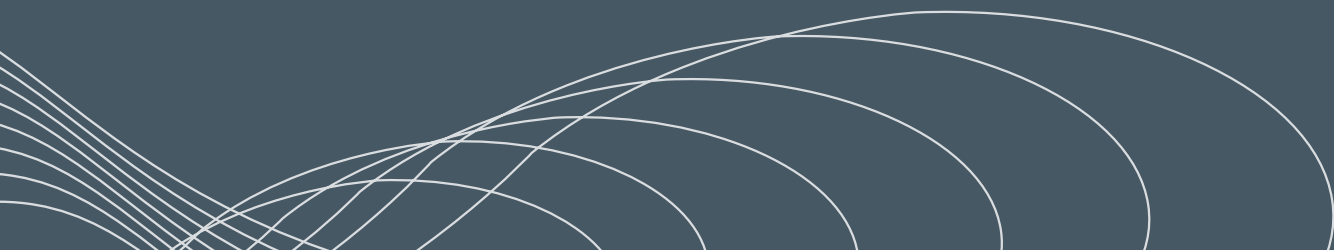




A P P E N D I X

G

REVISED BDAR



Snowy 2.0 Main Works

Biodiversity Development Assessment Report (Revised)

Prepared for Snowy Hydro Ltd
February 2020

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Snowy 2.0 Main Works

Biodiversity Development Assessment Report (Revised)

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24 February 2020

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

Executive Summary

ES1 Introduction and project

Snowy Hydro Limited (Snowy Hydro) proposes to develop Snowy 2.0, a large-scale pumped hydro-electric storage and generation project which would increase hydro-electric capacity within the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme). This would be achieved by establishing a new underground hydro-electric power station. Snowy 2.0 will link the existing Tantangara and Talbingo reservoirs within the Snowy Scheme through a series of underground tunnels and hydro-electric power station.

A previous version of the Biodiversity Development Assessment Report (BDAR) was submitted as a part of the Environmental Impact Statement (EIS) for Snowy 2.0 Main Works. Changes to project design, including a significant reduction in the disturbance footprint and resultant overall impacts, have prompted the preparation of this revised BDAR. This revised BDAR supports the Preferred Infrastructure Report and Response to Submissions (PIR-RTS) for the Snowy 2.0 Main Works. It documents the terrestrial biodiversity assessment methods and results, the initiatives built into the project design to avoid and minimise impacts to terrestrial biodiversity, including updates to project design, and the mitigation and management measures, including offset requirements, proposed to address any unavoidable residual impacts.

The BDAR addresses the requirements of the Secretary's Environmental Assessment Requirements (SEARs), including the requirements of the Commonwealth Department of the Environment and Energy (DoEE).

ES2 Landscape

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

Two areas of geological significance occur within the project area. A series of block streams occur along the upper sections of Lobs Hole Ravine Road, while the Lick Hole formation, supporting in-situ calcareous fossils, occurs mid-way down Lobs Hole Ravine Road.

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

The project area is located within KNP, which is largely vegetated across its 673,543 ha extent, with intact remnant vegetation extending into a further 1.6 million hectares across the Australian Alps. The extent of vegetation across KNP provides a high degree of connectivity. A total of 35,383 ha of native vegetation was mapped within the 36,041 ha buffer area. Native vegetation cover within the buffer area is approximately 98%.

ES3 Native vegetation

Extensive surveys were undertaken across the survey area as a part of the biodiversity assessment for Snowy 2.0. Surveys were undertaken in accordance with the NSW Biodiversity Assessment Method (BAM, OEH 2017a).

These surveys recorded 19 plant community types (PCTs), stratified into 64 vegetation zones, within the study area. This included one threatened ecological community listed as follows under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) respectively:

- Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions, listed as an endangered ecological community under the BC Act; and
- Alpine Sphagnum Bogs and Associated Fens listed as an endangered ecological community under the EPBC Act.

Snowy 2.0 Main Works will result in direct impacts to 424.25 ha of native vegetation, with indirect impacts to a further 585.81 ha.

ES4 Threatened species

Detailed and comprehensive targeted flora and fauna surveys have been conducted for Snowy 2.0 between August 2017 and December 2019. Surveys have been conducted in accordance with various NSW (DEC 2004, DECC 2009, OEH 2016c, OEH 2018a) and Commonwealth (DoE 2013a, DSEWPac 2010a, 2010b, 2010c, 2011a, 2011b) guidelines.

These surveys have resulted in a significant addition to our knowledge of the biodiversity values of the northern section of KNP, including several instances where new populations of threatened species have been recorded, or range extensions for threatened species:

- Detailed mapping of over 9,000 ha of native vegetation across the survey area.
- 44,222 individual records of the Mauve Burr-daisy (*Calotis glandulosa*) from targeted surveys, compared to 520 records of the species across Australia.
- 975 individual records of the Clover Glycine (*Glycine latrobeana*), known from two single records in NSW prior to surveys for Snowy 2.0. Several additional sub-populations identified, including a large population of over 600 plants on Gulf Plain, were identified in areas not impacted by Ox-eye Daisy (*Leucanthemum vulgare*).
- 1,484 individual records of the Kiandra Leek Orchid (*Prasophyllum retroflexum*), known from two records prior to surveys for Snowy 2.0. The species was recorded over large areas of KNP.
- The recording of a large, regional population of the Smoky Mouse (*Pseudomys fumeus*) across an estimated 6,000 to 7,000 ha of suitable habitat in the region.
- The recording of a large population of the Booroolong Frog (*Litoria booroolongensis*) along the Yarrangobilly River and Wallace's Creek.
- The recording of a number of additional sub-populations of the Alpine Tree Frog (*Litoria verreauxii alpina*) in the Eucumbene River, Murrumbidgee River, Tantangara Creek, Gooandra Creek and Nungar Creek.
- Thirty-seven new records of the Alpine She-oak Skink (*Cyclodomorphus praealtus*) across sub-alpine dry grasslands in the survey area, representing a range extension for this species.

In total, 76,726 individual records of 46 threatened flora and fauna species were recorded during surveys undertaken for Snowy 2.0 in the northern section of KNP and Polo Flat. This compares to just over 20,000 records of 70 threatened flora and fauna species across the whole of KNP prior to surveys for Snowy 2.0 being undertaken.

ES5 Groundwater dependent ecosystems

An assessment of groundwater dependent ecosystems (GDEs) was undertaken in accordance with the *NSW Government Risk Assessment Guidelines for Groundwater Dependent Ecosystems* (Serov et al. 2012). This assessment used groundwater levels as modelled by the regional numerical groundwater flow model (EMM 2019b), along with a stygofauna assessment by Macquarie University (2019) to identify GDEs across the project area and classify them according to the criteria in Serov et al. (2012).

The stygofauna assessment identified a total of five specimens from two families, likely to be obligate stygofauna representatives, from one of the 11 fractured rock sites (TMB02A) and two of the five Alpine bog and fen sites (GH01, GH02). Two PCTs were identified as having an entirely/obligate dependence on groundwater:

- PCT 637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion; and
- PCT 1225 - Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion.

A further six PCTs were identified as having a facultative -proportional or facultative – opportunistic dependence on groundwater:

- PCT 285 - Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion;
- PCT 299 - Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion;
- PCT 300 - Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment;
- PCT 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;
- PCT 303 - Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion; and
- PCT 679 - Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion.

The impact assessment identified that if groundwater decline is slow or gradual in areas where predicted drawdown is greater than 20 m, it may present opportunities for stygofauna to migrate to saturated areas whilst drawdown is occurring, resulting in minimal impacts. Impacts to surface GDEs may result from groundwater drawdown and changes in hydrology. Impacts may include changes in species composition. GDEs with an entirely/obligate dependence on groundwater are at greatest risk. However, based on the extent of each community to be impacted overall risk for all GDEs is assessed as low.

ES6 Impact assessment

ES6.1 Measures to avoid and minimise impacts

Snowy Hydro, in consultation with EMM and the design team, has undertaken significant steps to avoid, minimise and mitigate impacts arising from the Main Works project.

A key focus of project design has been to avoid and minimise impacts to biodiversity values identified during the field surveys. In recognition of the location of the Snowy 2.0 project in the KNP, and associated biodiversity and other values of the Park, the project has undergone significant steps to avoid, minimise and mitigate impacts.

This process has resulted in a number of measures undertaken to avoid and minimise impacts including:

- Significant revision of the project design and associated disturbance footprint since submission of the EIS, resulting in a significant reduction in associated impacts.
- Detailed design of the project to reduce the disturbance footprint, resulting in further avoidance of impacts to native vegetation and reduction in offset requirements.
- Investigation of alternative locations for key infrastructure during design works.
- Siting of stockpiles for excavated materials in low-quality vegetation where possible.
- Siting of the Exploratory Works camp in partially cleared areas.
- Siting of the Emergency egress, Cable, Ventilation Tunnel (ECVT) to minimise clearing due to terrain and access roads.
- Emplacement of excavated materials in Talbingo and Tantangara reservoirs where possible, minimising impacts to native vegetation and threatened species habitat.
- Removal of out of park emplacement to the east, negating the requirement for construction of the Tantangara East Road and associated impacts to native vegetation and threatened species habitat, particularly Clover Glycine.
- Removal of plateau power station complex option, reducing impacts to sensitive habitats in the plateau area.
- Change in power station complex location in the Marica area, including construction method, resulting in removal of elements and reduction in impacts.
- Location of the Marica ventilation shaft in existing cleared areas.
- Investigation of alternative locations for the communications cable routes, including removal of the southern communication route adjacent to the Snowy Mountains Highway.
- Moving of the southern communications route south at Boggy Plain to avoid sensitive Alpine bogs and fens and sub-alpine grassland habitat.
- Installation of the communications cable in existing firetrails.
- Development of a 50 m buffer zone along the Yarrangobilly River and avoidance and minimisation of works within this buffer.
- Siting of key infrastructure away from sensitive receiving environments.

These measures have resulted in substantive and significant reductions in impacts, recognising the siting of the project in KNP and sensitive environments. Residual impacts will be managed through a series of mitigation measures, outlined in Table 8.1.

ES6.2 Residual impacts and offsets

Residual impacts arising from Snowy 2.0 Main Works include:

- Direct impacts to 424.25 ha of native vegetation across 19 PCTs, including direct impacts to 1.03 ha of the Alpine Sphagnum Bogs and Associated Fens EEC.
- Direct impacts to 482.76 ha of habitat (and 44 individuals) for 17 threatened species credit species;
- Potential indirect impacts, including:
 - Indirect impact to 585.81 ha of native vegetation;
 - Indirect impact to 692.62 ha (and 1 individual) for 17 threatened species credit species;
 - increase in weeds and pathogens;
 - increase in predatory and pest species;
 - light and noise pollution during night works;
 - changes to runoff regimes;
 - fragmentation, resulting in reduction in connectivity; and
 - groundwater drawdown, resulting in changes in hydrology of GDEs.

A total of 12,927 ecosystem credits and 22,283 species credits are required to offset the residual impacts of Main Works. These offsets will be provided in accordance with the Snowy 2.0 Main Works Offset Strategy (Appended to the PIR-RTS).

