comment												1	1						
Department of Primary Industries	SG005		State government	Comment				1															
Snowy Mountains Regional Council	LG001		Local Government	Comment												1							
Inland Rivers Network	SIG001		Special interest group	Object															1				
National Parks Association of NSW	SIG002		Special interest group	Object								1		1	1				1		1	1	1
Iiona Roberts	C001		Community	Object															1				
James Smith	C002		Community	Support							1												
Joel Moller	C003		Community	Comment							1												
Jamie Potter	C004		Community	Support							1												
David Murray	C005		Community	Support							1												
Name withheld	C006		Community	Object			1				1												
Tim Drum	C007		Community	Object							1												
Kate de Jong	C008		Community	Support							1												
Paul White	C009		Community	Object							1												
Kate Fraancis	C010		Community	Commet							1												
Heather Bryatt	C011		Community	Comment							1												
Dawn Byatt	C012		Community	Support							1												
John Taber	C013		Community	Object							1												
Name withheld	C014		Community	Comment							1												
Antti Roppola	C015		Community	Comment							1												
Mark Cook	C016		Community	Support							1												
Paul Lucas	C017		Community	Comment							1												
Brian McIntosh	C018		Community	Comment							1									1			
Gary Bilton	C019		Community	Object							1							1		1	1		
TOTAL						**1**	**1**	**3**	**1**	**1**	**18**	**1**	**1**	**1**	**1**	**2**		**1**	**3**	**2**	**2**	**1**	**1**
State government						1	0	2	1	1	0	0	1	0	0	0		0	0	0	0	0	0
Local government						0	0	0	0	0	0	0	0	0	0	1		0	0	0	0	0	0
Individual						0	1	0	0	0	18	0	0	0	0	0		1	1	2	1	0	0
Special interest group						0	0	0	0	0	0	1	0	1	1	0		0	2	0	1	1	1

APPENDIX B

REGISTER OF SUBMITTERS

Appendix B

Register of submitters

Group	Reference number	Name	Where issues are addressed (section)
State government	SG001	Heritage Council of NSW	4.3
State government	SG002	NSW Environmental Protection Authority	4.4
State government	SG003	Office of Environment and Heritage	4.5
State government	SG004	Transport for NSW	4.6
State government	SG005	Department of Primary Industries	4.7
Local Government	LG001	Snowy Mountains Regional Council	4.2
Special interest group	SIG001	Inland Rivers Network	5
Special interest group	SIG002	National Parks Association of NSW	5
Community	C001	Iiona Roberts	6.5
Community	C002	James Smith	6.2
Community	C003	Joel Moller	6.2
Community	C004	Jamie Potter	6.2
Community	C005	David Murray	6.2
Community	C006	Name withheld	6.2 and 6.3
Community	C007	Tim Drum	6.2
Community	C008	Kate de Jong	6.2
Community	C009	Paul White	6.2
Community	C010	Kate Fraancis	6.2
Community	C011	Heather Bryatt	6.2
Community	C012	Dawn Byatt	6.2
Community	C013	John Taber	6.2
Community	C014	Name withheld	6.2
Community	C015	Antti Roppola	6.2
Community	C016	Mark Cook	6.2
Community	C017	Paul Lucas	6.2
Community	C018	Brian McIntosh	6.2 and 6.4
Community	C019	Gary Bilton	6.2, 6.4 and 6.5

APPENDIX C

BIODIVERSITY OFFSET REPORT

Appendix C

Biodiversity offset report

Snowy 2.0 Exploratory Works
Modification 2 Response to Submissions: Biodiversity

Prepared for Snowy Hydro Limited
December 2019

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Snowy 2.0 Exploratory Works

Modification 2 Response to Submissions: Biodiversity

Report Number

J17188 RP70

Client

Snowy Hydro Limited

Date

20 December 2019

Version

v1 Final

Prepared by	**Approved by**
	
Cassandra Kottaras Ecologist 20 December 2019	**Nathan Garvey** Associate Director 20 December 2019

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Appendices

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1 Submissions received

Comments were received for Modification 2 to the Snowy 2.0 Exploratory Works on 20 November 2019 from the Biodiversity and Conservation Division (BCD) of the NSW Department of Planning, Industry and Environment (DPIE) and the NSW National Parks and Wildlife Service (NPWS). Key matters on biodiversity values, native vegetation, the removal of dangerous trees and threatened species surveys are provided in Table 1.1, along with a response to each matter.

Table 1.1 Response to submissions

Submission	Response
Biodiversity The Department acknowledges that considerable effort has been made to reduce disturbance and supports measures for avoiding impacts to threatened fauna habitat. The residual impacts requiring offsets include 0.93 ha of Eastern Pygmy-possum habitat and 0.06 ha of Smoky Mouse habitat and direct impacts to 1.62 ha of native vegetation consisting of six plant community types. The resulting credit requirement is 32 species credits and 36 ecosystem credits. An additional area of 0.38 ha of native vegetation will be trimmed to 1.1 m high, including lopping or removal of any trees present. The Department understands that these trees require further assessment for breeding or roosting habitat of hollow-dependent threatened fauna.	This comment is noted. The comment regarding further assessment for breeding and roosting habitat of hollow dependent threatened fauna is addressed in the section title "**Threatened species and targeted survey methods"** below.
Native vegetation, trimming and tree removal Modification Report Section 3.3.2 (page 21) states "to minimise impacts to potential Smoky Mouse habitat it is proposed to trim vegetation and selectively remove trees as required along some sections of the upper sections of Lobs Hole Ravine Road. Vegetation removal will occur at a width of 7.4 m and 1.1 m height for the extent of upper Lobs Hole Ravine Road." BDAR Section 2.4.2 lacks specific detail about trimming and tree removal along Lobs Hole Ravine Road south to enable transport of the tunnel boring machine. It is unclear how trimming to 1.1 m height and removal of trees will occur without impact to Smoky Mouse habitat. Modification Report Section 3.3.4iii (page 27) identifies the removal of dangerous trees along Lobs Hole Ravine Road north. NPWS understand that a full tree risk assessment (not included as part of Modification 2) has been conducted. The BDAR should identify specific mitigation measures for the residual impacts being assessed. Impact mitigation measures in Table 7.1 (pages 97-99) rely on general reference to pre-clearing and vegetation clearing protocols in the EMM (2019) Biodiversity Management Plan (BMP) to mitigate impacts on threatened species habitat from trimming and tree removal. The Department understands that the EMM BMP has been superseded by construction BMPs developed for Exploratory Works Stage 1 by Leed (approved in May 2019) and Stage 2 by Future Generation (approved in August 2019). *Recommended actions:* • Describe in detail the techniques and equipment to be used for vegetation and tree removal, including trimming to 1.1 m • Clarify the extent of dangerous trees identified for removal along Lobs Hole Ravine Road (north) and ensure they are included in the biodiversity assessment • Clarify the impact and the exact number of trees required to be trimmed and or removed completely along Lobs Hole Ravine Road	Vegetation trimming along Lobs Hole Ravine Road (south) to enable the transport of the tunnel boring machine (TBM) to Lobs Hole will be conducted in a way that minimises impacts to Smoky Mouse, with vegetation trimming limited to vegetation above 1.1 m as far as practical. Any trimmed or removed vegetation will be left in-situ. Further detail is provided in Section 3.1.2. Surveys undertaken for Snowy 2.0 have shown that the Smoky Mouse is positively correlated with habitat complexity at ground level, including large logs and coarse woody debris. Given vegetation below 1.1 m will not be removed, that clearing will occur on average only for 1.2 m either side of the existing disturbed area, and that any removed vegetation (including logs and coarse woody debris) will be left in-situ it is deemed that impacts to Smoky Mouse will be avoided and minimised. A tree risk assessment identified 140 trees that present a safety risk to traffic on Lobs Hole Ravine Road (north). Six of these trees have been recently removed as they were located within the approved Exploratory Works disturbance area and do not require additional consideration. The pre-clearing process outlined in the Biodiversity Management Plan, Appendix C (BMP, EMM 2019a) will be undertaken, as per the commitments in the Exploratory Works Biodiversity Assessment Report (BDAR, EMM 2018) and the Modification 2 BDAR (EMM 2019b). Clearing procedures for mitigating impacts during the removal of trees and trimming of vegetation is discussed further in Section 3.1.3. The 134 residual dangerous trees along Lobs Hole Ravine Road (north) will be offset through calculation of vegetation integrity scores of management zones, as set out in Section 3. Offsets required for the dangerous tree removal have been addressed in Section 3.2.1. A credit report is provided in Appendix C.

Table 1.1 Response to submissions

Submission	Response
• Specify the 'pre-clearance process' and 'clearing procedures' for mitigating impacts of Modification 2 due to removal of vegetation and threatened species habitat and indirect impacts due to trimming of native vegetation and selective tree lopping and removal, including: – best practice tree trimming to minimise long-term impact to threatened species habitat due to subsequent tree death – determining whether a tree is lopped or removed, such as proportion of canopy removal that triggers complete tree removal – minimising damage to Understorey vegetation – delineation of area to be trimmed to 1.1 m – monitoring and reporting procedures for tree removal by licensed wildlife handlers and qualified ecologists. *Recommended condition of consent:* Procedures for tree· removal and vegetation trimming must ensure that damage to surrounding vegetation is avoided.	
Threatened species and targeted survey methods The northern section of Lobs Hole Ravine Road did not have targeted threatened species survey due to timing. BDAR Section 6.3.3 (page 60) states that "where required, additional pre-clearance surveys will be completed within this area before construction works are undertaken", and the results are to be addressed in the response to submissions (RTS). The BAM requires the assessment results and credit requirements to be identified within the BDAR. The Department's strong preference is that a revised and complete BDAR be provided rather than parts of the assessment being presented in the RTS. The use of upper-storey vegetation by Smoky Mouse, including tree hollows, is not well understood. Any habitat element within the relevant plant community types may be utilised by Smoky Mouse, including trees. *Recommended actions:* • Clarify the location of potential habitat that has not been surveyed for each species in Table 6.4 • Explain the process for determining where a survey will be required • After clarifying the trees to be removed, update the BDAR to consider the potential impact of tree canopy removal on Smoky Mouse and hollow-dependent fauna, including Gang Gang Cockatoo • After pre-clearing surveys have been completed during the correct months, provide a revised and complete BDAR	Targeted threatened flora surveys along Lobs Hole Ravine Road (north) were conducted in November and December 2019. No threatened flora species were recorded. Further details on surveys methods and results is provided in Section 2.2. A habitat assessment was undertaken along Lobs Hole Ravine Road (north) to identify suitable habitat for nocturnal and diurnal birds and arboreal mammals within the 134 dangerous trees proposed for removal (Figure 2.4). The assessment identified 39 hollow bearing trees, with two of the 39 trees containing hollows suitable of the Masked Owl and Barking Owl. Further details on surveys methods and results is provided in Section 2.2. Further pre-clearance surveys of these 39 trees will be completed as a part of the pre-clearance process.

Table 1.1 Response to submissions

Submission	Response
Smoky Mouse The assessment identified that 0.06 ha of Smoky Mouse habitat will be impacted by Modification 2. The Department is concerned with the incremental nature of how impacts to Smoky Mouse are being considered. The Exploratory Works EIS, including the original approval plus Modification 1 and 2, and then Main Works impacts in the same location will result in an increasing cumulative impact that makes it difficult to contextualise for individual assessments. In the absence of an overall assessment, we request an updated summary of cumulative impact to Smoky Mouse habitat with each separate development application. It is essential that the mitigation measures described in the EMM BMP (2019), as mentioned in BDAR Section 7.2.4 (page 95) will continue to be implemented to reduce the potential of vehicle strike on Smoky Mouse. *Recommended actions:* • Include a table of incremental loss of Smoky Mouse habitat for all Snowy 2.0-related projects and modifications, including trimming Ensure current measures to reduce potential vehicle strike continue to be implemented through Biodiversity Management Plans developed for Exploratory Works modifications and future Snowy 2.0 projects	Section 7.3.2 of the Exploratory Works Modification 2 BDAR (EMM 2019b) outlines the cumulative loss of Smoky Mouse habitat for all Exploratory Works projects, being 1.83 ha. As a result of design changes since exhibition, an additional 0.13 ha of Smoky Mouse habitat will be impacted and a reduction of 0.06 ha of Smoky Mouse habitat. Therefore, the cumulative loss of Smoky Mouse habitat for all Exploratory Works projects will be 1.90 ha. Current measures in place to reduce the potential vehicle strike as outlined in the BMP (EMM 2019a) will continue to be implemented in the additional Modification 2 areas. The proposed restriction on night-time movements long Lobs Hole Ravine Road South will be maintained.
Regent Honeyeater Regent Honeyeaters have recently been recorded flying over Lobs Hole. *Recommended action:* • Include a protocol for stopping work if Regent Honeyeaters are sighted and observed to be foraging or breeding within the project area. An appropriately experienced ecologist is to determine whether Regent Honeyeaters are using the plant community type being impacted. Work should not to recommence in that vegetation type until the breeding or foraging period is complete.	The biodiversity management plan prepared in accordance with Schedule 3, Condition 6 of the Exploratory Works infrastructure approval includes an unexpected threatened species find procedure. This procedure is applicable to all activities that have the potential to impact any threatened flora and fauna, including the Regent Honeyeater.
Mitigation measures Section 2.4.2 (page 14) describes maintenance works within the existing road and disturbed area along Lobs Hole Ravine Road north. *Recommended action:* • Include a mitigation measure stating that spoil and sediment resulting from clearing of existing culverts and temporary removal of roll-overs must not be pushed or piled into native vegetation.	Additional mitigation measures to minimise the impacts of road maintenance on native vegetation are outlined in Section 3.1.4.

2 Stage 1: Biodiversity Assessment

Following public exhibition of the Modification 2 assessment report, feedback from government and community stakeholders has been considered. Further design has also been undertaken by the construction contractor to optimise the proposed works. Several project improvements have been identified and incorporated within the Modification 2 RTS. The key project improvements are:

- Removal of approved borehole BH5205 and replacement with BH5203, to be located on a previously disturbed drill pad and access road off the Marica Track.
- Clarification of the proposed height for vegetation trimming on Lobs Hole Ravine Road South.
- Development of a protocol for post-approval vegetation removal in consultation with DPIE Biodiversity and Conservation Division (BCD).

Further details for each of these project elements have been addressed in Section 3 of the Response to Submissions Report. Additional vegetation clearing associated with changes to the Exploratory Works disturbance boundary (including dangerous tree removal) have been assessed in Section 2.1. The reduction in vegetation clearing resulting from the removal of approved borehole BH5205 has been accounted for within this assessment, with the reduced impacts to the vegetation zone calculated in Section 2.1.2.

This section provides details of the proposed changes to the Modification 2 proposal and revised biodiversity impact assessments based on these changes.

2.1 Native vegetation

2.1.1 Methods

i Detailed vegetation mapping

Please refer to Section 5.2.1 in EMM (2019b) for a detailed methodology for vegetation mapping and habitat assessment. This section outlines how plant community types (PCTs) were mapped and stratified for the Snowy 2.0 project, including Exploratory Works Modification 2.

A tree risk assessment identified 140 trees that present a safety risk to traffic on Lobs Hole Ravine Road (north). Six of these trees were located within the approved Exploratory Works disturbance area and do not require additional consideration.

Each of the residual 134 dangerous trees were mapped using the following data:

- waypoints of tree locations; and
- a canopy height model developed using Light Detection and Ranging (LiDAR) data and hi-resolution aerial imagery.

Tree canopies were drawn around visible canopies using the canopy height model. These footprints were included as a part of the vegetation zones the trees were mapped within.

ii Vegetation integrity assessment

Please refer to Section 5.2.2 of EMM (2019b) for detailed methodology of vegetation integrity assessment. Vegetation integrity plots within the broader survey area were chosen for the Modification 2 assessment. All plots used are part of the vegetation zones being impacted and are considered representative of the vegetation zones within the Modification 2 footprint.

Vegetation zones were split into management zones based on whether they occurred within the disturbance footprint (including the original footprint and additional areas) or dangerous tree removal area. Changes in vegetation integrity score (future vegetation integrity score) were calculated for each of these management zones based on the following:

- Disturbance – all scores were set to 0.
- Tree - the composition and structure scores for the tree growth form were set to zero, leaving scores for all other growth forms at the current score. Functional scores for large trees and stem size class were set to zero; all other function scores were not modified.

2.1.2 Results

i Plant community types

Site investigations, including determination of plant community types (PCTs) using the methods described in Section 5.2.1 in EMM (2019b), identified the presence of nine PCTs within the disturbance footprint, one of which is within the avoidance footprint. Removal of dangerous trees will result in impacts to 1.09 ha of native vegetation across eight PCTs.

The PCT, vegetation formation and vegetation class within Modification 2, including the original Modification 2 disturbance footprint and dangerous trees, are provided in Table 2.1.

Table 2.1 Plant community types mapped within the Modification 2 disturbance footprint, including the avoidance footprint for Modification 1

Plant community type	Vegetation formation	Vegetation class	Area (ha) of disturbance footprint for Modification 2	Dangerous tree removal area (ha)	Avoidance footprint for BH5205 (ha)	Total area (ha) of disturbance footprint
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	-	0.02	-	0.02
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	0.56	0.41	-	0.97

Table 2.1 Plant community types mapped within the Modification 2 disturbance footprint, including the avoidance footprint for Modification 1

Plant community type	Vegetation formation	Vegetation class	Area (ha) of disturbance footprint for Modification 2	Dangerous tree removal area (ha)	Avoidance footprint for BH5205 (ha)	Total area (ha) of disturbance footprint
PCT 300 – Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment	Wet Sclerophyll Forests (Grassy sub-formation)	Southern Tableland Wet Sclerophyll Forests	0.28	0.06	-	0.34
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	-	<0.01[1]	-	<0.01[1]
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	0.13	0.01	-	0.14
PCT 952 – Mountain Gum - Narrow-leaved Peppermint - Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion	Grassy Woodlands	Subalpine Woodlands	-	0.35	-	0.35
PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	Dry Sclerophyll Forests (Shrubby sub-formation)	Southern Tableland Dry Sclerophyll Forests	0.13	0.23	-0.06	0.30
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	Grassy Woodlands	Subalpine Woodlands	0.07	0.01	-	0.08
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Grassy Woodlands	Subalpine Woodlands	0.58	-	-	0.58
TOTAL			**1.75**	**1.09**	**-0.06**	**2.78**

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

ii Vegetation zones

Each of the nine PCTs identified within the revised disturbance footprint was stratified into vegetation zones based on broad condition state. This process identified 15 vegetation zones within the revised disturbance footprint, as outlined in Table 2.2.

Table 2.2 Vegetation zones mapped within the Modification 2 disturbance footprint, including the avoidance footprint for Modification 1

Plant community type	Condition	Area (ha) of disturbance footprint for Modification 2	Dangerous tree removal area (ha)	Avoidance footprint for BH5205 (ha)	Total area (ha) of disturbance footprint
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	Medium	-	0.01	-	0.01
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	Other	-	0.01	-	0.01
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	Derived grassland	0.10	-	-	0.10
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	High	0.46	0.41	-	0.87
PCT 300 – Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment	Medium	0.20	0.06	-	0.26
PCT 300 – Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment	High	0.08	-	-	0.08
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	Derived grassland	<0.01[1]	-	-	<0.01[1]
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	Medium	<0.01[1]	<0.01[1]	-	<0.01[1]
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	High	0.13	0.01	-	0.14
PCT 952 – Mountain Gum - Narrow-leaved Peppermint - Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion	Other	-	0.35	-	0.35
PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	0.07	-	-	0.07
PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	0.06	0.23	-0.06	0.23
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	High	0.07	0.01	-	0.08

Table 2.2 Vegetation zones mapped within the Modification 2 disturbance footprint, including the avoidance footprint for Modification 1

Plant community type	Condition	Area (ha) of disturbance footprint for Modification 2	Dangerous tree removal area (ha)	Avoidance footprint for BH5205 (ha)	Total area (ha) of disturbance footprint
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	0.45	-	-	0.45
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Other	0.13[2]	-	-	0.09
TOTAL		**1.75**	**1.09**	**-0.06**	**2.78**

Notes: 1. Vegetation zones with an area less than 0.01 ha were not inputted into the BAM calculator.
2. Additional area of disturbance footprint.

iii Vegetation integrity survey plots

Thirteen vegetation integrity plots were used to calculate the vegetation integrity scores for each PCT (Table 2.3). For the reasons outlined in Section 2.1.1ii ten plots were located outside the disturbance footprint; however, all plots are considered representative of the vegetation zones within the disturbance footprint.

Table 2.3 Vegetation integrity survey plots

Plant community type	Condition	Area (ha)	Plot ID
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	Medium	0.01	1046
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	Other	0.01	5
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	Derived grassland	0.10	187
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	High	0.87	190
PCT 300 – Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment	Medium	0.26	192
PCT 300 – Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment	High	0.08	1001
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	High	0.14	1053

Table 2.3 Vegetation integrity survey plots

Plant community type	Condition	Area (ha)	Plot ID
PCT 952 – Mountain Gum - Narrow-leaved Peppermint - Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion	Other	0.35	214
PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	0.07	11
PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	0.23	216
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	High	0.08	2276
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	0.45	3303
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Other	0.13	2274

iv Vegetation integrity score

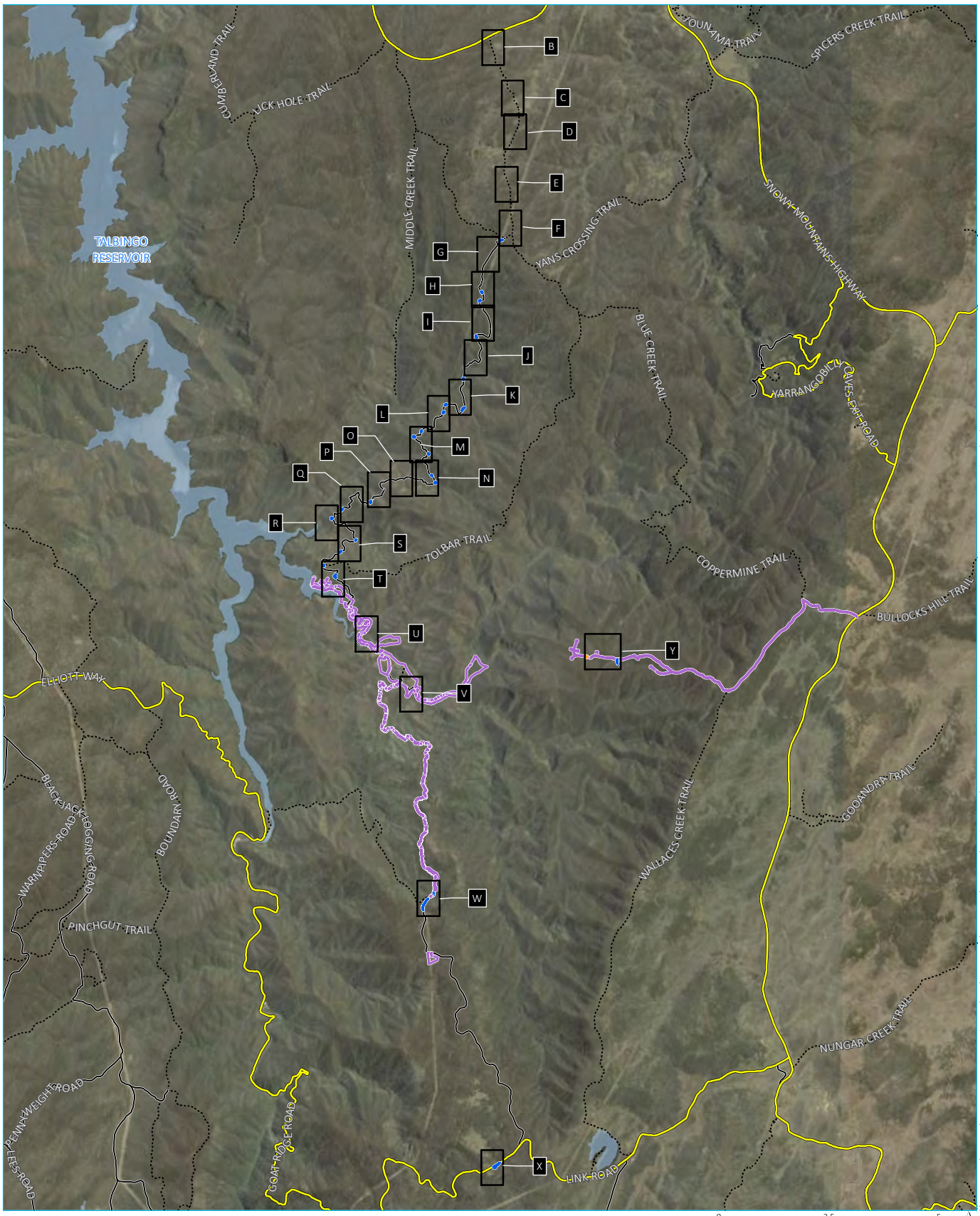
The vegetation integrity score for each vegetation zone is provided in Table 2.4. Future vegetation integrity scores based on the management zones outlined in Section 2.1.1 iv are provided in Table 3.1 below.

Table 2.4 Vegetation integrity scores for all vegetation zones within Modification 2 disturbance boundary

Plant community type	Condition	Vegetation integrity score
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	Medium	40.1
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	Other	58
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	Derived grassland	41.2
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	High	55.3
PCT 300 – Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment	Medium	56
PCT 300 – Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment	High	56.8
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	High	71.9

Table 2.4 Vegetation integrity scores for all vegetation zones within Modification 2 disturbance boundary

Plant community type	Condition	Vegetation integrity score
PCT 952 – Mountain Gum - Narrow-leaved Peppermint - Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion	Other	66.2
PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	36.7
PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	79
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	High	85.3
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	41.1
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Other	37.7



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

0 2.5 5 km

GDA 1994 MGA Zone 55

N

KEY

- Page index
- Management zone
- Waterbody
- Main road
- Local road
- Vehicular track
- Modification 2 approved construction footprint
- Exploratory works approved construction footprint
- Avoidance area

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 a

snowy 2.0

EMM creating opportunities

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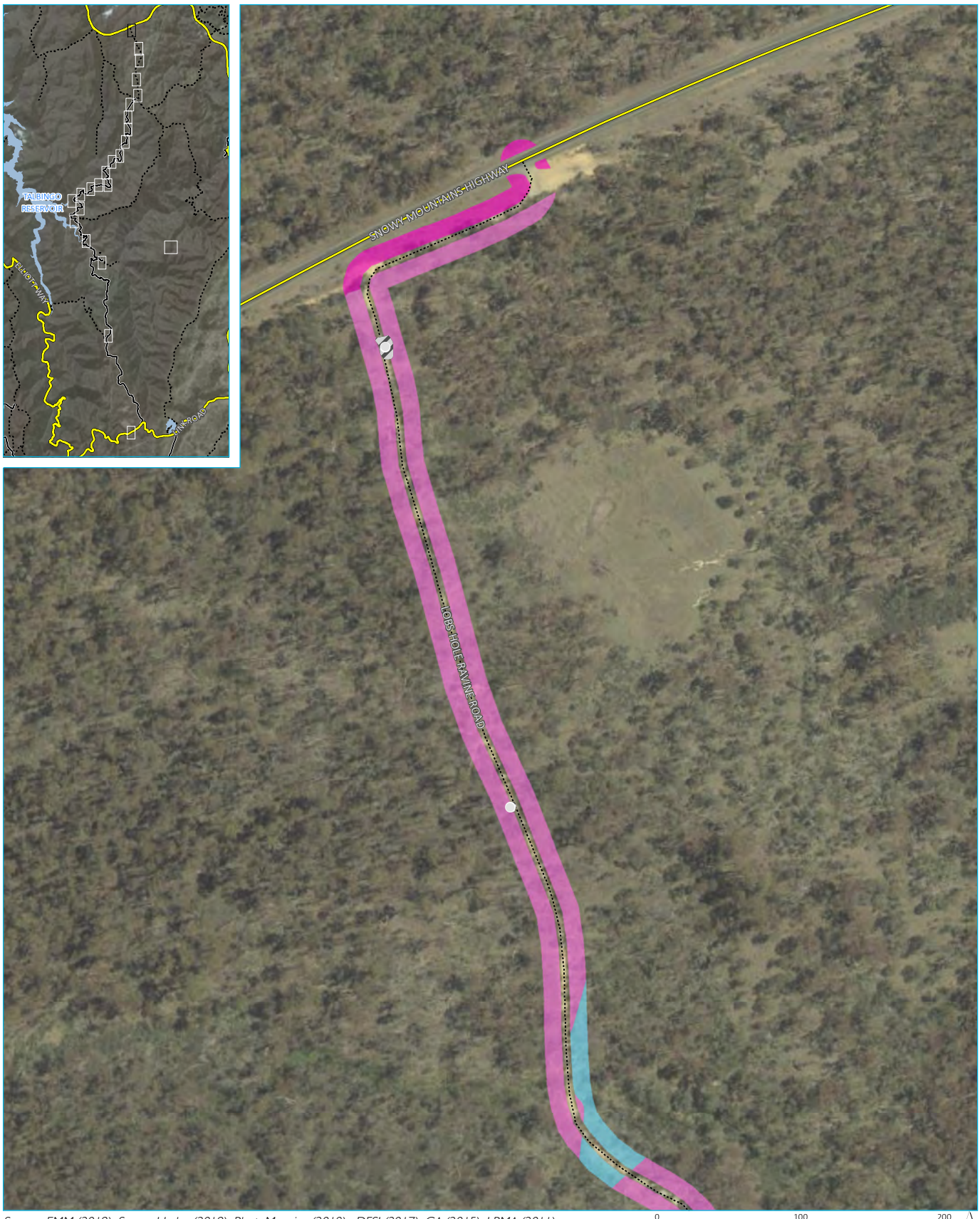

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Main road
- Vehicular track
- Dangerous tree
- Management zone

PCT 679

- Other

PCT 952

- Poor
- Other

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 b

snowy 2.0

EMM creating opportunities

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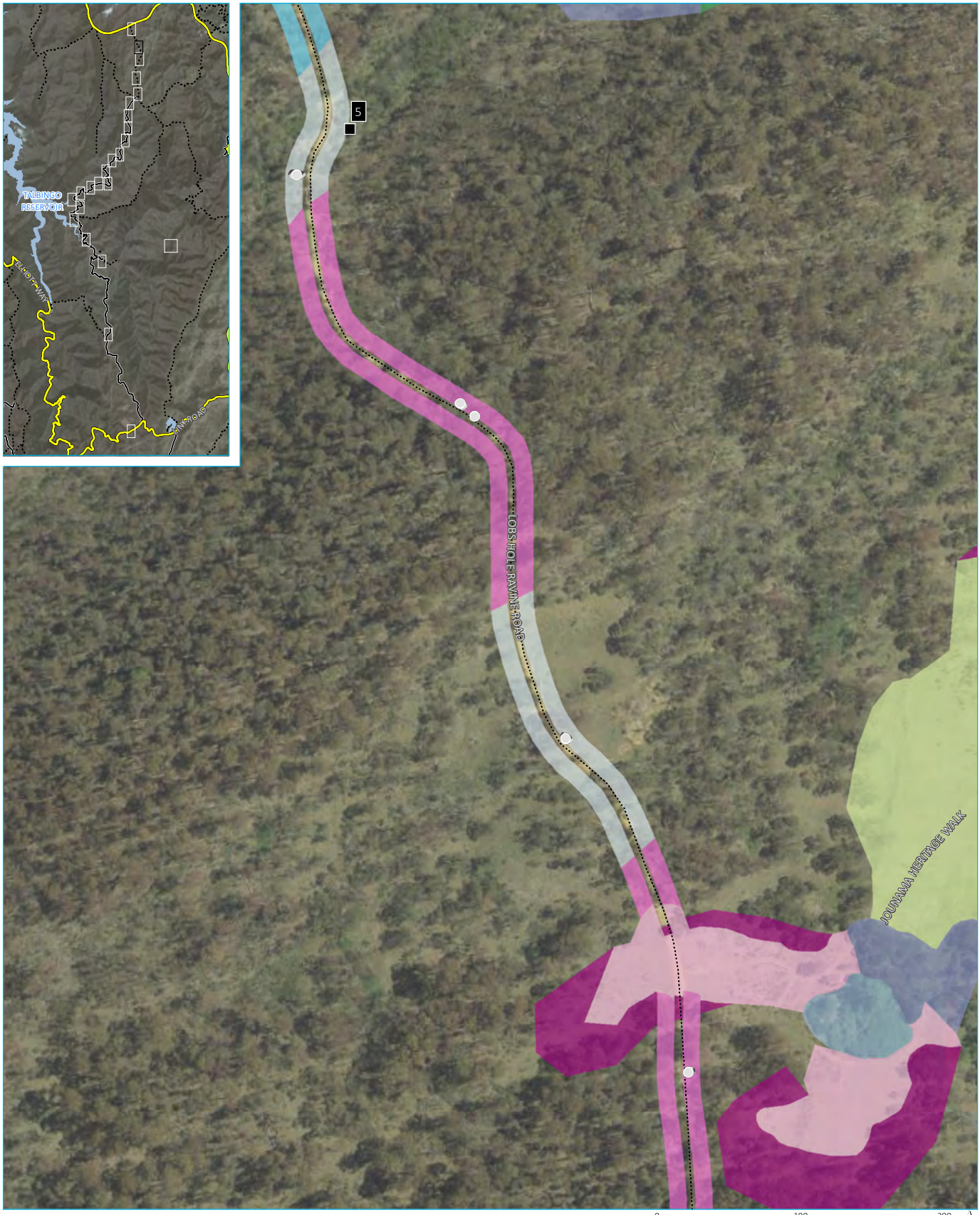


Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Vehicular track
- Plot location
- Dangerous tree
- Management zone

PCT 285
- Medium
- Low
- Other

PCT 303
- Medium
- Derived grassland

PCT 679
- Other

PCT 952
- Medium
- Other

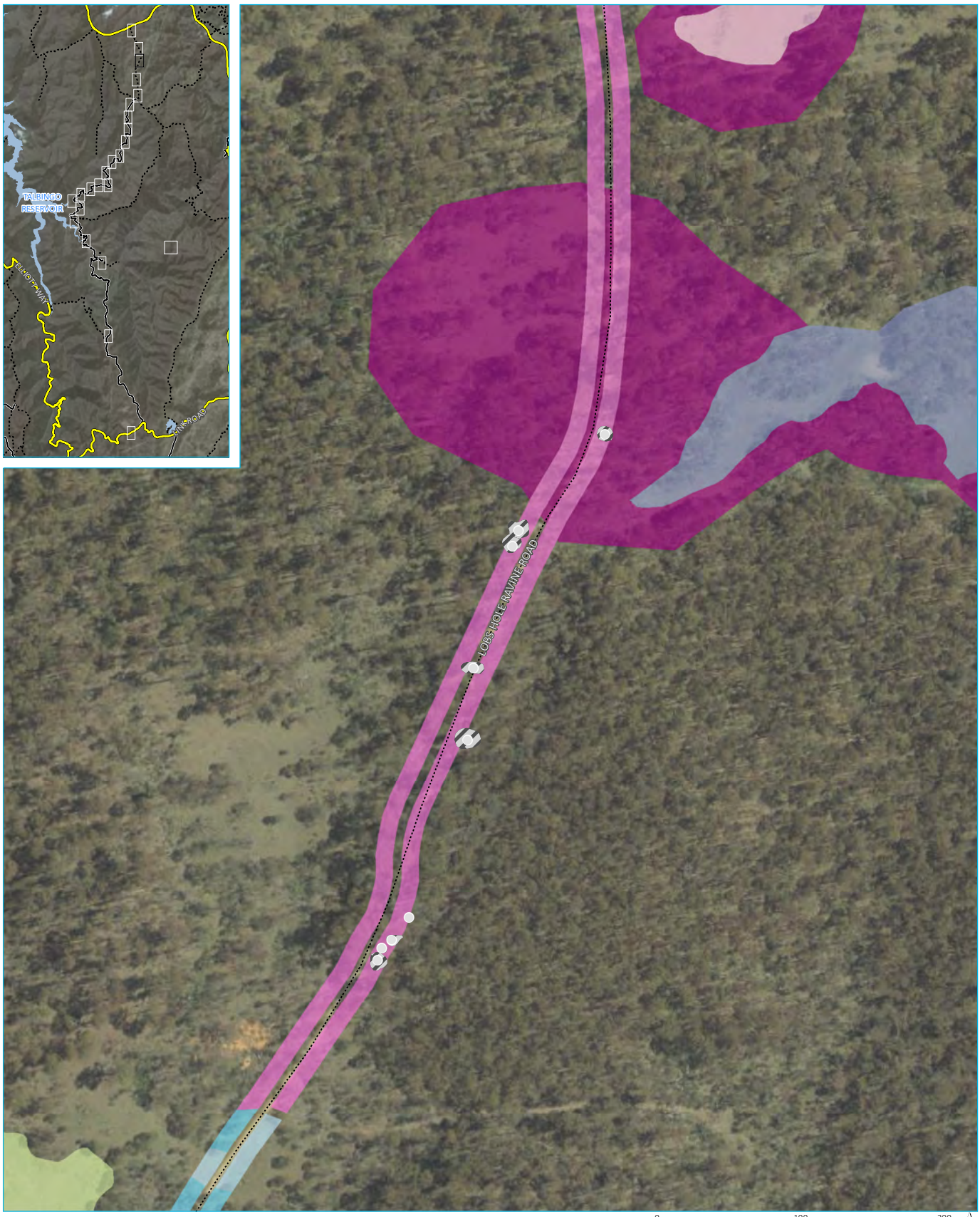
- Derived grassland

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 c

snowy 2.0

EMM creating opportunities



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

0 100 200 m
GDA 1994 MGA Zone 55

KEY

- Vehicular track
- Dangerous tree
- Management zone

PCT 285
- Medium

PCT 303
- Derived grassland

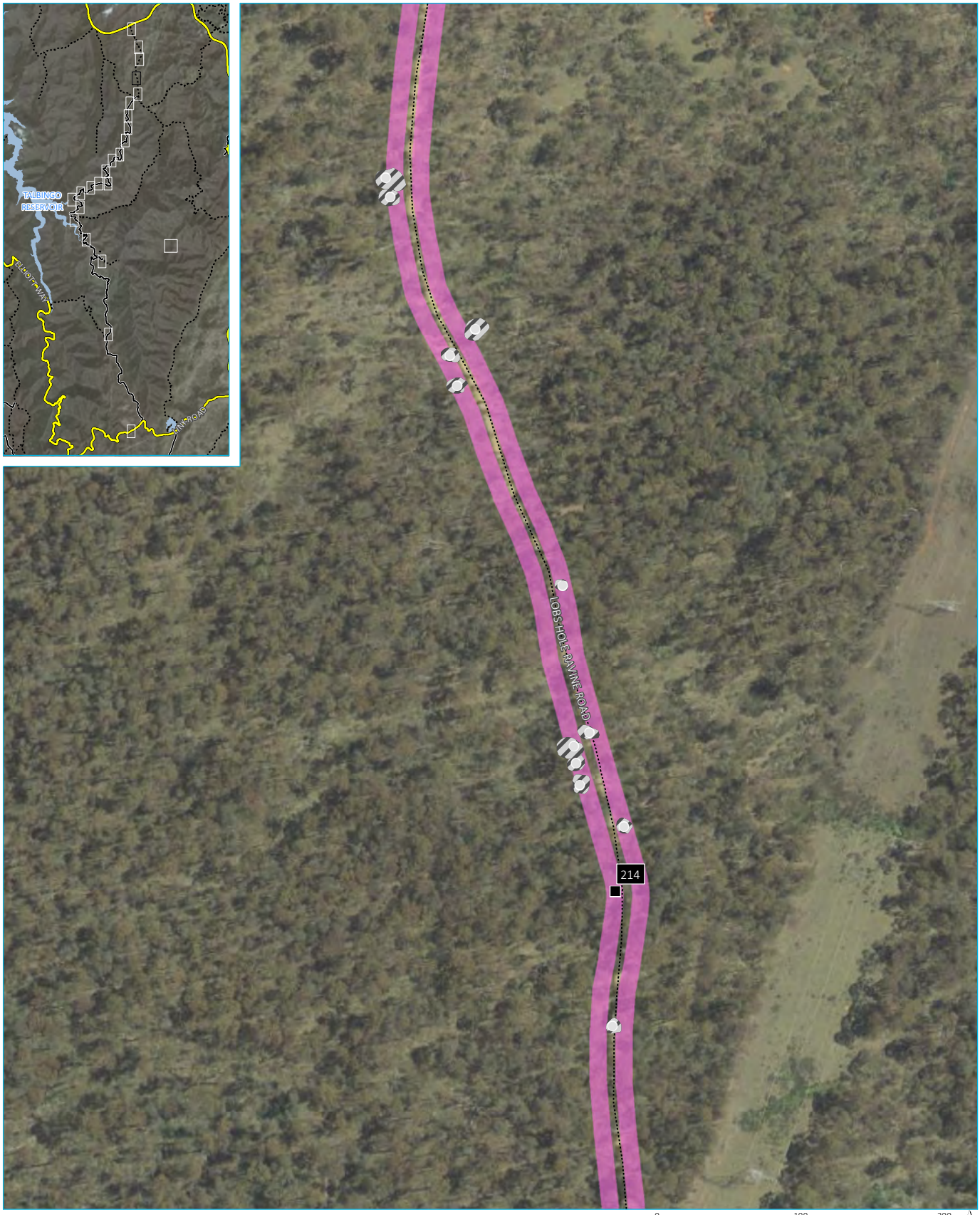
PCT 679
- Other
- Derived grassland

PCT 952
- Medium
- Other
- Derived grassland

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 d

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO001_PCTsPlotsAndDangerousTrees_20191212_01.mxd 18/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Vehicular track
- Plot location
- Dangerous tree
- Management zone