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Abbreviations

AHD	Australian Height Datum
BAM	Biodiversity Assessment Method
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BCD	Biodiversity and Conservation Division, Environment, Energy and Science Group of the Department of Planning, Industry and Environment
BC Regulation	NSW Biodiversity Conservation Regulation 2017
BDAR	Biodiversity Development Assessment Report
Bionet	BioNet Atlas of NSW Wildlife
Biosecurity Act	NSW <i>Biosecurity Act 2015</i>
BOS	Biodiversity Offsets Scheme
CEEC	Critically endangered ecological community
CHM	Canopy Height Model
CSSI	Critical State significant infrastructure
DoEE	Commonwealth Department of the Environment and Energy
DFSI	NSW Department of Finance, Services and Innovation
DIWA	Directory of Important Wetlands in Australia
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
ECVT	Emergency egress, Cable, Ventilation Tunnel
EEC	Endangered ecological community
EIS	Environmental Impact Statement
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPis	Environmental Planning Instruments
ESCP	Erosion and sediment control plan
FGJV	Future Generation Joint Venture
FM Act	NSW <i>Fisheries Management Act 1994</i>
FSL	Full Supply Level
GDEs	Groundwater Dependent Ecosystems
GIS	Geographic Information System
GPS	Geographic Positioning System
IBRA	Interim Biogeographic Regionalisation of Australia
KFH	Key Fish Habitats
KNP	Kosciuszko National Park
KTP	Key Threatening Process
LGA	Local Government Area
LiDAR	Light Detection and Ranging
MAT	Main Access Tunnel
MNES	Matters of National Environmental Significance
MOL	Minimum Operating Level
MW	Main Works
NEM	National Energy Market

NPW Act	NSW <i>National Parks and Wildlife Act 1974</i>
NPWS	New South Wales National Parks and Wildlife Service
OEH	Office of Environment and Heritage (now Department of Planning, Industry and Environment)
PCT	NSW Plant Community Type
PMST	Protected Matters Search Tool
PoM	Plan of Management
PIR-RTS	Preferred Infrastructure Report and Response to Submissions
RVA	Rapid Vegetation Assessment
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
Snowy Hydro	Snowy Hydro Limited
Snowy Scheme	Snowy Mountains Hydro-electric Scheme
SRD SEPP	State and Regional Development SEPP
SSI	State significant infrastructure
TBDC	Threatened Biodiversity Data Collection
TBM	Tunnel Boring Machine
TECs	Threatened Ecological Communities
TPZ	Tree Protection Zone
VIS	Vegetation Information System
WoNS	Weed of National Significance

Part A

Stage 1: Biodiversity Assessment

1 Introduction

1.1 The project

Snowy Hydro Limited (Snowy Hydro) proposes to develop Snowy 2.0, a large-scale pumped hydro-electric storage and generation project which would increase hydro-electric capacity within the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme). Snowy 2.0 is the largest committed renewable energy project in Australia and is critical to underpinning system security and reliability as Australia transitions to a decarbonised economy. Snowy 2.0 will link the existing Tantangara and Talbingo reservoirs within the Snowy Scheme through a series of underground tunnels and a new hydro-electric power station will be built underground.

Snowy 2.0 has been declared to be State significant infrastructure (SSI) and critical State significant infrastructure (CSSI) by the former NSW Minister for Planning under Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and is defined as CSSI in clause 9 of Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). CSSI is infrastructure that is deemed by the NSW Minister to be essential for the State for economic, environmental or social reasons. An application for CSSI must be accompanied by an environmental impact statement (EIS).

Separate applications are being submitted by Snowy Hydro for different stages of Snowy 2.0 under Part 5, Division 5.2 of the EP&A Act. This includes the preceding first stage of Snowy 2.0, Exploratory Works for Snowy 2.0 (the Exploratory Works) and the stage subject of this current application, Snowy 2.0 Main Works (the Main Works). In addition, an application under Part 5, Division 5.2 of the EP&A Act is also being submitted by Snowy Hydro for a segment factory that will make tunnel segments for both the Exploratory Works and Main Works stages of Snowy 2.0.

The first stage of Snowy 2.0, the Exploratory Works, includes an exploratory tunnel and portal and other exploratory and construction activities primarily in the Lobs Hole area of the Kosciuszko National Park (KNP). The Exploratory Works were approved by the former NSW Minister for Planning on 7 February 2019 as a separate project application to the Department of Planning, Industry and Environment (DPIE; SSI 9208).

This Biodiversity Development Assessment Report (BDAR) has been prepared to accompany an application and supporting EIS for the **Snowy 2.0 Main Works**, with this revised BDAR prepared in support of the Preferred Infrastructure Report and Response to Submissions (PIR-RTS). As the title suggests, this stage of the project covers the major construction elements of Snowy 2.0, including permanent infrastructure (such as the underground power station, power waterways, access tunnels, chambers and shafts), temporary construction infrastructure (such as construction adits, construction compounds and accommodation), management and storage of excavated rock material and establishing supporting infrastructure (such as road upgrades and extensions, water and sewage treatment infrastructure, and the provision of construction power). Snowy 2.0 Main Works also includes the operation of Snowy 2.0.

Snowy 2.0 Main Works is shown in Figure 1.1 and Figure 1.2. If approved, the Snowy 2.0 Main Works would commence before completion of Exploratory Works.

The Snowy 2.0 Main Works do not include the direct connection works proposed by TransGrid (TransGrid 2018) that provide connection between the cableyard and the National Energy Market (NEM). These transmission works will provide the ability for Snowy 2.0 (and other generators) to efficiently and reliably transmit additional renewable energy to major load centres during periods of peak demand, as well as enable a supply of renewable energy to pump water from Talbingo Reservoir to Tantangara Reservoir during periods of low demand. While the upgrade works to the wider transmission network and connection between the cableyard and the network form part of the CSSI declaration for Snowy 2.0, they do not form part of this application and will be subject to separate application and approval processes, managed by TransGrid.

With respect to the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), on 30 October 2018 Snowy Hydro referred the Snowy 2.0 Main Works to the Commonwealth Department of the Environment and Energy (DoEE) and nominated that Snowy 2.0 Main Works has potential to have a significant impact on MNES and the environment generally.

On 5 December 2018, Snowy 2.0 Main Works were deemed a controlled action by the Assistant Secretary of the DoEE. It was also determined that potential impacts of the project will be assessed by accredited assessment under Part 5, Division 5.2 of the EP&A Act. This accredited process will enable DPIE to manage the assessment of Snowy 2.0 Main Works, including the issuing of the assessment requirements for the EIS. Once the assessment has been completed, the Commonwealth Minister for the Environment will make a determination under the EPBC Act.

1.2 Project location

Snowy 2.0 Main Works are located within the Australian Alps, in southern NSW, about mid-way between Canberra and Albury. Snowy 2.0 Main Works is within both the Snowy Valleys and Snowy Monaro Regional local government areas (LGAs).

The nearest large towns to Snowy 2.0 Main Works are Cooma and Tumut. Cooma is located about 50 kilometres (km) south-east of the project area (or 70 km by road from Providence Portal at the southern edge of the project area), and Tumut is located about 35 km north west of the project areas (or 45 km by road from Tumut 3 power station at the northern edge of the project area). Other townships near the project area include Talbingo, Cabramurra, Adaminaby and Tumbarumba. Talbingo and Cabramurra were built for the original Snowy Scheme workers and their families, while Adaminaby was relocated in 1957 to make way for the establishment of Lake Eucumbene.

The location of Snowy 2.0 Main Works with respect to the region is shown in Figure 1.1.

The pumped hydro-electric scheme elements of Snowy 2.0 Main Works are mostly underground, between the southern ends of Tantangara and Talbingo reservoirs, a straight-line distance of 27 km. Surface works will also occur at locations on and between the two reservoirs. Key locations for surface works include:

- **Tantangara Reservoir** - at a full supply level (FSL) of about 1,229 metres (m) to Australian Height Datum (AHD), Tantangara Reservoir will be the upper reservoir for Snowy 2.0 and include the headrace tunnel and intake structure. The site will also be used for a temporary construction compound, accommodation camp and other temporary ancillary activities;
- **Marica** - this site will be used primarily for construction including construction of vertical shafts to the underground power station (ventilation shaft) and headrace tunnel (surge shaft), and a temporary accommodation camp;

- **Lobs Hole** - the site will be used primarily for construction but will also become the main entrance to the power station during operation. Lobs Hole will provide access to the Exploratory Works tunnel, which will be refitted to become the main access tunnel (MAT), as well as the location of the emergency egress, cable and ventilation tunnel (ECVT), portal, associated services and accommodation camp; and
- **Talbingo Reservoir** - at a FSL of about 546 m AHD, Talbingo Reservoir will be the lower reservoir for Snowy 2.0 and will include the tailrace tunnel and water intake structure. The site will also be used for temporary construction compounds and other temporary ancillary activities.
- **Rock Forest** - the area comprises private property under lease to Snowy Hydro for use as a logistics site during construction.

Works will also be required within the two reservoirs for the placement of excavated rock and surplus cut material, where possible. Supporting infrastructure will include establishing or upgrading access tracks and roads and electricity connections to construction sites.

Most of the proposed pumped hydro-electric and temporary construction elements and most of the supporting infrastructure for Snowy 2.0 Main Works are located within the boundaries of KNP, although the disturbance footprint for the project during construction is less than 0.09% of the total KNP area. Some of the supporting infrastructure and construction sites and activities (including sections of road upgrade, power and communications infrastructure) extends beyond the National Park boundaries. These sections of infrastructure are primarily located to the south of Tantangara Reservoir. One temporary construction site is located beyond the National Park along the Snowy Mountains Highway about 3 km east of Providence Portal (referred to as Rock Forest).

1.2.1 Project area

The project area for Snowy 2.0 Main Works has been identified and includes all the elements of the project, including all construction and operational elements. The project area is shown on Figure 1.2. Key features of the project area are:

- the water bodies of Tantangara and Talbingo reservoirs, covering areas of 19.4 square kilometres (km²) and 21.2 km² respectively. The reservoirs provide the water to be utilised in Snowy 2.0;
- major watercourses including the Yarrangobilly, Eucumbene and Murrumbidgee rivers and some of their tributaries;
- KNP, within which the majority of the project area is located. Within the project area, KNP is characterised by two key zones: upper slopes and inverted treelines in the west of the project area (referred to as the 'ravine') and associated subalpine treeless flats and valleys in the east of the project area (referred to as the 'plateau'); and
- farmland southeast of KNP at Rock Forest.

The project area is interspersed with built infrastructure including recreational sites and facilities, main roads as well as unsealed access tracks, hiking trails, farmland, electricity infrastructure, and infrastructure associated with the Snowy Scheme.

1.2.2 Disturbance footprint and study area

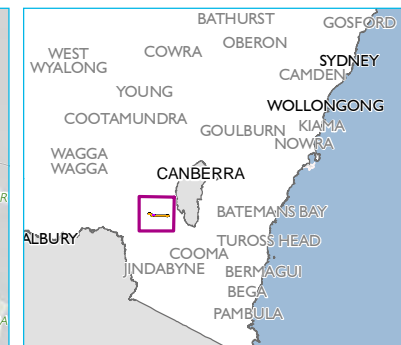
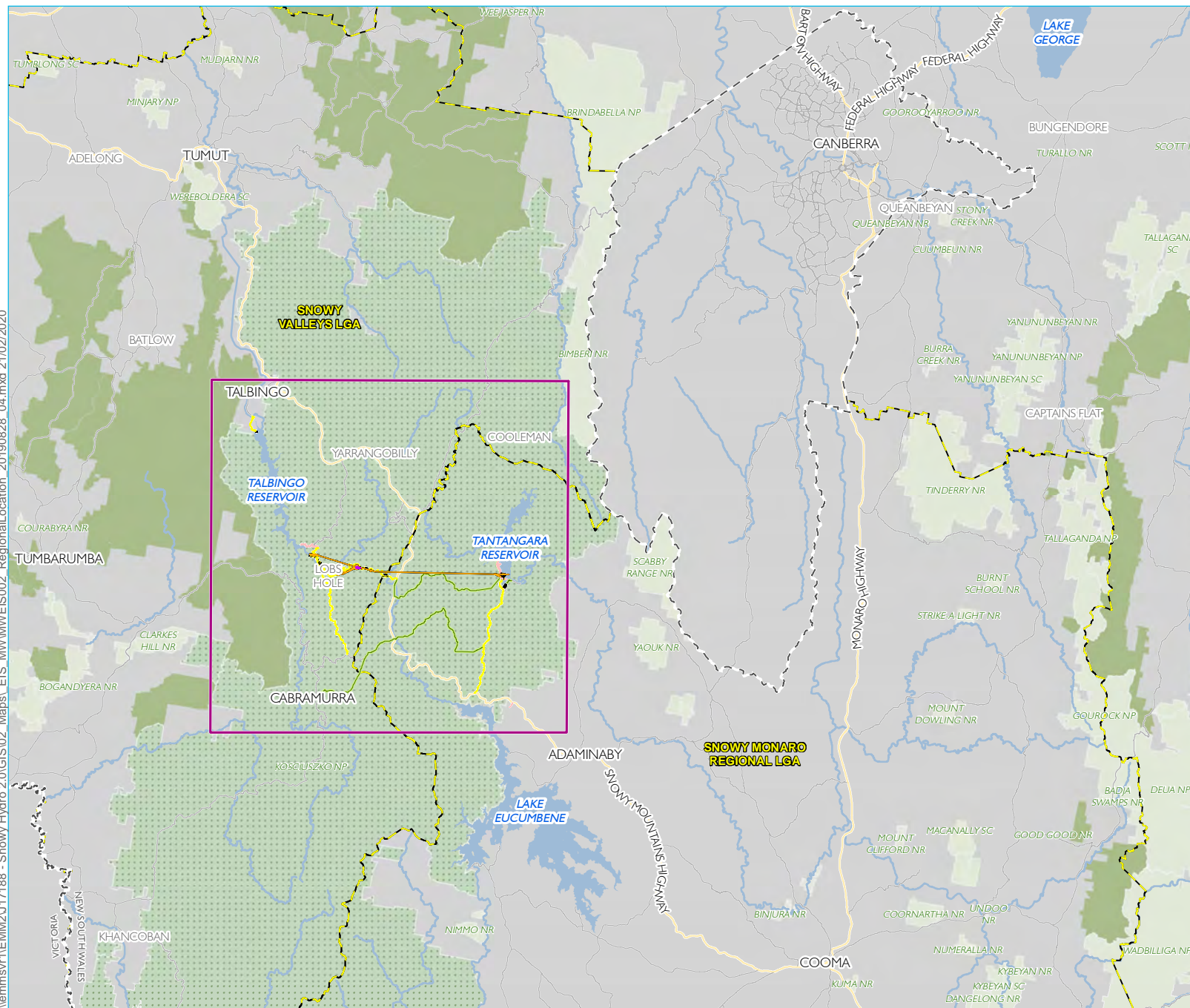
The disturbance footprint is the area where land will be directly disturbed by Snowy 2.0 Main Works and includes all areas subject to clearing and ground disturbance. A key refinement to design since public exhibition of the Main Works EIS is a change to and clarification of the disturbance footprint, previously identified in the Main Works EIS (EMM 2019a) and BDAR (EMM 2019b). A summary of the change is described in Table 3.2 of the main PIR-RTS document. Overall, the disturbance footprint has been reduced from 1,678 ha to 640 ha. This updated disturbance footprint is based on a reference design, which will be modified further during detailed design; the disturbance footprint will be minimised as much as possible during this process. The disturbance footprint for the project during construction is less than 0.09% of the total KNP area.

In addition to the disturbance footprint previously described in the Main Works EIS, a new term, called the 'construction envelope', has been developed. The construction envelope is the maximum extent within which the disturbance footprint corridor can move to allow the final siting of infrastructure through the detailed design process.

The study area for the purposes of this biodiversity assessment included a broader area than will be used for the construction and operation of Snowy 2.0 Main Works and includes areas of direct and indirect impact. Indirect disturbance areas are further addressed in Section 7.1.2.

Surveys have been undertaken over a broad area of approximately 9,000 ha, allowing for identification of key biodiversity values, guidance on measures to avoid and minimise impacts and revisions to the design. This is referred to in this report as the survey area.

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- KEY**
- Project area
 - Snowy 2.0 Main Works operational elements
 - Tunnels, portals, intakes, shafts
 - Power station
 - Utilities
 - Permanent road
 - Snowy 2.0 Main Works construction elements
 - Temporary construction compounds and surface works
 - Temporary access road
 - Existing environment
 - Main road
 - Local road
 - Watercourse
 - Waterbodies
 - Kosciuszko National Park
 - NPWS reserve
 - State forest
 - Local government area boundary
 - State boundary

Regional setting

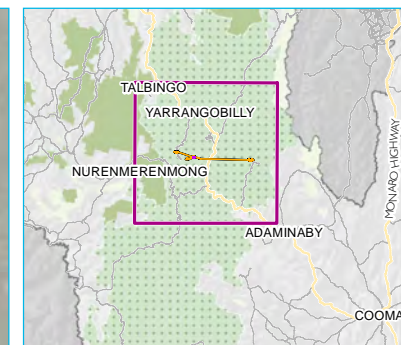
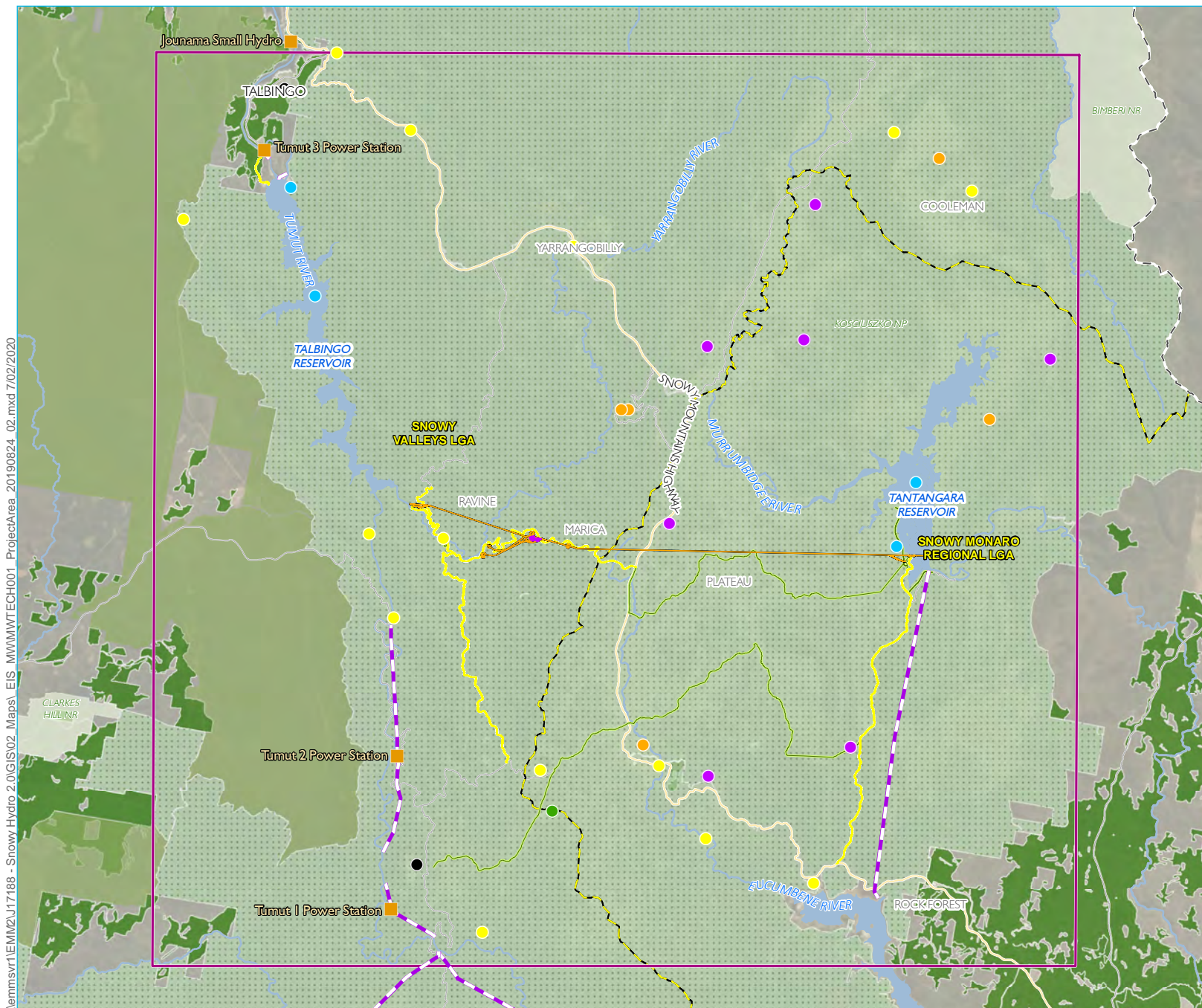
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 1.1



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

0 25 50 km
GDA 1994 MGA Zone 55

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- KEY**
- Project area
 - Existing Snowy Scheme
 - Power station
 - Snowy Tumut pipeline tunnel
 - Recreational use areas
 - Camping
 - Camping - horses permitted
 - Fishing and boating
 - Place of interest
 - Ski resort
 - Township
 - Snowy 2.0 Main Works operational elements
 - Tunnels, portals, intakes, shafts
 - Power station
 - Utilities
 - Permanent road
 - Existing environment
 - Main road
 - Local road
 - Watercourse
 - Waterbodies
 - Kosciuszko National Park
 - NPWS reserve
 - State forest
 - Grazing
 - Local government area boundary
 - State boundary

Snowy 2.0 project area

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 1.2



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



1.3 Refinements of the project

Snowy Hydro and its appointed EPC contractor, FGJV, continue to refine and improve the design for Snowy 2.0 as information is obtained from the geotechnical investigation program and Exploratory Works. In addition, matters raised by agencies and stakeholders during public exhibition of the Main Works EIS has necessitated refinements to key elements of the project. These are described in more detail in Section 3.2 of the PIR-RTS, however include:

- Considerable refinement of the disturbance area, which has reduced the overall disturbance area by 62% and therefore improved the project outcomes compared to previously predicted impacts in the EIS. As a consequence of the detailed design not yet being complete (as is normal for a major project at this stage of the process), the new concept of a larger “construction envelope” has been introduced and used in the PIR-RTS and this report. The construction envelope represents the limits of where disturbance may occur during construction of the Main Works. The disturbance footprint is a smaller, indicative corridor inside the construction envelope. As detailed design continues, final siting of the infrastructure (ie the disturbance footprint) can move within the assessed construction envelope subject to recommended environmental management measures and provided it does not exceed the limits defined by the construction envelope.
- Updated design and methodology for excavated material management. This has resulted in some key improvements including a reduction in the total volumes of excavated rock, improved water quality outcomes, significant improvements to the final landforms of on-land emplacement areas via the use of a geomorphic approach to landform design and rehabilitation, and commitment to remove material generated from Marica to a location outside the KNP.
- Reduced traffic volumes, which has improved the performance of the local and regional road network compared to previously predicted impacts.
- Refinement of the groundwater model to better represent the inflow mitigation that will occur from the segmental concrete lining of the power waterway. The refinement of the model to reflect this inflow restriction has reduced the quantity of groundwater predicted to flow into the excavated headrace tunnel across the plateau. This has reduced the predicted water table drawdown extents and interactions with bogs and fens, reduced streamflow impacts and reduced the quantity of process water to be discharged to Tantangara Reservoir.