PCT 952

- Other

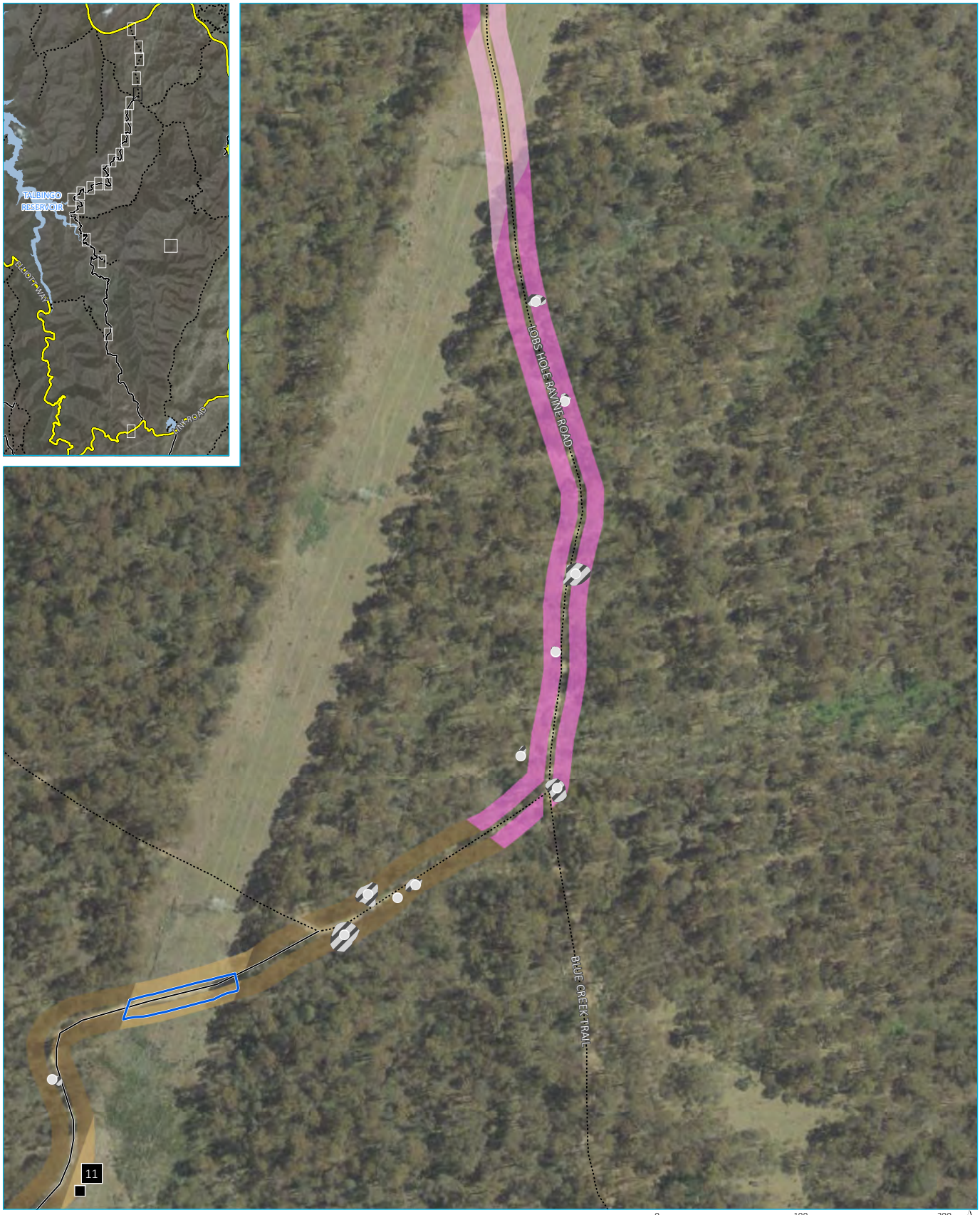
Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 e

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO001_PCTsPlotsAndDangerousTrees_20191212_01.mxd 18/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Local road
- Vehicular track
- Plot location
- Dangerous tree
- Modification 2 approved construction footprint
- Management zone

PCT 952
- Other
- Derived grassland

PCT 953
- High
- Derived grassland

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 f

snowy 2.0

EMM creating opportunities

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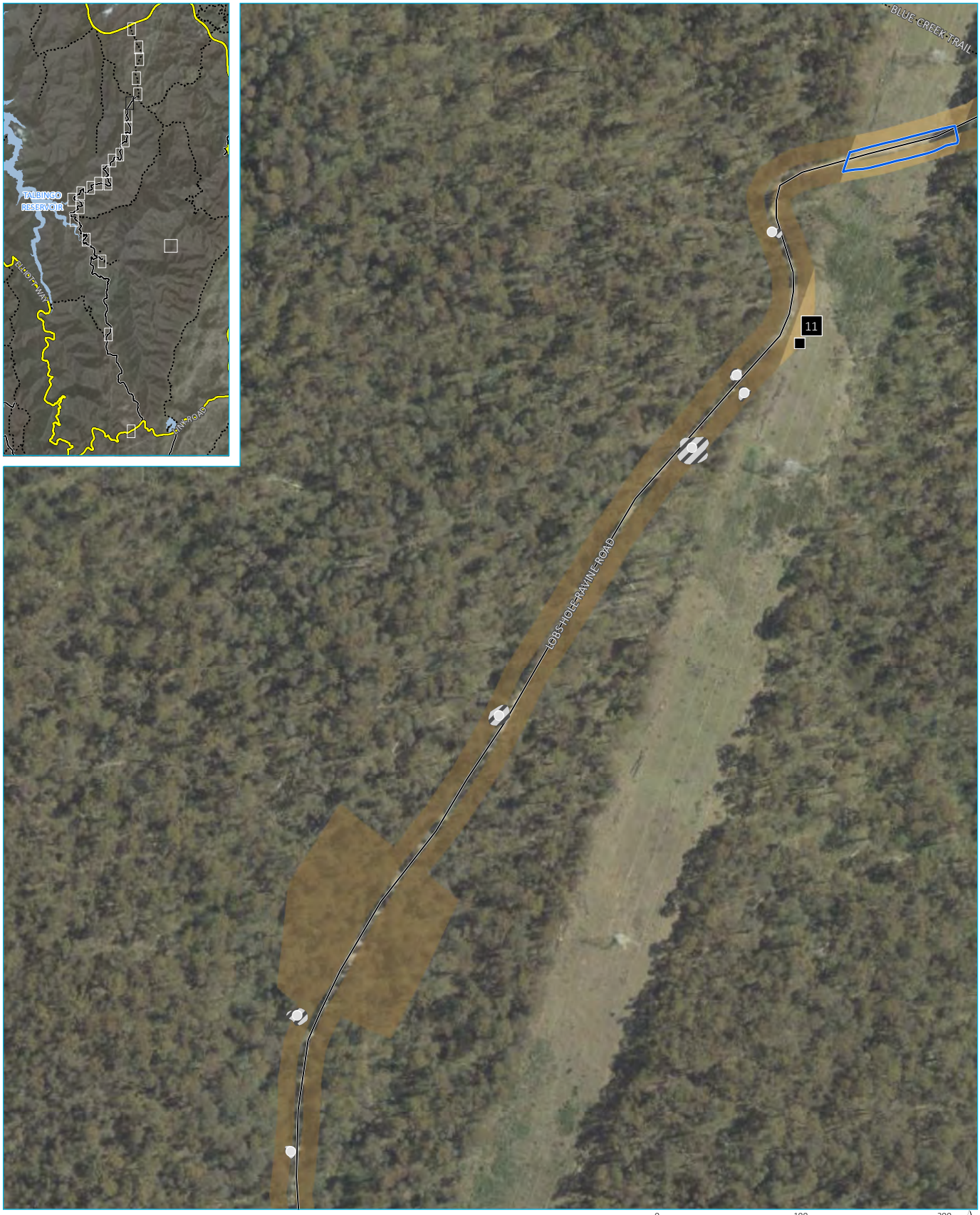

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Vehicular track
- Plot location
- Dangerous tree
- Modification 2 approved construction footprint
- Management zone

PCT 953

- High
- Derived grassland

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 g

snowy 2.0

EMM creating opportunities

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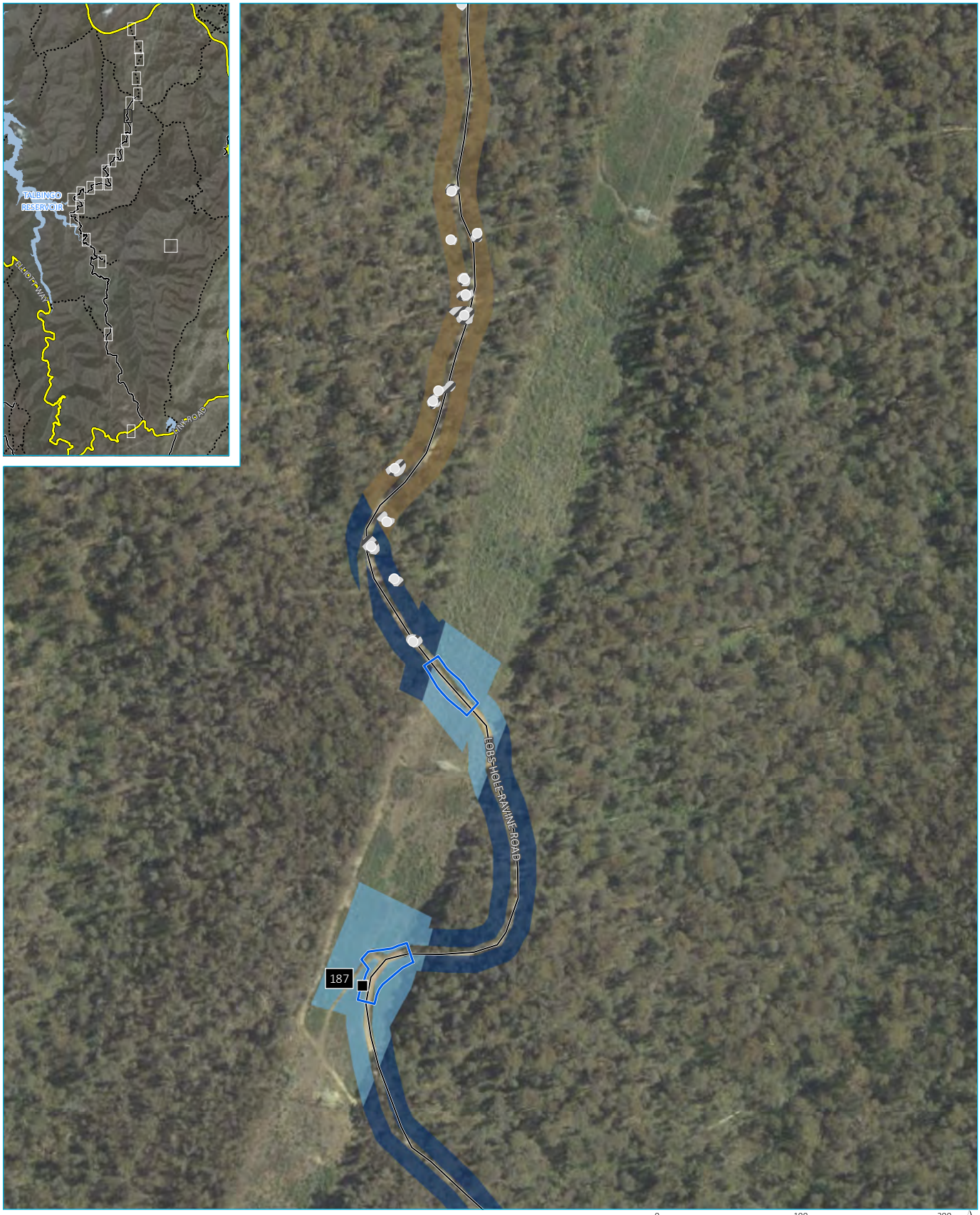

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Plot location
- Dangerous tree
- Modification 2 approved construction footprint
- Management zone

PCT 296
- High

- Derived grassland

PCT 953
- High

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 h

snowy 2.0

EMM creating opportunities

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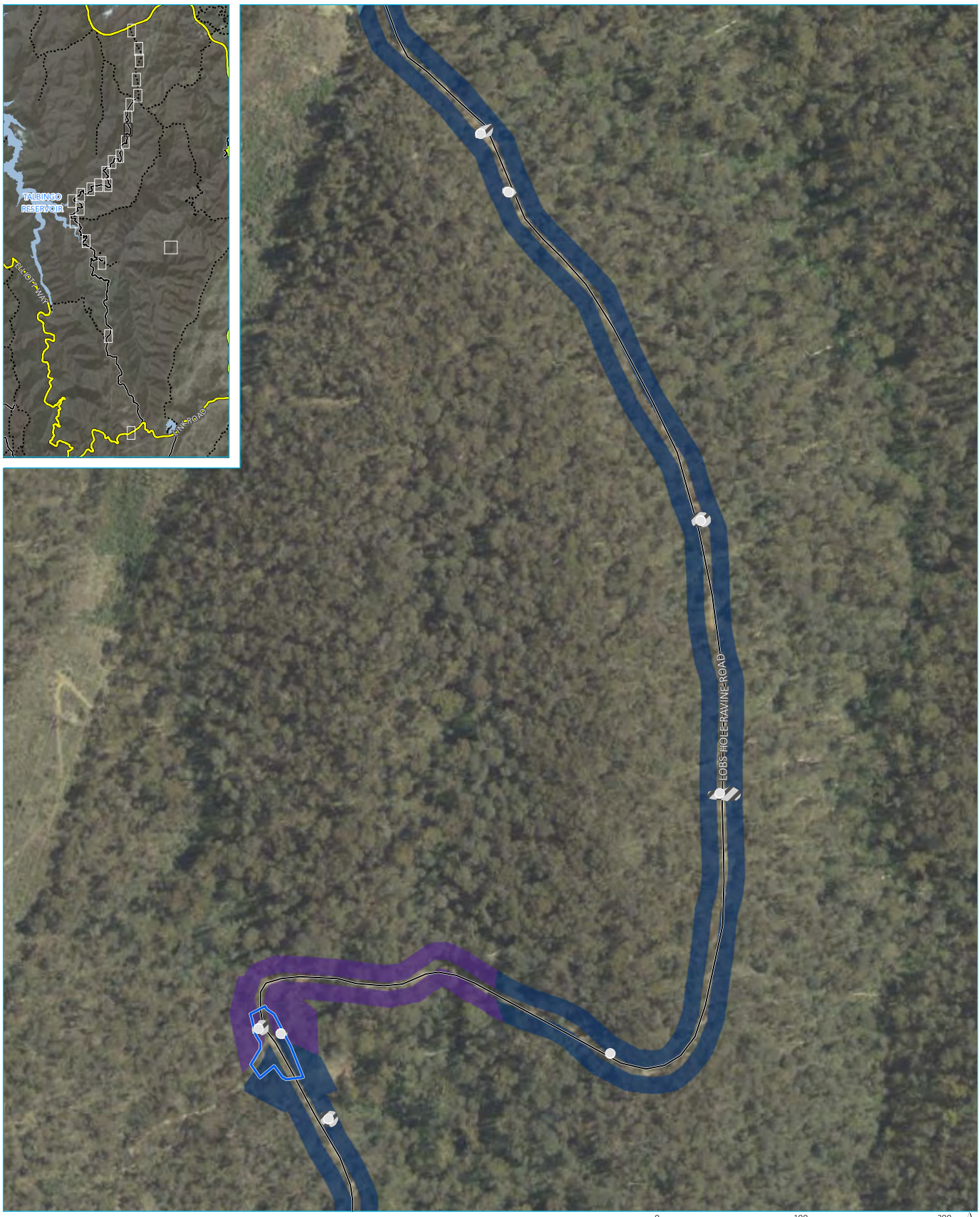

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Dangerous tree
- Modification 2 approved construction footprint
- Management zone

PCT 296

- High
- Derived grassland

PCT 300

- Medium

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 i

snowy 2.0

EMM creating opportunities

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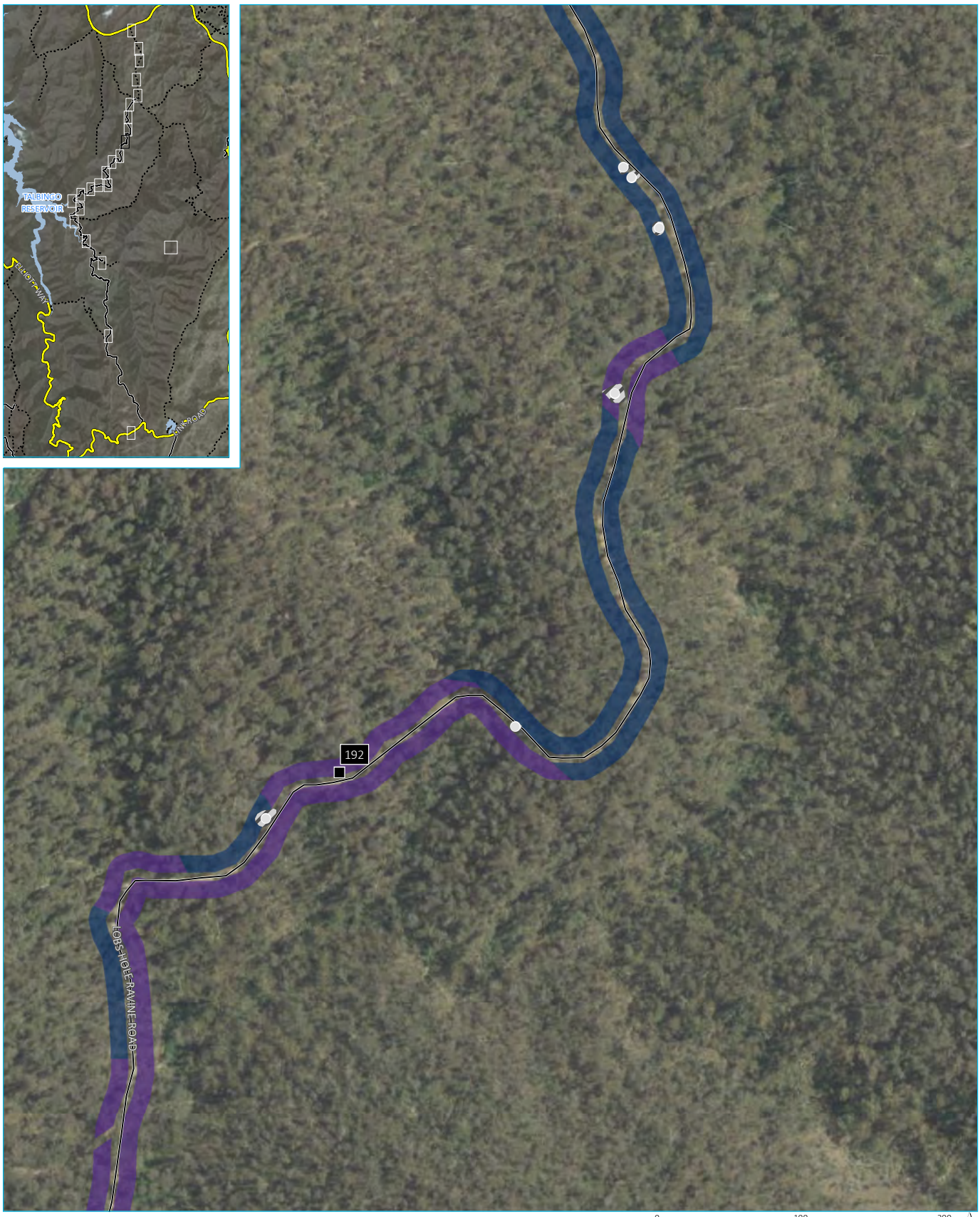

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55

KEY

- Local road
- Plot location
- Dangerous tree
- Management zone

PCT 296

- High

PCT 300

- Medium

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 j

snowy 2.0

EMM creating opportunities

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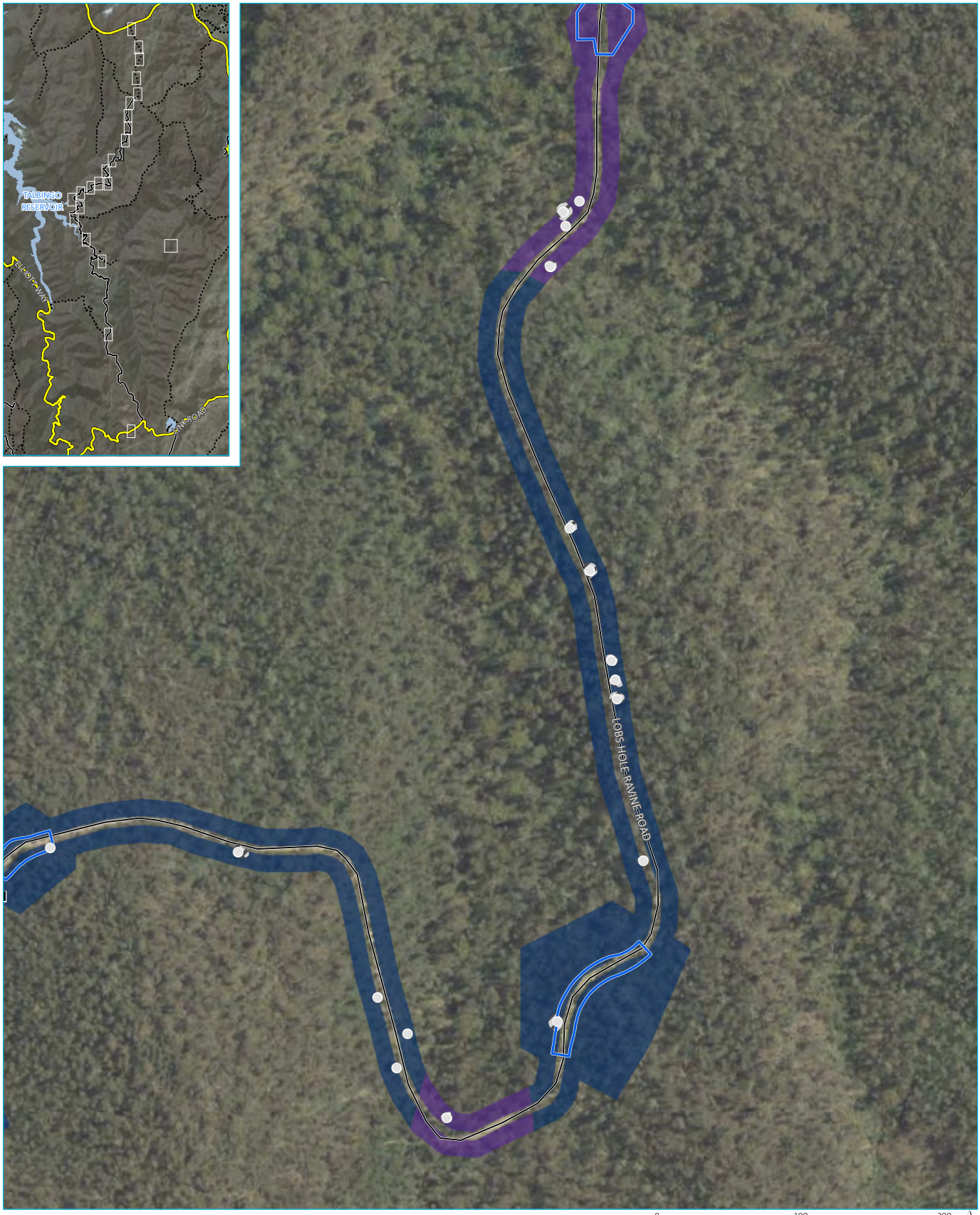

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Plot location
- Dangerous tree
- Modification 2 approved construction footprint
- Management zone

PCT 296
- High

PCT 300
- Medium

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 k

snowy 2.0

EMM creating opportunities

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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Plot location
- Dangerous tree
- Modification 2 approved construction footprint
- Management zone

PCT 296

- High
- Derived grassland

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 l

snowy 2.0

EMM creating opportunities

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

0 100 200 m

GDA 1994 MGA Zone 55

N

KEY

- Local road
- Dangerous tree
- Modification 2 approved construction footprint
- Management zone

PCT 296

- High
- Derived grassland

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 m

snowy 2.0

EMM creating opportunities

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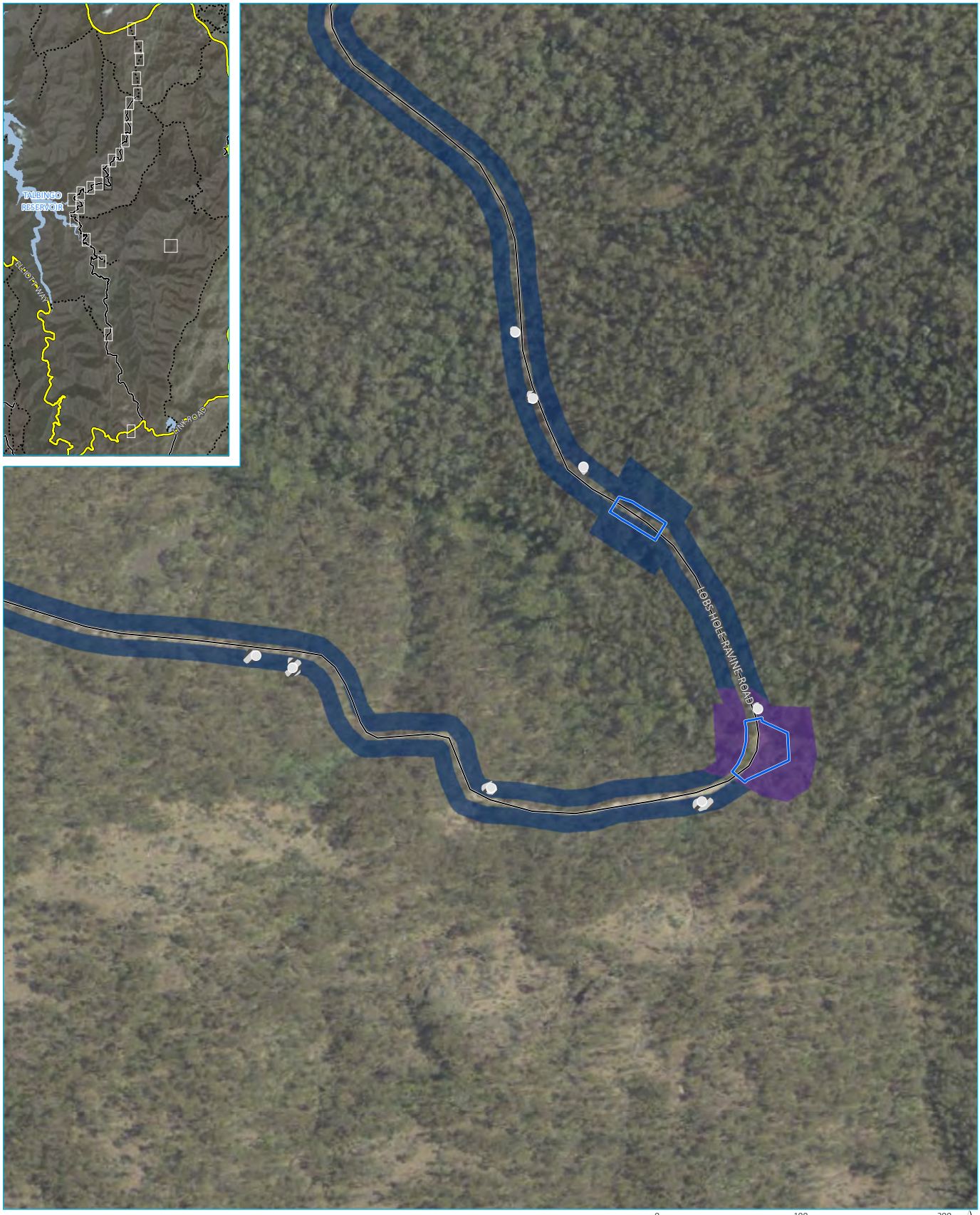

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Dangerous tree
- Modification 2 approved construction footprint
- Management zone

PCT 296
- High

PCT 300
- Medium

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 n

snowy 2.0

EMM creating opportunities

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

0 100 200 m

GDA 1994 MGA Zone 55

N

KEY

- Local road
- Dangerous tree
- Management zone

PCT 296

- High

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 o

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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Dangerous tree
- Modification 2 approved construction footprint
- Management zone

PCT 296

- High
- Derived grassland

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 p

snowy 2.0

EMM creating opportunities

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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Dangerous tree
- Modification 2 approved construction footprint
- Management zone

PCT 296

- High
- Derived grassland

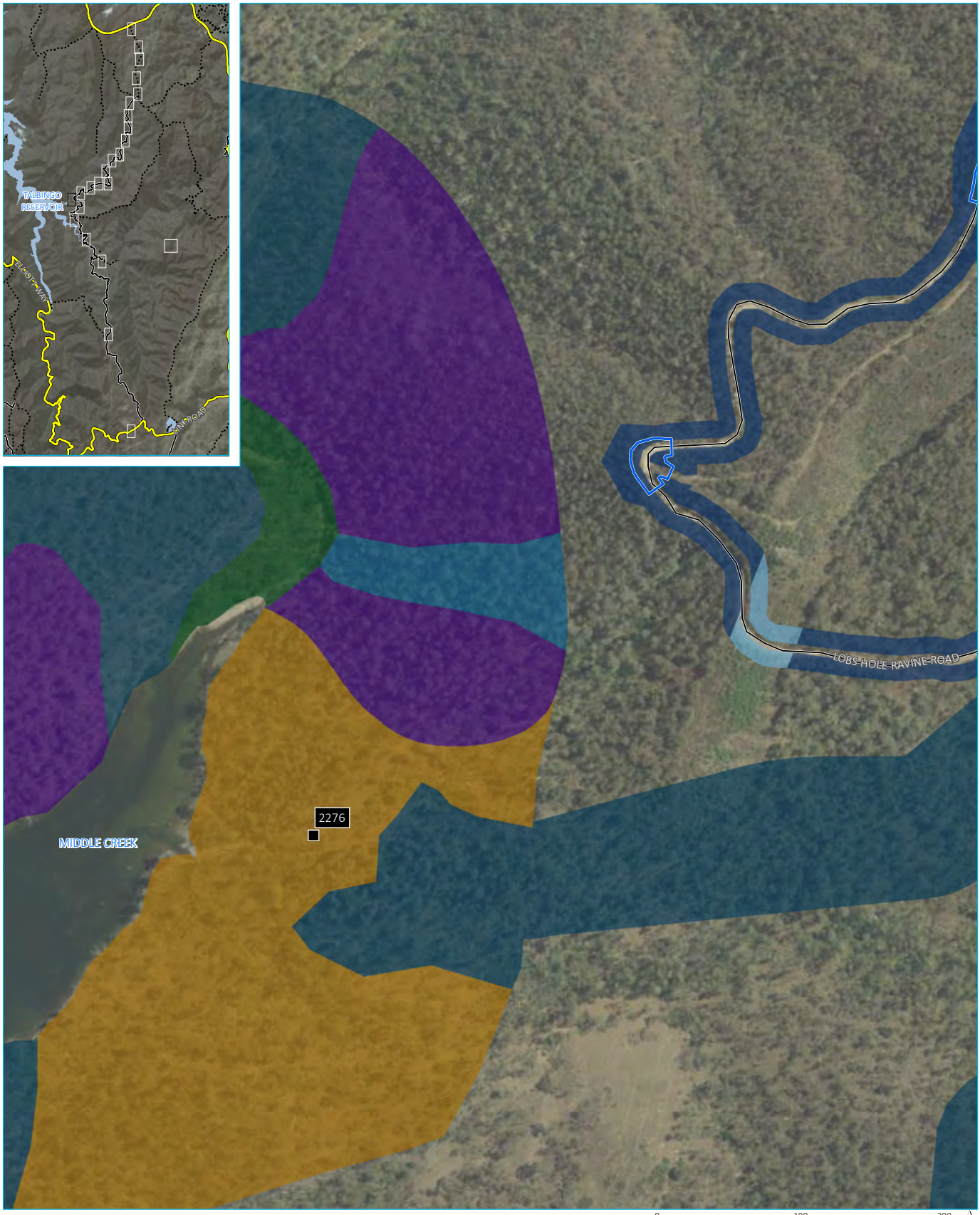
Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 q

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_RtS\ECO001_PCTsPlotsAndDangerousTrees_20191212_01.mxd 18/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Plot location
- Modification 2 approved construction footprint

PCT 299
- High

PCT 296
- High

- Derived grassland

PCT 300
- High

PCT 729
- High
- Medium

PCT 1191
- High

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 r

snowy 2.0

EMM creating opportunities

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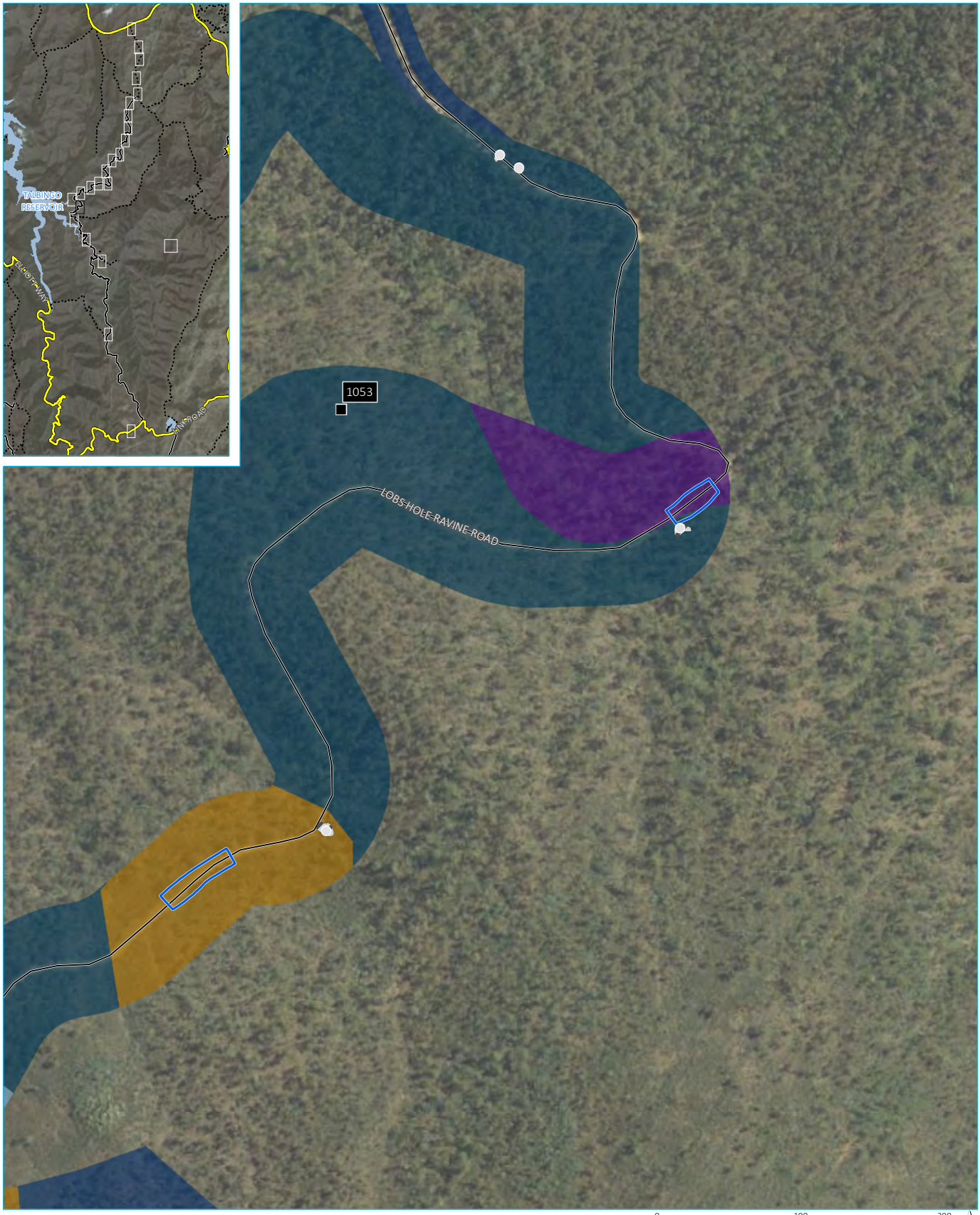


Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Plot location
- Dangerous tree
- Modification 2 approved construction footprint
- Management zone

PCT 296
- High

PCT 300
- High

PCT 729
- High
- Derived grassland

PCT 1191
- High

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 s

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\177188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_RtS\ECO001_PCTsPlotsAndDangerousTrees_20191212_01.mxd 18/12/2019

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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Vehicular track
- Plot location
- Modification 2 approved construction footprint
- Exploratory works approved construction footprint

PCT 296
- High

PCT 300
- High
- Medium
- Derived grassland

PCT 729
- High
- Medium
- Derived grassland

PCT 1191
- High
- Medium
- Derived grassland

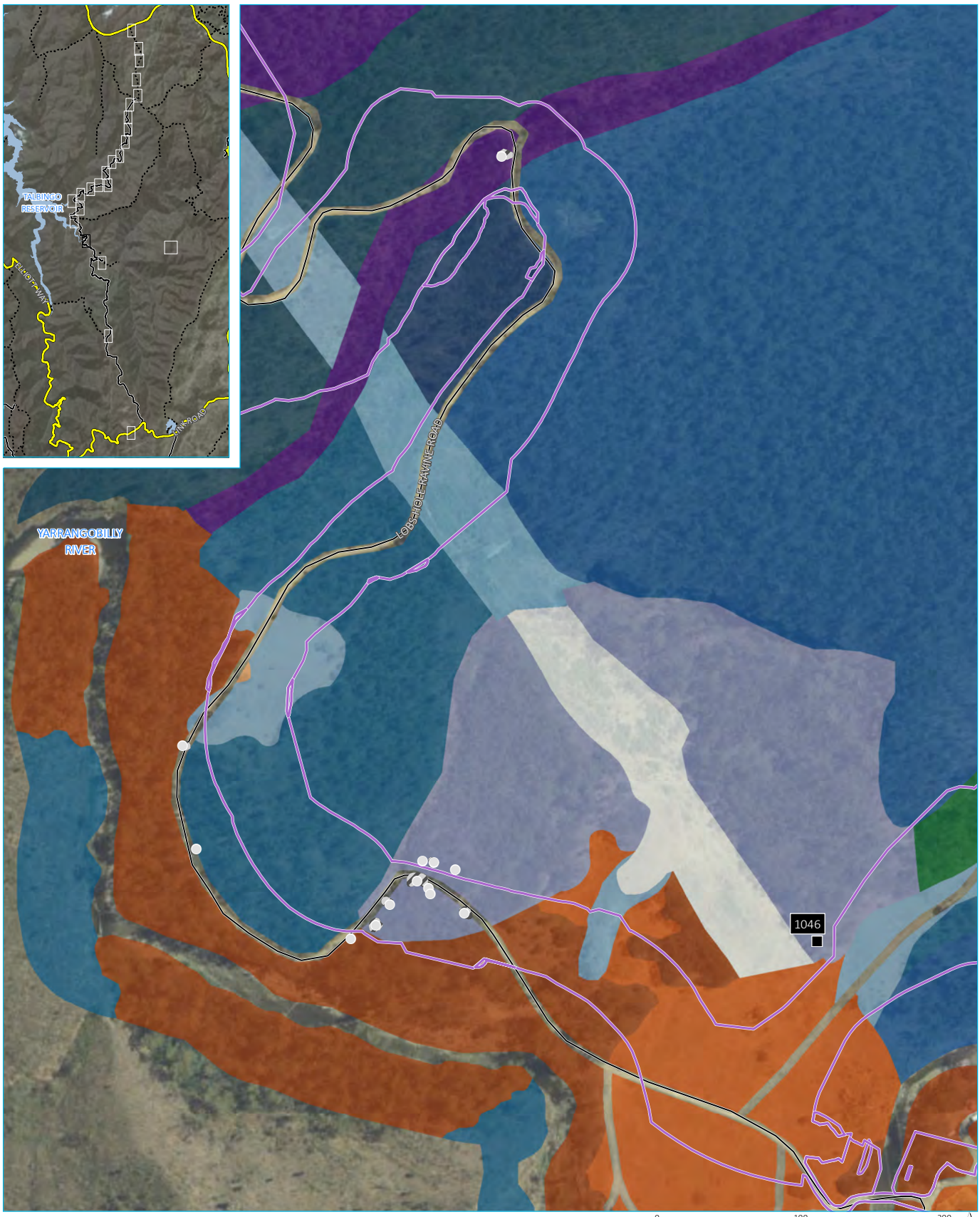
Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 t

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO001_PCTsPlotsAndDangerousTrees_20191212_01.mxd 18/12/2019



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

KEY

- Local road
- Plot location
- Dangerous tree
- Exploratory works approved construction footprint

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 u

snowy 2.0

EMM creating opportunities

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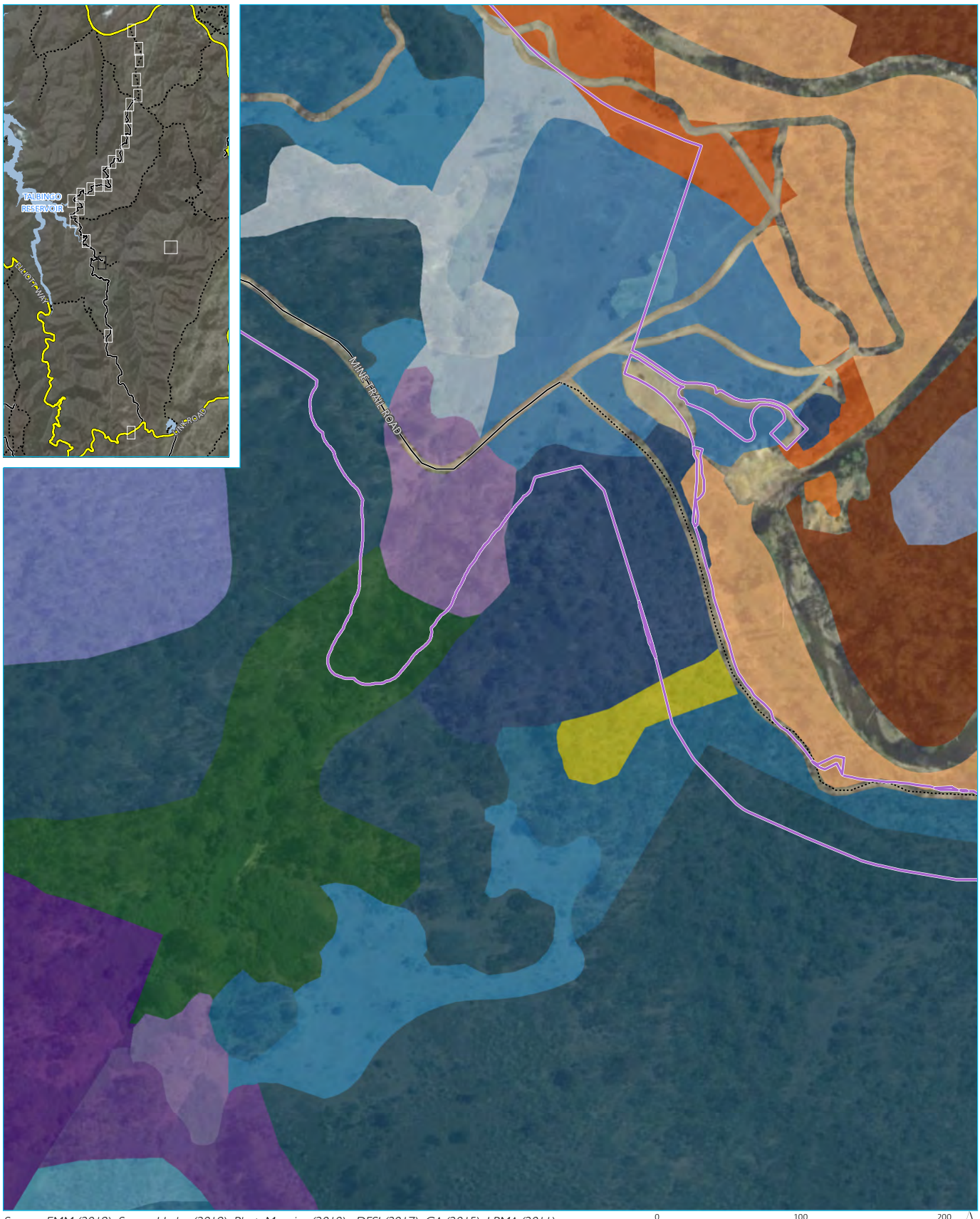


Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Local road
- Vehicular track
- Exploratory works approved construction footprint

PCT 297
- 297, High

PCT 299
- High

PCT 285
- High
- Medium
- Low
- Poor

PCT 296
- High
- Low

PCT 300
- High
- Medium
- Low

PCT 302
- High
- Low

- Poor

- Poor
- Other

PCT 729
- High
- Medium
- Low
- Poor

PCT 999
- High

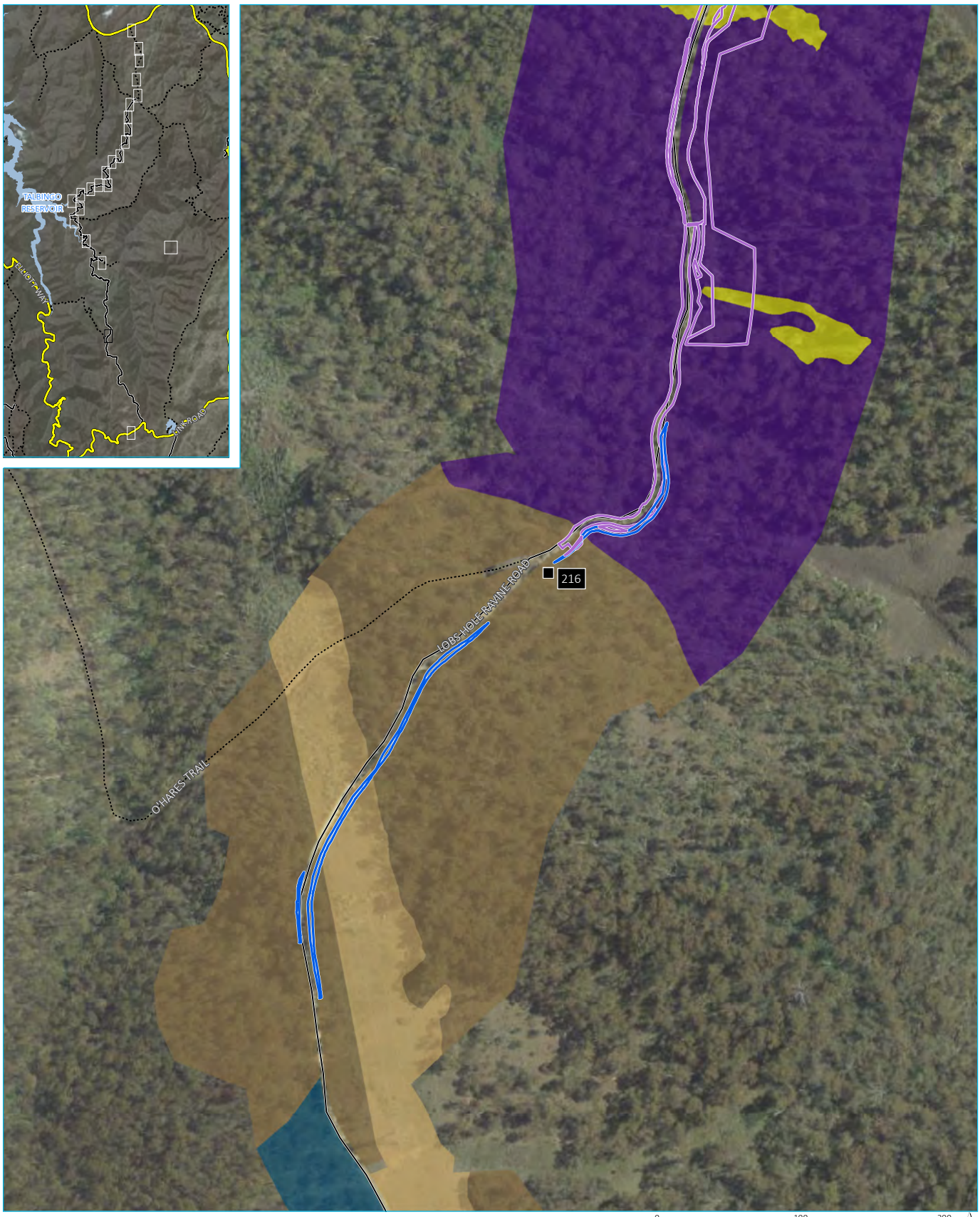
Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 v

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO001_PCTsPlotsAndDangerousTrees_20191212_01.mxd 18/12/2019



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

0 100 200 m

GDA 1994 MGA Zone 55

N

KEY

- Local road
- Vehicular track
- Plot location
- Modification 2 approved construction footprint
- Exploratory works approved construction footprint

PCT 300
- High

PCT 643
- Low

PCT 953
- High
- Derived grassland

PCT 1196
- High

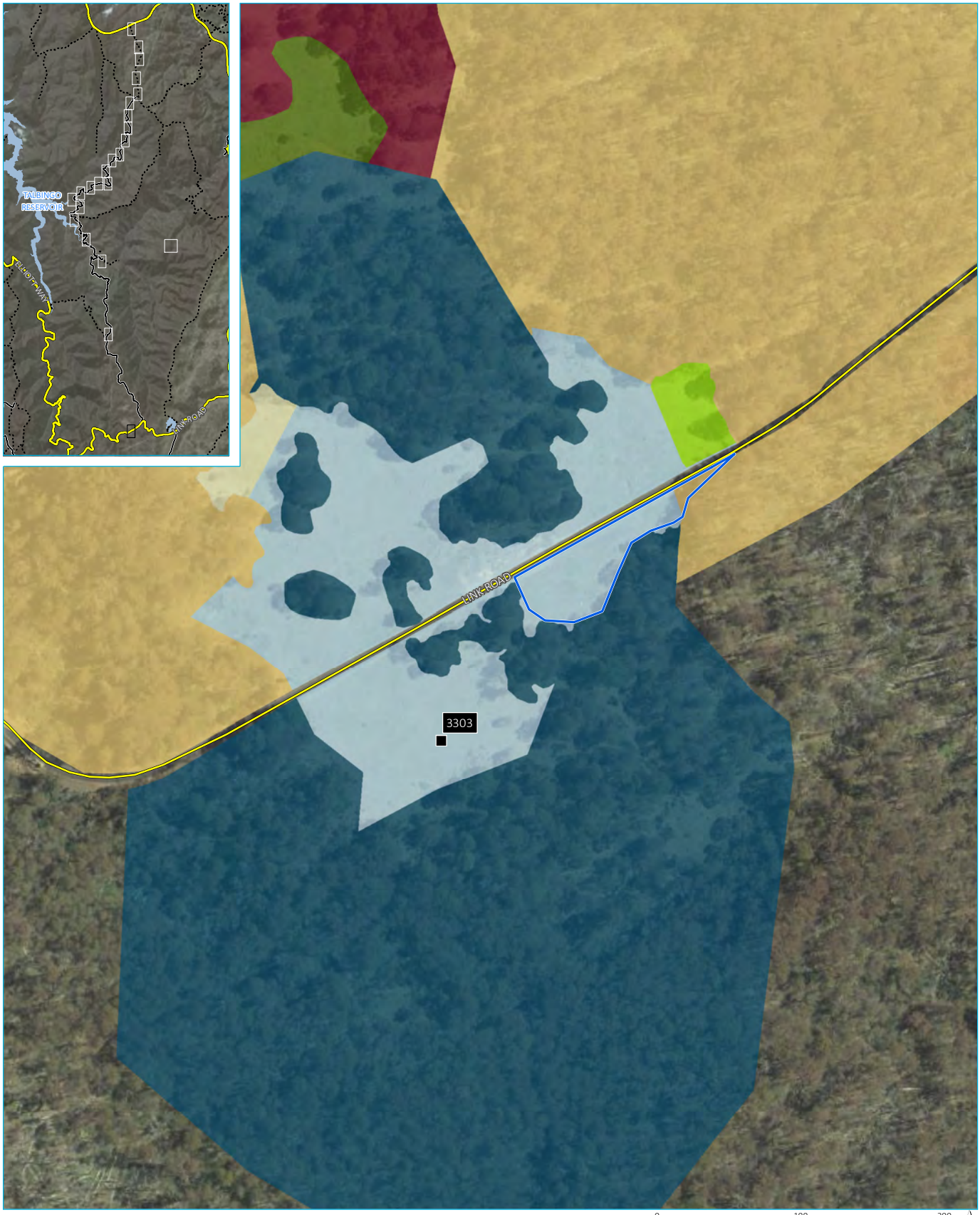
Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 w

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_RtS\ECO001_PCTsPlotsAndDangerousTrees_20191212_01.mxd 18/12/2019



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

0 100 200 m

GDA 1994 MGA Zone 55

N

KEY

- Main road
- Plot location
- Modification 2 approved construction footprint

PCT 639
- High
- Derived grassland

PCT 644
- High

PCT 1224
- High
- Poor

PCT 1196
- High
- Derived grassland

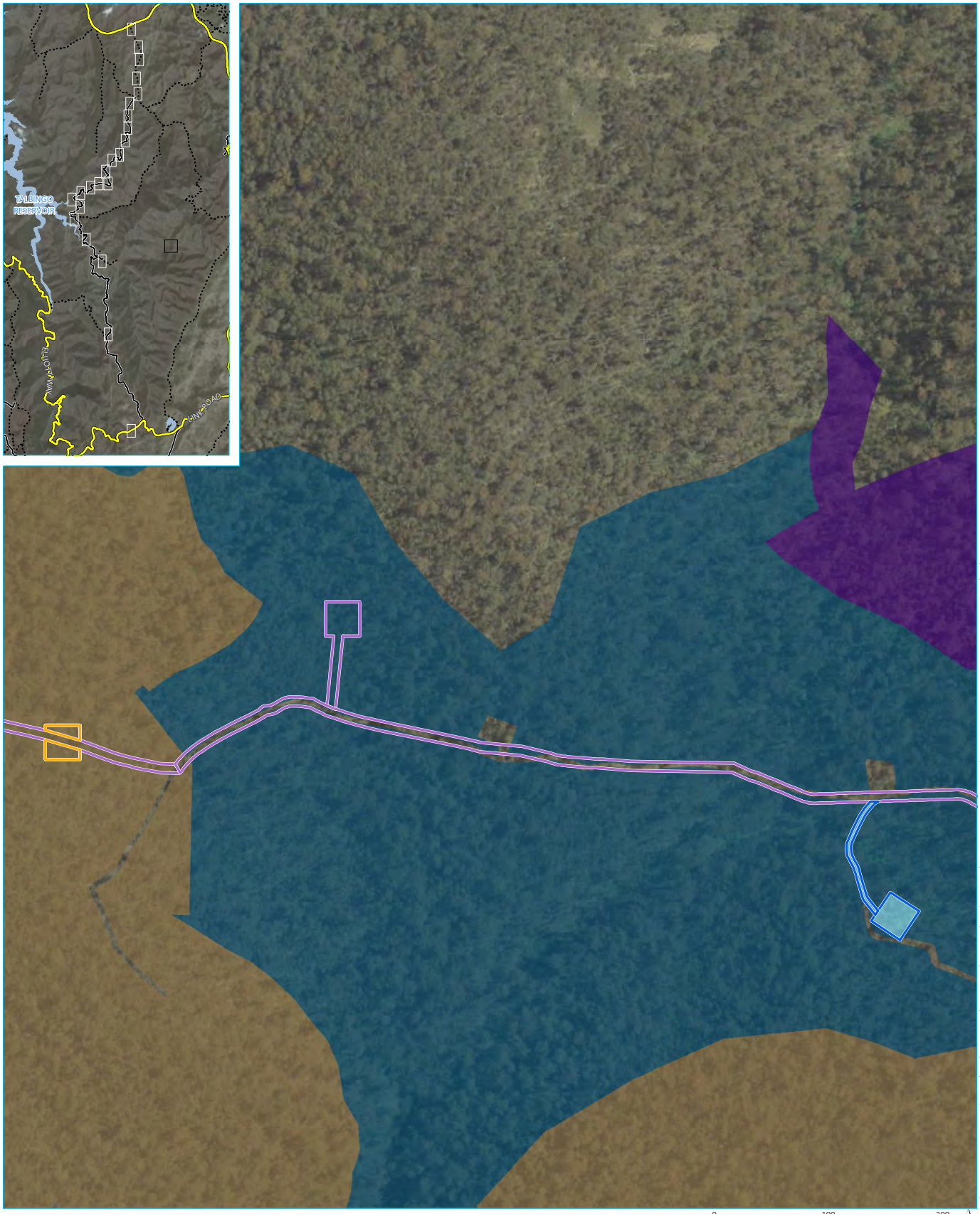
Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 x

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO001_PCTsPlotsAndDangerousTrees_20191212_01.mxd 18/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Modification 2 approved construction footprint
- Exploratory works approved construction footprint
- Avoidance footprint

PCT 300
- High

PCT 953
- High

PCT 1196
- High
- Other

Plant Community Type and vegetation zone mapping within the additional Modification 2 areas including plot

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.1 y

O:\J17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_RtS\ECO001_PCTsPlotsAndDangerousTrees_20191218_02.mxd 18/12/2019

2.2 Threatened species assessment, including dangerous tree removal

2.2.1 Targeted survey methods

i Targeted flora surveys

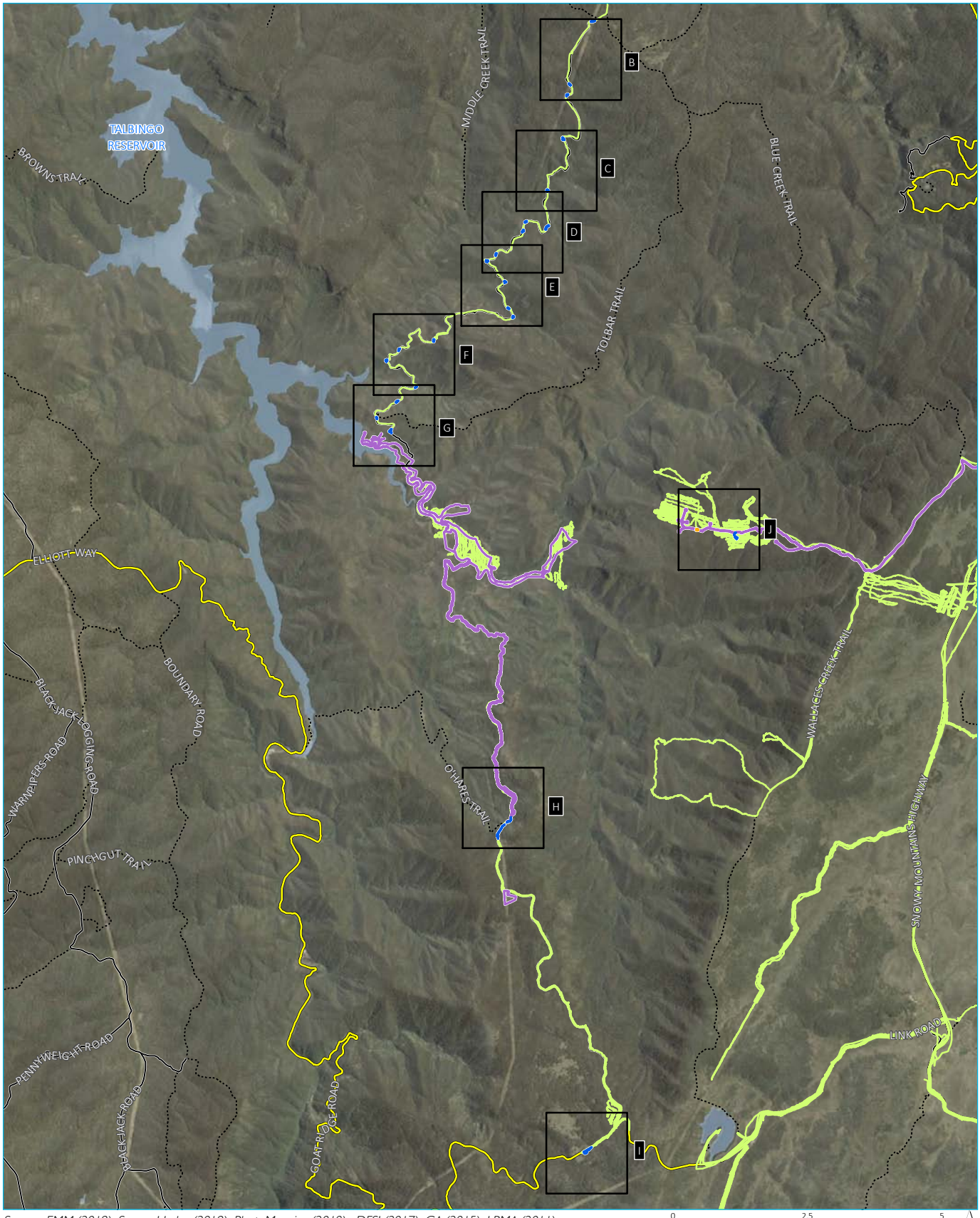
Targeted flora surveys have been undertaken in accordance with OEH (2016) and DoE (2013) guidelines, and included transects spaced at intervals of 5 m.

Targeted flora surveys were undertaken within the survey area during January 2018 and November and December 2019. Targeted flora survey locations are illustrated in Figure 2.2.

ii Fauna habitat assessment

A habitat assessment was conducted along Lobs Hole Ravine Road (north) on 10 December 2019 to investigate the 134 dangerous trees required for removal. Each tree was checked for hollows, with hollow sizes recorded. Any trees suitable for specific species was recorded. Surveys focused on identifying breeding habitat for hollow-dependent birds (eg Gang-gang Cockatoo, Barking Owl and Masked Owl).

This habitat assessment is considered suitable to identify nest trees for the Gang-Gang Cockatoo, as the species was observed nesting in trees outside of the disturbance area during this habitat assessment. However, the habitat assessment was conducted outside of the breeding season for the Barking Owl and Masked Owl, and further targeted surveys will be required to confirm whether any identified suitable breeding trees are being utilised.



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

0 2.5 5 km

GDA 1994 MGA Zone 55

N

KEY

- Main road
- Local road
- Vehicular track
- Flora survey transect
- Page index
- Waterbody
- Modification 2 approved construction footprint
- Exploratory works approved construction footprint
- Avoidance area

Flora survey locations

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.2 a

snowy 2.0

EMM creating opportunities

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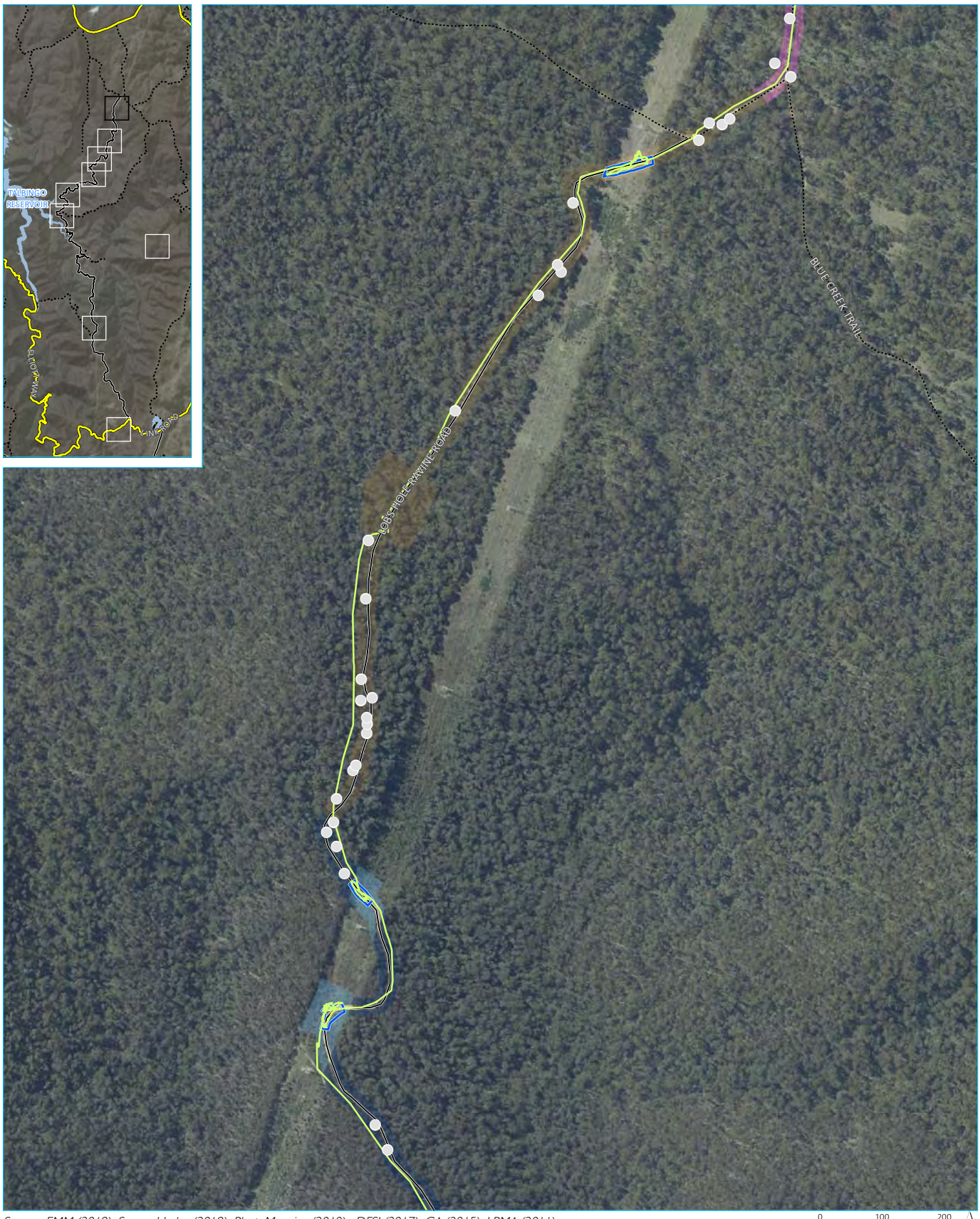


Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Main road
- Local road
- Vehicular track
- Flora survey transect
- Modification 2 approved construction footprint

PCT 296
- High
- Derived grassland

PCT 952
- Other

PCT 953
- High
- Derived grassland

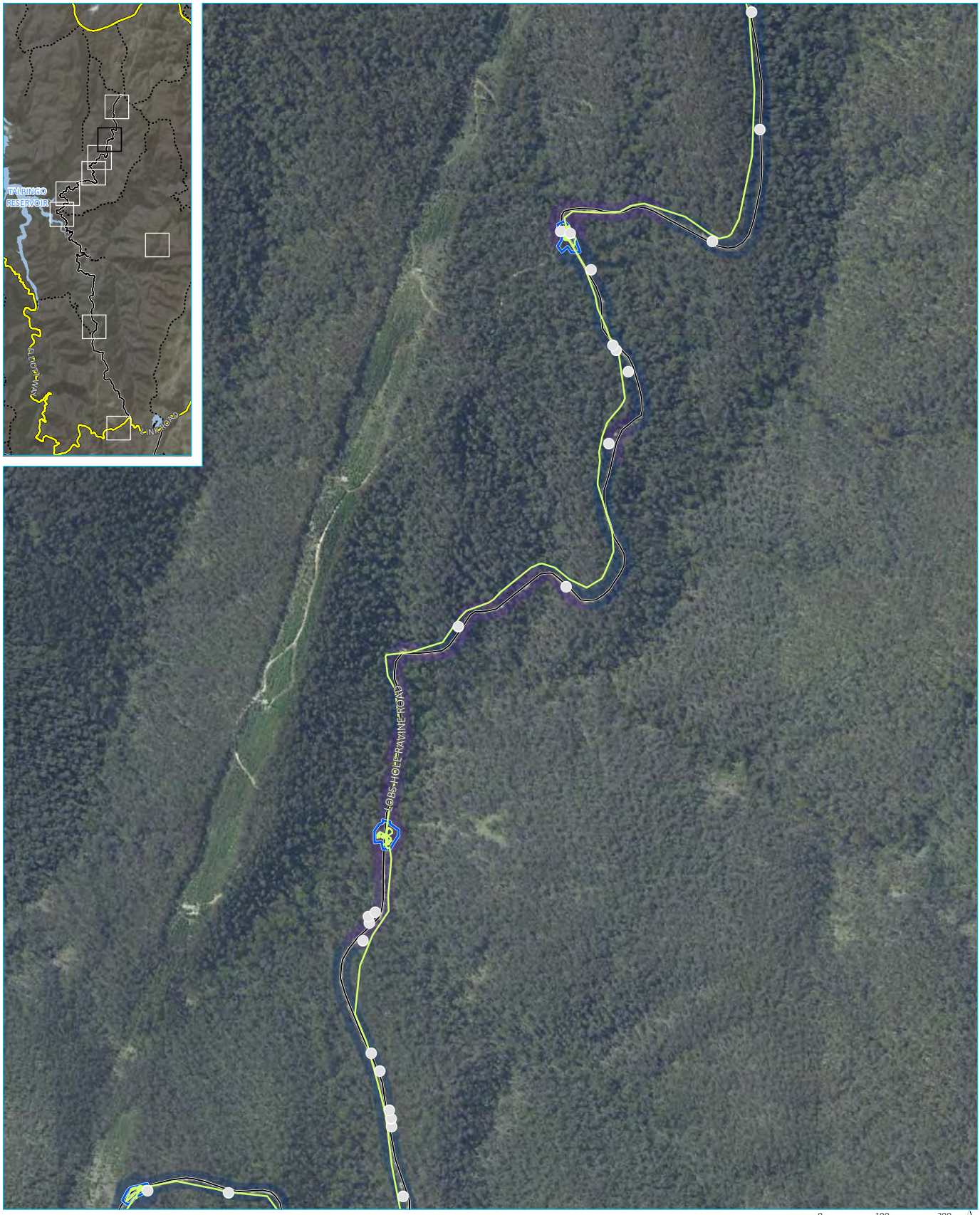
Flora survey locations

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.2 b

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_RtS\ECO002_FloraSurveyLocations_20191212_01.mxd 18/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Main road
- Local road
- Vehicular track
- Flora survey transect
- Modification 2 approved construction footprint

PCT 296
- High

PCT 300
- Medium

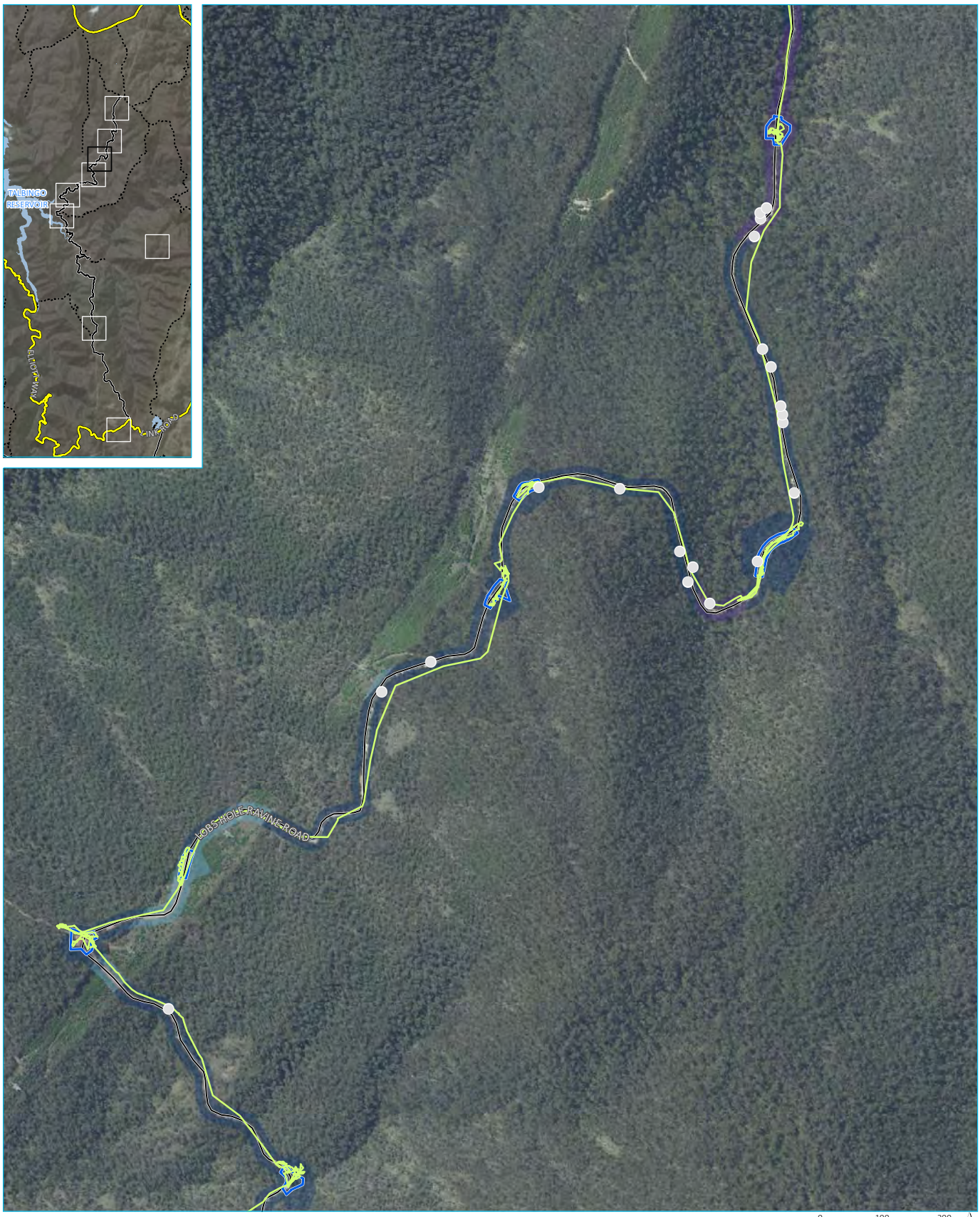
Flora survey locations

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.2 c

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_RtS\ECO002_FloraSurveyLocations_20191212_01.mxd 18/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Main road
- Local road
- Vehicular track
- Flora survey transect
- Modification 2 approved construction footprint