Since the exhibition of the Main Works EIS, DPIE has requested that Snowy Hydro consider alternative options for management of excavated rock. As a result, alternative excavated spoil management options compared to that articulated in the Main Works EIS and the updated design and methodology, are provided in Section 3.2.2 of the PIR-RTS. Updated impacts on native vegetation and threatened species habitat within these excavated rock emplacement areas are included in this revised BDAR; as well as updated credit requirements, included in Annexure H.

An updated project description that consolidates the refinements made to the project since exhibition is provided in Appendix O of the PIR-RTS.

1.4 Proponent

Snowy Hydro is the proponent for the Snowy 2.0 Main Works. Snowy Hydro is an integrated energy business – generating energy, providing price risk management products for wholesale customers and delivering energy to homes and businesses. Snowy Hydro is the fourth largest energy retailer in the NEM and is Australia’s leading provider of peak, renewable energy.

1.5 Purpose of this report

A previous version of the BDAR was submitted as a part of the EIS for Snowy 2.0 Main Works. Changes to project design, including a significant reduction in the disturbance footprint and resultant overall impacts, have prompted the preparation of this revised BDAR. This revised BDAR supports the PIR-RTS for the Snowy 2.0 Main Works. It documents the terrestrial biodiversity assessment methods and results, the initiatives built into the project design to avoid and minimise impacts to terrestrial biodiversity, and the mitigation and management measures, including offset requirements, proposed to address any unavoidable residual impacts.

The specific objectives of this assessment are to:

- describe the existing biodiversity values and existing environment;
- identify and assess the potential for presence of biodiversity values, including threatened species and communities listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and/or EPBC Act;
- identify ecological constraints within and impacts arising from the Main Works (as revised);
- provide mitigation measures to reduce the impacts from the proposal on biodiversity wherever possible; and
- where impacts are unavoidable, consider compensatory measures that are appropriate for the Main Works.

This BDAR has been prepared in accordance with the *Biodiversity Assessment Method* (BAM, OEH 2017a).

1.5.1 Assessment guidelines and requirements

This terrestrial biodiversity assessment has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) for Snowy 2.0 Main Works, issued on 31 July 2019, as well as relevant government assessment requirements, guidelines and policies, and in consultation with the relevant government agencies.

The SEARs must be addressed in the EIS. Table 1.1 lists the matters relevant to this assessment and where they are addressed in this report.

Table 1.1 Relevant matters raised in SEARs

Requirement	Section addressed
An assessment of the biodiversity impacts of the project on terrestrial, aquatic and groundwater-dependent ecosystems, including listed Commonwealth and State threatened species and communities and listed Commonwealth migratory species	This report and the aquatic ecology assessment (Cardno 2019) appended to the EIS.
A strategy to offset any residual impacts of the project on these ecosystems, focusing on enhancing the biodiversity values of the Kosciuszko National Park in the medium to long term.	Snowy 2.0 Main Works Offset Strategy (EMM 2019d) appended to the EIS.

To inform preparation of the SEARs, the DPIE invited relevant government agencies to advise on matters to be addressed in the EIS. These matters were taken into account by the Secretary for DPIE when preparing the SEARs.

1.6 Related projects

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

- Snowy 2.0 Exploratory Works (SSI-9208) – a Snowy Hydro project with Minister’s approval;
- Snowy 2.0 Transmission Connection Project (SSI-9717) – a project proposed by TransGrid; and
- Snowy 2.0 – Segment Factory (SSI-10034) – a project proposed by Snowy Hydro.

While these projects form part of the CSSI declaration for Snowy 2.0 and Transmission Project, they do not form part of Snowy Hydro’s application for Snowy 2.0 Main Works. These related projects are subject to separate application and approval processes. Staged submission and separate approval is appropriate for a project of this magnitude, due to its complexity and funding and procurement processes. However, cumulative impacts have been considered in this report, where relevant.

1.7 Information sources

1.7.1 Publications and databases

In order to provide context for the Main Works, information about flora and fauna species, populations, communities and habitats from the locality (generally within 10 km) was obtained from the following databases:

- BioNet Atlas of NSW Wildlife for previous threatened species records;
- Commonwealth Department of the Environment and Energy (DoEE) *Protected Matters Search Tool* (PMST) for Matters of National Environmental Significance (MNES) likely to occur within the Main Works areas; and
- the NSW Plant Community Types (PCTs), as held within the BioNet Vegetation Classification database.

1.7.2 Other relevant reports

This terrestrial biodiversity assessment has been prepared with reference to other technical reports that were prepared as part of the Snowy 2.0 Main Works EIS. The other relevant reports referenced in this terrestrial biodiversity assessment are listed below.

- Aquatic ecology assessment (Cardno 2019) – Appended to the EIS;
- Bushfire risk and hazard assessment (Eco Logical 2019) – Appended to the EIS;
- Water assessment (EMM 2019c) – Appended to the EIS;
- Revised modelling report (EMM 2020a) – Appended to the PIR-RTS;
- Revised water management report (EMM 2020b) – Appended to the PIR-RTS;
- Noise and vibration impact assessment (EMM 2019d) – Appended to the EIS;
- Traffic and Transport Assessment Report (SCT 2019) – Appended to the EIS;
- Rehabilitation strategy (SLR 2019) – Appended to the EIS;

- Palaeozoic geodiversity assessment (Percival 2019) – Appended to the EIS; and
- Cenozoic geodiversity assessment (Troedson 2019) – Appended to the EIS.

1.7.3 Spatial data

Spatial data encompassing the Main Works project area, including the disturbance footprint, was obtained from Future Generation Joint Venture (FGJV) and Snowy Hydro. Base map data was obtained from Department of Finance, Services and Innovation (DFSI) NSW databases, with cadastral data obtained from DFSI digital cadastral database. Mapping for stream orders was obtained from DPI.

The following spatial datasets were utilised during the development of this report:

- *State Vegetation Type Map: Riverina Region Version v1.2 - VIS_ID 4469* (OEH 2016a);
- *South East Local Land Services Biometric vegetation map – VIS_ID 4211* (OEH 2015);
- *Mitchell Landscapes Version V3.1* (OEH 2016b);
- *Interim Biogeographic Regionalisation of Australia (IBRA) Version 7* (DoEE 2017a);
- Directory of important wetlands (DoEE 2018); and
- NSW Wetlands (OEH 2010).

Mapping undertaken during the site assessment was conducted using a hand-held GPS unit, mobile tablet computers running Collector for ArcGIS™ and Survey123 for ArcGIS™ and aerial photo interpretation. Accuracy is subject to accuracy of GPS devices, generally ± 5 m. Mapping has been produced using a Geographic Information System (GIS; ArcGIS 10.5).

1.8 Legislative requirements

The project has been assessed against the key biodiversity legislation and government policy, including:

- EPBC Act;
- BC Act;
- *NSW Fisheries Management Act 1994* (FM Act);
- NSW EP&A Act;
- *NSW Biosecurity Act 2015*; and
- *NSW National Parks and Wildlife Act 1974* (NPW Act).

These are discussed further in Section 2.

2 Legislative context

This chapter provides a brief outline of the key biodiversity legislation and government policy considered in this assessment.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and water resources which are defined as MNES under the EPBC Act. These are:

- world heritage properties;
- places listed on the National Heritage Register;
- Ramsar wetlands of international significance;
- threatened flora and fauna species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- water resources, in relation to coal seam gas or large coal mining development.

Under the EPBC Act, a person proposing to take an action that may or will have a significant impact on MNES, or the environment generally for “Commonwealth agencies”, is to be referred to DoEE for determination as to whether or not it is a controlled action. If deemed a controlled action the project is assessed under the EPBC Act and a decision made as to whether or not to grant approval.

The Main Works project has been referred to the Commonwealth Minister for the Environment and determined to be a controlled action on 15 December 2018 (EPBC 2018/8322). The project will be assessed by an accredited process. An assessment of the project against the EPBC Act is provided in Section 8. The Secretary determined that the following controlling provisions apply:

- National Heritage places (Sections 15B & 15C of the EPBC Act);
- Listed threatened species and communities (Sections 18 & 18A of the EPBC Act);
- Listed migratory species (Sections 20 & 20A of the EPBC Act); and
- Commonwealth action (Section 28 of the EPBC Act).

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act was enacted to encourage the consideration and management of impacts of proposed development or land-use changes on the environment and the community in NSW. The EP&A Act is administered by DPIE.

The EP&A Act provides the overarching structure for planning in NSW and is supported by other statutory environmental planning instruments (EPIs) including SEPPs. EPIs relevant to the natural environment are outlined further below.

i State Environmental Planning Policy (State and Regional Development) 2011

On 7 March 2018, Snowy 2.0 was declared to be CSSI by the NSW Minister for Planning under the provisions of the EP&A Act 1979 and is defined in clause 9 of Schedule 5 of the SRD SEPP.

ii State Environmental Planning Policy No 44 – Koala Habitat Protection

State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44) aims to encourage the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of Koala (*Phascolarctos cinereus*) population decline. It applies to areas of native vegetation greater than 1 ha and in councils listed in Schedule 1 of SEPP 44.

Snowy 2.0, including the Main Works, has been declared to be CSSI under Part 5 of the EP&A Act. In accordance with Part 5.22 of the EP&A Act environmental planning instruments do not apply to or in respect of SSL. Therefore, SEPP 44 is not required to be considered.

Despite this, no Koalas or Koala scats were found in the Main Works survey area during targeted surveys (Section 6.3.4iie). The site is therefore not considered potential Koala habitat under SEPP 44.

2.2.2 Fisheries Management Act 1994

The FM Act contains provisions for the conservation of fish stocks, key fish habitat (KFH), biodiversity, threatened species, populations and ecological communities. It regulates the conservation of fish, vegetation and some aquatic macroinvertebrates and the development and sharing of the fishery resources of NSW for present and future generations. The FM Act lists threatened species, populations and ecological communities, key threatening processes (KTPs) and declared critical habitat. Assessment guidelines to determine whether a significant impact is expected are detailed in section 220ZZ and 220ZZA of the FM Act.

Another objective of the FM Act is to conserve KFH. These are defined as aquatic habitats that are important to the sustainability of recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. KFH is defined in sections 2.2.1 and 2.2.2 of the Policy and Guidelines for Fish Conservation and Management (DPI 2013).

The impact of Main Works on threatened aquatic species, populations, communities, habitats and KFH have been assessed separately and are presented in the aquatic ecology assessment (Cardno 2019) appended to the EIS.

2.2.3 Biodiversity Conservation Act 2016

The BC Act details mechanisms for the conservation of biodiversity in NSW through the protection of threatened flora and fauna species, populations and ecological communities. The BC Act, together with the NSW Biodiversity Conservation Regulation 2017 (BC Regulation), established the Biodiversity Offsets Scheme (BOS).

The BOS includes establishment of the BAM(OEH 2017a) for use by accredited persons in biodiversity assessment under the scheme. The purpose of the BAM is to assess the impact of actions on threatened species and threatened ecological communities (TECs) and their habitats and determine offset requirements.

The BAM sets out the requirements for a repeatable and transparent assessment of terrestrial biodiversity values in order to:

- identify the biodiversity values on land subject to proposed development area;
- determine the residual impacts of a proposed development following all measures to avoid, minimise and mitigate impacts; and
- quantify and describe the biodiversity credits required to offset the residual impacts of proposed development on biodiversity values.

For SSI projects, including CSSI projects, use of the BAM is mandatory unless a waiver is sought. The biodiversity assessment for the Main Works has been undertaken in accordance with the requirements of the BAM (OEH 2017a), as set out in this BDAR.

2.2.4 Biosecurity Act 2015

The primary objective of the Biosecurity Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

Amongst other things, the Biosecurity Act stipulates management arrangements for weed biosecurity risks in NSW, with the aim to prevent, eliminate and minimise risks. Management arrangements include:

- any land managers and users of land have a responsibility for managing weed biosecurity risks that they know about or could reasonably be expected to know about;
- applies to all land within NSW and all waters within the limits of the State; and
- local strategic weed management plans will provide guidance on the outcomes expected to discharge duty for the weeds in that plan.

The Riverina Regional Strategic Weed Management Plan 2017 - 2022 (RLLS 2017) outlines how government, industry, and the community will share responsibility and work together to identify, minimise, respond to and manage weeds within the Riverina Region, which includes the Main Works project area. The plan also supports regional implementation of the Biosecurity Act.

Blackberry (*Rubus fruticosus* species aggregate), a weed of national significance (WoNS) and State Priority was identified within the Main Works survey area. The Biosecurity Act imposes a general duty on persons who deal with biosecurity matters to prevent, minimise and eliminate the risk so far as is reasonably practicable, and also imposes mandatory measures for Blackberry as per Part 2, Division 8, clause 33 of the NSW Biosecurity Regulation 2018, being that a person must not import into the State or sell.

Sweet Briar (*Rosa rubiginosa*), identified within the Main Works survey area, is identified in Appendix 2 of RLLS (2017) as another weed of concern to the Riverina Region. Weeds identified in Appendix 2 of RLLS (2017) may be subject to the General Biosecurity Duty, as outlined in the Biosecurity Act, and may be a focus for local management plans and coordinated campaigns by the community and other stakeholders in the region.

2.2.5 National Parks and Wildlife Act 1979

Under the NPW Act, the Director General of The NSW National Parks and Wildlife Service (NPWS) is responsible for the care, control and management of all national parks and various other categories of protected area. The primary responsibilities of NPWS under this legislation are the protection and maintenance of natural and cultural values, and the fostering of public appreciation, understanding and enjoyment of those values.

The KNP Plan of Management (PoM, DEC 2006a) details management objectives for such features within the park such as native plants and animals, soils, karst, rivers, lakes etc. Management objectives follow those specified within the NPW Act. Relevant management objectives include:

- native plant species and communities are maintained and/or rehabilitated and include a representative range of successional stages and age classes;
- viable populations of all native animal species that currently occur in the park are maintained or restored;
- the diversity of native species found in the park is maximised at a regional scale; and
- research informs the management of the native animals of the park.

The requirements of the NPW Act and KNP PoM have been considered in this report.

3 Landscape features

The identification of landscape features in the Main Works project area was determined using Section 4 of the BAM (OEH 2017a), as summarised within this chapter.

3.1 Landscape features

3.1.1 Bioregions and landscapes

The Main Works project area occurs across three IBRA regions and four subregions (Figure 3.1):

- South Eastern Highlands IBRA region, Bondo subregion and Monaro subregion;
- NSW South Western Slopes IBRA region and Inland slopes subregion; and
- Australian Alps IBRA region and Snowy Mountains subregion.

As the majority of the project area is located in the South Eastern Highlands IBRA region and Bondo IBRA subregion these were the region and subregion used in this assessment.

The Main Works project area occurs across five BioNet NSW Landscapes (formerly Mitchell Landscapes, Figure 3.1):

- Kings Cross Montane;
- Tantangara High Plains and Peaks;
- Pinbeyan – Ravine Ranges;
- Cabramurra – Kiandra Basalt Caps and Sands; and
- Jindabyne Plains (Rock Forest).

As the majority of the project area is located in the Pinbeyan - Ravine Ranges BioNet NSW Landscape this was the landscape used in this assessment.

3.1.2 Watercourses and wetlands

The project area is located within the Murrumbidgee catchment in the Australian Alps, south-eastern NSW. The Murrumbidgee catchment covers 84,000 square kilometres of southern NSW. It is bordered by the Great Dividing Range to the east, the Lachlan Catchment to the north and the Murray Catchment to the south (NOW 2011). A small portion of the project area between Talbingo and Tantangara Reservoirs is located within the Snowy catchment (Eucumbene). The NSW portion of the catchment area is 9,070 square kilometres (DPIE 2019).

The western section of the project area intersects two major watercourses; Wallace's Creek and the Yarrangobilly River. Within the project area, Wallace's Creek forms a sixth-order stream while the Yarrangobilly River (Photograph 3.1) forms a seventh-order stream. The Yarrangobilly River and Wallace's Creek are perennial streams. Stream substratum consists of unconsolidated boulder, cobble, pebble and gravel substratum with little evidence of siltation. The riparian zone of both watercourses is reasonably well vegetated, except for the lower section of the Yarrangobilly River, which has been subject to historic clearing in Lobs Hole. In this area some banks are unvegetated. Both watercourses are subject to significant infestation by Blackberry. This section of the project area is situated adjacent to Talbingo Reservoir. The Reservoir was constructed between 1968 and 1970 as a part of the Snowy Mountains Hydro-Electric Scheme (the Snowy Scheme, Lister 2001). It has a surface area of 1,940 ha and has a capacity of 921,000 ML when full. The reservoir supplies water to the Tumut 3 power station. The edges of the reservoir are located largely within the KNP, except for the northern section adjacent to the dam wall. The edges are largely vegetated, including intact native vegetation. Numerous stags are located within the reservoir, resulting from the inundation of forests when the dam was completed. Talbingo Reservoir is mapped in the NSW Wetlands spatial dataset.



Photograph 3.1 The Yarrangobilly River at Lobs Hole, upstream of Lobs Hole Ravine Road crossing

Along the western edge of Tantangara Reservoir, the project area intersects a first order tributary of the Murrumbidgee River. This stream is present as a minor drainage line, and only flows during heavy rainfall. Tantangara Reservoir was constructed between 1958 to 1960 as part of the Snowy Scheme. The reservoir dams the headwaters of the Murrumbidgee River. Before the construction of Tantangara Dam, the flow regime of Murrumbidgee catchment was highly variable. Since 1960 Tantangara Dam has captured and diverted a large portion of its inflows to Eucumbene (Snowy Scientific Committee 2010).

Other project elements intersect a number of minor and major watercourses associated with the Murrumbidgee River, including Gooandra Creek, Tantangara Creek and Nungar Creek. These perennial watercourses consist of open flats, with a main channel and a number of offline pools located in broad valleys, as well as incised channels in steeper terrain. Vegetation consists of wet grasslands and alpine bogs and fens in areas where organic material has accumulated.

A proposed access road also intersects the upper reaches of the Eucumbene River, a tributary of the Snowy River, in a third-order section of the river. At this location, the river consists of a minor channel located in a cold air valley depression.

No Directory of Important Wetlands in Australia (DIWA) wetlands or Ramsar wetlands are located within or immediately adjacent to the Main Works project area.

Wetlands, watercourses and associated buffers are shown in Figure 3.2.

3.1.3 Connectivity

The project area is located within KNP, which is largely vegetated across its 688,405 ha extent, with intact remnant vegetation extending into a further 1.6 million hectares across the Australian Alps. The extent of vegetation across KNP provides a high degree of connectivity.

The various watercourses provide suitable connectivity for aquatic and semi-aquatic species (such as fish and amphibians) and species which use linear features (such as birds and bats) to navigate. The wooded area supports connective features for terrestrials and arboreal mammals, birds, reptiles etc. The previously disturbed areas within Lobs Hole containing open grassland and paddock trees are considered less suitable for the movement of mammals that require vegetation cover to avoid predation.

3.1.4 Areas of geological significance and soil hazard features

Several areas of geological significance are located within the project area. A summary is provided below, with further details in the geodiversity assessments (Percival 2019 and Troedson 2019) appended to the EIS.

i Periglacial landforms

The Pleistocene glacial landforms in KNP are the only examples of this landform on the mainland of Australia and are of national and international significance (OEH 2011). Periglacial features of the park include terracing, solifluction lobes, sliding and shattered boulders and block streams (also known as scree slopes or boulder streams, Photograph 3.2). The periglacial evidence can be found in most areas above 1,000 m and possibly as far down as 600 m.

Block streams (or scree slopes) are listed under 'Rocks and Landforms' in Schedule 1 (Significant Natural and Cultural Features) of the KNP PoM (DEC 2006a). They are defined as 'river' or field of rocks that have moved downhill on mass and which were held together by ice. They occur in various areas of KNP, including the project area, where they occur along a section of Lobs Hole Ravine Road (Figure 3.2). The block stream at this location is dated to about 20,000 years ago. Rapid condition assessments are assigned to the Ravine block stream every three years, in accordance with the *KNP Geodiversity Action Plan* (OEH 2011).



Photograph 3.2 **Boulder streams along Lobs Hole Ravine Road**

ii **Ravine karst areas**

Outcropping strata of the Devonian age Lick Hole Formation is located along the lower section of Lobs Hole Ravine Road, approximately 12 km from the intersection with Link Road (Figure 3.2). The geological formation was formerly known as the Lick Hole Limestone (Geological Survey of New South Wales 1966). It is exposed in a hill slope road cutting which ranges up to about 2 m in height.

The strata consists of grey friable shale with a high density of calcareous, rounded nodules (Photograph 3.3). The nodules are light brown in colour, hard and brittle, and slightly elongated with dimensions typically of about 2 to 3 cm in diameter and 4 to 10 cm in length. Some appear to display the remains of branching structure and are assumed to be corals. Less abundant shell-fish fossils were also observed.