PCT 296
- High
- Derived grassland

PCT 300
- Medium

Flora survey locations

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.2 d

snowy 2.0

EMM creating opportunities

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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Main road
- Local road
- Vehicular track
- Flora survey transect
- Modification 2 approved construction footprint

PCT 296
- High
- Derived grassland

PCT 300
- Medium

Flora survey locations

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.2 e

snowy 2.0

EMM creating opportunities

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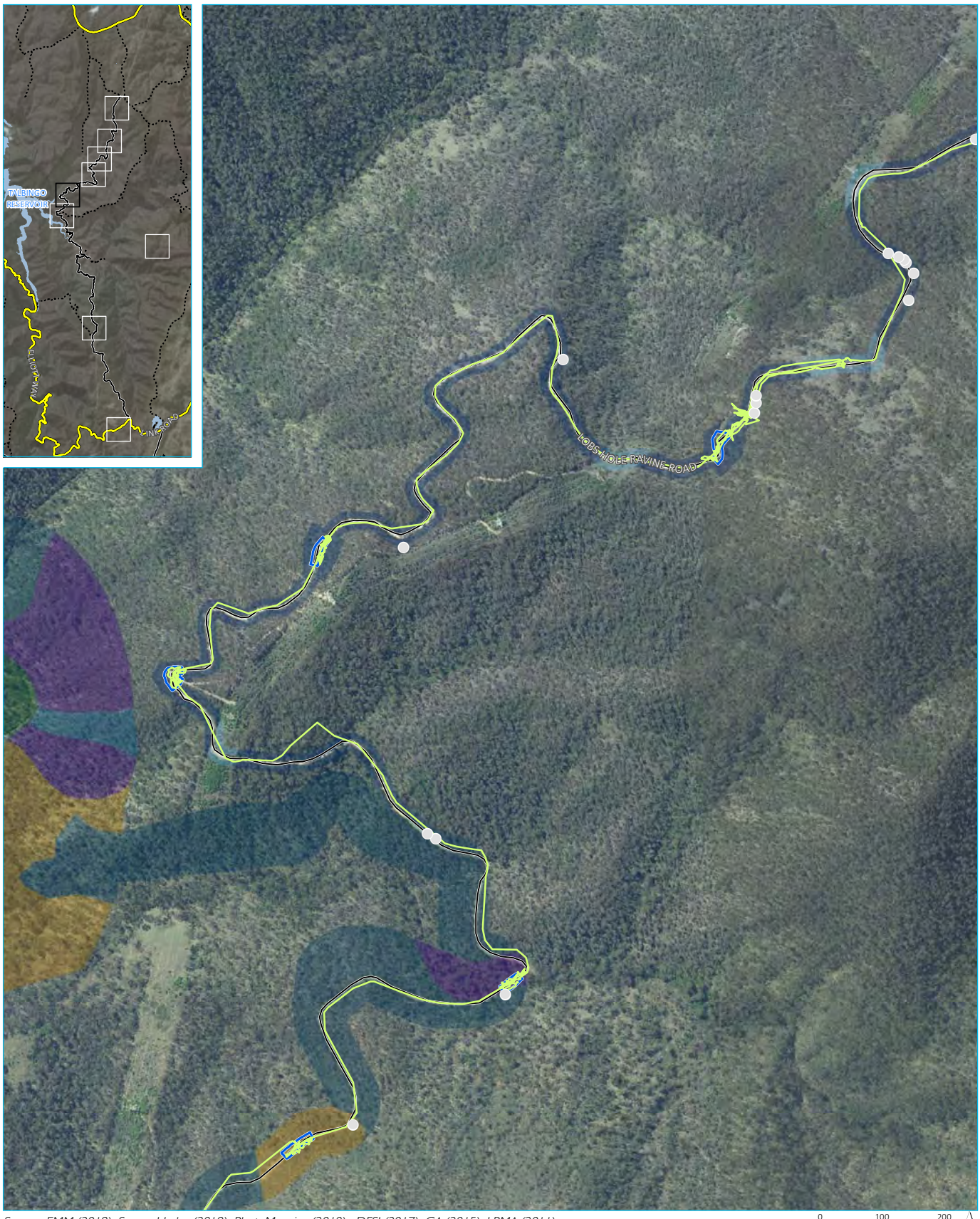


Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Main road
- Local road
- Vehicular track
- Flora survey transect
- Modification 2 approved construction footprint

PCT 299
- High

PCT 296
- High
- Derived grassland

PCT 300
- High

PCT 729
- High
- Medium

PCT 1191
- High

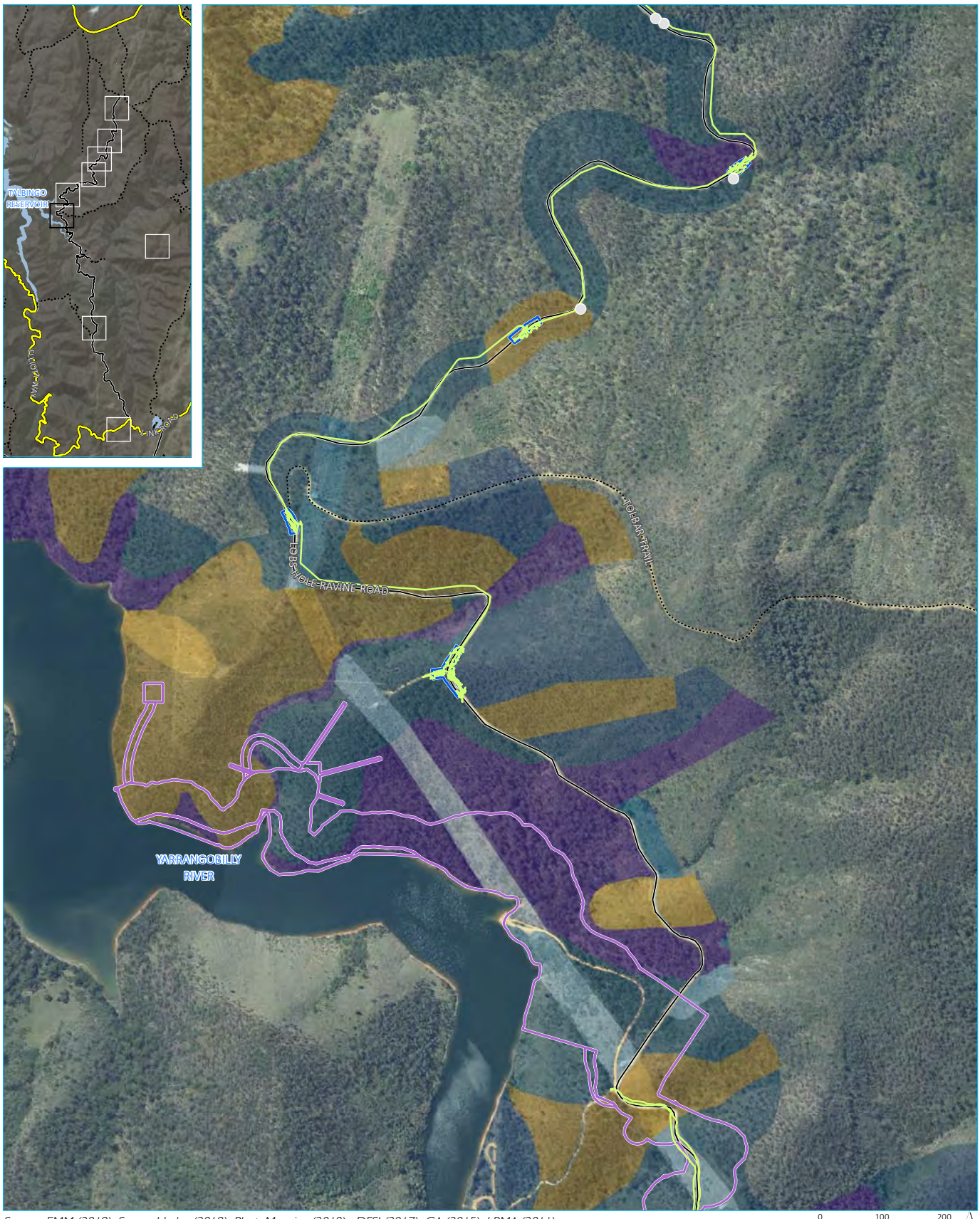
Flora survey locations

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.2 f

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO002_FloraSurveyLocations_20191212_01.mxd 18/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Main road
- Local road
- Vehicular track
- Flora survey transect
- Modification 2 approved construction footprint
- Exploratory works approved construction footprint

PCT 296
- High

PCT 300
- High
- Medium
- Derived grassland

PCT 311
- High

PCT 729
- High
- Medium
- Derived grassland

PCT 1191
- High
- Medium
- Derived grassland

Flora survey locations

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.2 g

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_RtS\ECO002_FloraSurveyLocations_20191212_01.mxd 18/12/2019

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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Main road
- Local road
- Vehicular track
- Flora survey transect
- Modification 2 approved construction footprint
- Exploratory works approved construction footprint

PCT 300
- High

PCT 643
- Low

PCT 729
- High

PCT 953
- High

- Derived grassland

PCT 1196
- High
- Derived grassland

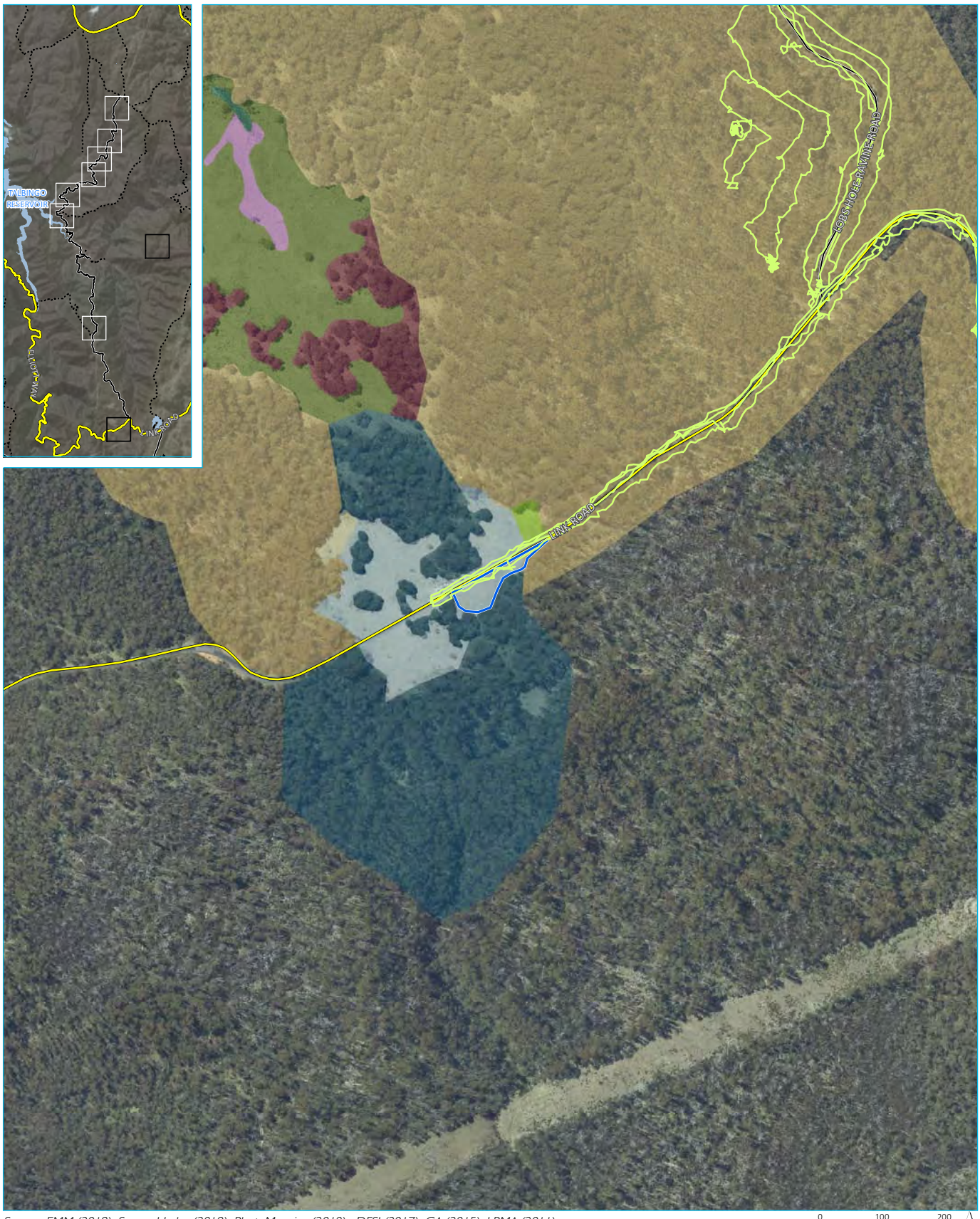
Flora survey locations

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.2 h

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO002_FloraSurveyLocations_20191212_01.mxd 18/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Main road
- Local road
- Vehicular track
- Flora survey transect
- Modification 2 approved construction footprint

PCT 303
- High

- Other

PCT 637
- High

PCT 639
- High
- Derived grassland

PCT 644
- High

PCT 1225
- Other

PCT 1224
- High
- Poor

PCT 1196
- High
- Derived grassland

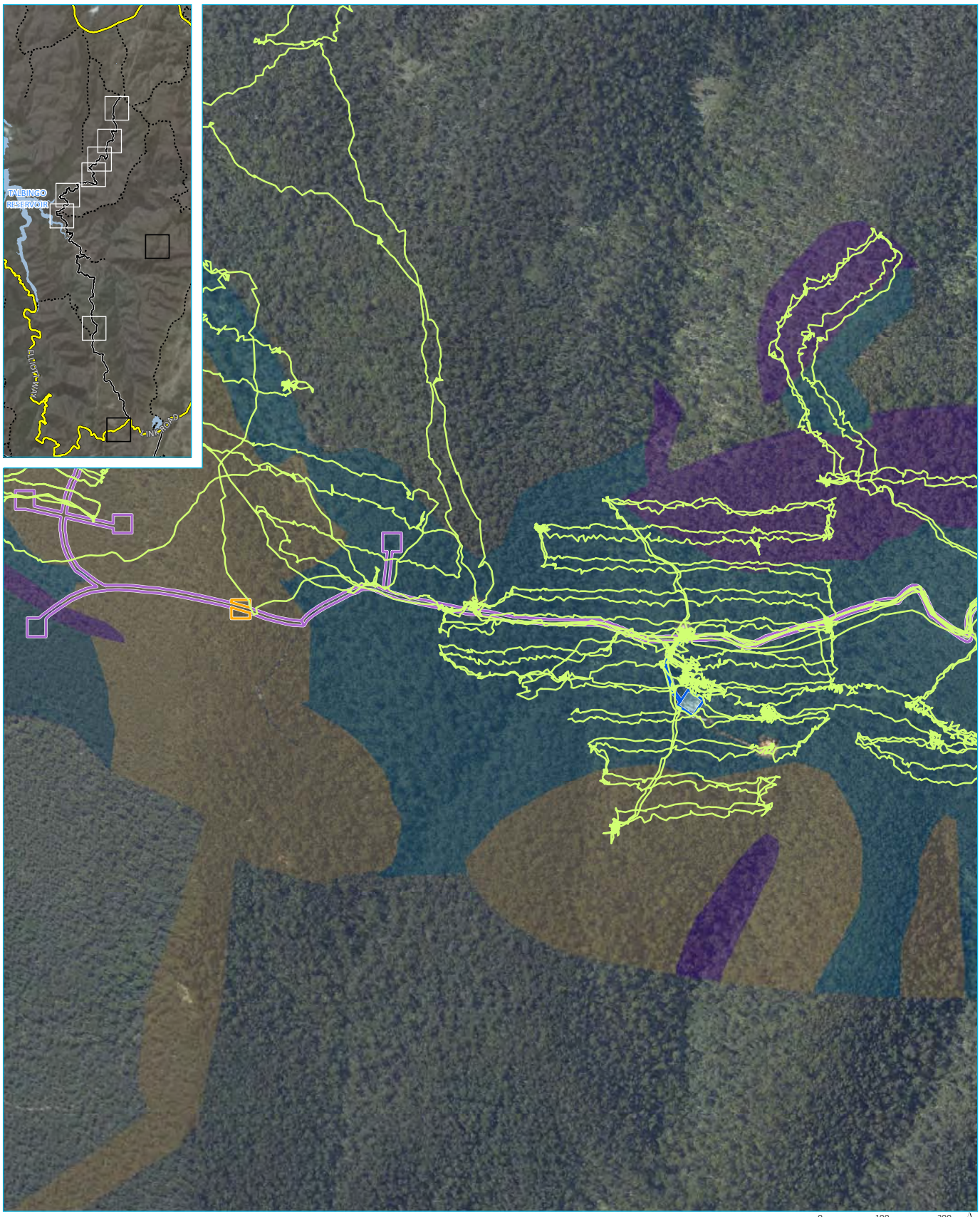
Flora survey locations

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.2 i

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO002_FloraSurveyLocations_20191212_01.mxd 18/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Main road
- Local road
- Vehicular track
- Flora survey transect
- Modification 2 approved construction footprint
- Exploratory works approved construction footprint
- Avoidance area

PCT 300
- High

PCT 729
- High

PCT 953
- High

PCT 1196
- High

Other

Flora survey locations

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.2 i

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_RtS\ECO002_FloraSurveyLocations_20191212_01.mxd 18/12/2019

2.2.2 Targeted survey results

i Threatened flora survey results

No threatened flora species were recorded during targeted surveys within the Modification 2 study area. All candidate threatened flora species are considered to have a low likelihood of occurrence with the disturbance footprint following targeted surveys.

One species, *Caladenia montana*, was recorded adjacent to the disturbance footprint. Due to recent changes to the data in the threatened biodiversity data collection (TBDC) *Caladenia montana* was not considered as a candidate species until recently. The first samples recorded in October 2019 were confirmed as *Caladenia montana*. Targeted surveys undertaken in November and December 2019 recorded *Caladenia* sp. that had gone to seed and could not be reliably identified. For the purposes of this assessment, all records of *Caladenia* sp. were deemed *Caladenia montana*. No records of *Calandenia montana* were recorded within 30 m of the disturbance boundary. Therefore, for the purposes of the BAM a species polygon has not been developed.

ii Fauna habitat assessment

A habitat assessment was completed for each of the 134 dangerous trees to be removed. Thirty-nine of the dangerous trees contain hollows. Hollows ranged from small (less than 5 cm diameter) to large (30 cm diameter).

No Gang-gang Cockatoos were recorded nesting in any trees during the habitat assessment. Two of the 39 hollow-bearing trees supported hollows considered suitable for the Masked Owl or Barking Owl.

Nine threatened fauna species have been recorded within or adjacent to the dangerous trees (Figure 2.4):

- Six threatened bird species:
  - Dusky Woodswallow (ecosystem credit species);
  - Flame Robin (ecosystem credit species);
  - Gang-gang Cockatoo;
  - Masked Owl (ecosystem credit species);
  - Turquoise Parrot (ecosystem credit species);
  - Varied Sittella (ecosystem credit species);
- Three threatened mammal species:
  - Eastern Bentwing-bat (ecosystem credit species);
  - Eastern False Pipistrelle (ecosystem credit species); and
  - Eastern Pygmy-possum.

2.2.3 Species credit species

A list of candidate species credit species predicted to occur within Modification 2, along with an assessment of whether the survey area provides suitable habitat (including dangerous trees), whether the species was recorded during targeted surveys and whether the species will be impacted by the modification is provided within Table 2.5.

Based on targeted surveys, the following species will be impacted by Exploratory Works Modification 2:

- Barking Owl – 0.01 ha;
- Eastern Pygmy-possum – 1.00 ha;
- Masked Owl – 0.01 ha; and
- Smoky Mouse – 0.13 ha.

These species will require offsets in accordance with the BAM (OEH 2017a).

Table 2.5 Species credit species, habitat suitability and targeted survey results

Scientific name	Common name	Biodiversity risk weighting	Habitat present within the disturbance footprint	Surveys required for removal of dangerous trees	Recorded during field surveys	Impacted by development	Justification
Flora							
Caladenia montana	-	1.50	Yes. Predominantly well-drained slopes and ridges in the upper sections of Lobs Hole Ravine.	No	Yes	No	Not recorded within the development footprint.
Pomaderris cotoneaster	Cotoneaster Pomaderris	2.00	Yes. Predominantly riparian zones.	No	No	No	Not recorded during targeted surveys.
Pterostylis alpina	-	2.00	Yes. Moist slopes near streams.	No	No	No	Not recorded during targeted surveys.
Thesium australe	Austral Toadflax	1.50	Yes. Upper sections of Lobs Hole Ravine Road in damp sections of PCT 1196.	No	No	No	Not recorded during targeted surveys.
Fauna							
Callocephalon fimbriatum	Gang-gang Cockatoo (Breeding)	2.00	Yes. Breeding habitat largely restricted to areas with suitably sized hollows in PCT 1196 along Lobs Hole Ravine Road north and south. Species forages more broadly across the survey area.	Yes	Yes	No	No breeding hollows were recorded within the main disturbance footprint. Although suitable breeding hollows were recorded along Lobs Hole Ravine Road (north), the species was not observed nesting in any of these trees, despite being recorded in adjacent areas. The species is not considered present in any dangerous trees for the purposes of this assessment.

Table 2.5 Species credit species, habitat suitability and targeted survey results

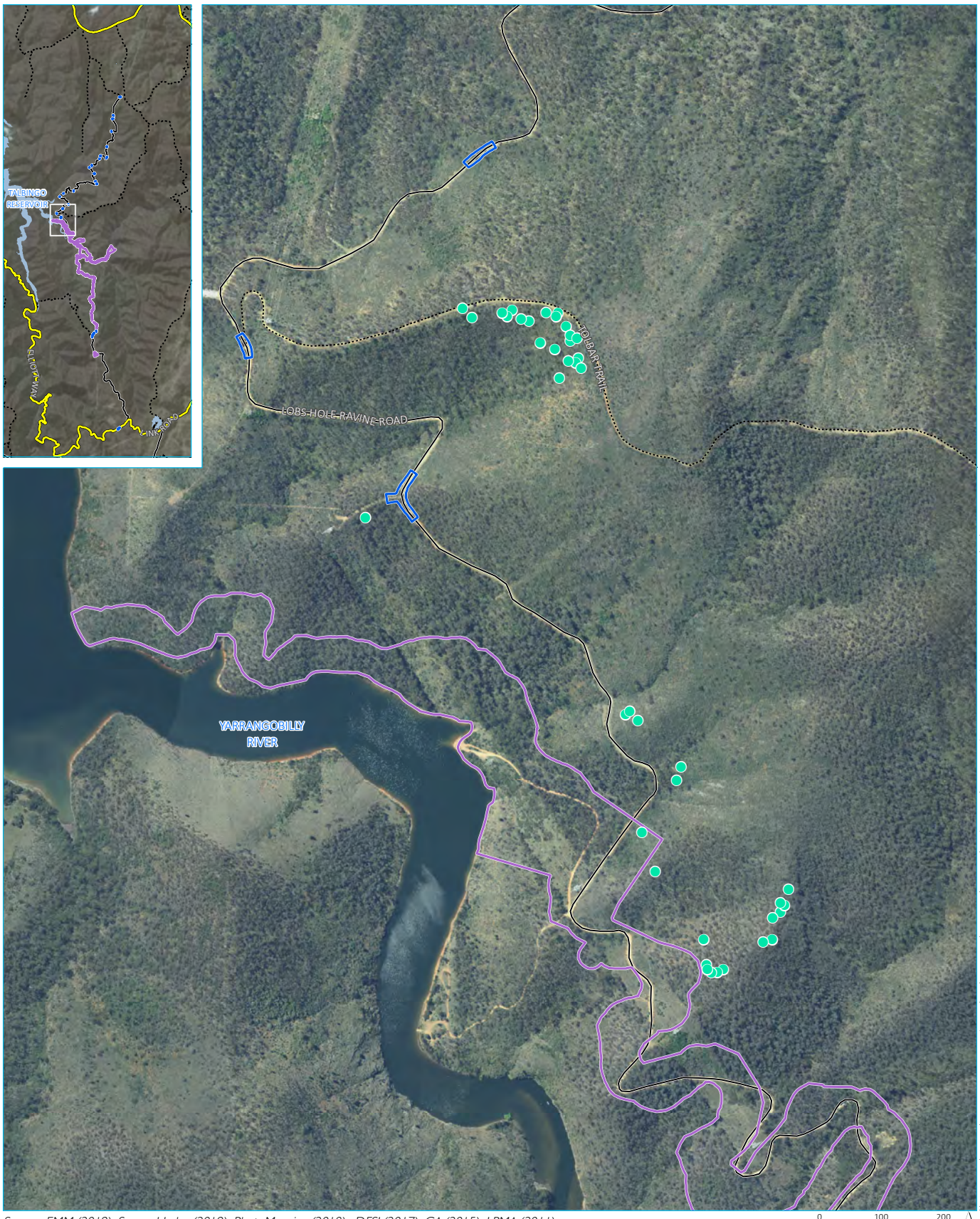
Scientific name	Common name	Biodiversity risk weighting	Habitat present within the disturbance footprint	Surveys required for removal of dangerous trees	Recorded during field surveys	Impacted by development	Justification
Cercartetus nanus	Eastern Pygmy-possum	2.00	Yes. Species occurs in a broad range of habitats within the survey area, usually associated with a dense midstorey and/or feed species such as Banksias.	No	Yes	Yes	PCTs 296, 300, 729 and 953 have been considered suitable habitat on the basis of suitably dense understorey habitat with flowering Banksias. PCTs in Derived Grassland condition classes (eg PCT 1196) were excluded as they do not provide a sufficiently dense understorey selected by the species.
Ninox connivens	Barking Owl (Breeding)	2.00	Yes. Suitable nesting habitat is limited to areas of mature trees adjacent to Talbingo Reservoir.	Yes. .	No	Yes	The Barking Owl is considered scarce at higher elevations of the tablelands (NPWS 2003). Given the species is known to respond strongly to call playback but was not recorded during targeted surveys it is considered unlikely to occur within the main disturbance footprint. Potential breeding hollows for the Barking Owl were observed in two trees along Lobs Hole Ravine Road (north). Species polygons have been developed for these two trees by buffering the potential nest trees by 100 m and intersecting this with the canopy of the trees to be removed. This species polygon intersected 22 m^2 (0.0022 ha) of PCT 296 and 126 m^2 (0.0126 ha) of PCT 953.

Table 2.5 Species credit species, habitat suitability and targeted survey results

Scientific name	Common name	Biodiversity risk weighting	Habitat present within the disturbance footprint	Surveys required for removal of dangerous trees	Recorded during field surveys	Impacted by development	Justification
Petaurus norfolcensis	Squirrel Glider	2.00	Yes. Suitable feed and nesting trees are limited to the habitat along Lobs Hole Ravine Road north and south.	No	No	No	Not recorded during targeted surveys and considered unlikely to occur.
Petroica rodinogaster	Pink Robin	2.00	Yes. Tall, open eucalypt forest, particularly in densely vegetated gullies largely on upper sections of Lobs Hole Ravine Road and along the Yarrangobilly River.	No	No	No	Species was recorded adjacent to the disturbance boundary, along Link Road. The species was not recorded during targeted surveys within the project area and is not considered to be impacted by the development.
Phascogale tapoatafa	Brush-tailed Phascogale	2.00	Yes.	No	No	No	Not recorded during targeted surveys and considered unlikely to occur.
Phascolarctos cinereus	Koala (Breeding)	2.00	Yes. Scarce in the KNP, but potential to occur in Eucalypt forest and woodland below 800 m elevation.	No	No	No	Not recorded during targeted surveys.
Pseudomys fumeus	Smoky Mouse	3.00	Yes. Tall forests dominated by Mountain Gum and Snow Gum, 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.	No	Yes	Yes	Species was recorded within PCTs 729, 953 and 1196 above 1,000m altitude, not within Derived Grassland condition classes.

Table 2.5 Species credit species, habitat suitability and targeted survey results

Scientific name	Common name	Biodiversity risk weighting	Habitat present within the disturbance footprint	Surveys required for removal of dangerous trees	Recorded during field surveys	Impacted by development	Justification
Tyto novaehollandiae	Masked Owl (Breeding)	2.00	Yes. Breeding habitat containing suitable hollows limited to PCT 1196 along Lobs Hole Ravine Road.	Yes.	Yes	Yes	Species was recorded within the main disturbance boundary as a result of call playback. However, no nesting hollows were identified during surveys, therefore no breeding species will be impacted by development. Potential breeding hollows for the Masked Owl were observed in two trees along Lobs Hole Ravine Road (north). Species polygons have been developed for these two trees by buffering the potential nest trees by 100 m and intersecting this with the canopy of the trees to be removed. This species polygon intersected 22 m^2 (0.0022 ha) of PCT 296 and 126 m^2 (0.0126 ha) of PCT 953.



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

0 100 200 m
GDA 1994 MGA Zone 55

N

KEY

- Local road
- Vehicular track
- Modification 2 approved construction footprint
- Exploratory Works approved construction footprint

Threatened species

- *Caladenia montana*

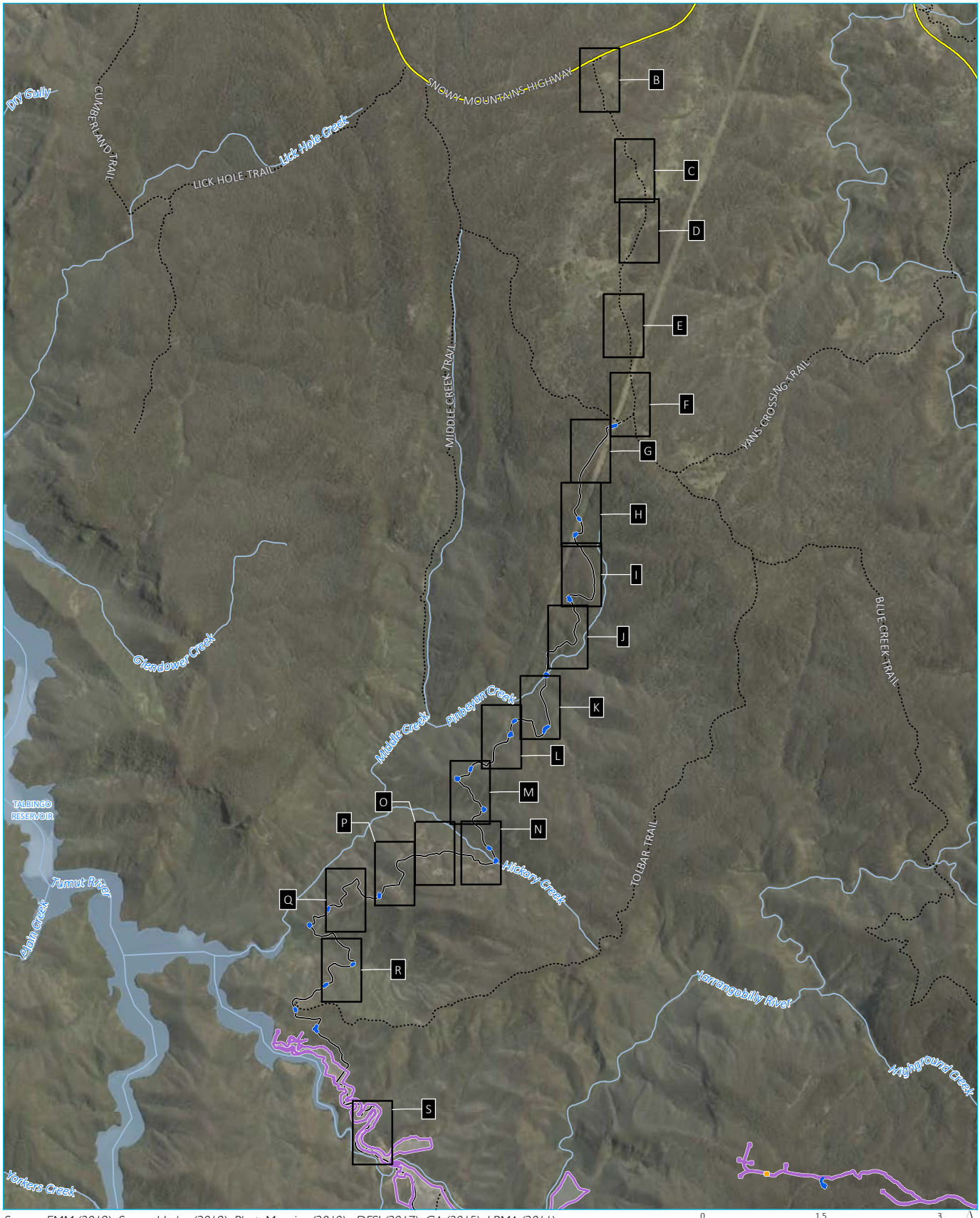
Flora survey results

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.3

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\171188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO003_FloraSurveyResults_20191212_01.mxd 12/12/2019



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

0 1.5 3 km

GDA 1994 MGA Zone 55

N

KEY

- Main road
- Local road
- Vehicular track
- Named watercourse
- Waterbody
- Modification 2 approved construction footprint
- Exploratory Works approved construction footprint
- Avoidance area

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 a

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_RtS\ECO004_DTHabitatAssessment_OVERVIEW_20191212_01.mxd 18/12/2019

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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Hollow bearing tree
- Habitat assessment track
- Watercourse / drainage line
- Main road
- Vehicular track

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 b

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO004_DTHabitatAssessment_20191212_01.mxd 17/12/2019

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

0 100 200 m

GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Hollow bearing tree
- Habitat assessment track
- Watercourse / drainage line
- Vehicular track

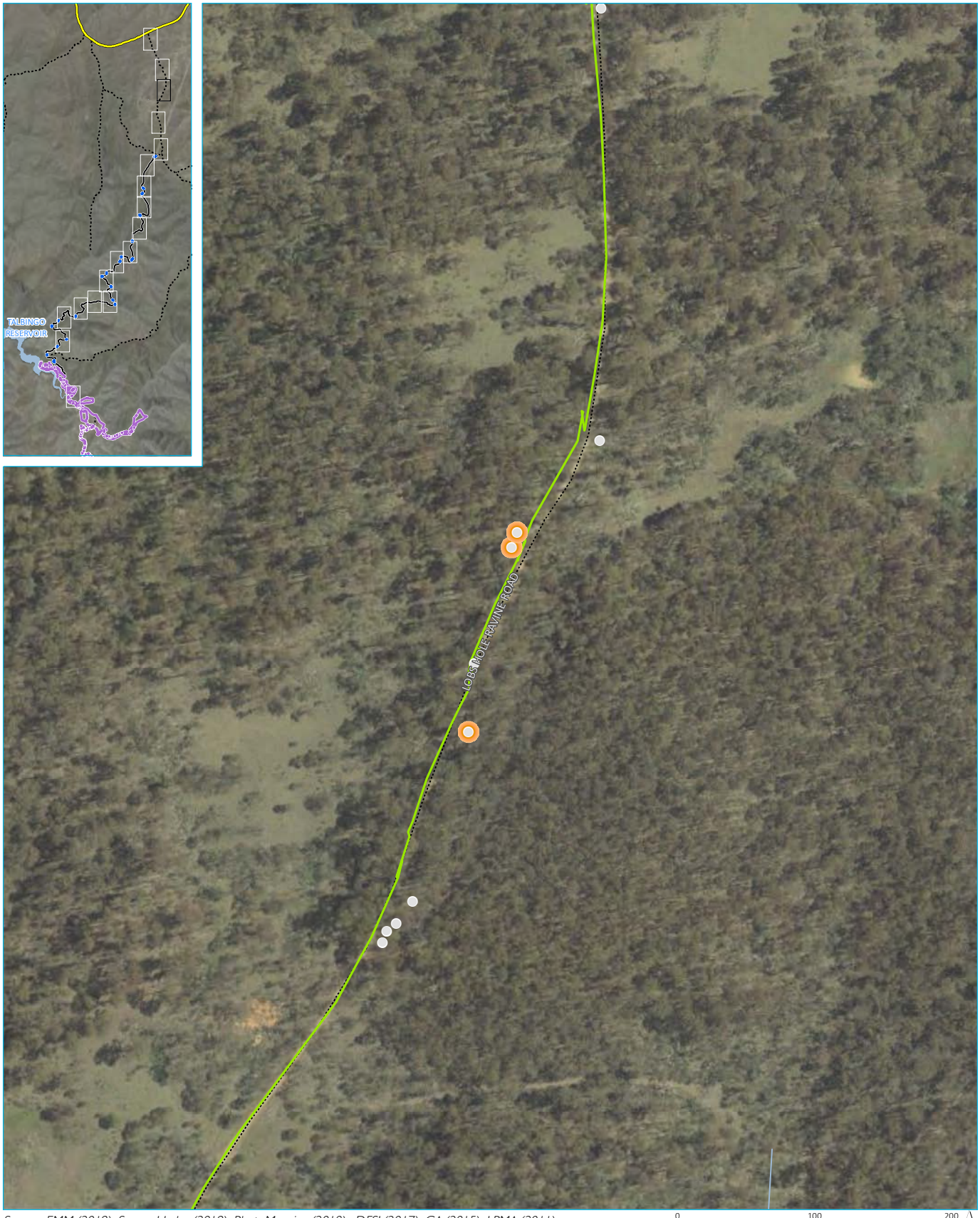
Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 c

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\171188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO004_DTHabitatAssessment_20191212_01.mxd 17/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Hollow bearing tree
- Habitat assessment track
- Watercourse / drainage line
- Vehicular track