The Australian Stratigraphic Units Database (Geoscience Australia 2019) describes the Lick Hole Formation as a “fossiliferous well-bedded marine limestone with a pronounced rubbly appearance to spheroidal concretions to 10 cm, and calcareous shale; fossils include corals, trilobites, brachiopods and molluscs”.



Photograph 3.3 **In situ calcareous fossils of the Lick Hole Formation**

3.1.5 Areas of outstanding biodiversity value

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

3.2 Assessment of site context

The site context has been assessed in accordance with Section 4.3 of BAM (OEH 2017a) for site-based developments.

Mapping of native vegetation within a 1,500 m buffer of the Main Works Project area was undertaken using vegetation mapping collected as a part of surveys for the Snowy 2.0 project, aerial mapping interpretation and spatial data from OEH (2016a) and OEH (2015). This mapping was modified using the vegetation extent as mapped by EMM (see Section 4). Forty-five PCTs were mapped within the 1500 m buffer, including:

- PCT 277 - Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion;
- PCT 285 - Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion;
- PCT 287 - Long-leaved Box - Red Box - Red Stringybark mixed open forest on hills and hillslopes in the NSW South Western Slopes Bioregion;
- PCT 290 - Red Stringybark - Red Box - Long-leaved Box - Inland Scribbly Gum tussock grass - shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion;

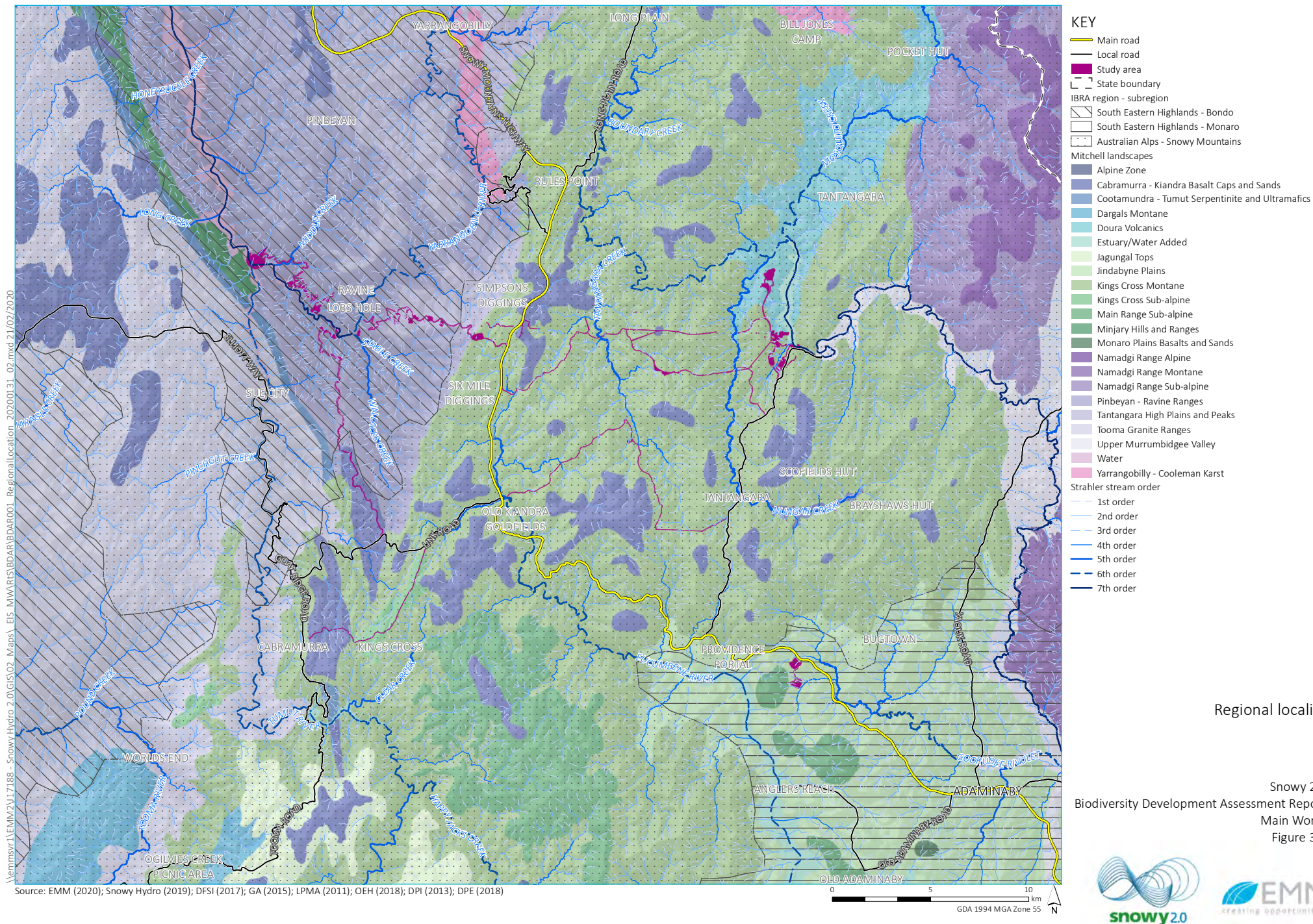
- PCT 295 - Robertson's Peppermint - Broad-leaved Peppermint - Norton's Box - stringybark shrub-fern open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion;
- PCT 296 - Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion;
- PCT 297 - Broad-leaved Peppermint - Norton's Box - Red Stringybark tall open forest on red clay on hills in the southern part of the NSW South Western Slopes Bioregion;
- PCT 299 - Riparian Ribbon Gum - Robertson's Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion;
- PCT 300 - Ribbon Gum - Narrow-leaved (Robertson's) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment;
- PCT 301 - Drooping She oak - Ricinocarpus bowmannii - grasstree tall open shrubland of the Coolac - Tumut Serpentine Belt;
- 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;
- PCT 303 - Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion;
- PCT 304 - Candlebark - Apple Box - Narrow-leaved Peppermint tall open forest on granite in the Tumbarumba region of the South Eastern Highlands Bioregion and upper NSW South Western Slopes Bioregion;
- PCT 305 - Apple Box - Broad-leaved Peppermint - Red Stringybark shrubby hill open forest in the upper NSW South Western Slopes Bioregion and adjacent South Eastern Highlands Bioregion;
- PCT 306 - Red Box - Red Stringybark - Norton's Box hill heath shrub - tussock grass open forest of the Tumut region;
- PCT 310 - Norton's Box - Red Stringybark grassy tall open forest on sheltered slopes in the Tumbarumba - Murray River region of the NSW South Western Slopes Bioregion;
- PCT 311 - Red Stringybark - Broad-leaved Peppermint - Nortons Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion;
- PCT 313 - Brittle Gum - Broad-leaved Peppermint open forest with tall dense shrub understorey on riparian coarse grained granitic soils in the NSW South Western Slopes Bioregion;
- PCT 314 - Apple Box - Red Stringybark basalt scree open forest in the upper Murray River region;
- PCT 316 - Norton's Box - Red Box - Red Stringybark +/- Nodding Flax Lily forb-grass open forest mainly on the Tumut region;
- PCT 637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion;

- PCT 638 - Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 639 - Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion;
- PCT 643 - Alpine shrubland on scree, blockstreams and rocky sites of high-altitude areas of Kosciuszko National Park, Australian Alps Bioregion;
- PCT 644 - Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 679 - Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion;
- PCT 788 - Coral Heath - tea-tree wet heath of escarpment ranges and eastern tablelands, Sydney Basin Bioregion and South East Corner Bioregion;
- PCT 893 - Kangaroo Grass - *Poa fawcettiae* open grassland on limestone in northern Kosciuszko NP, Australian Alps Bioregion;
- PCT 938 - Montane lakes of the Monaro region, South Eastern Highlands Bioregion;
- PCT 939 - Montane wet heath and bog of the eastern tablelands, South Eastern Highlands Bioregion;
- PCT 952 - Mountain Gum - Narrow-leaved Peppermint - Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion;
- PCT 953 - Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion;
- PCT 1100 - Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion;
- PCT 1110 - River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion;
- PCT 1190 - Snow Gum - Candle Bark shrubby open forest in valleys of the southern ACT ranges, South Eastern Highlands Bioregion;
- PCT 1191 - Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion;

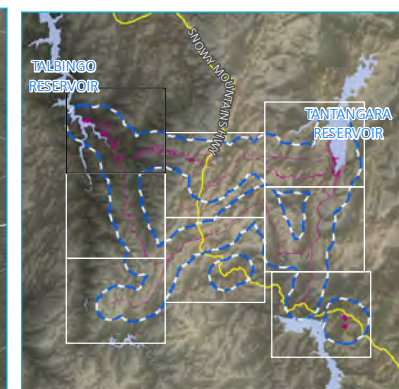
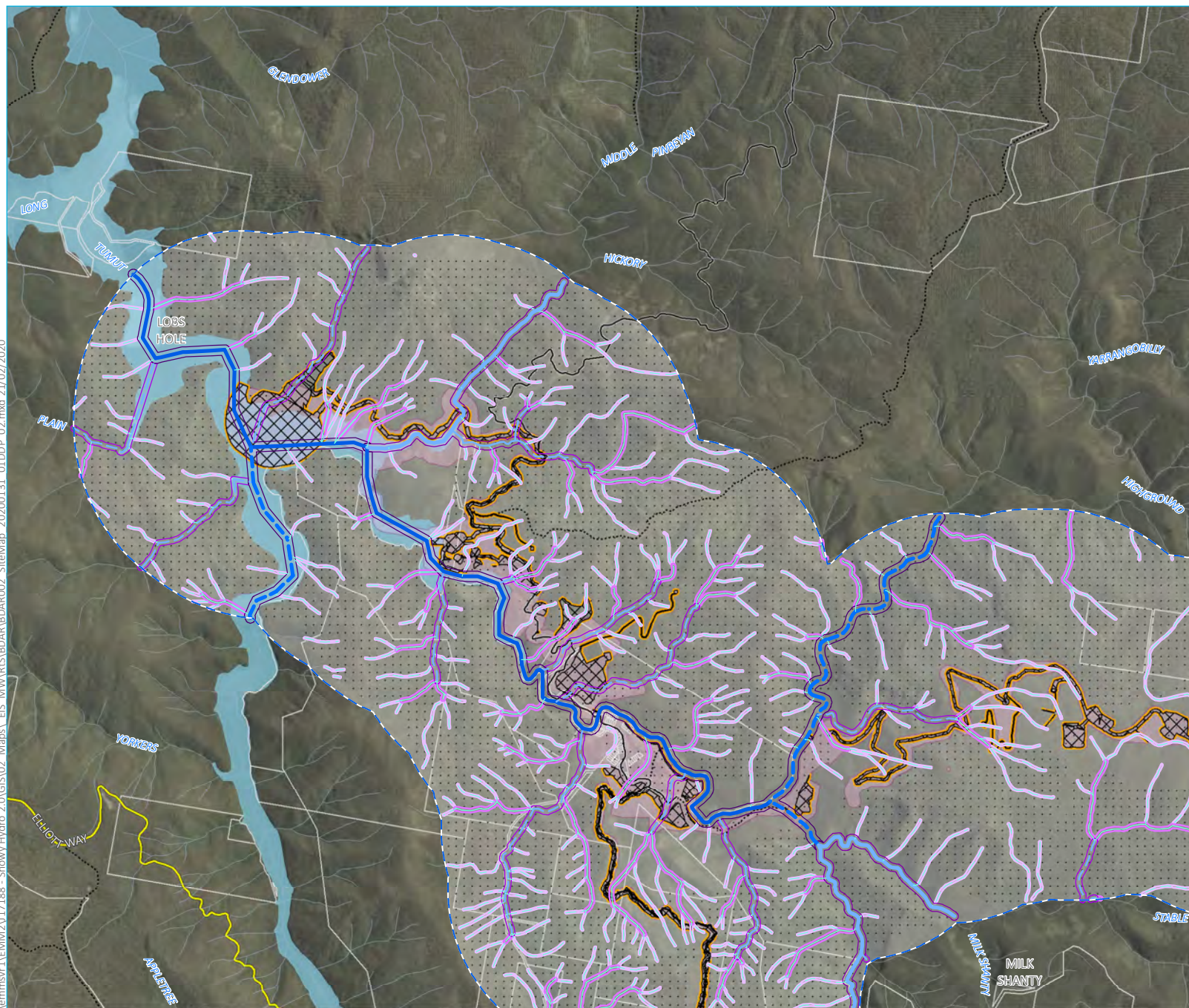
- PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 1224 - Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 1225 - Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 1271 - Tea-tree tall riparian shrubland, South Eastern Highlands Bioregion, South East Corner Bioregion and Australian Alps Bioregion;
- PCT 1376 - Wallaby Grass - Redleg Grass low grassland of the South Eastern Highlands; and
- PCT 1377 - Kangaroo Grass - Snowgrass tussock grassland on slopes and ridges of the tablelands, South Eastern Highlands.