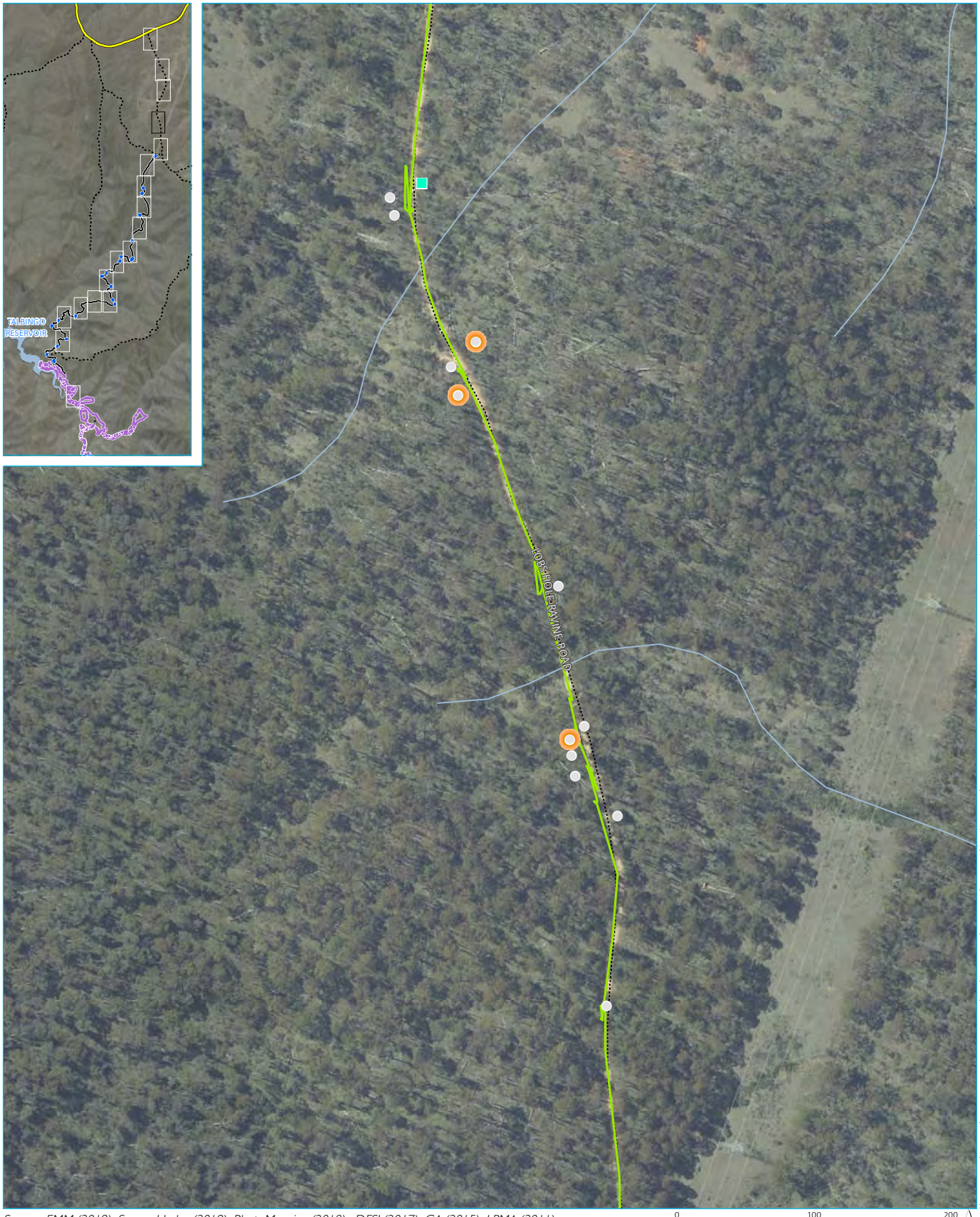
Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 d

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\177188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_RtS\ECO004_DTHabitatAssessment_20191212_01.mxd 17/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Hollow bearing tree
- Habitat assessment track
- Watercourse / drainage line
- Vehicular track

Threatened species

- Flame Robin

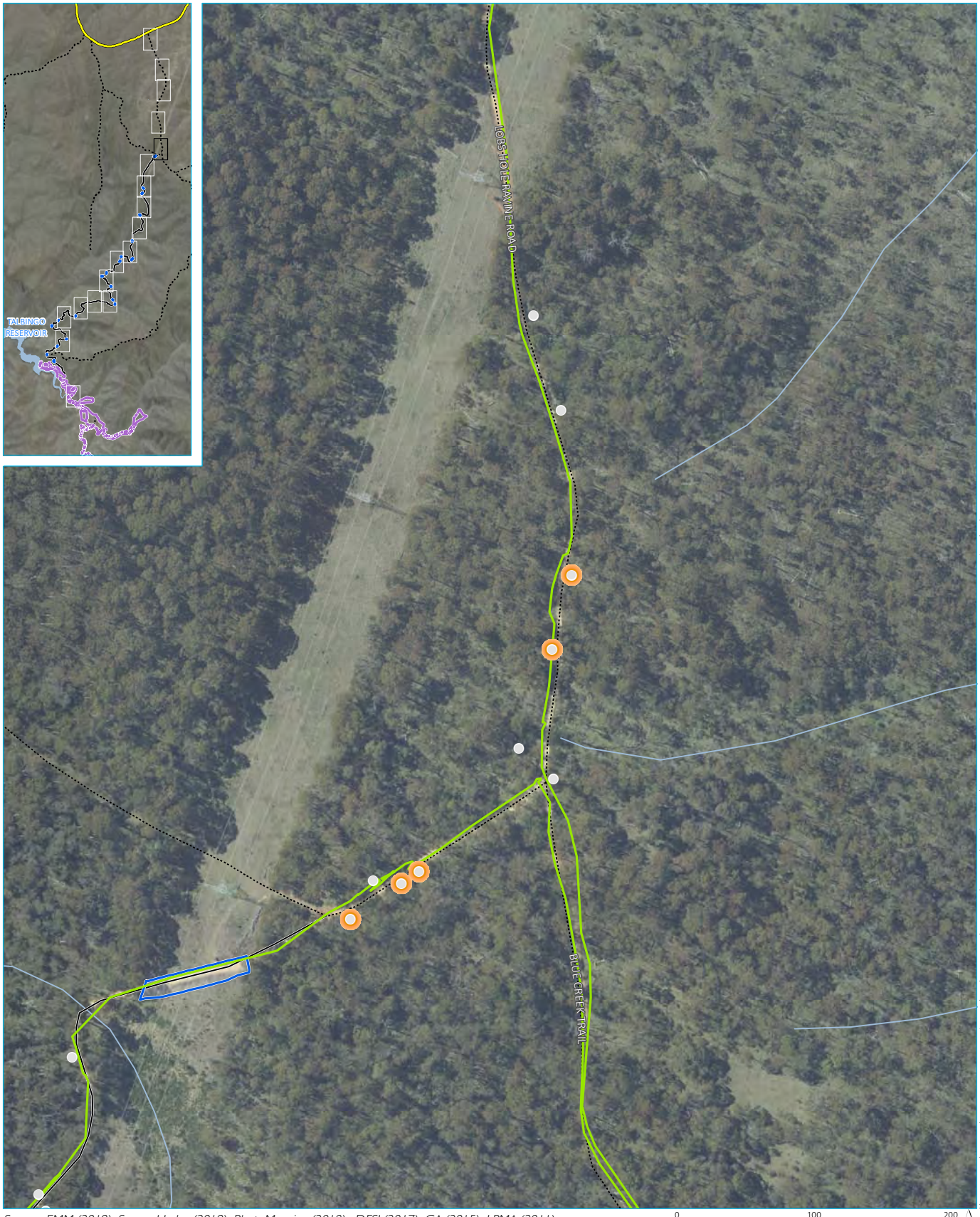
Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 e

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\177188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO004_DTHabitatAssessment_20191212_01.mxd 17/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Hollow bearing tree
- Modification 2 approved construction footprint
- Habitat assessment track
- Watercourse / drainage line
- Local road
- Vehicular track

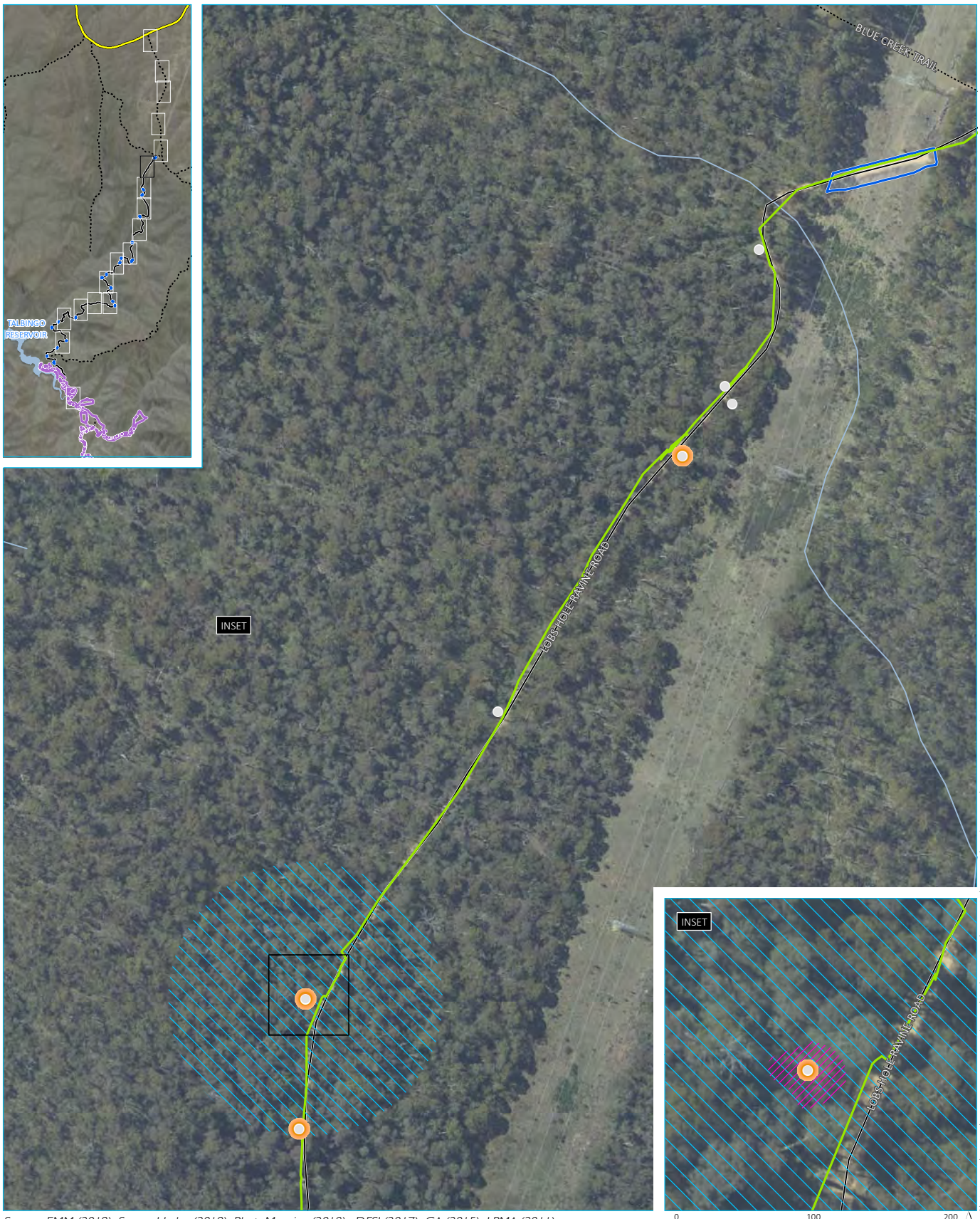
Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 f

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\177188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO004_DTHabitatAssessment_20191212_01.mxd 17/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Hollow bearing tree
- Modification 2 approved construction footprint
- Species habitat - Barking Owl and Masked Owl
- Species polygon - Barking Owl and Masked Owl
- Habitat assessment track
- Watercourse / drainage line
- Local road
- Vehicular track

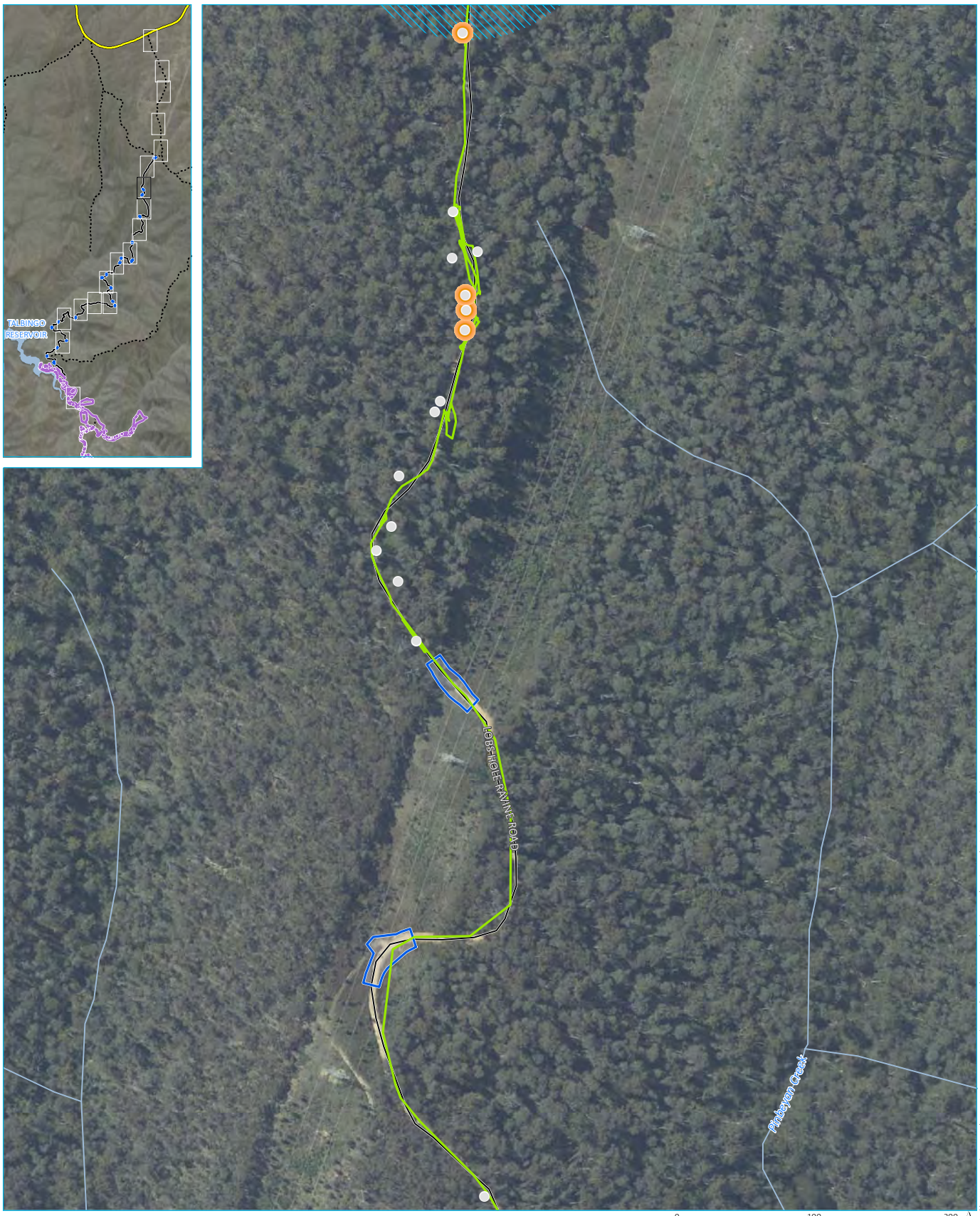
Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 g

snowy 2.0

EMM creating opportunities

\\emmsvr1\EMM2\177188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_EW_MOD2\Ecology_Rts\ECO004_DTHabitatAssessment_20191212_01_G_O.mxd 17/12/2019



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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Hollow bearing tree
- Modification 2 approved construction footprint
- Species habitat - Barking Owl and Masked Owl
- Habitat assessment track
- Watercourse / drainage line
- Local road

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 h

snowy 2.0

EMM creating opportunities

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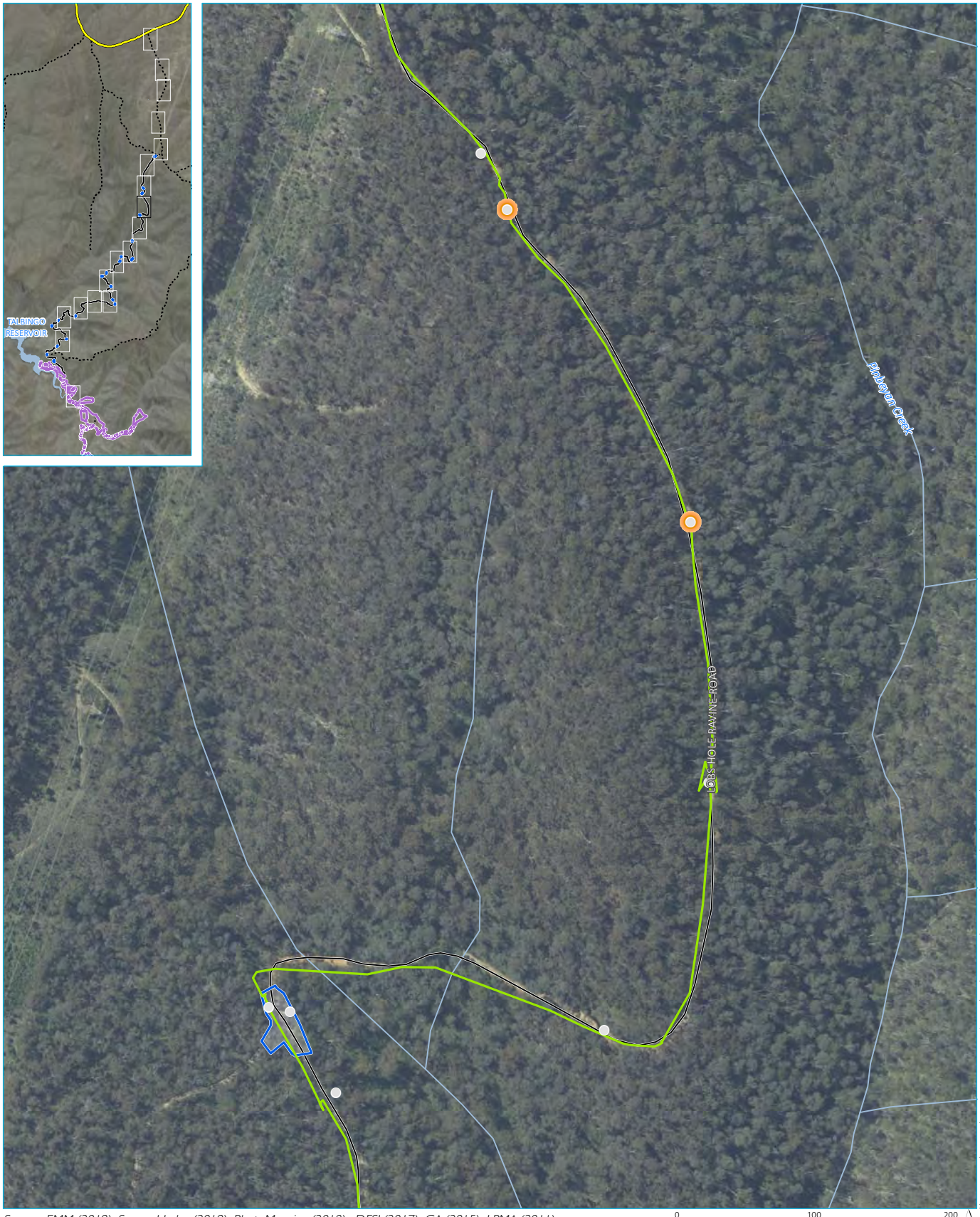

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55

KEY

- Dangerous tree
- Hollow bearing tree
- Modification 2 approved construction footprint
- Habitat assessment track
- Watercourse / drainage line
- Local road

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 i

snowy 2.0

EMM creating opportunities

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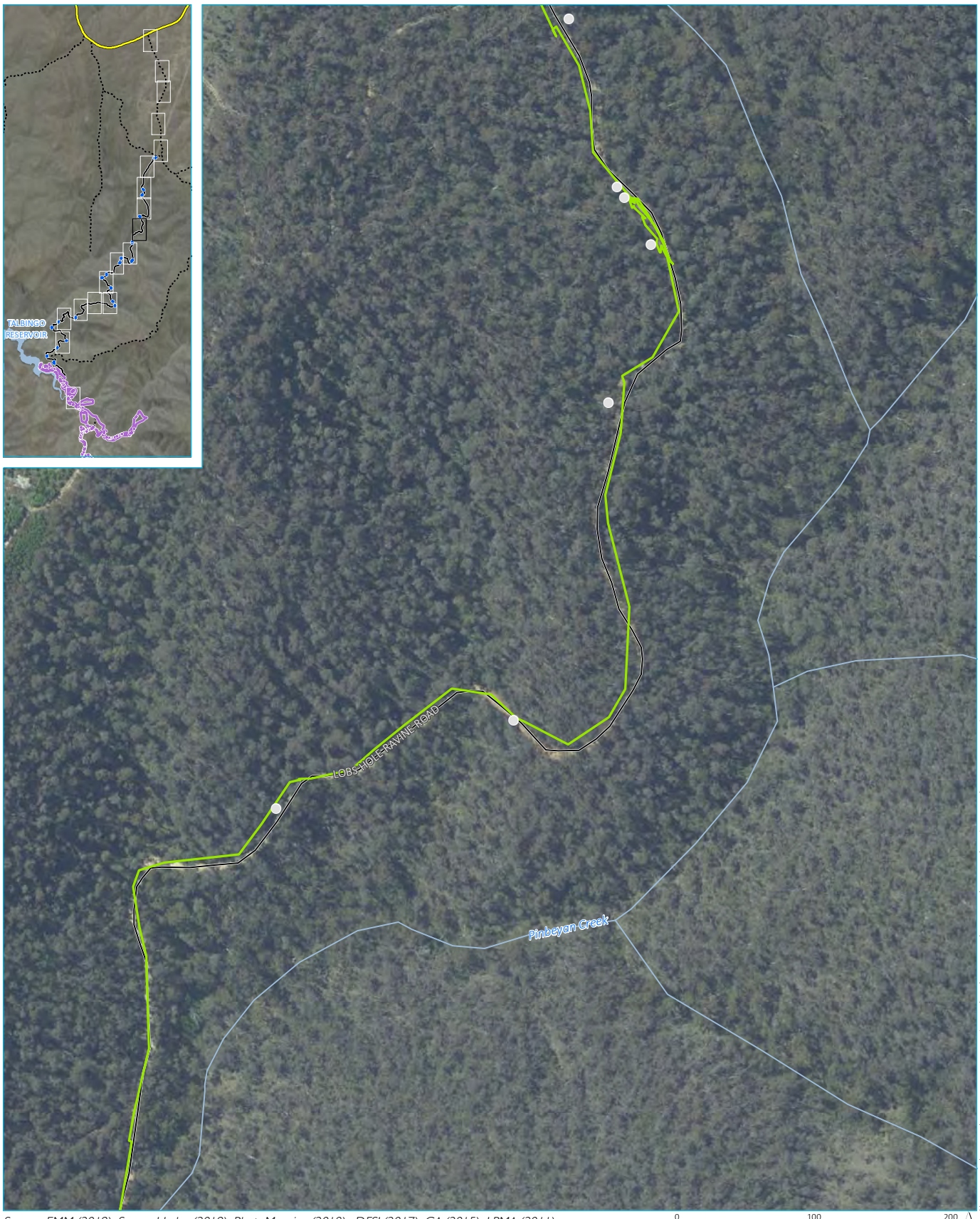

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Habitat assessment track
- Watercourse / drainage line
- Local road

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 j

snowy 2.0

EMM creating opportunities

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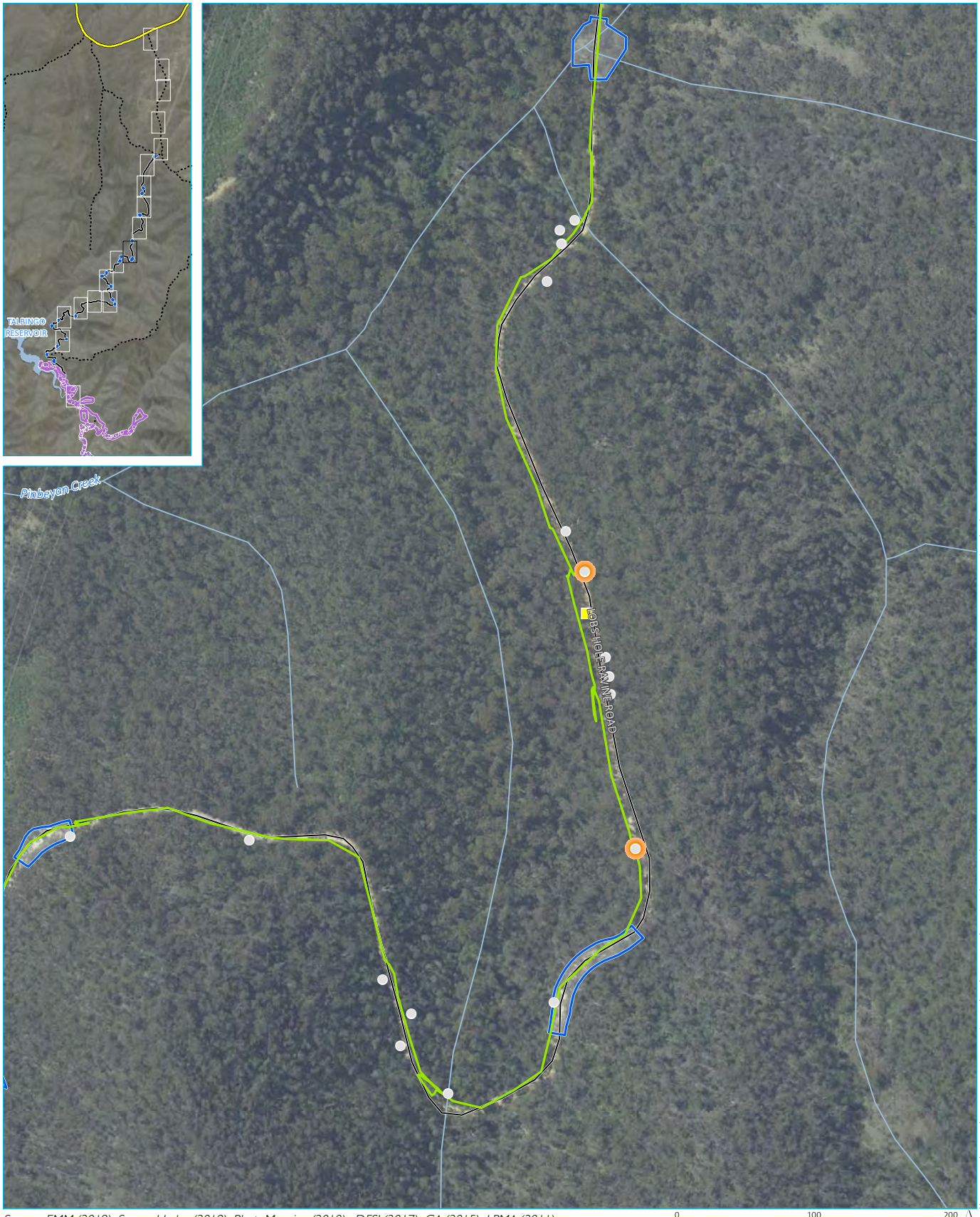

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Hollow bearing tree
- Modification 2 approved construction footprint
- Habitat assessment track
- Watercourse / drainage line
- Local road

Threatened species

- Dusky Woodswallow

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 k

snowy 2.0

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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Hollow bearing tree
- Modification 2 approved construction footprint
- Habitat assessment track
- Watercourse / drainage line
- Local road

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 l

snowy 2.0

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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Modification 2 approved construction footprint
- Habitat assessment track
- Watercourse / drainage line
- Local road

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 m

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EMM creating opportunities

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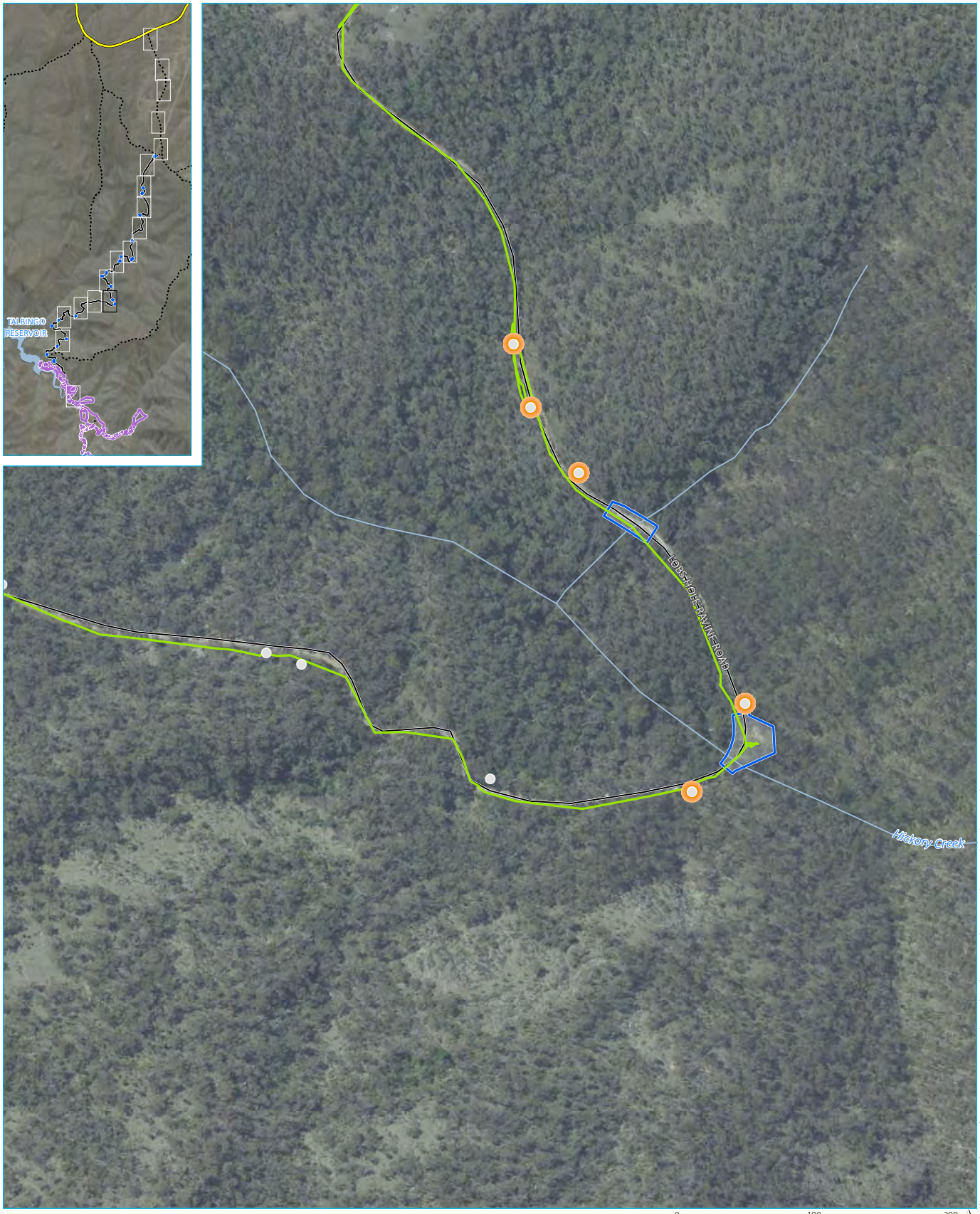

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Hollow bearing tree
- Modification 2 approved construction footprint
- Habitat assessment track
- Watercourse / drainage line
- Local road

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 n

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

KEY

- Dangerous tree
- Hollow bearing tree
- Species habitat - Barking Owl and Masked Owl
- Species polygon - Barking Owl and Masked Owl
- Habitat assessment track
- Watercourse / drainage line
- Local road

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 o

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EMM creating opportunities

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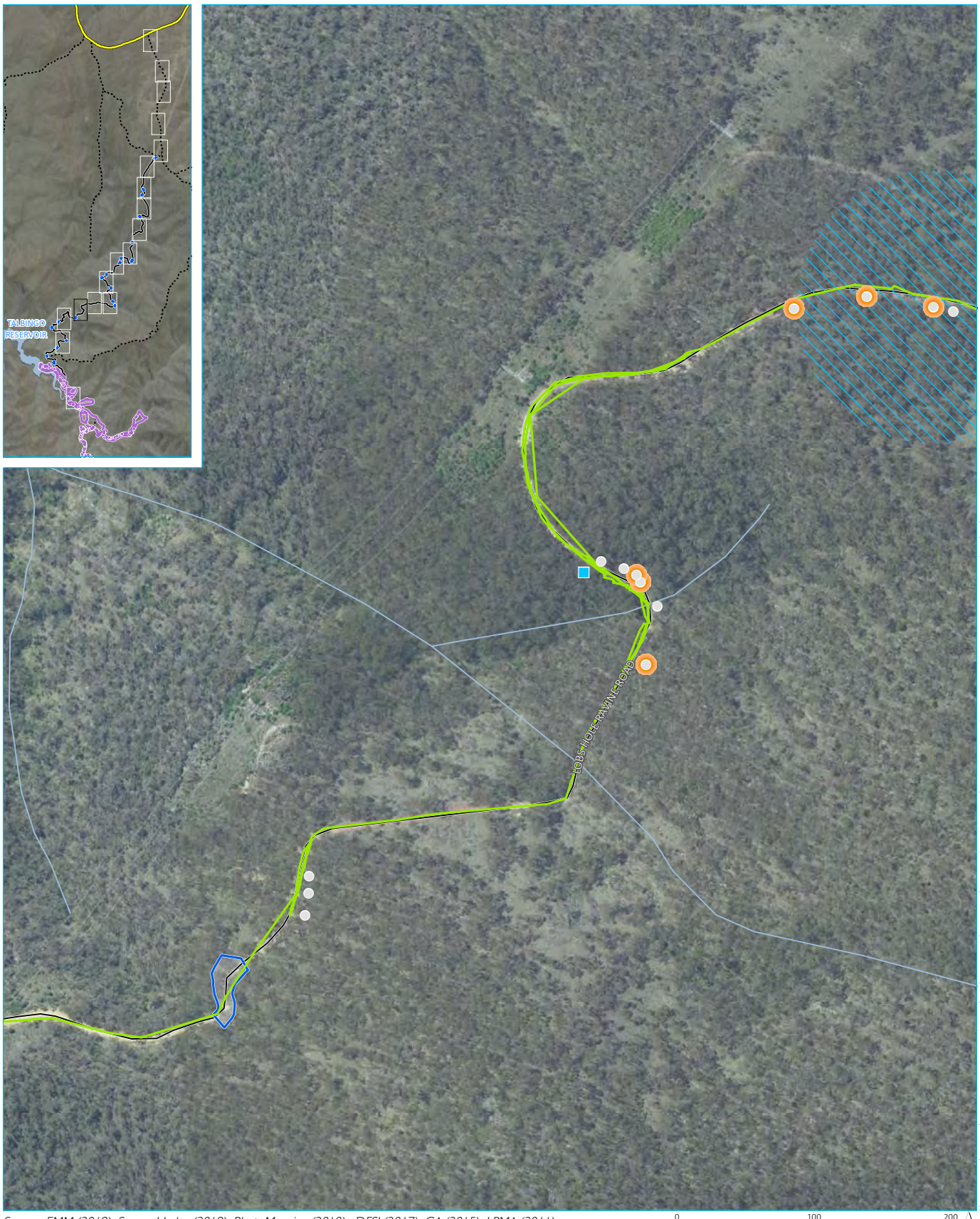

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Hollow bearing tree
- Modification 2 approved construction footprint
- Species habitat - Barking Owl and Masked Owl
- Species polygon - Barking Owl and Masked Owl
- Habitat assessment track
- Watercourse / drainage line
- Local road

Threatened species

- Varied Sitella

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 p

snowy 2.0

EMM creating opportunities

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

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Hollow bearing tree
- Modification 2 approved construction footprint
- Habitat assessment track
- Watercourse / drainage line
- Local road

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 q

snowy 2.0

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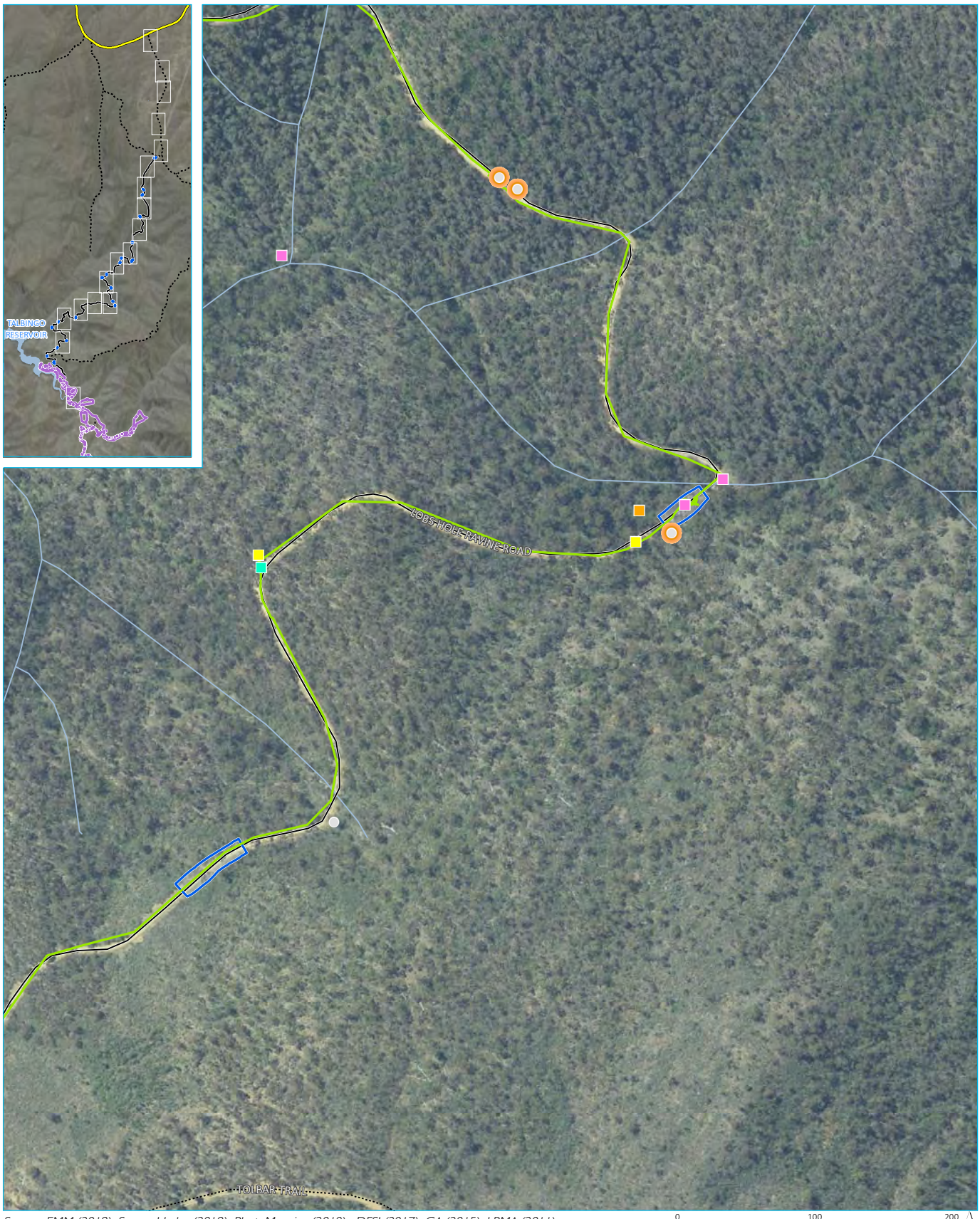

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m

GDA 1994 MGA Zone 55

N

KEY

- Dangerous tree
- Hollow bearing tree
- Modification 2 approved construction footprint
- Habitat assessment track
- Watercourse / drainage line
- Local road
- Vehicular track

Threatened species

- Dusky Woodswallow
- Flame Robin
- Gang-gang Cockatoo
- Turquoise Parrot

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 r

snowy 2.0

EMM creating opportunities

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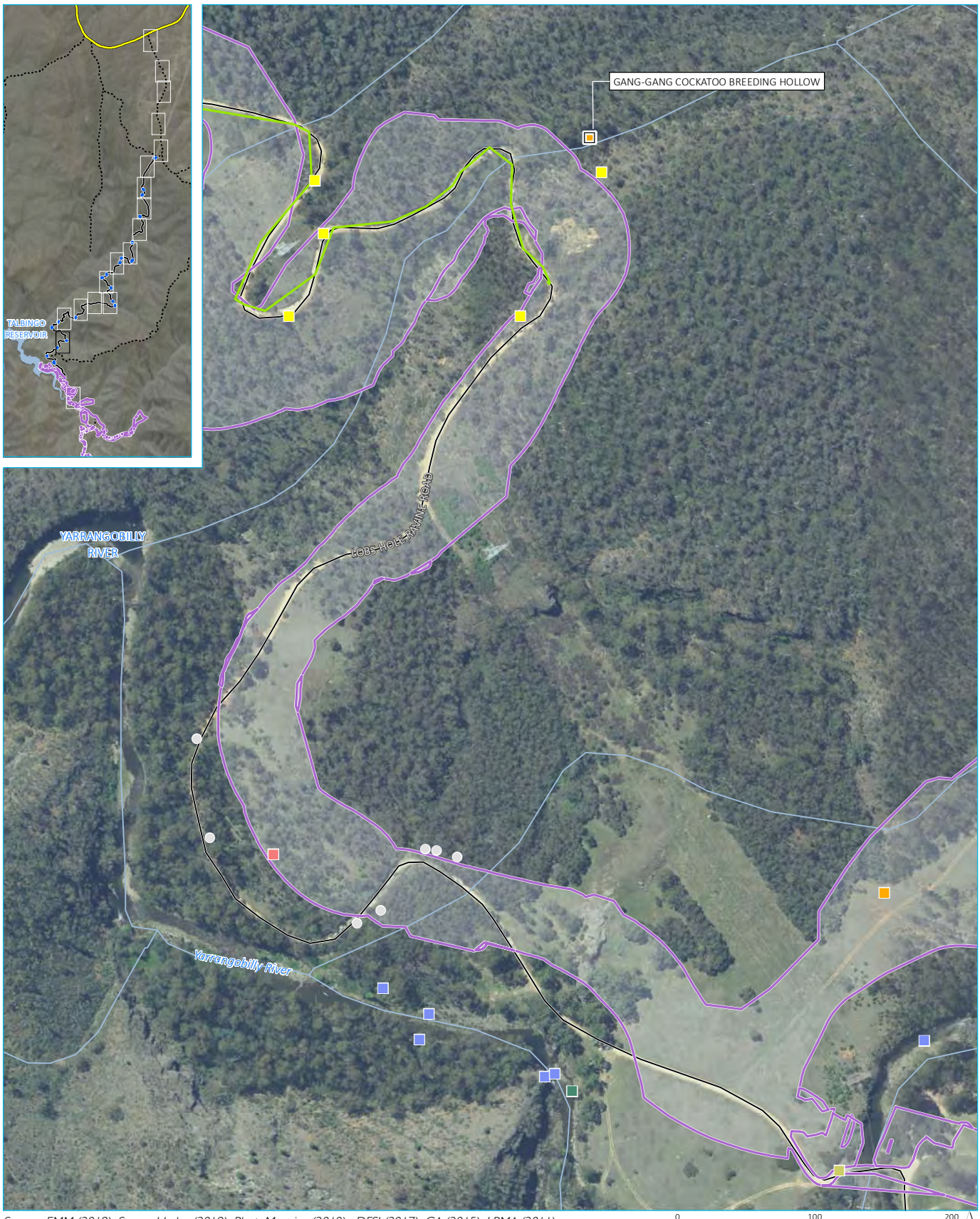


Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); DFSI (2017); GA (2015); LPMA (2011)

0 100 200 m
GDA 1994 MGA Zone 55
N

KEY

- Dangerous tree
- Exploratory Works approved construction footprint;
- Habitat assessment track
- Watercourse / drainage line
- Local road
- Gang-gang Cockatoo breeding hollow

Threatened species

- Booroolong Frog
- Dusky Woodswallow
- Eastern Bentwing-bat
- Eastern False Pipistrelle
- Eastern Pygmy-possum
- Gang-gang Cockatoo
- Masked Owl

Habitat assessment of dangerous trees

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
Figure 2.4 s

snowy 2.0

EMM creating opportunities

3 Stage 2: Impact Assessment

3.1 Measures to avoid, minimise and mitigate

Potential direct, indirect and prescribed impacts were addressed in the Modification 2 BDAR (EMM 2019b), as well as serious and irreversible impacts (SAII).

This section acknowledges the commitment to the mitigation measures outlined in EMM (2019b). Additional mitigation measures are outlined further below.

3.1.1 Unexpected finds procedure

The biodiversity management plan prepared in accordance with Schedule 3, Condition 6 of the Exploratory Works infrastructure approval includes an unexpected threatened species find procedure. This procedure is applicable to all activities that have the potential to impact any threatened flora and fauna

3.1.2 Vegetation trimming to enable TBM transport

Vegetation trimming to enable transport of the TBM to Lobs Hole will involve trimming and removal of trimmed vegetation along Lobs Hole Ravine Road (south). This trimming and removal is required to provide adequate clearance for the maximum load transport down this road. As per the diagram shown in Plate 3.1, the load width is 6.8 m, requiring trimming and removal to a width of 7.4 m, being an additional 0.2 m either side of the 6.8 m load. Based on an average existing road disturbance of 5 m, this will require trimming of vegetation 1.2 m either side of the existing road surface. All vegetation above 1.1 m will require trimming and removal; vegetation below 1.1 m will be left intact.

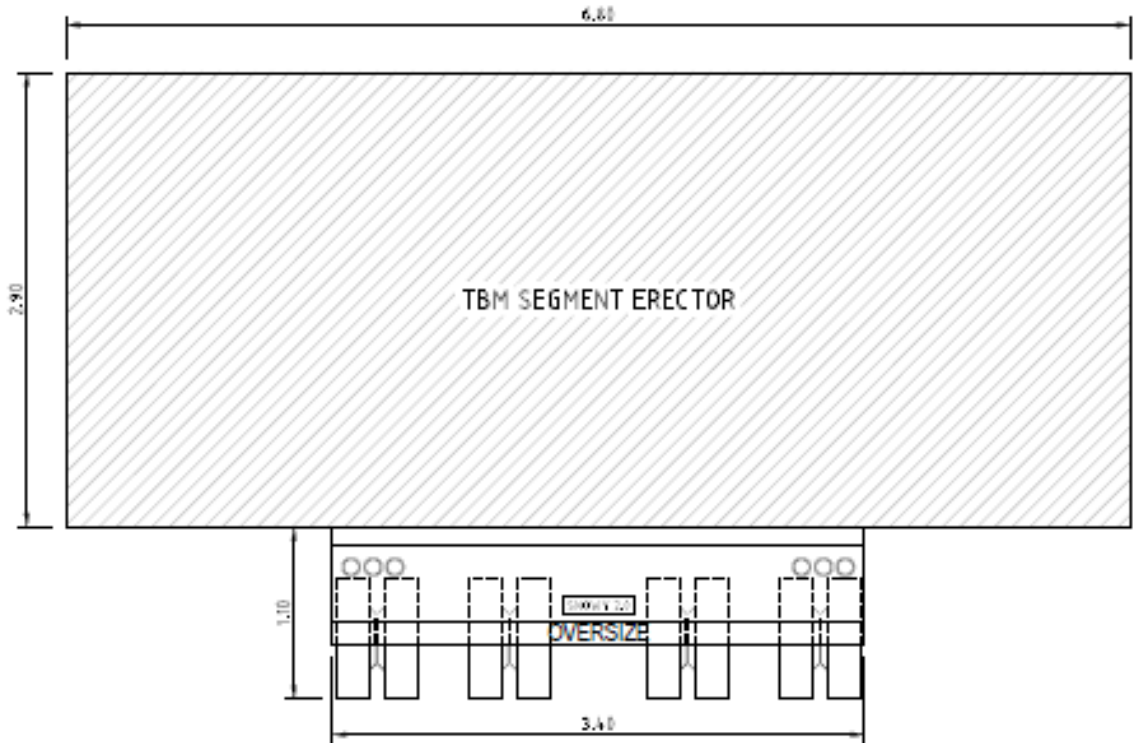


Plate 3.1 TBM load cross section

During the clearing process, the trimming of vegetation will be undertaken in accordance with the pre-clearing process, with inspection of vegetation by an Ecologist prior to remove. Vegetation will be trimmed to a height of 1.1 m, with trimmed vegetation left in-situ to provide additional cover.

Where required, trees will be removed in a manner which avoids and minimises impacts to adjacent vegetation. Wherever feasible, trees will be removed using sectional dismantling of the tree, with upper limbs removed using tree climbers and elevated work platforms, and gently lowered to the ground or felled onto the road. The trunk will be removed using a tree harvester. This removal method will minimise impacts to adjacent vegetation and threatened species habitat. The removal of any hollow-bearing limbs will be undertaken in accordance with the pre-clearance and clearing procedures outlined in the Exploratory Works Biodiversity Management Plan, as updated, including staged clearing.

All hollow-bearing limbs and sections of trunk will be retained adjacent to the works area (but outside the disturbance boundary wherever possible) as habitat. These limbs and trunk sections should be gently placed into these areas, minimising vegetation disturbance.

i Potential for additional vegetation trimming

As discussed in Section 3.1.3 of the Modification 2 Response to Submissions, further detailed design has identified that the proposed vegetation trimming height of 1.1 m may not achieve adequate clearance for safe access in some sections for the vehicle transporting the TBM. This is due to the need to provide safe separation between the TBM load and surrounding vegetation where the grade of the road will lead to some variation in the height of the trailer relative to the surrounding vegetation. That is, there are likely to be instances where the horizontal alignment or cross fall of the road results in the height of the trailer being less than 1.1 m, particularly on the inside corner of bends. This would result in potential obstructions for safe access for the vehicle transporting the TBM.

It is expected that the majority of the vegetation trimming will occur at or above 1.1 m height, however there are likely to be some instances where vegetation may require trimming below 1.1 m to provide for safe access for the vehicle transporting the TBM. The site specific vegetation trimming will need to be determined on-site prior to transport of the TBM.

To minimise any impacts to biodiversity and threatened species, a protocol for post-approval vegetation removal will be developed and included in the biodiversity management plan required under Schedule 3 Condition 6. This will include measures to manage any vegetation trimming below 1.1 m. This will outline measures to consult with DPIE Biodiversity and Conservation Division (BCD) regarding any areas of vegetation trimming below 1.1 m within potential Smoky Mouse habitat.

3.1.3 Dangerous tree removal

A total of 134 trees are likely to require complete removal. Some of the trees identified for removal contain small to large-sized hollows, potentially providing habitat for the Masked Owl and Barking Owl. The Gang-gang Cockatoo was not found to be nesting in any of these trees.

Wherever feasible, trees will be delimbed to reduce safety risks, reduced in height by at least 50% and retained in-situ as habitat trees. This will be determined on a case-by-case basis, with the priority being safety of construction workers and road users. Where this is not feasible, due to safety risks etc., complete removal will be required.

Trees will be removed in a manner which avoids and minimises impacts to adjacent vegetation. Wherever feasible, trees will be removed using sectional dismantling of the tree, with upper limbs removed using tree climbers and elevated work platforms, and gently lowered to the ground or felled onto the road. The trunk will be removed using a tree harvester. This removal method will minimise impacts to adjacent vegetation and threatened species habitat. The removal of any hollow-bearing limbs will be undertaken in accordance with the pre-clearance and clearing procedures outlined in the Exploratory Works Biodiversity Management Plan, as updated, including staged clearing.

All hollow-bearing limbs and sections of trunk will be retained adjacent to the works area (but outside the disturbance boundary wherever possible) as habitat. These limbs and trunk sections should be gently placed into these areas, minimising vegetation disturbance.

3.1.4 Lobs Hole Ravine Road (north)

During maintenance of culverts along Lobs Hole Ravine Road (north) spoil and sediment removed from culverts will be disposed of appropriately and will not be pushed or piled into adjacent areas of native vegetation. Spoil and sediment should be collected and disposed of in approved construction areas.

3.2 Impacts requiring offsets

3.2.1 Impacts on native vegetation

A summary of ecosystem credits required for all vegetation zones, including changes in vegetation integrity score, are provided in Table 3.1. A total of 54 ecosystem credits are required to offset the residual impacts to 2.74 ha of native vegetation within the disturbance boundary of the Exploratory Works Modification 2. A credit report is provided in Appendix C.

Table 3.1 Summary of ecosystem credits required for impacts to all vegetation zones for Modification 2

Vegetation zone number	PCT	Vegetation zone	Area (ha)	Vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity score	Credits required
1	PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	296_DNG	0.10	41.2	0	-41.2	2
2	PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	296_High	0.87	55.3	0	-55.3	18
3	PCT 300 – Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment	300_Medium	0.26	56	7.2	-48.8	5
4	PCT 300 – Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment	300_High	0.08	56.8	0	-56.8	2
5	PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	729_High	0.14	71.9	2.9	-69	4
6	PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	953_DNG	0.07	36.7	0	-36.7	1
7	PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	953_High	0.23	79	45.3	-33.7	3
8	PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	1191_High	0.08	85.3	7.2	-78.1	4
9	PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	1196_DNG	0.45	41.1	0	-41.1	7

Table 3.1 Summary of ecosystem credits required for impacts to all vegetation zones for Modification 2

Vegetation zone number	PCT	Vegetation zone	Area (ha)	Vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity score	Credits required
10	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	285_Medium	0.01	40.1	25.2	-14.9	1
11	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	285_Other	0.01	58	39.4	-18.6	1
12	PCT 952 – Mountain Gum - Narrow-leaved Peppermint - Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion	952_Other	0.35	66.2	39.2	-27	4
13	PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	1196_Other	0.13	37.7	0	-37.7	2

3.2.2 Impacts on threatened species

A summary of the species credits required for all vegetation zones occupied by threatened species credit species, including changes in vegetation integrity score, are provided in Table 3.2. A total of 30 species credits are required to offset the residual impacts to 1.15 ha of threatened species credit species habitat of Modification 2. A credit report is provided in Appendix C.

Table 3.2 Summary of threatened species credits required for Modification 2

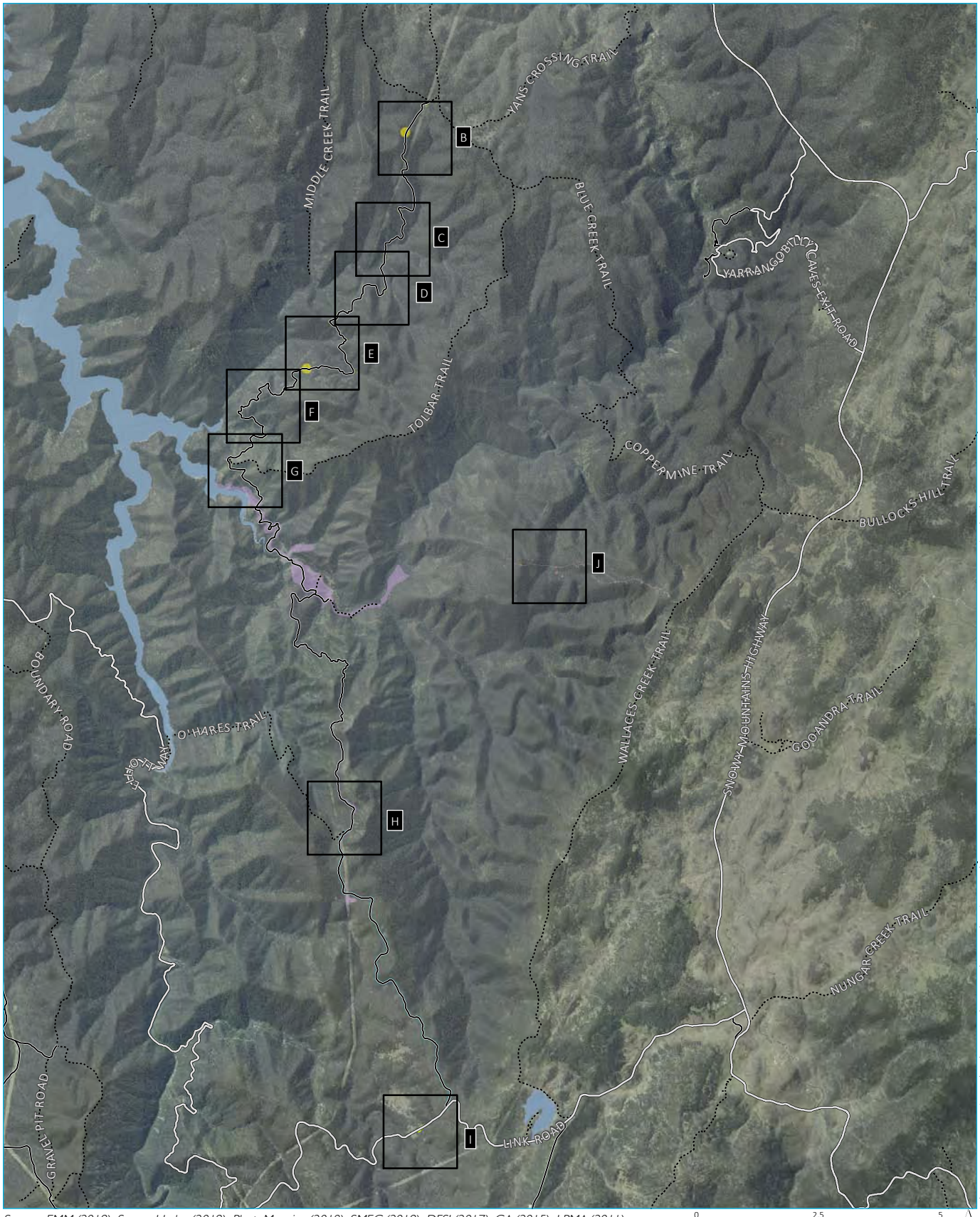
Species	Vegetation zone name	Area (ha)/individual (HL)	Habitat condition	Future habitat condition	Loss of habitat condition	Candidate SAII	Species credits
Eastern Pygmy-possum	296_High	0.46	55.3	0	-55.3	No	13
Eastern Pygmy-possum	300_High	0.08	56.8	0	-56.8	No	2
Eastern Pygmy-possum	300_Medium	0.2	56	7.2	-48.8	No	5
Eastern Pygmy-possum	729_High	0.13	71.9	2.9	-69	No	4
Eastern Pygmy-possum	1196_Other	0.09	37.7	0	-37.7	No	2
Barking Owl	296_High	0.00	55.3	0	-55.3	No	0
Barking Owl	953_High	0.01	79	45.3	-33.7	No	0
Smoky Mouse	1196_Other	0.13	37.7	0	-37.7	Yes	4
Masked Owl	296_High	0.00	55.3	0	-55.3	No	0
Masked Owl	953_High	0.01	79	45.3	-33.7	No	0

3.3 Impacts not requiring offsets

Additional areas not requiring assessment in accordance with Section 10.4 of the BAM (OEH 2017a) include:

- trimming of native vegetation to 1.1 m;
- existing roads;
- cleared and highly disturbed land; and
- watercourses.

As vegetation trimming along Lobs Hole Ravine Road (south) will not result in any notable impacts to native vegetation or threatened species habitat, impacts will be short-term and vegetation will be able to naturally regenerate no offsets have been determined for this component of the project.



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

0 2.5 5 km
GDA 1994 MGA Zone 55

N

KEY

- Main road
- Local road
- Vehicular track
- Waterbody
- Serious and irreversible impacts
- Impacts requiring offsets
- Impacts not requiring offsets
- Areas not requiring assessment
- Exploratory works approved construction footprint

Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment

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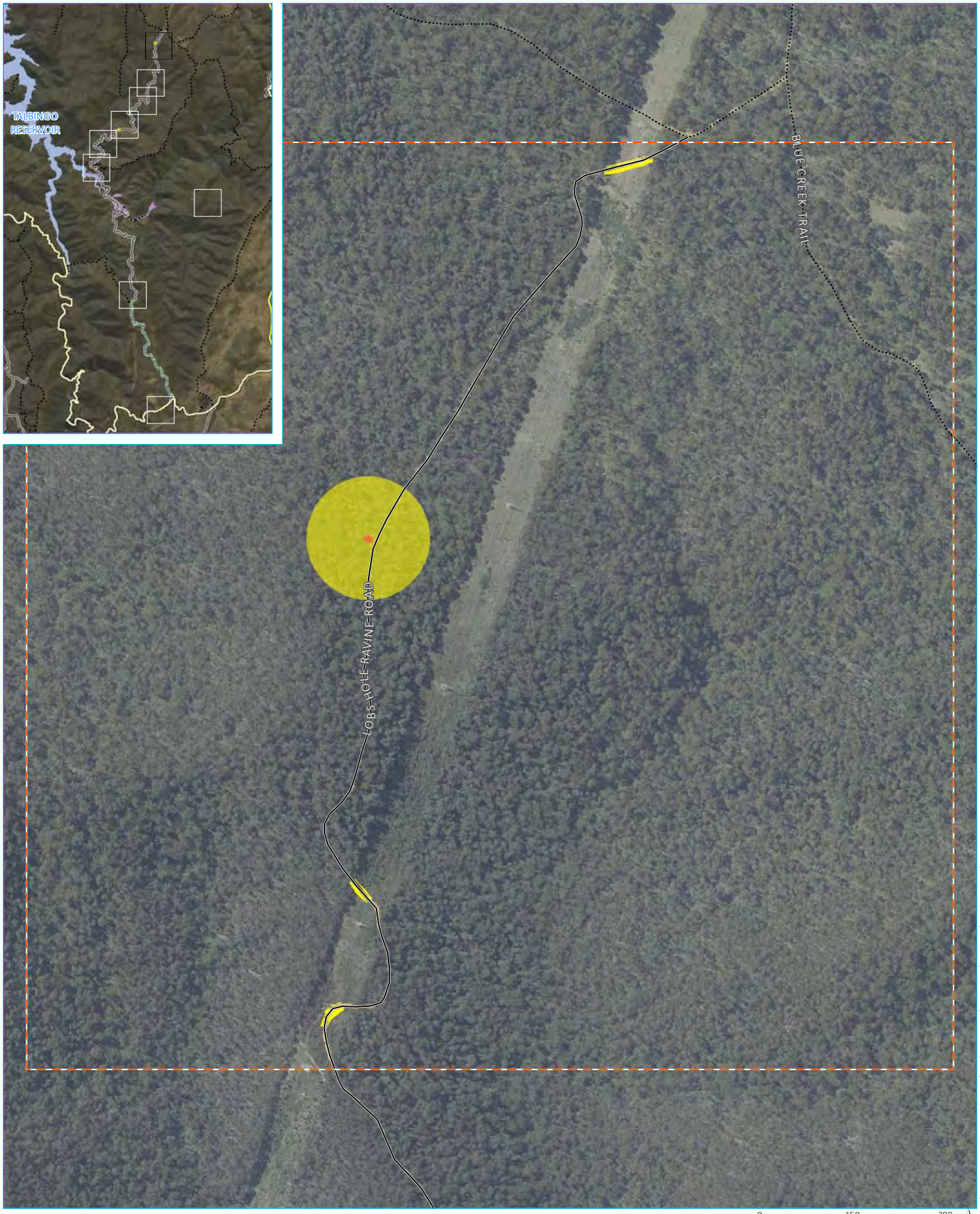

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)

0 150 300 m
GDA 1994 MGA Zone 55
N

KEY

- Local road
- Vehicular track
- Serious and irreversible impacts
- Impacts requiring offsets

Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment

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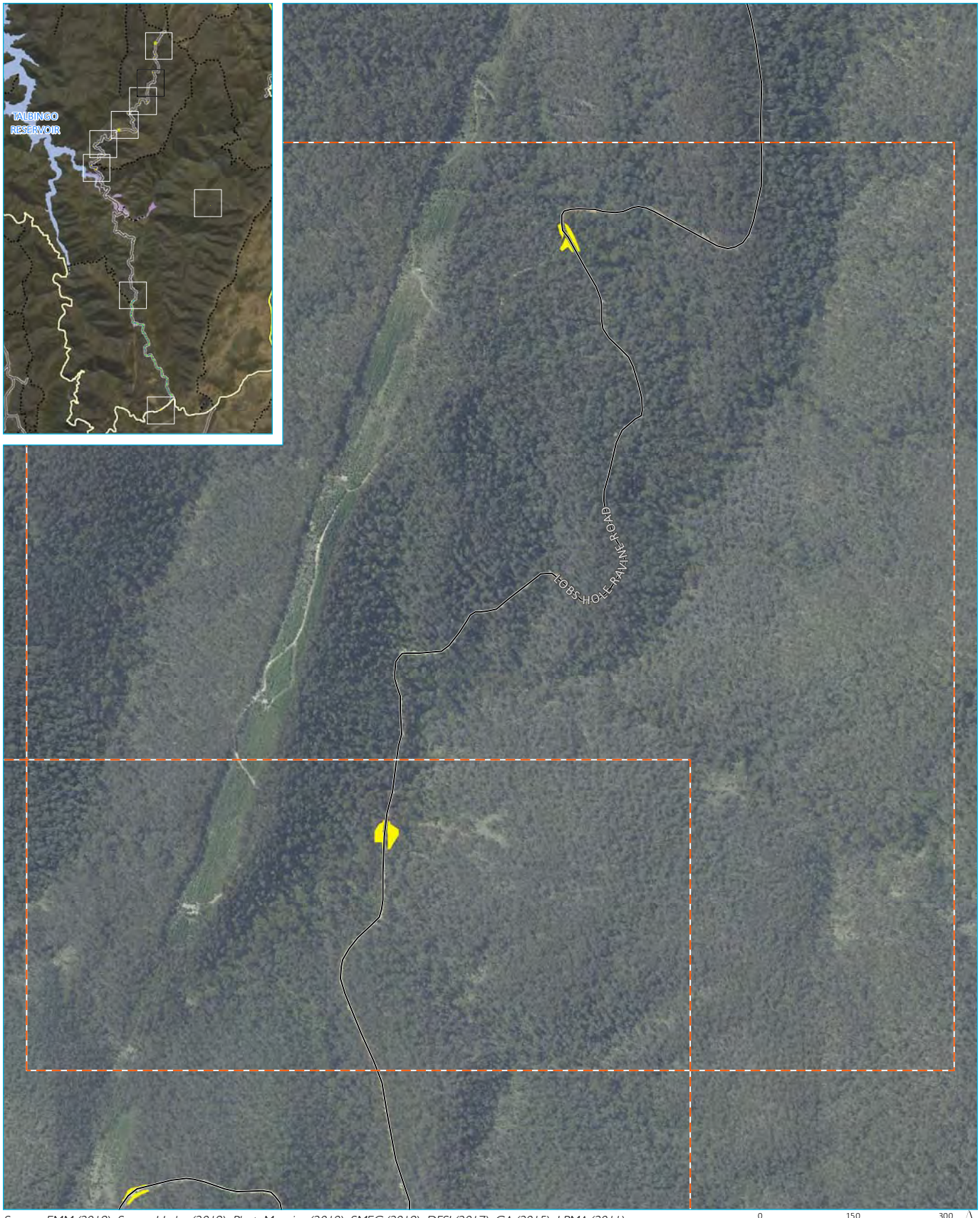

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)

0 150 300 m
GDA 1994 MGA Zone 55
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KEY

Local road

Impacts requiring offsets

Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
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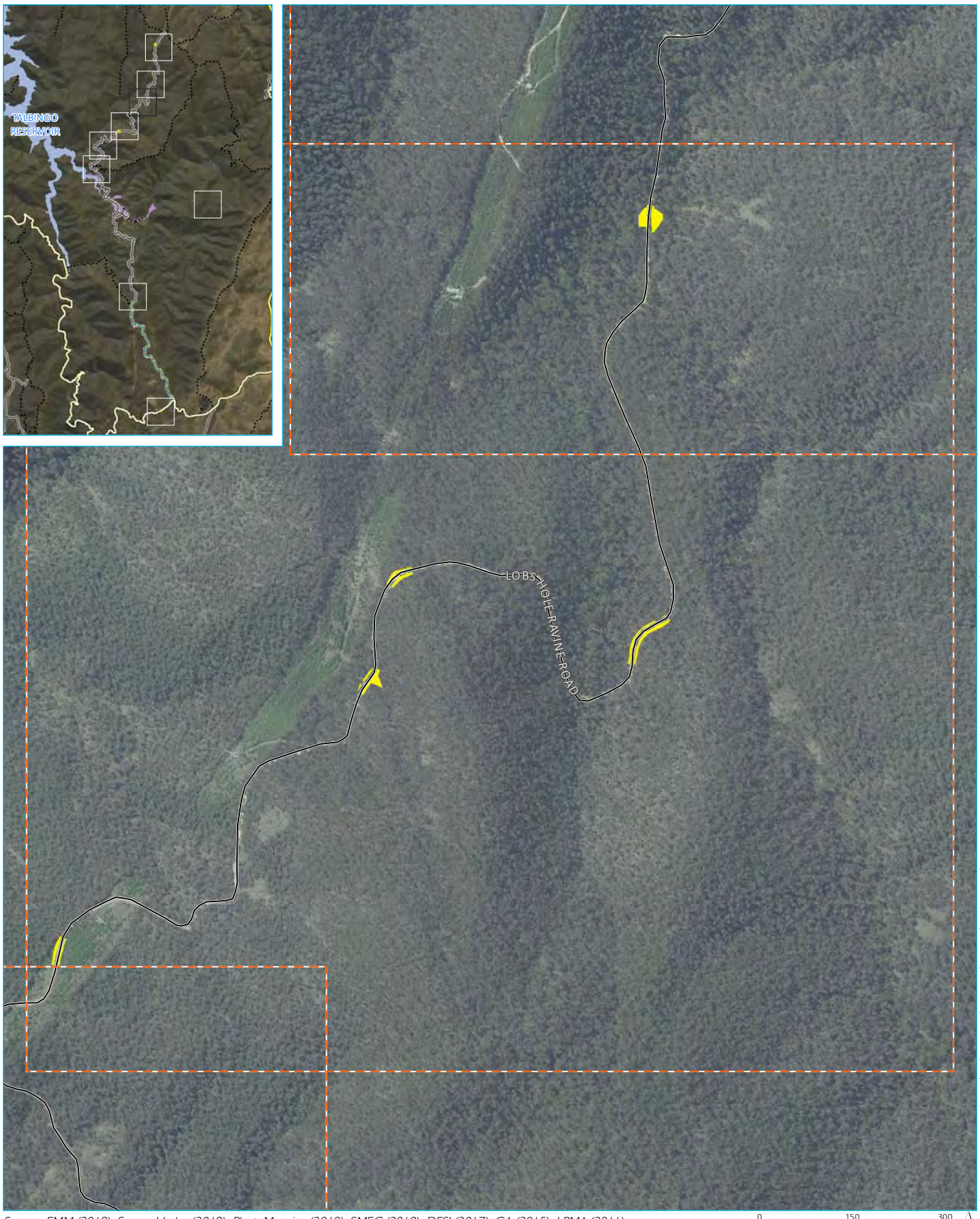

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)

0 150 300 m
GDA 1994 MGA Zone 55
N

KEY

— Local road

Impacts requiring offsets

Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
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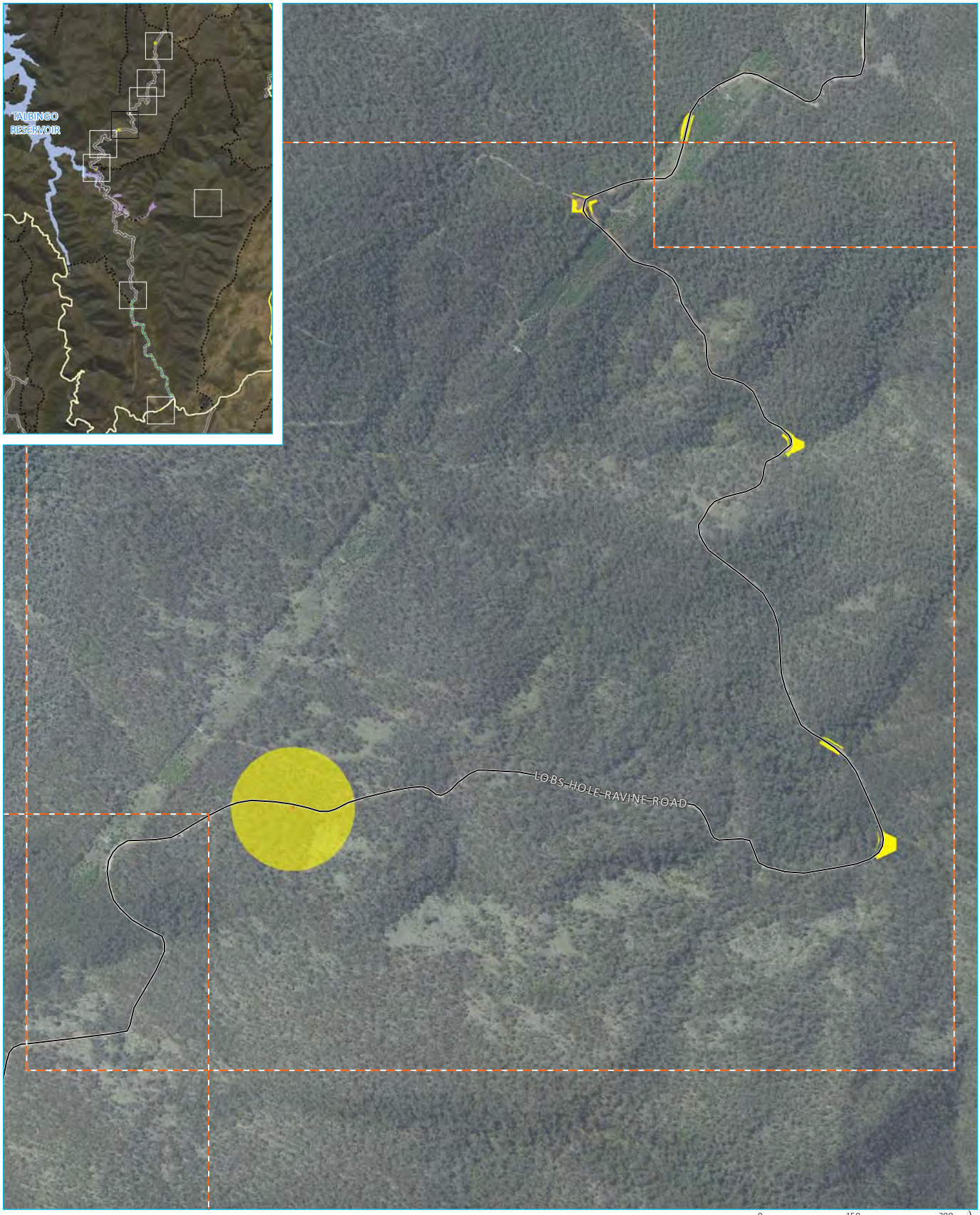

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)