A conservative approach was undertaken to include all areas of native vegetation, including the mapped candidate native grassland that are likely to be derived from the mapped woodland communities. This approach allowed a greater list of threatened species to be filtered in for later assessment of habitat suitability for Main Works.

Native vegetation cover within the 1,500 m buffer area (including the project area) was determined as the sum of the areas of native vegetation map units listed above, divided by the entire buffer area. Approximately 35,383 ha of native vegetation was mapped within the 36,041 ha buffer area (Figure 3.2). Native vegetation cover within the buffer area is approximately 98%.



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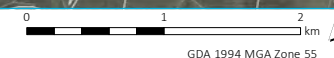
KEY

- Disturbance area
- Indirect disturbance area
- Construction envelope
- 1500 m buffer
- Native vegetation
- Cadastral
- NSW Wetlands (OEH, 2009)
- Main road
- Local road
- Vehicular track
- Watercourse
- Strahler stream order
 - 1st order
 - 2nd order
 - 3rd order
 - 4th order
 - 5th order
 - 6th order
 - 7th order
- Riparian buffer
 - 10 m
 - 20 m
 - 30 m
 - 40 m
 - 50 m

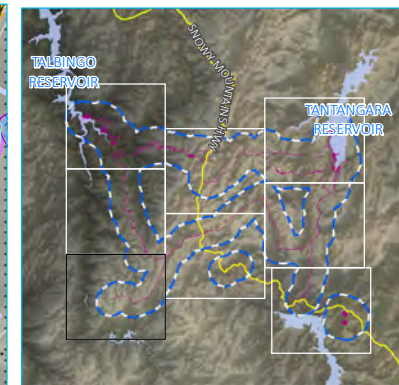
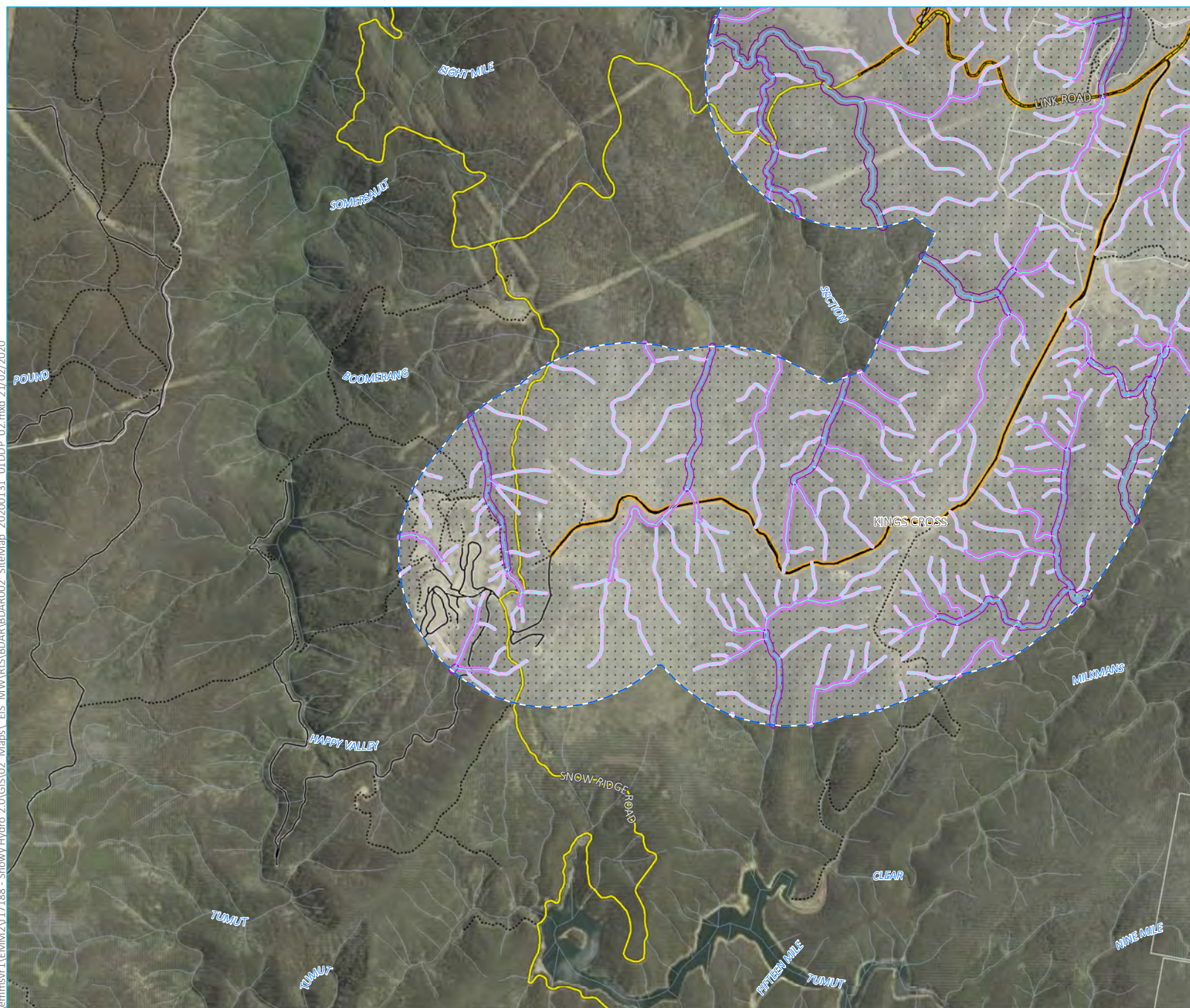
Site map, Main Works

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 3.2 2

Source: EMM (2020); Snowy Hydro (2019); LPI (2019); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011); OEH (2014, 2016); DPI (2013)



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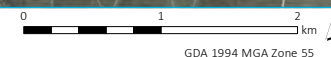
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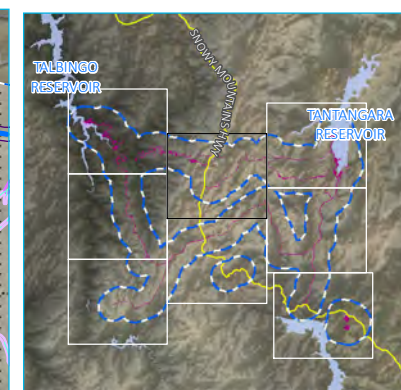
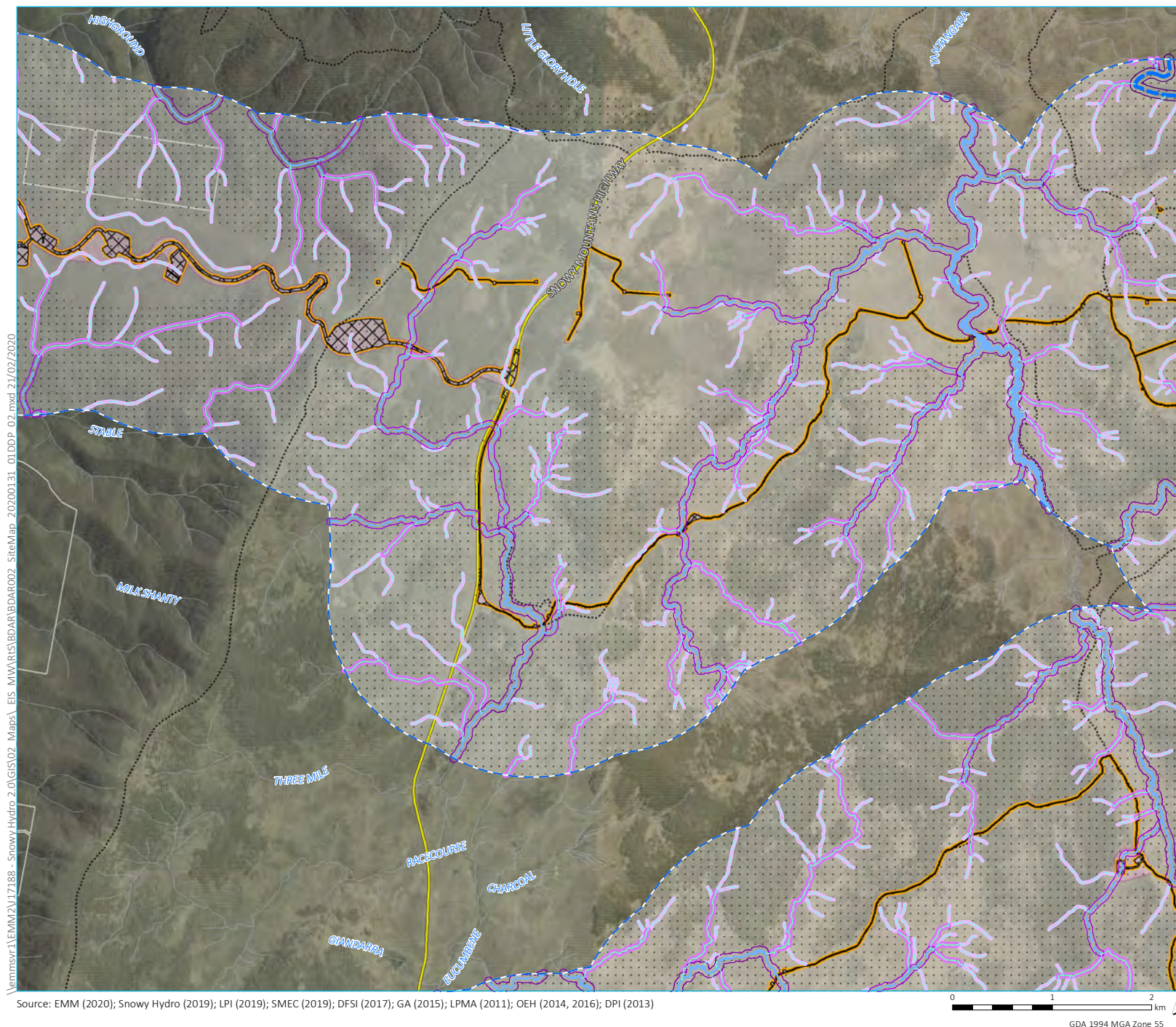
- Disturbance area
- Indirect disturbance area
- Construction envelope
- 1500 m buffer
- Native vegetation
- Cadastral
- Main road
- Local road
- Vehicular track
- Watercourse
- Strahler stream order
 - 1st order
 - 2nd order
 - 3rd order
 - 4th order
 - 5th order
- Riparian buffer
 - 10 m
 - 20 m
 - 30 m
 - 40 m