0 150 300 m
GDA 1994 MGA Zone 55
N

KEY

- Local road
- Serious and irreversible impacts
- Impacts requiring offsets

Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
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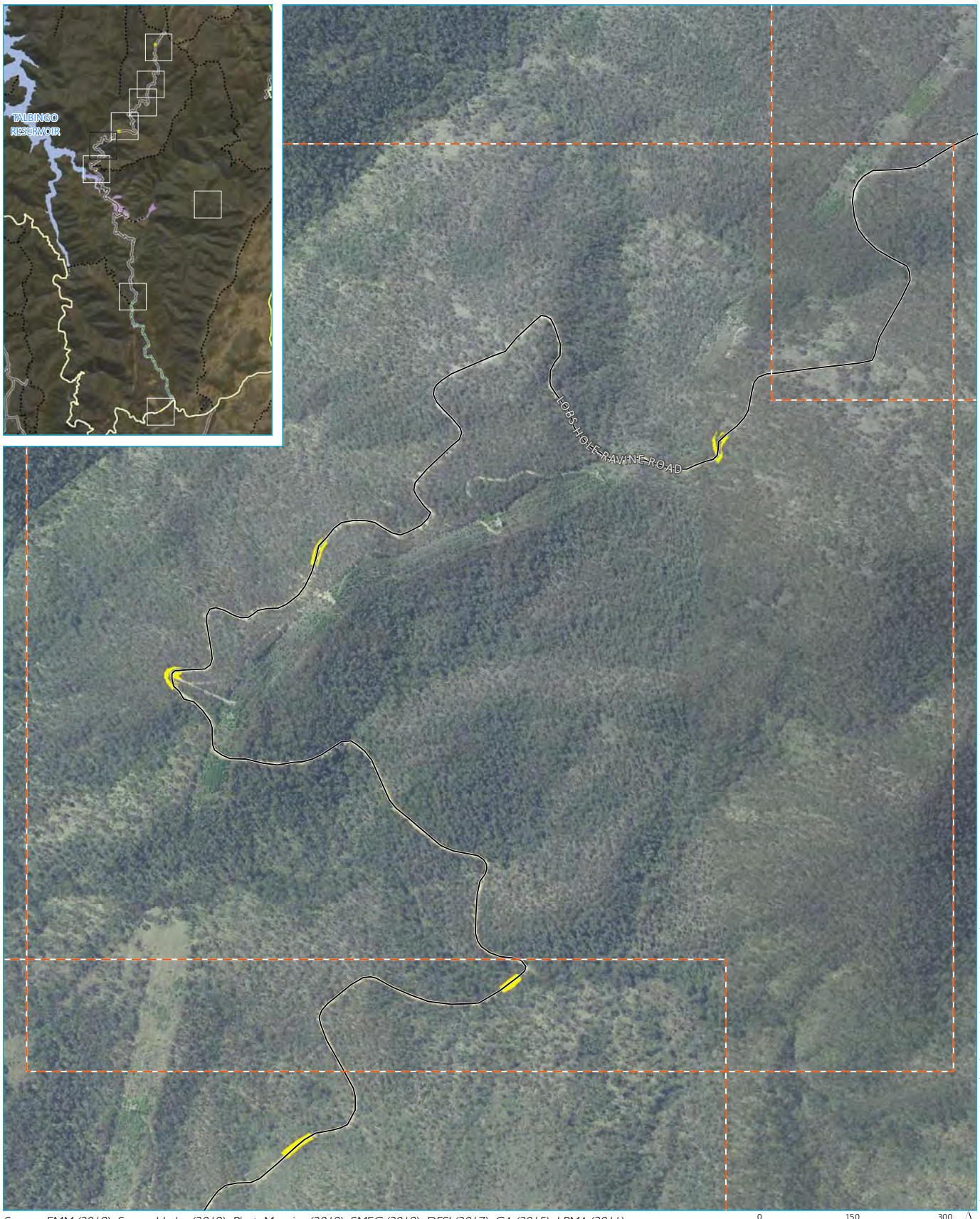

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)

0 150 300 m
GDA 1994 MGA Zone 55
N

KEY

Local road

Impacts requiring offsets

Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment

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Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
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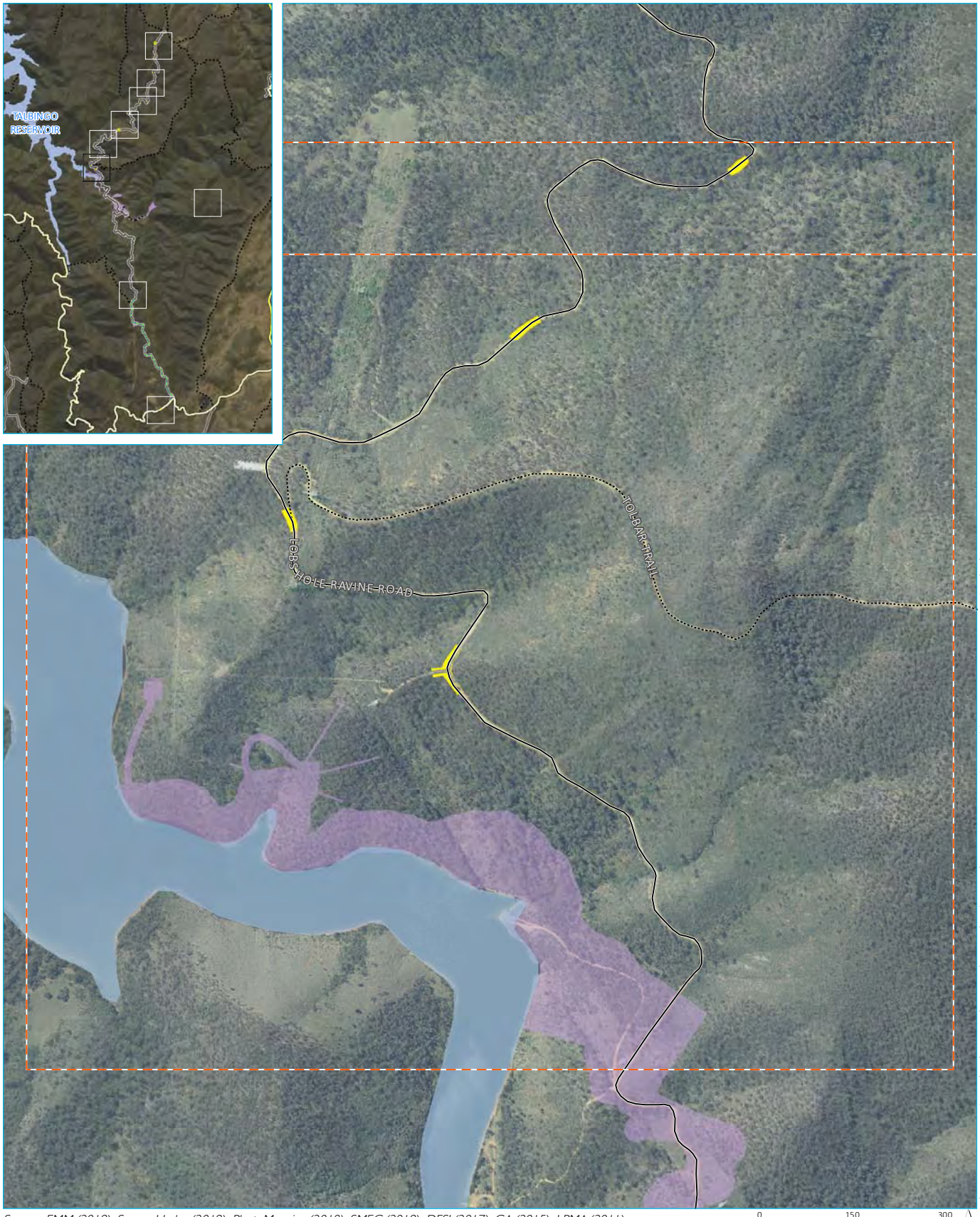

Source: EMM (2019); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011)

KEY

- Local road
- Vehicular track
- Waterbody
- Impacts requiring offsets
- Exploratory works approved construction footprint

Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment

Snowy 2.0
Exploratory Works - Modification 2
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
- Serious and irreversible impacts
- Impacts requiring offsets
- Impacts not requiring offsets
- Areas not requiring assessment
- Exploratory works approved construction footprint

Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
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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)

0 150 300 m
GDA 1994 MGA Zone 55
N

KEY

- Main road
- Local road
- Impacts requiring offsets
- Impacts not requiring offsets
- Areas not requiring assessment

Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment

Snowy 2.0
Exploratory Works - Modification 2
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

- Serious and irreversible impacts
- Impacts requiring offsets
- Exploratory works approved construction footprint

Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment

Snowy 2.0
Exploratory Works - Modification 2
Response to Submissions
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4 Conclusion

As a result of the additional assessment undertaken for the response to submissions including additional offsets for the removal of dangerous trees, and changes to the Modification 2 boundary, additional offsets will be required to offset the removal of native vegetation and impacts to threatened species habitat. Residual impacts following the amendments within this response to submissions include:

- clearing of 2.78 ha of native vegetation (including the removal of 134 dangerous trees); and
- impacts to 1.15 ha of threatened species habitat for four species credit species.

Threatened species survey identified nine fauna species recorded adjacent to the dangerous trees. Further assessment will be completed to identify any threatened species potentially using the dangerous trees.

A total of 54 ecosystem credits are required for the Exploratory Works Modification 2 disturbance footprint and dangerous tree removal, and 30 species credits arising from Modification 2. These impacts will be offset in accordance with the objective and principles outlined in the biodiversity framework.

References

DoE 2013. Survey Guidelines for Australia's Threatened Orchids. Guidelines for Detecting Orchids Listed As 'Threatened' Under the Environment Protection and Biodiversity Conservation Act 1999. Department of the Environment, Canberra.

EMM 2018. Biodiversity Development Assessment Report, Exploratory Works for Snowy 2.0. Report prepared for Snowy Hydro Ltd by EMM Consulting Pty Ltd, St Leonards, NSW.

EMM 2019a. Exploratory Works Biodiversity Management Plan, Snowy 2.0. Report prepared for Snowy Hydro Ltd by EMM Consulting Pty Ltd, St Leonards, NSW.

EMM 2019b. Biodiversity Assessment Development Report, Exploratory Works Modification 2 for Snowy 2.0. Report prepared for Snowy Hydro Ltd by EMM Consulting Pty Ltd, St Leonards, NSW.

OEH 2016. NSW Guide to Surveying Threatened Plants, NSW Office of Environment and Heritage, Sydney.

Appendix A

Vegetation integrity assessment - datasheets

BAM Site – Field Survey Form

Plot ID:	5	**Date:**	18-12-17	**Survey Name:**	Lobs Hole Ravine Access Road			**Recorders:**	AM, SD
Zone:	55	**Easting:**	628809.7544	**Plot dimensions:**	20m x 50m			**Midline bearing:**	35
Datum:	GDA94	**Northing:**	6051892.769	**IBRA region:**	South Eastern Highlands (Bondo)			**Zone ID:**	
Plant Community Type:			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			**Confidence:**	High	**Photo #:**	
Vegetation Class:			Upper Riverina Dry Sclerophyll Forests			**EEC:**	No	**Confidence:**	Low

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	1
	Shrubs:	4
	Grasses etc.:	9
	Forbs:	14
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	20
	Shrubs:	1.8
	Grasses etc.:	17.9
	Forbs:	3.3
	Ferns:	0
	Other:	0
High Threat Weed cover:		0.4

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	0	0	0
50 – 79 cm:	1	0	0
30 – 49 cm:	1	0	0
20 – 29 cm:	1	0	0
10 – 19 cm:	1	0	0
5 – 9 cm:	1	0	0
< 5 cm:	1	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	37		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	20	30	40	80	75	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots:	49					0.4					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Drainage depression	**Lf Pattern (A)**	Plateau	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)	Alluvial loams and clays	**Soil Surface Texture**	Loam	**Soil Colour**	Dark brown	**Soil Depth**	Medium
Lithology (B)							
Slope	Flat	**Aspect**	North-east	**Site Drainage**		**Distance to nearest water & type**	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):	Light	greater than 10yo	Mostly young trees <30cm DBH
Cultivation (inc. pasture):			No evidence
Soil erosion:			No evidence
Firewood / CWD removal:			No evidence
Grazing (identify native/stock):	Light		Minor damage from feral pigs
Fire damage:	Moderate	3 to 10 yo	
Storm damage:			No evidence
Weediness:	Moderate		Exotic grasses and forbs
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	Lobs Hole Ravine Access Road				
Date:	18-12-17	**Plot ID:**	5	**Recorders:**	AM, SD

GF Code	***Top 3 native species in each growth form group: Full species name mandatory*** ***All other native and exotic species: Full species name where practicable***	Cover	Abund	Voucher	N, E or HTE	Stratum
Tree (TG)	*Eucalyptus camphora*	20	30		N	
Forb (FG)	*Stylidium graminifolium*	0.1	10		N	
Grass & grasslike	*Poa labillardierei var. labillardierei*	0.5	20		N	
Grass & grasslike	*Poa clivicola*	10	200		N	
Grass & grasslike	*Poa helmsii*	5	20		N	
Forb (FG)	*Bulbine bulbosa*	0.5	50		N	
Shrub (SG)	*Epacris breviflora*	0.5	10		N	
Forb (FG)	*Hypericum japonicum*	0.5	50		N	
Grass & grasslike	*Luzula modesta*	0.5	100		N	
Shrub (SG)	*Leptospermum myrtifolium*	1	50		N	
Grass & grasslike	*Juncus australis*	0.5	50		N	
Grass & grasslike	*Themeda triandra*	0.1	10		N	
Forb (FG)	*Senecio quadridentatus*	0.1	10		N	
Forb (FG)	*Epilobium gunnianum*	0.1	10		N	
Forb (FG)	*Haloragis heterophylla*	1	500		N	
Forb (FG)	*Hypoxis hygrometrica*	0.1	20		N	
Forb (FG)	*Ranunculus lappaceus*	0.1	20		N	
	Hypericum perforatum	0.1	10		HTE	
	Trifolium repens	0.5	20		E	
	Holcus lanatus	5	500		E	
	Centaurium erythraea	0.1	50		E	
	Rubus anglocandicans	0.5	10		E	
	Conyza canadensis var. canadensis	0.1	200		E	
	Rosa rubiginosa	0.3	10		HTE	
	Medicago lupulina	0.2	20		E	
Forb (FG)	*Geranium solanderi*	0.2	40		N	
Forb (FG)	*Oreomyrrhis eriopoda*	0.1	10		N	
Grass & grasslike	*Schoenus apogon*	1	200		N	
Forb (FG)	*Oxalis perennans*	0.1	20		N	
Forb (FG)	*Veronica subtilis*	0.2	30		N	
Grass & grasslike	*Carex appressa*	0.2	10		N	
	Cirsium vulgare	0.1	5		E	
	Hypochaeris radicata	0.1	5		E	
Shrub (SG)	*Pimelea pauciflora*	0.1	5		N	
Forb (FG)	*Asperula scoparia*	0.1	5		N	
	Cerastium glomeratum	0.1	2		E	
Forb (FG)	*Gonocarpus micranthus*	0.1	10		N	
	Sonchus oleraceus	0.1	2		E	
Shrub (SG)	*Rubus parvifolius*	0.2	5		N	
Grass & grasslike	*Carex gaudichaudiana*	0.1	2		N	

BAM Site – Field Survey Form

Plot ID:	11	**Date:**	19-12-17	**Survey Name:**	Lobs Hole Ravine Access Road	**Recorders:**	AM, SD
Zone:	55	**Easting:**	628566.026	**Plot dimensions:**	20m x 50m	**Midline bearing:**	180
Datum:	GDA94	**Northing:**	6048199.292	**IBRA region:**	South Eastern Highlands (Bondo)	**Zone ID:**	
Plant Community Type:	953: Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion			**Confidence:**	Medium	**Photo #:**	
Vegetation Class:	Southern Tableland Dry Sclerophyll Forests			**EEC:**	No	**Confidence:**	Low

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	2
	Shrubs:	9
	Grasses etc.:	8
	Forbs:	15
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0.3
	Shrubs:	3.1
	Grasses etc.:	81.4
	Forbs:	4.4
	Ferns:	0
	Other:	0
High Threat Weed cover:		7.1

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	0	0	0
50 – 79 cm:	0	0	0
30 – 49 cm:	0	0	0
20 – 29 cm:	0	0	0
10 – 19 cm:	0	0	0
5 – 9 cm:	0	0	0
< 5 cm:	0	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	27		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	60	60	30	50	50	20	1	0	15	10	0	0	0	0	3	0	0	0	5	2
Average of the 5 subplots:	50					9.2					0.6					1.4				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Hillslope	**Lf Pattern (A)**	Low hills	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)	Metamorphic rock (unidentified)	**Soil Surface Texture**	Clay loam	**Soil Colour**	Light brown	**Soil Depth**	Medium
Lithology (B)							
Slope	3	**Aspect**	South-east	**Site Drainage**		**Distance to nearest water & type**	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):		greater than 10yo	Derived grassland from clearing for powerline easement
Cultivation (inc. pasture):			No evidence
Soil erosion:			No evidence
Firewood / CWD removal:			No evidence
Grazing (identify native/stock):	Light		No evidence of livestock or feral animals
Fire damage:			No evidence
Storm damage:			No evidence
Weediness:	Moderate		Exotic forbs
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	Lobs Hole Ravine Access Road						
		Date:	19-12-17	**Plot ID:**	11	**Recorders:**	AM, SD

GF Code	***Top 3 native species in each growth form group: Full species name mandatory*** ***All other native and exotic species: Full species name where practicable***	Cover	Abund	Voucher	N, E or HTE	Stratum
	Hypericum perforatum	7	300		HTE	
Forb (FG)	*Veronica derwentiana subsp. derwentiana*	0.3	2		N	
Grass & grasslike	*Themeda triandra*	50	1000		N	
Grass & grasslike	*Lomandra bracteata*	0.5	30		N	
Grass & grasslike	*Poa sieberiana*	30	1000		N	
Shrub (SG)	*Leptospermum myrtifolium*	0.3	5		N	
	Taraxacum officinale	0.2	50		E	
Forb (FG)	*Dichondra repens*	2	500		N	
	Acetosella vulgaris	0.1	30		HTE	
Forb (FG)	*Geranium solanderi*	0.3	50		N	
Forb (FG)	*Dianella revoluta*	0.5	20		N	
Shrub (SG)	*Daviesia latifolia*	1	30		N	
Shrub (SG)	*Pimelea pauciflora*	0.2	20		N	
	Centaurium erythraea	0.1	30		E	
Shrub (SG)	*Rubus parvifolius*	0.3	5		N	
Forb (FG)	*Stellaria pungens*	0.2	20		N	
Grass & grasslike	*Poa helmsii*	0.2	5		N	
Shrub (SG)	*Epacris breviflora*	0.2	5		N	
	Holcus lanatus	0.2	10		E	
	Hypochaeris radicata	0.2	40		E	
Tree (TG)	*Eucalyptus dalrympleana*	0.1	1		N	
Shrub (SG)	*Hakea microcarpa*	0.1	1		N	
Forb (FG)	*Cymbonotus lawsonianus*	0.1	3		N	
Forb (FG)	*Erigeron bellidioides*	0.1	3		N	
	Verbascum virgatum	0.1	5		E	
Forb (FG)	*Veronica calycina*	0.1	10		N	
Forb (FG)	*Oxalis perennans*	0.1	5		N	
Shrub (SG)	*Cassinia ochracea*	0.8	5		N	
Tree (TG)	*Eucalyptus pauciflora*	0.2	5		N	
Forb (FG)	*Euchiton japonicus*	0.2	50		N	
Shrub (SG)	*Bossiaea foliosa*	0.1	1		N	
Forb (FG)	*Hypericum gramineum*	0.1	20		N	
Grass & grasslike	*Rytidosperma penicillatum*	0.3	80		N	
Forb (FG)	*Microtis unifolia*	0.1	10		N	
Forb (FG)	*Gonocarpus tetragynus*	0.1	10		N	
Shrub (SG)	*Hibbertia obtusifolia*	0.1	5		N	
Forb (FG)	*Ranunculus lappaceus*	0.1	5		N	
Forb (FG)	*Dipodium spp.*	0.1	1		N	
Grass & grasslike	*Lomandra filiformis subsp. filiformis*	0.1	5		N	
Grass & grasslike	*Anthosachne scabra*	0.2	20		N	
Grass & grasslike	*Lachnagrostis filiformis*	0.1	1		N	

BAM Site – Field Survey Form

Plot ID:	187	**Date:**	08-01-18	**Survey Name:**	Lobbs Hole Ravine Road north	**Recorders:**	SD
Zone:	55	**Easting:**	628142.3788	**Plot dimensions:**	20m x 50m	**Midline bearing:**	90
Datum:	GDA94	**Northing:**	6046952.08	**IBRA region:**	South Eastern Highlands (Bondo)	**Zone ID:**	
Plant Community Type:	296: Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion			**Confidence:**	Medium	**Photo #:**	
Vegetation Class:	Southern Tableland Dry Sclerophyll Forests			**EEC:**	No	**Confidence:**	High

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	3
	Shrubs:	10
	Grasses etc.:	6
	Forbs:	6
	Ferns:	1
	Other:	1
Sum of Cover of native vascular plants by growth form group	Trees:	2
	Shrubs:	10.8
	Grasses etc.:	7.2
	Forbs:	3.8
	Ferns:	60
	Other:	0.5
High Threat Weed cover:		1.1

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	0	0	0
50 – 79 cm:	0	0	0
30 – 49 cm:	0	0	0
20 – 29 cm:	0	0	0
10 – 19 cm:	0	0	0
5 – 9 cm:	0	0	0
< 5 cm:	0	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	84		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	60	98	100	40	90	20	5	5	60	5	0	20	10	70	40	0	0	0	0	0
Average of the 5 subplots:	77.6					19					28					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Hillslope	**Lf Pattern (A)**	Hills	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)	Sedimentary rock (unidentified)	**Soil Surface Texture**	Clay	**Soil Colour**	Brown	**Soil Depth**	Medium
Lithology (B)							
Slope	17	**Aspect**	East	**Site Drainage**	Medium	**Distance to nearest water & type**	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):	Severe	greater than 10yo	Poweline easement
Cultivation (inc. pasture):			
Soil erosion:	Moderate	greater than 10yo	Powerline clearing
Firewood / CWD removal:			
Grazing (identify native/stock):			
Fire damage:			
Storm damage:			
Weediness:	Light	3 to 10 yo	
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, …, 10, 15, 20, 25, …100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

Survey Name:	Lobbs Hole Ravine Road north				
Date:	08-01-18	**Plot ID:**	187	**Recorders:**	SD

GF Code	***Top 3 native species in each growth form group: Full species name mandatory*** ***All other native and exotic species: Full species name where practicable***	Cover	Abund	Voucher	N, E or HTE	Stratum
Fern (EG)	*Pteridium esculentum*	60	1000		N	
Shrub (SG)	*Cassinia ochracea*	1	20		N	
Forb (FG)	*Asperula scoparia*	1	100		N	
Grass & grasslike	*Lomandra longifolia*	2	80		N	
Tree (TG)	*Acacia dealbata*	1	10		N	
Shrub (SG)	*Platylobium montanum*	0.7	40		N	
Shrub (SG)	*Daviesia latifolia*	1	30		N	
Forb (FG)	*Gonocarpus tetragynus*	0.5	40		N	
Other (OG)	*Cassytha glabella*	0.5	20		N	
	Hypericum perforatum	1	200		HTE	
Shrub (SG)	*Pimelea linifolia*	3	200		N	
Shrub (SG)	*Leucopogon fletcheri subsp. brevisepalus*	3	200		N	
Grass & grasslike	*Deyeuxia quadriseta*	0.5	50		N	
Forb (FG)	*Stylidium graminifolium*	1	200		N	
Grass & grasslike	*Poa sieberiana var. sieberiana*	3	300		N	
Shrub (SG)	*Hibbertia obtusifolia*	0.5	30		N	
Tree (TG)	*Eucalyptus dalrympleana*	0.5	2		N	
Tree (TG)	*Eucalyptus mannifera subsp. mannifera*	0.5	2		N	
Shrub (SG)	*Persoonia chamaepeuce*	0.2	5		N	
Forb (FG)	*Stellaria pungens*	1	100		N	
Shrub (SG)	*Tetratheca bauerifolia*	1	50		N	
Shrub (SG)	*Baeckea utilis*	0.1	10		N	
	Centaurium erythraea	0.3	30		E	
	Taraxacum officinale	0.5	50		E	
	Hypochaeris glabra	0.3	30		E	
Grass & grasslike	*Anthosachne scabra*	0.5	50		N	
Forb (FG)	*Scleranthus fasciculatus*	0.2	10		N	
Grass & grasslike	*Poa sieberiana var. cyanophylla*	0.7	50		N	
	Aira elegantissima	0.2	20		E	
	Holcus lanatus	0.2	20		E	
Shrub (SG)	*Lomatia myricoides*	0.3	2		N	
	Agrostis capillaris	0.1	5		HTE	
Grass & grasslike	*Aristida ramosa*	0.5	30		N	
Forb (FG)	*Microtis unifolia*	0.1	1		N	

BAM Site – Field Survey Form

Plot ID:	190	**Date:**	09-01-18	**Survey Name:**	Lobs Hole Ravine Road north	**Recorders:**	SD
Zone:	55	**Easting:**	627370.4074	**Plot dimensions:**	20m x 50m	**Midline bearing:**	300
Datum:	GDA94	**Northing:**	6044577.778	**IBRA region:**	South Eastern Highlands (Bondo)	**Zone ID:**	

Plant Community Type:	296: Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	**Confidence:**	High	**Photo #:**	
Vegetation Class:	Southern Tableland Dry Sclerophyll Forests	**EEC:**	No	**Confidence:**	High

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	3
	Shrubs:	11
	Grasses etc.:	5
	Forbs:	6
	Ferns:	1
	Other:	2
Sum of Cover of native vascular plants by growth form group	Trees:	20
	Shrubs:	29.3
	Grasses etc.:	2.5
	Forbs:	0.9
	Ferns:	0.1
	Other:	0.6
High Threat Weed cover:		0

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	0	0	0
50 – 79 cm:	1	0	2
30 – 49 cm:	0	0	0
20 – 29 cm:	0	0	0
10 – 19 cm:	0	0	0
5 – 9 cm:	0	0	0
< 5 cm:	0	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	200		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	90	80	80	95	95	0	2	5	5	0	10	10	30	30	15	15	1	10	1	10
Average of the 5 subplots:	88					2.4					19					7.4				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Hillslope	**Lf Pattern (A)**	Mountains	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)	Sedimentary rock (unidentified)	**Soil Surface Texture**	Sandy loam	**Soil Colour**	Brown	**Soil Depth**	Shallow
Lithology (B)							
Slope	30	**Aspect**	North-west	**Site Drainage**	Good	**Distance to nearest water & type**	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):	Moderate	greater than 10yo	
Cultivation (inc. pasture):			
Soil erosion:	Moderate	greater than 10yo	
Firewood / CWD removal:			
Grazing (identify native/stock):			
Fire damage:	Light	3 to 10 yo	
Storm damage:			
Weediness:			
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	Lobs Hole Ravine Road north				
Date:	09-01-18	**Plot ID:**	190	**Recorders:**	SD

GF Code	***Top 3 native species in each growth form group: Full species name mandatory*** ***All other native and exotic species: Full species name where practicable***	Cover	Abund	Voucher	N, E or HTE	Stratum
Tree (TG)	*Eucalyptus mannifera subsp. mannifera*	7	5		N	
Tree (TG)	*Eucalyptus dives*	3	5		N	
Tree (TG)	*Eucalyptus macrorhyncha*	10	10		N	
Shrub (SG)	*Acacia obliquinervia*	10	100		N	
Shrub (SG)	*Dillwynia phylicoides*	15	200		N	
Other (OG)	*Cassytha glabella*	0.5	20		N	
Shrub (SG)	*Brachyloma daphnoides*	1	30		N	
Forb (FG)	*Dianella revoluta*	0.1	10		N	
Forb (FG)	*Poranthera spp.*	0.2	30		N	
Forb (FG)	*Gonocarpus tetragynus*	0.2	30		N	
Forb (FG)	*Asperula spp.*	0.2	30		N	
Grass & grasslike	*Lomandra bracteata*	0.1	20		N	
Shrub (SG)	*Cassinia longifolia*	0.7	20		N	
Shrub (SG)	*Hibbertia obtusifolia*	0.5	20		N	
Forb (FG)	*Senecio quadridentatus*	0.1	1		N	
Grass & grasslike	*Rytidosperma pallidum*	2	100		N	
Shrub (SG)	*Tetratheca bauerifolia*	1	200		N	
Shrub (SG)	*Persoonia chamaepeuce*	0.2	30		N	
Other (OG)	*Hardenbergia violacea*	0.1	10		N	
Shrub (SG)	*Exocarpos strictus*	0.1	2		N	
Shrub (SG)	*Banksia canei*	0.5	2		N	
Grass & grasslike	*Poa spp.*	0.2	20		N	
Grass & grasslike	*Austrostipa scabra*	0.1	10		N	
Shrub (SG)	*Pimelea linifolia*	0.1	10		N	
Shrub (SG)	*Leucopogon fletcheri subsp. brevisepalus*	0.2	10		N	
Grass & grasslike	*Lomandra filiformis subsp. filiformis*	0.1	5		N	
Forb (FG)	*Stylidium graminifolium*	0.1	5		N	
Fern (EG)	*Asplenium flabellifolium*	0.1	5		N	

BAM Site – Field Survey Form

Plot ID:	192	**Date:**	09-01-18	**Survey Name:**	Lobbs Hole Ravine Road north	**Recorders:**	SD
Zone:	55	**Easting:**	627958.7871	**Plot dimensions:**	20m x 50m	**Midline bearing:**	160
Datum:	GDA94	**Northing:**	6045556.519	**IBRA region:**	South Eastern Highlands (Bondo)	**Zone ID:**	
Plant Community Type:	300: Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment			**Confidence:**	High	**Photo #:**	
Vegetation Class:	Southern Tableland Wet Sclerophyll Forests			**EEC:**	No	**Confidence:**	High

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	3
	Shrubs:	13
	Grasses etc.:	5
	Forbs:	12
	Ferns:	0
	Other:	3
Sum of Cover of native vascular plants by growth form group	Trees:	25.5
	Shrubs:	38.8
	Grasses etc.:	16.5
	Forbs:	2.4
	Ferns:	0
	Other:	0.4
High Threat Weed cover:		0

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	1	0	0
50 – 79 cm:	3	0	5
30 – 49 cm:	0	0	0
20 – 29 cm:	0	0	0
10 – 19 cm:	0	0	0
5 – 9 cm:	0	0	0
< 5 cm:	0	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	30		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	100	100	60	80	95	0	0	50	25	1	10	10	20	15	20	0	0	0	95	0
Average of the 5 subplots:	87					15.2					15					19				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Hillslope	**Lf Pattern (A)**	Mountains	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)	Sedimentary rock (unidentified)	**Soil Surface Texture**	Clay	**Soil Colour**	Brown	**Soil Depth**	Medium
Lithology (B)							
Slope	30	**Aspect**	South-east	**Site Drainage**	Medium	**Distance to nearest water & type**	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):	Moderate	greater than 10yo	
Cultivation (inc. pasture):			
Soil erosion:	Light	greater than 10yo	
Firewood / CWD removal:			
Grazing (identify native/stock):			
Fire damage:	Light	3 to 10 yo	
Storm damage:			
Weediness:			
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	Lobbs Hole Ravine Road north				
Date:	09-01-18	**Plot ID:**	192	**Recorders:**	SD

GF Code	***Top 3 native species in each growth form group: Full species name mandatory*** ***All other native and exotic species: Full species name where practicable***	Cover	Abund	Voucher	N, E or HTE	Stratum
Tree (TG)	*Eucalyptus robertsonii*	20	10		N	
Tree (TG)	*Eucalyptus mannifera subsp. mannifera*	5	5		N	
Shrub (SG)	*Daviesia latifolia*	20	500		N	
Shrub (SG)	*Grevillea rosmarinifolia*	2	50		N	
Shrub (SG)	*Leucopogon fletcheri subsp. brevisepalus*	5	200		N	
Shrub (SG)	*Cassinia aculeata*	5	10		N	
Shrub (SG)	*Platylobium montanum*	2	100		N	
Tree (TG)	*Acacia melanoxylon*	0.5	5		N	
Shrub (SG)	*Olearia phlogopappa*	0.8	30		N	
Grass & grasslike	*Lomandra filiformis subsp. coriacea*	0.3	20		N	
Shrub (SG)	*Persoonia chamaepeuce*	2	80		N	
Forb (FG)	*Asperula scoparia*	0.5	50		N	
Grass & grasslike	*Poa sieberiana var. sieberiana*	5	500		N	
Forb (FG)	*Geranium solanderi*	0.1	10		N	
Grass & grasslike	*Lomandra filiformis subsp. filiformis*	0.2	30		N	
Grass & grasslike	*Poa sieberiana var. cyanophylla*	10	1000		N	
Forb (FG)	*Podolepis jaceoides*	0.3	100		N	
Forb (FG)	*Gonocarpus tetragynus*	0.2	40		N	
Forb (FG)	*Stackhousia monogyna*	0.1	1		N	
Forb (FG)	*Stellaria pungens*	0.2	20		N	
Shrub (SG)	*Banksia canei*	0.5	8		N	
Forb (FG)	*Ranunculus lappaceus*	0.2	20		N	
Shrub (SG)	*Acacia pravissima*	0.1	5		N	
	Centaurium erythraea	0.1	10		E	
Forb (FG)	*Galium binifolium*	0.2	30		N	
Forb (FG)	*Poranthera microphylla*	0.2	30		N	
Other (OG)	*Clematis aristata*	0.1	10		N	
Other (OG)	*Glycine tabacina*	0.2	30		N	
Shrub (SG)	*Coprosma quadrifida*	0.1	1		N	
Other (OG)	*Glycine microphylla*	0.1	10		N	
Forb (FG)	*Veronica derwentiana subsp. derwentiana*	0.2	5		N	
Shrub (SG)	*Exocarpos strictus*	0.2	1		N	
Grass & grasslike	*Lomandra longifolia*	1	20		N	
Shrub (SG)	*Cassinia longifolia*	1	20		N	
Shrub (SG)	*Coprosma hirtella*	0.1	1		N	
Forb (FG)	*Viola betonicifolia*	0.1	20		N	
Forb (FG)	*Viola hederacea*	0.1	1		N	

BAM Site – Field Survey Form

Plot ID:	214	**Date:**	19-12-17	**Survey Name:**	Lobs Hole Ravine Access Road	**Recorders:**	AM, SD
Zone:	55	**Easting:**	628853.4591	**Plot dimensions:**	20m x 50m	**Midline bearing:**	235
Datum:	GDA94	**Northing:**	6049403.484	**IBRA region:**	South Eastern Highlands (Bondo)	**Zone ID:**	
Plant Community Type:		952: Mountain Gum - Narrow-leaved Peppermint - Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion		**Confidence:**	High	**Photo #:**	
Vegetation Class:		Subalpine Woodlands		**EEC:**	No	**Confidence:**	Low

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	3
	Shrubs:	7
	Grasses etc.:	9
	Forbs:	22
	Ferns:	0
	Other:	4
Sum of Cover of native vascular plants by growth form group	Trees:	13
	Shrubs:	8.2
	Grasses etc.:	4.7
	Forbs:	4
	Ferns:	0
	Other:	1
High Threat Weed cover:		0

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	1	0	0
50 – 79 cm:	5	0	1
30 – 49 cm:	1	0	0
20 – 29 cm:	1	0	0
10 – 19 cm:	1	0	0
5 – 9 cm:	1	0	0
< 5 cm:	1	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	57		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	75	90	80	70	65	15	2	0	1	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots:	76					3.6					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Hillslope	**Lf Pattern (A)**	Plateau	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)	Sedimentary rock (unidentified)	**Soil Surface Texture**	Loam	**Soil Colour**	Dark brown	**Soil Depth**	Medium
Lithology (B)							
Slope	3	**Aspect**	South-east	**Site Drainage**		**Distance to nearest water & type**	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):	Light	greater than 10yo	Historical clearing/logging
Cultivation (inc. pasture):			No evidence
Soil erosion:			No evidence
Firewood / CWD removal:			No evidence of recent removal
Grazing (identify native/stock):	Light		Native herbivores. No evidence of livestock or feral animals
Fire damage:	Moderate	3 to 10 yo	Understorey fire within the last 2 to 5 years
Storm damage:			No evidence
Weediness:	Light		Very low weed cover
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	Lobs Hole Ravine Access Road				
Date:	19-12-17	**Plot ID:**	214	**Recorders:**	AM, SD

GF Code	***Top 3 native species in each growth form group: Full species name mandatory*** ***All other native and exotic species: Full species name where practicable***	Cover	Abund	Voucher	N, E or HTE	Stratum
Tree (TG)	*Eucalyptus dalrympleana*	5	2		N	
Tree (TG)	*Eucalyptus radiata*	7	5		N	
Shrub (SG)	*Daviesia latifolia*	5	200		N	
Shrub (SG)	*Hibbertia obtusifolia*	0.5	20		N	
Tree (TG)	*Eucalyptus pauciflora*	1	20		N	
Forb (FG)	*Wahlenbergia gloriosa*	0.1	50		N	
Forb (FG)	*Poranthera microphylla*	0.2	50		N	
Forb (FG)	*Thysanotus tuberosus*	0.1	50		N	
Shrub (SG)	*Platylobium formosum*	1	100		N	
Forb (FG)	*Stellaria pungens*	0.5	100		N	
Forb (FG)	*Arthropodium milleflorum*	0.5	80		N	
Grass & grasslike	*Poa sieberiana var. sieberiana*	3	300		N	
Other (OG)	*Clematis aristata*	0.5	200		N	
Forb (FG)	*Arrhenechthites mixta*	0.3	50		N	
Forb (FG)	*Microtis unifolia*	0.1	10		N	
Grass & grasslike	*Dichelachne rara*	0.2	40		N	
Grass & grasslike	*Dichelachne rara*	0.2	40		N	
Forb (FG)	*Senecio prenanthoides*	0.1	30		N	
Grass & grasslike	*Lomandra bracteata*	0.2	30		N	
Grass & grasslike	*Lomandra filiformis subsp. filiformis*	0.5	50		N	
Shrub (SG)	*Olearia phlogopappa*	0.5	20		N	
Shrub (SG)	*Tetratheca bauerifolia*	0.5	100		N	
Forb (FG)	*Viola betonicifolia*	0.1	30		N	
Grass & grasslike	*Rytidosperma penicillatum*	0.2	50		N	
Grass & grasslike	*Anthosachne scabra*	0.2	30		N	
Forb (FG)	*Lobelia gibbosa*	0.1	5		N	
Forb (FG)	*Brachyscome spathulata*	0.1	10		N	
Forb (FG)	*Asperula scoparia*	0.5	200		N	
Shrub (SG)	*Cassinia ochracea*	0.5	20		N	
Forb (FG)	*Diuris spp.*	0.1	5		N	
Forb (FG)	*Veronica derwentiana subsp. derwentiana*	0.3	5		N	
Other (OG)	*Glycine tabacina*	0.1	30		N	
Grass & grasslike	*Luzula flaccida*	0.1	10		N	
Forb (FG)	*Brachyscome spp.*	0.1	20		N	
Grass & grasslike	*Poa sieberiana var. cyanophylla*	0.1	5		N	
Forb (FG)	*Gastrodia sesamoides*	0.1	3		N	
Forb (FG)	*Geranium solanderi*	0.2	40		N	
Forb (FG)	*Wahlenbergia stricta*	0.1	30		N	
Other (OG)	*Glycine clandestina*	0.2	20		N	
Forb (FG)	*Hypericum gramineum*	0.1	10		N	
Forb (FG)	*Lobelia pedunculata*	0.1	5		N	
Forb (FG)	*Ranunculus lappaceus*	0.1	10		N	
Shrub (SG)	*Pimelea linifolia*	0.2	40		N	
Other (OG)	*Desmodium varians*	0.2	20		N	
Forb (FG)	*Coronidium scorpioides*	0.1	20		N	

BAM Site – Field Survey Form

Plot ID:	216	**Date:**	12-12-17	**Survey Name:**	Access Roads	**Recorders:**	SD, EL
Zone:	55	**Easting:**	627032.6318	**Plot dimensions:**	20m x 50m	**Midline bearing:**	211
Datum:	GDA94	**Northing:**	6033444.058	**IBRA region:**	South Eastern Highlands (Bondo)	**Zone ID:**	
Plant Community Type:	953: Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion			**Confidence:**		**Photo #:**	
Vegetation Class:	Southern Tableland Dry Sclerophyll Forests			**EEC:**		**Confidence:**	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	6
	Shrubs:	7
	Grasses etc.:	5
	Forbs:	18
	Ferns:	0
	Other:	2
Sum of Cover of native vascular plants by growth form group	Trees:	22.3
	Shrubs:	6.9
	Grasses etc.:	72.3
	Forbs:	4
	Ferns:	0
	Other:	0.3
High Threat Weed cover:		0.2

BAM Attribute (1000 m2 plot) DBH			
DBH	**Stem count (euc)**	**Stem count (non-euc)**	**Stems with Hollows**
80 + cm:	1	0	1
50 – 79 cm:	3	0	3
30 – 49 cm:	1	0	0
20 – 29 cm:	1	0	0
10 – 19 cm:	1	0	0
5 – 9 cm:	1	0	0
< 5 cm:	1	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	43		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	10	45	25	50	10	2	20	0	20	5	0	0	0	0	0	0	4	0	4	0
Average of the 5 subplots:	28					9.4					0					1.6				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Hillslope	**Lf Pattern (A)**	Mountains	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)	Metamorphic rock (unidentified)	**Soil Surface Texture**	Clay loam	**Soil Colour**	Brown	**Soil Depth**	Shallow
Lithology (B)							
Slope	28	**Aspect**	NW	**Site Drainage**	Good	**Distance to nearest water & type**	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):	Moderate	greater than 10yo	
Cultivation (inc. pasture):			No evidence
Soil erosion:	Light		Associated with access track adjacent
Firewood / CWD removal:			No evidence
Grazing (identify native/stock):	Light	greater than 10yo	Native and exotic herbivores
Fire damage:	Light	greater than 10yo	
Storm damage:			No evidence
Weediness:	Light	less than 3yo	Forbs
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	Access Roads						
		Date:	12-12-17	**Plot ID:**	216	**Recorders:**	SD, EL

GF Code	***Top 3 native species in each growth form group: Full species name mandatory*** ***All other native and exotic species: Full species name where practicable***	Cover	Abund	Voucher	N, E or HTE	Stratum
Tree (TG)	*Eucalyptus pauciflora*	10	10		N	
Tree (TG)	*Eucalyptus rubida x dalrympleana*	5	5		N	
Tree (TG)	*Eucalyptus dalrympleana*	2	1		N	
Tree (TG)	*Acacia melanoxylon*	5	40		N	
Shrub (SG)	*Cassinia longifolia*	5	60		N	
Shrub (SG)	*Mirbelia platylobioides*	0.3	30		N	
Forb (FG)	*Plantago gaudichaudii*	0.7	200		N	
Grass & grasslike	*Poa sieberiana*	70	1000		N	
	Crepis capillaris	0.1	20		E	
Forb (FG)	*Gonocarpus teucrioides*	0.5	80		N	
Forb (FG)	*Cullen microcephalum*	0.3	30		N	
Forb (FG)	*Stackhousia monogyna*	0.1	20		N	
Shrub (SG)	*Exocarpos strictus*	1	20		N	
Other (OG)	*Desmodium varians*	0.2	40		N	
Forb (FG)	*Hydrocotyle laxiflora*	0.3	100		N	
	Trifolium arvense	0.1	20		E	
Forb (FG)	*Wahlenbergia gloriosa*	0.1	20		N	
Tree (TG)	*Acacia dealbata subsp. subalpina*	0.2	3		N	
Forb (FG)	*Asperula conferta*	0.5	100		N	
Grass & grasslike	*Carex breviculmis*	0.1	20		N	
Grass & grasslike	*Themeda triandra*	2	100		N	
Forb (FG)	*Lotus australis*	0.4	30		N	
Forb (FG)	*Chrysocephalum semipapposum*	0.2	20		N	
Forb (FG)	*Senecio quadridentatus*	0.1	10		N	
	Centaurium erythraea	0.1	5		E	
Tree (TG)	*Eucalyptus robertsonii*	0.1	10		N	
Forb (FG)	*Chrysocephalum apiculatum*	0.1	5		N	
Forb (FG)	*Viola betonicifolia*	0.1	10		N	
	Hypericum perforatum	0.2	50		HTE	
Forb (FG)	*Rumex brownii*	0.1	1		N	
Forb (FG)	*Cymbonotus lawsonianus*	0.1	10		N	
Forb (FG)	*Galium gaudichaudii*	0.1	10		N	
Grass & grasslike	*Lomandra micrantha subsp. Tuberculata*	0.1	10		N	
Forb (FG)	*Podolepis spp.*	0.1	1		N	
Shrub (SG)	*Leucopogon fletcheri subsp. brevisepalus*	0.2	1		N	
Other (OG)	*Glycine tabacina*	0.1	10		N	
Forb (FG)	*Hypericum gramineum*	0.1	20		N	
Grass & grasslike	*Dichelachne spp.*	0.1	10		N	
Shrub (SG)	*Cassinia aculeata*	0.1	2		N	
Shrub (SG)	*Coprosma hirtella*	0.1	1		N	
Shrub (SG)	*Mirbelia oxylobioides*	0.2	1		N	
Forb (FG)	*Leptorhynchos squamatus*	0.1	30		N	

BAM Site – Field Survey Form

Plot ID:	1001	**Date:**	16-03-18	**Survey Name:**	X1	**Recorders:**	JA, ACM
Zone:	55	**Easting:**	624845.63	**Plot dimensions:**	20m x 20m	**Midline bearing:**	120
Datum:	GDA94	**Northing:**	6040478.855	**IBRA region:**	South Eastern Highlands (Bondo)	**Zone ID:**	
Plant Community Type:	300: Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment			**Confidence:**		**Photo #:**	
Vegetation Class:	Southern Tableland Wet Sclerophyll Forests			**EEC:**	No	**Confidence:**	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	2
	Shrubs:	7
	Grasses etc.:	6
	Forbs:	7
	Ferns:	0
	Other:	1
Sum of Cover of native vascular plants by growth form group	Trees:	40
	Shrubs:	75.6
	Grasses etc.:	5.5
	Forbs:	0.7
	Ferns:	0
	Other:	0.1
High Threat Weed cover:		32.1

BAM Attribute (1000 m2 plot) DBH			
DBH	**Stem count (euc)**	**Stem count (non-euc)**	**Stems with Hollows**
80 + cm:	1	0	0
50 – 79 cm:	4	0	3
30 – 49 cm:	7	0	0
20 – 29 cm:	4	0	0
10 – 19 cm:	15	0	0
5 – 9 cm:	10	0	0
< 5 cm:	16	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	51		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	95	100	90	100	100	5	0	10	0	0	15	0	0	5	40	0	0	0	0	0
Average of the 5 subplots:	97					3					12					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Hillslope	**Lf Pattern (A)**	Low hills	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)	Alluvial loams and clays	**Soil Surface Texture**	Gravelly clay covered with litter	**Soil Colour**	Brown	**Soil Depth**	Shallow
Lithology (B)							
Slope	Slight slope down along midline	**Aspect**	120°SE	**Site Drainage**		**Distance to nearest water & type**	approx 30m

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):			
Cultivation (inc. pasture):			
Soil erosion:			
Firewood / CWD removal:			
Grazing (identify native/stock):			
Fire damage:			
Storm damage:			
Weediness:	Severe	greater than 10yo	
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	X1						
		Date:	16-03-18	Plot ID:	1001	Recorders:	JA, ACM

GF Code	*Top 3 native species in each growth form group: Full species name mandatory* *All other native and exotic species: Full species name where practicable*	Cover	Abund	Voucher	N, E or HTE	Stratum
Tree (TG)	*Eucalyptus viminalis*	15	5		N	
Tree (TG)	*Eucalyptus dives*	25	12		N	
Shrub (SG)	*Acacia pravissima*	70	400		N	
Shrub (SG)	*Cassinia longifolia*	5	5		N	
Shrub (SG)	*Exocarpos strictus*	0.2	5		N	
	Rubus fruticosus sp. agg.	30	10		HTE	
	Rosa rubiginosa	0.1	5		HTE	
	Hypericum perforatum	2	50		HTE	
Grass & grasslike	*Poa sieberiana*	5	100		N	
Grass & grasslike	*Lomandra multiflora subsp. Multiflora*	0.1	5		N	
Grass & grasslike	*Lomandra spp.*	0.1	2		N	
Forb (FG)	*Stellaria pungens*	0.1	30		N	
Other (OG)	*Glycine clandestina*	0.1	2		N	
Forb (FG)	*Asperula conferta*	0.1	40		N	
Forb (FG)	*Gonocarpus tetragynus*	0.1	30		N	
Shrub (SG)	*Mirbelia oxylobioides*	0.1	12		N	
Forb (FG)	*Acaena novae-zelandiae*	0.1	5		N	
Grass & grasslike	*Rytidosperma penicillatum*	0.1	10		N	
	Centaurium erythraea	0.1	5		E	
Shrub (SG)	*Hibbertia obtusifolia*	0.1	2		N	
Shrub (SG)	*Leucopogon fletcheri subsp. brevisepalus*	0.1	2		N	
Grass & grasslike	*Carex incomitata*	0.1	3		N	
Grass & grasslike	*Carex breviculmis*	0.1	20		N	
Forb (FG)	*Acaena ovina*	0.1	5		N	
Shrub (SG)	*Acrotriche serrulata*	0.1	1		N	
Forb (FG)	*Stackhousia spp.*	0.1	3		N	
Forb (FG)	*Lagenophora stipitata*	0.1	4		N	

BAM Site – Field Survey Form

Plot ID:	1046	**Date:**	14-03-18	**Survey Name:**	Talbingo	**Recorders:**	JA, CW
Zone:	55	**Easting:**	625822.7811	**Plot dimensions:**	20m x 20m	**Midline bearing:**	<Null>
Datum:	GDA94	**Northing:**	6039177.971	**IBRA region:**	South Eastern Highlands (Bondo)	**Zone ID:**	
Plant Community Type:		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		**Confidence:**	High	**Photo #:**	
Vegetation Class:		Upper Riverina Dry Sclerophyll Forests		**EEC:**	No	**Confidence:**	High

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	1
	Shrubs:	3
	Grasses etc.:	4
	Forbs:	2
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	70
	Shrubs:	20.2
	Grasses etc.:	8.4
	Forbs:	0.2
	Ferns:	0
	Other:	0
High Threat Weed cover:		35.2

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	0	0	0
50 – 79 cm:	0	0	0
30 – 49 cm:	0	0	0
20 – 29 cm:	3	0	0
10 – 19 cm:	35	0	0
5 – 9 cm:	24	0	0
< 5 cm:	45	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	25		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	95	80	70	70	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots:	77					0					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Gully	**Lf Pattern (A)**	Plain	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)	Conglomerate	**Soil Surface Texture**	Loamy	**Soil Colour**	Grey-brown	**Soil Depth**	Shallow
Lithology (B)							
Slope		**Aspect**		**Site Drainage**	Poor	**Distance to nearest water & type**	150m

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):			
Cultivation (inc. pasture):			
Soil erosion:			
Firewood / CWD removal:			
Grazing (identify native/stock):			
Fire damage:			
Storm damage:			
Weediness:	Moderate	greater than 10yo	
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	Talbingo				
Date:	14-03-18	**Plot ID:**	1046	**Recorders:**	JA, CW

GF Code	***Top 3 native species in each growth form group: Full species name mandatory*** ***All other native and exotic species: Full species name where practicable***	Cover	Abund	Voucher	N, E or HTE	Stratum
Tree (TG)	*Eucalyptus camphora subsp. humeana*	70	75		N	
Shrub (SG)	*Pimelea pauciflora*	20	30		N	
	Hypericum perforatum	10	4000		HTE	
	Centaurium erythraea	0.1	50		E	
	Rubus fruticosus sp. agg.	25	10		HTE	
	Crepis capillaris	0.1	10		E	
Shrub (SG)	*Exocarpos strictus*	0.1	3		N	
Forb (FG)	*Geranium solanderi*	0.1	20		N	
	Acetosella vulgaris	0.1	200		HTE	
Grass & grasslike	*Carex incomitata*	0.1	10		N	
	Rosa rubiginosa	0.1	3		HTE	
Forb (FG)	*Acaena ovina*	0.1	50		N	
Grass & grasslike	*Microlaena stipoides*	0.1	50		N	
Grass & grasslike	*Themeda triandra*	8	600		N	
Grass & grasslike	*Rytidosperma penicillatum*	0.2	50		N	
	Cirsium vulgare	0.1	5		E	
	Hypochaeris radicata	0.1	30		E	
Shrub (SG)	*Cassinia spp.*	0.1	1		N	

BAM Site – Field Survey Form

Plot ID:	1053	**Date:**	07-02-18	**Survey Name:**	Access Roads - PLOT 184A	**Recorders:**	AM, DK
Zone:	55	**Easting:**	625099.684	**Plot dimensions:**	20m x 50m	**Midline bearing:**	260
Datum:	GDA94	**Northing:**	6041600.275	**IBRA region:**	South Eastern Highlands (Bondo)	**Zone ID:**	
Plant Community Type:	729: Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion			**Confidence:**	Medium	**Photo #:**	
Vegetation Class:	Southern Tableland Dry Sclerophyll Forests			**EEC:**	No	**Confidence:**	Medium

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	3
	Shrubs:	15
	Grasses etc.:	5
	Forbs:	11
	Ferns:	0
	Other:	1
Sum of Cover of native vascular plants by growth form group	Trees:	35
	Shrubs:	24.4
	Grasses etc.:	3.7
	Forbs:	2.2
	Ferns:	0
	Other:	0.1
High Threat Weed cover:		0.1

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	0	0	0
50 – 79 cm:	1	0	0
30 – 49 cm:	1	0	0
20 – 29 cm:	1	0	0
10 – 19 cm:	1	0	0
5 – 9 cm:	1	0	0
< 5 cm:	1	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	43		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	90	90	60	45	75	5	5	20	40	5	0	1	10	0	0	0	0	0	0	3
Average of the 5 subplots:	72					15					2.2					0.6				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Hillslope	**Lf Pattern (A)**	Mountains	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)		**Soil Surface Texture**	Loam	**Soil Colour**	Brown	**Soil Depth**	
Lithology (B)							
Slope	5-10	**Aspect**	0	**Site Drainage**		**Distance to nearest water & type**	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):	Moderate	greater than 10yo	
Cultivation (inc. pasture):			No evidence
Soil erosion:			No evidence
Firewood / CWD removal:			No evidence
Grazing (identify native/stock):	Light		Macropods
Fire damage:	Light	greater than 10yo	
Storm damage:			No evidence
Weediness:	Light		Exotic forbs
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	Access Roads - PLOT 184A					
	Date:	07-02-18	**Plot ID:**	1053	**Recorders:**	AM, DK

GF Code	***Top 3 native species in each growth form group: Full species name mandatory*** ***All other native and exotic species: Full species name where practicable***	Cover	Abund	Voucher	N, E or HTE	Stratum
Tree (TG)	*Eucalyptus dives*	5	4		N	
Tree (TG)	*Eucalyptus macrorhyncha*	25	30		N	
Tree (TG)	*Eucalyptus rubida*	5	7		N	
Shrub (SG)	*Cassinia longifolia*	5	20		N	
Shrub (SG)	*Banksia canei*	1	2		N	
Shrub (SG)	*Acacia pravissima*	0.5	2		N	
Shrub (SG)	*Pultenaea subspicata*	3	20		N	
Shrub (SG)	*Cryptandra amara*	3	40		N	
Shrub (SG)	*Dillwynia rudis*	0.5	5		N	
Grass & grasslike	*Dichelachne rara*	1	200		N	
Forb (FG)	*Chrysocephalum semipapposum*	1	50		N	
Forb (FG)	*Stylidium graminifolium*	0.1	30		N	
Forb (FG)	*Hypericum gramineum*	0.2	50		N	
	Trifolium arvense	0.1	100		E	
	Centaurium erythraea	0.1	20		E	
Grass & grasslike	*Rytidosperma penicillatum*	2	200		N	
Shrub (SG)	*Brachyloma daphnoides*	4	40		N	
Forb (FG)	*Euchiton japonicus*	0.1	30		N	
Shrub (SG)	*Dodonaea viscosa subsp. angustissima*	2	10		N	
Grass & grasslike	*Poa sieberiana var. sieberiana*	0.5	20		N	
Grass & grasslike	*Lomandra filiformis subsp. coriacea*	0.1	20		N	
Shrub (SG)	*Hibbertia obtusifolia*	0.2	2		N	
Shrub (SG)	*Bursaria spinosa*	1	5		N	
Shrub (SG)	*Acacia siculiformis*	1	10		N	
	Hypericum perforatum	0.1	5		HTE	
Other (OG)	*Glycine clandestina*	0.1	5		N	
Shrub (SG)	*Dillwynia phylicoides*	2	10		N	
Shrub (SG)	*Indigofera australis*	0.1	3		N	
Forb (FG)	*Hovea heterophylla*	0.1	2		N	
Forb (FG)	*Gonocarpus tetragynus*	0.2	50		N	
Shrub (SG)	*Grevillea arenaria subsp. canescens*	0.1	3		N	
Forb (FG)	*Wahlenbergia stricta subsp. stricta*	0.1	10		N	
Forb (FG)	*Hydrocotyle sibthorpioides*	0.1	2		N	
Forb (FG)	*Galium gaudichaudii subsp. gaudichaudii*	0.1	5		N	
Forb (FG)	*Pimelea curviflora var. sericea*	0.1	3		N	
Forb (FG)	*Poranthera microphylla*	0.1	20		N	
Shrub (SG)	*Leucopogon attenuatus*	1	10		N	
Grass & grasslike	*Dichelachne sieberiana*	0.1	10		N	

BAM Site – Field Survey Form

Plot ID:	2274	**Date:**	12-04-19	**Survey Name:**		**Recorders:**	IM, DK
Zone:	55	**Easting:**	650897.3207	**Plot dimensions:**	20 x 50 m	**Midline bearing:**	151
Datum:	GDA94	**Northing:**	6021044.847	**IBRA region:**	South Eastern Highlands (Monaro)	**Zone ID:**	
Plant Community Type:		1196: Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion		**Confidence:**	High	**Photo #:**	
Vegetation Class:		Subalpine Woodlands		**EEC:**	No	**Confidence:**	High

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	2
	Shrubs:	2
	Grasses etc.:	7
	Forbs:	11
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0.2
	Shrubs:	40.5
	Grasses etc.:	91.5
	Forbs:	1.2
	Ferns:	0
	Other:	0
High Threat Weed cover:		0.2

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	0	0	0
50 – 79 cm:	0	0	0
30 – 49 cm:	0	0	0
20 – 29 cm:	0	0	0
10 – 19 cm:	0	0	0
5 – 9 cm:	0	0	0
< 5 cm:	1	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	2	4	3	5	8	20	8	1	1	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots:	4.4					6					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Hillslope	**Lf Pattern (A)**	Other	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**	Valley		
Lithology (A)		**Soil Surface Texture**		**Soil Colour**		**Soil Depth**	
Lithology (B)							
Slope	1	**Aspect**	SSE	**Site Drainage**	Good	**Distance to nearest water & type**	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):	Severe	greater than 10yo	Pasture
Cultivation (inc. pasture):	Severe	greater than 10yo	Pasture
Soil erosion:	Light	greater than 10yo	Not limiting native regen
Firewood / CWD removal:			
Grazing (identify native/stock):	Severe	greater than 10yo	Cattle and sheep
Fire damage:			
Storm damage:			
Weediness:	Light		
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:						
	Date:	12-04-19	Plot ID:	2274	Recorders:	IM, DK

GF Code	*Top 3 native species in each growth form group: Full species name mandatory* *All other native and exotic species: Full species name where practicable*	Cover	Abund	Voucher	N, E or HTE	Stratum
Shrub (SG)	*Pimelea pauciflora*	0.5	3	No	N	
Shrub (SG)	*Pultenaea polifolia*	40	200	No	N	
Grass & grasslike	*Themeda triandra*	50	1000	No	N	
Grass & grasslike	*Anthosachne scabra*	0.2	100	No	N	
Grass & grasslike	*Microlaena stipoides*	0.1	20	No	N	
Forb (FG)	*Chrysocephalum apiculatum*	0.1	30	No	N	
	Acetosella vulgaris	0.2	300	No	HTE	
	Centaurium spp.	0.1	30	No	E	
	Hypochaeris radicata	0.2	30	No	E	
Forb (FG)	*Cymbonotus preissianus*	0.1	10	No	N	
Forb (FG)	*Scleranthus biflorus*	0.2	8	No	N	
Grass & grasslike	*Cynodon dactylon*	0.1	3	No	N	
Forb (FG)	*Veronica calycina*	0.1	2	No	N	
Forb (FG)	*Hovea heterophylla*	0.1	4	No	N	
Forb (FG)	*Gonocarpus tetragynus*	0.1	2	No	N	
Grass & grasslike	*Rytidosperma spp.*	40	1500	No	N	
Grass & grasslike	*Poa sieberiana var. sieberiana*	1	20	No	N	
Tree (TG)	*Eucalyptus rubida*	0.1	4	No	N	
Forb (FG)	*Senecio spp.*	0.1	20	No	N	
Forb (FG)	*Ranunculus spp.*	0.1	10	No	N	
Tree (TG)	*Eucalyptus pauciflora*	0.1	2	No	N	
Forb (FG)	*Solenogyne gunnii*	0.1	8	No	N	
Forb (FG)	*Plantago spp.*	0.1	1	No	N	
Forb (FG)	*Poranthera microphylla*	0.1	4	No	N	
	Anthoxanthum odoratum	0.1	10	No	E	
Grass & grasslike	*Aristida ramosa*	0.1	2	No	N	

BAM Site – Field Survey Form

Plot ID:	2276	**Date:**	14-04-19	**Survey Name:**	2276	**Recorders:**	MP, CE
Zone:	55	**Easting:**	624563.6143	**Plot dimensions:**	20m x 50m	**Midline bearing:**	154
Datum:	GDA94	**Northing:**	6041770.869	**IBRA region:**	South Eastern Highlands (Bondo)	**Zone ID:**	

Plant Community Type:	1191: Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	**Confidence:**	High	**Photo #:**	
Vegetation Class:	Subalpine Woodlands	**EEC:**	No	**Confidence:**	High

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	5
	Shrubs:	12
	Grasses etc.:	8
	Forbs:	14
	Ferns:	0
	Other:	1
Sum of Cover of native vascular plants by growth form group	Trees:	15.9
	Shrubs:	46.6
	Grasses etc.:	61.2
	Forbs:	1.7
	Ferns:	0
	Other:	0.2
High Threat Weed cover:		6.3

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	0	0	0
50 – 79 cm:	2	0	0
30 – 49 cm:	3	0	0
20 – 29 cm:	1	0	0
10 – 19 cm:	1	0	0
5 – 9 cm:	1	0	0
< 5 cm:	1	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	33		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	20	70	50	60	45	50	0	0	0	0	0	0	3	2	0	10	0	15	0	0
Average of the 5 subplots:	49					10					1					5				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Hillslope	**Lf Pattern (A)**	Hills	**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)	Quartzs and stone	**Soil Surface Texture**	Loamy	**Soil Colour**	Browm	**Soil Depth**	Moderate
Lithology (B)							
Slope		**Aspect**	SW	**Site Drainage**	Good	**Distance to nearest water & type**	50m

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):			
Cultivation (inc. pasture):			
Soil erosion:			
Firewood / CWD removal:			
Grazing (identify native/stock):			
Fire damage:			
Storm damage:			
Weediness:	Moderate	less than 3yo	Rubus fructicosis agg
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	25-03-06 0:00						
		Date:	14-04-19	Plot ID:	2276	Recorders:	MP, CE

GF Code	*Top 3 native species in each growth form group: Full species name mandatory* *All other native and exotic species: Full species name where practicable*	Cover	Abund	Voucher	N, E or HTE	Stratum
Grass & grasslike	*Themeda triandra*	55	500	No	N	
Shrub (SG)	*Bursaria spinosa*	20	100	No	N	
Shrub (SG)	*Exocarpos strictus*	1	20	No	N	
	Potentilla recta	0.6	50	No	E	
	Hypericum perforatum	1	100	No	HTE	
Grass & grasslike	*Poa costiniana*	5	100	No	N	
Shrub (SG)	*Banksia canei*	3	10	No	N	
Tree (TG)	*Eucalyptus rubida*	2	2	No	N	
Tree (TG)	*Eucalyptus stellulata*	5	3	No	N	
	Rosa rubiginosa	0.1	3	No	HTE	
	Rubus fruticosus sp. agg.	5	20	No	HTE	
Tree (TG)	*Acacia melanoxylon*	1.5	3	No	N	
	Centaurium spp.	0.1	60	No	E	
Grass & grasslike	*Rytidosperma spp.*	0.1	10	No	N	
Forb (FG)	*Geranium spp.*	0.1	10	No	N	
Other (OG)	*Glycine clandestina*	0.2	15	No	N	
Grass & grasslike	*Lomandra filiformis*	0.6	20	No	N	
	Paspalum dilatatum	0.1	10	No	HTE	
Forb (FG)	*Dichondra repens*	0.2	100	No	N	
Forb (FG)	*Gonocarpus tetragynus*	0.1	60	No	N	
Tree (TG)	*Eucalyptus dives*	0.4	1	No	N	
	Acetosella vulgaris	0.1	12	No	HTE	
Shrub (SG)	*Pimelea linifolia*	1	100	No	N	
Shrub (SG)	*Leucopogon ericoides*	0.4	20	No	N	
Forb (FG)	*Hypericum gramineum*	0.1	4	No	N	
	Conyza spp.	0.1	4	No	E	
Shrub (SG)	*Leucopogon virgatus*	0.8	20	No	N	
Shrub (SG)	*Dodonaea viscosa subsp. Angustissima*	3	30	No	N	
Shrub (SG)	*Mirbelia oxylobioides*	15	25	No	N	
Forb (FG)	*Dianella spp.*	0.2	15	No	N	
Forb (FG)	*Viola betonicifolia*	0.1	4	No	N	
Forb (FG)	*Ajuga australis*	0.1	4	No	N	
Forb (FG)	*Asperula conferta*	0.1	50	No	N	
	Hypochaeris radicata	0.1	8	No	E	
Grass & grasslike	*Dichelachne rara*	0.1	10	No	N	
Forb (FG)	*Oxalis perennans*	0.1	4	No	N	
Forb (FG)	*Hovea heterophylla*	0.1	6	No	N	
Shrub (SG)	*Pimelea curviflora*	0.2	20	No	N	
Grass & grasslike	*Luzula spp.*	0.1	8	No	N	
Shrub (SG)	*Brachyloma daphnoides*	2	40	No	N	
Shrub (SG)	*Hibbertia obtusifolia*	0.1	4	No	N	
Forb (FG)	*Hydrocotyle laxiflora*	0.1	10	No	N	
Tree (TG)	*Eucalyptus dalrympleana*	7	11	No	N	
Grass & grasslike	*Lomandra multiflora subsp. Multiflora*	0.1	1	No	N	
Shrub (SG)	*Acrotriche serrulata*	0.1	2	No	N	
Forb (FG)	*Cymbonotus spp.*	0.1	4	No	N	
Forb (FG)	*Acaena spp.*	0.2	10	No	N	

Grass & grasslike	*Poa helmsii*	0.2	4	No	N	
	Verbascum virgatum	0.1	4	No	E	
Forb (FG)	*Plantago spp.*	0.1	6	No	N	

BAM Site – Field Survey Form

Plot ID:	3303	**Date:**	25-06-19	**Survey Name:**	LINK RD	**Recorders:**	MP DK
Zone:	55	**Easting:**	628407.8108	**Plot dimensions:**	20m x 50m	**Midline bearing:**	228
Datum:	GDA94	**Northing:**	6027219.862	**IBRA region:**	Australian Alps (Snowy Mountains)	**Zone ID:**	
Plant Community Type:	1196: Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion				**Confidence:**	High	**Photo #:**
Vegetation Class:	Subalpine Woodlands				**EEC:**	No	**Confidence:** High

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	0
	Shrubs:	5
	Grasses etc.:	7
	Forbs:	15
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0
	Shrubs:	2.1
	Grasses etc.:	81.3
	Forbs:	9.9
	Ferns:	0
	Other:	0
High Threat Weed cover:		0.1

BAM Attribute (1000 m2 plot) DBH			
DBH	Stem count (euc)	Stem count (non-euc)	Stems with Hollows
80 + cm:	0	0	0
50 – 79 cm:	0	0	0
30 – 49 cm:	0	0	0
20 – 29 cm:	0	0	0
10 – 19 cm:	0	0	0
5 – 9 cm:	0	0	0
< 5 cm:	0	0	0
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0		

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each):	95	75	70	50	50	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots:	68					0.2					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		**Lf Element (A)**	Hillslope	**Lf Pattern (A)**		**Microrelief**	
		Lf Element (B)		**Lf Pattern (B)**			
Lithology (A)		**Soil Surface Texture**		**Soil Colour**		**Soil Depth**	
Lithology (B)							
Slope	1	**Aspect**	W	**Site Drainage**	Moderate	**Distance to nearest water & type**	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing (inc. logging):	Severe	greater than 10yo	Cleared duringpowerlines being built. Prob a laydown
Cultivation (inc. pasture):			
Soil erosion:			
Firewood / CWD removal:			
Grazing (identify native/stock):	Light		Macropod
Fire damage:			
Storm damage:			
Weediness:	Moderate		Some exotic grasses. Close to a road
Other:			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Survey Name:	LINK RD						
		Date:	25-06-19	**Plot ID:**	3303	**Recorders:**	MP DK

GF Code	*Top 3 native species in each growth form group: Full species name mandatory* *All other native and exotic species: Full species name where practicable*	Cover	Abund	Voucher	N, E or HTE	Stratum
Grass & grasslike	*Poa helmsii*	5	50		N	
Grass & grasslike	*Poa spp.*	25	500		N	
Shrub (SG)	*Bossiaea foliosa*	0.1	2		N	
Shrub (SG)	*Hakea microcarpa*	0.4	2		N	
Shrub (SG)	*Pimelea linifolia*	1	60		N	
Forb (FG)	*Scleranthus biflorus*	2	1000		N	
Forb (FG)	*Epilobium spp.*	1	2000		N	
Grass & grasslike	*Carex spp.*	1	900		N	
	Hypochaeris radicata	1	250		E	
Forb (FG)	*Geranium spp.*	0.2	80		N	
Grass & grasslike	*Rytidosperma pilosum*	50	2000		N	
Forb (FG)	*Stellaria pungens*	0.1	10		N	
Forb (FG)	*Pratia spp.*	0.2	100		N	
Forb (FG)	*Oreomyrrhis spp.*	0.2	100		N	
	Acetosella vulgaris	0.1	50		HTE	
Forb (FG)	*Acaena spp.*	0.2	60		N	
Forb (FG)	*Ranunculus spp.*	0.1	10		N	
Forb (FG)	*Ajuga australis*	0.3	25		N	
Forb (FG)	*Acaena novae-zelandiae*	0.1	10		N	
	Trifolium repens	0.1	4		E	
Shrub (SG)	*Podolobium alpestre*	0.4	8		N	
	Conyza spp.	0.1	1		E	
Forb (FG)	*Cardamine spp.*	0.1	40		N	
Forb (FG)	*Euchiton spp.*	0.3	1000		N	
Grass & grasslike	*Lomandra spp.*	0.1	30		N	
Forb (FG)	*Asperula scoparia*	0.1	15		N	
Forb (FG)	*Asteraceae indeterminate*	1	150		N	
	Poaceae indeterminate	3	250		E	
Forb (FG)	*Oreomyrrhis argentea*	4	300		N	
Grass & grasslike	*Luzula spp.*	0.1	10		N	
Shrub (SG)	*Acrothamnus hookeri*	0.2	4		N	
Grass & grasslike	*Carex inversa*	0.1	4		N	

Appendix B

Vegetation integrity assessment – plot data

Table B.1 Vegetation integrity plot data

plot	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	strucShrub	strucGrass	strucForbs	strucFerns	strucOther	funLargeTrees	funHollowtrees	funLitterCover	funLenFallenLogs	funTreeStem5to9	funTreeStem10to19	funTreeStem20to29	funTreeStem30to49	funTreeStem50to79	funTreeRegen	funHighThreatExotic
187	55	628142	6046952	90	3	10	6	6	1	1	2.0	10.8	7.2	3.8	60.0	0.5	0	0	77.6	84.0	0	0	0	0	0	0	1.1
190	55	627370	6044578	300	3	11	5	6	1	2	20.0	29.3	2.5	0.9	0.1	0.6	1	2	88.0	200.0	0	0	0	0	1	0	0.0
192	55	627959	6045557	160	3	13	5	12	0	3	25.5	38.8	16.5	2.4	0.0	0.4	1	5	87.0	30.0	0	0	0	0	1	0	0.0
1001	55	624846	6040479	120	2	7	6	7	0	1	40.0	75.6	5.5	0.7	0.0	0.1	1	3	97.0	51.0	1	1	1	1	1	1	32.1
1053	55	625100	6041600	260	3	15	5	11	0	1	35.0	24.4	3.7	2.2	0.0	0.1	1	0	72.0	43.0	1	1	1	1	1	1	0.1
11	55	628566	6048199	180	2	9	8	15	0	0	0.3	3.1	81.4	4.4	0.0	0.0	0	0	50.0	27.0	0	0	0	0	0	0	7.1
216	55	627033	6033444	211	6	7	5	18	0	2	22.3	6.9	72.3	4.0	0.0	0.3	4	4	28.0	43.0	1	1	1	1	1	1	0.2
2276	55	624564	6041771	154	5	12	8	14	0	1	15.9	46.6	61.2	1.7	0.0	0.2	2	0	49.0	33.0	1	1	1	1	1	1	6.3
3303	55	628408	6027220	228	0	5	7	15	0	0	0.0	2.1	81.3	9.9	0.0	0.0	0	0	68.0	0.0	0	0	0	0	0	0	0.1
1046	55	625823	6039178	0	1	3	4	2	0	0	70.0	20.2	8.4	0.2	0.0	0.0	0	0	77.0	25.0	1	1	1	0	0	1	35.2
5	55	628810	6051893	35	1	4	9	14	0	0	20.0	1.8	17.9	3.3	0.0	0.0	1	0	49.0	37.0	1	1	1	1	1	1	0.4
214	55	628853	6049403	235	3	7	9	22	0	4	13.0	8.2	4.7	4.0	0.0	1.0	6	1	76.0	57.0	1	1	1	1	1	1	0.0
2274	55	650897	6021045	151	2	2	7	11	0	0	0.2	40.5	91.5	1.2	0.0	0.0	0	0	4.4	0.0	0	0	0	0	0	1	0.2

Appendix C

Credit Report

BAM Credit Summary Report

Proposal Details

Assessment Id
00016724/BAAS17109/19/00016725

Proposal Name
Snowy Hydro - EW Modification 2

BAM data last updated *
26/11/2019

Assessor Name

Report Created
18/12/2019

BAM Data version *
22

Assessor Number

BAM Case Status
Open

Date Finalised
To be finalised

Assessment Revision
1

Assessment Type
Major Projects

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion								
1	296_DNG	41.2	0.1	0.25	High Sensitivity to Potential Gain	1.50		2
2	296_High	55.3	0.9	0.25	High Sensitivity to Potential Gain	1.50		18

						Subtotal	**20**
Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion							
5	729_High	69.0	0.1	0.25	High Sensitivity to Potential Gain	1.50	4
						Subtotal	**4**
Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion							
10	285_Medium	14.9	0.0	0.25	High Sensitivity to Potential Gain	2.00	1
11	285_Other	18.6	0.0	0.25	High Sensitivity to Potential Gain	2.00	1
						Subtotal	**2**
Mountain Gum - Narrow-leaved Peppermint - Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion							
12	952_Other	27.0	0.4	0.25	High Sensitivity to Potential Gain	1.75	4
						Subtotal	**4**
Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion							
6	953_DNG	36.7	0.1	0.25	High Sensitivity to Potential Gain	1.50	1
7	953_High	33.7	0.2	0.25	High Sensitivity to Potential Gain	1.50	3
						Subtotal	**4**
Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment							
3	300_Medium	48.8	0.3	0.25	High Sensitivity to Potential Gain	1.50	5

4	300_High	56.8	0.1	0.25	High Sensitivity to Potential Gain	1.50		2
							Subtotal	**7**
Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion								
8	1191_High	78.1	0.1	0.25	High Sensitivity to Potential Gain	2.50		4
							Subtotal	**4**
Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion								
9	1196_DNG	41.1	0.5	0.25	High Sensitivity to Potential Gain	1.50		7
13	1196_Other	37.7	0.1	0.25	High Sensitivity to Potential Gain	1.50		2
							Subtotal	**9**
							Total	**54**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Cercartetus nanus / Eastern Pygmy-possum (Fauna)						
296_High	55.3	0.46	0.25	2	False	13
300_Medium	48.8	0.2	0.25	2	False	5
729_High	69.0	0.13	0.25	2	False	4
300_High	56.8	0.08	0.25	2	False	2
1196_Other	37.7	0.13	0.25	2	False	2
					Subtotal	**26**

Ninox connivens / Barking Owl (Fauna)						
296_High	55.3	0	0.25	2	False	0
953_High	33.7	0.01	0.25	2	False	0
					Subtotal	**0**
Pseudomys fumeus / Smoky Mouse (Fauna)						
1196_Other	37.7	0.13	0.25	3	True	4
					Subtotal	**4**
Tyto novaehollandiae / Masked Owl (Fauna)						
296_High	55.3	0	0.25	2	False	0
953_High	33.7	0.01	0.25	2	False	0
					Subtotal	**0**

EMM
creating opportunities

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