Site map, Main Works

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 3.2 4

Source: EMM (2020); Snowy Hydro (2019); LPI (2019); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011); OEH (2014, 2016); DPI (2013)



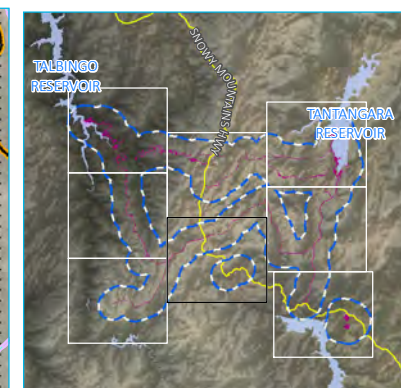
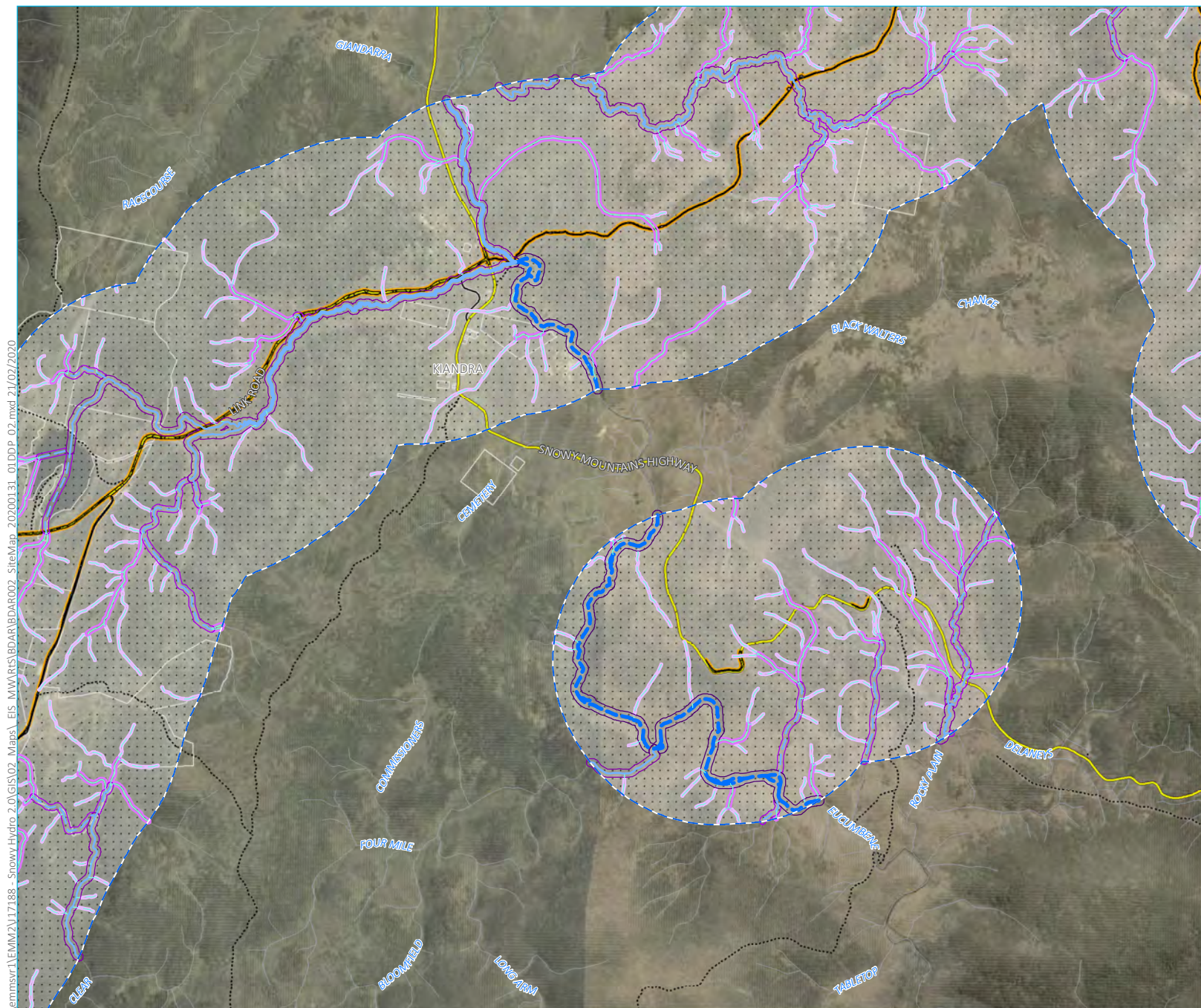


- KEY**
- Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - 1500 m buffer
 - Native vegetation
 - Cadastral
 - Main road
 - Vehicular track
 - Watercourse
 - Stahler stream order**
 - 1st order
 - 2nd order
 - 3rd order
 - 4th order
 - 5th order
 - 6th order
 - Riparian buffer**
 - 10 m
 - 20 m
 - 30 m
 - 40 m
 - 50 m

Site map, Main Works

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 3.2.5



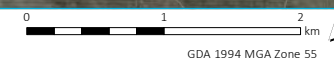


- KEY**
- Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - 1500 m buffer
 - Native vegetation
 - Cadastral
 - Main road
 - Local road
 - Vehicular track
 - Watercourse
 - Strahler stream order
 - 1st order
 - 2nd order
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 - 5th order
 - 6th order
 - Riparian buffer
 - 10 m
 - 20 m
 - 30 m
 - 40 m
 - 50 m

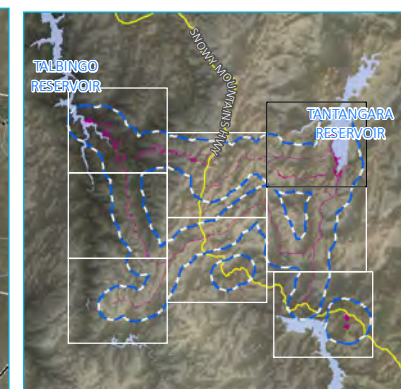
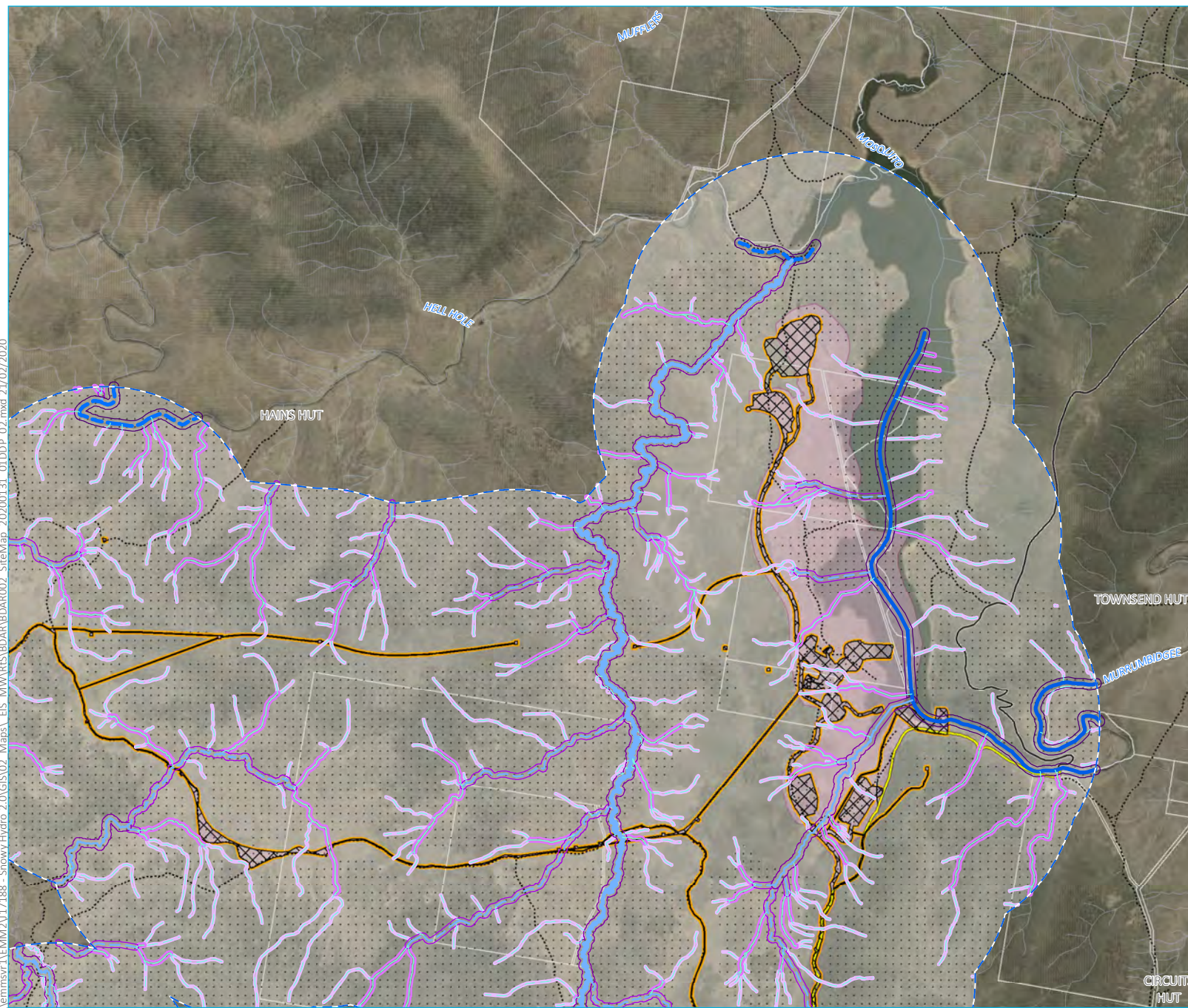
Site map, Main Works

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 3.2 6

Source: EMM (2020); Snowy Hydro (2019); LPI (2019); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011); OEH (2014, 2016); DPI (2013)



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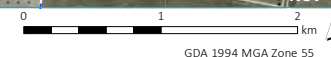
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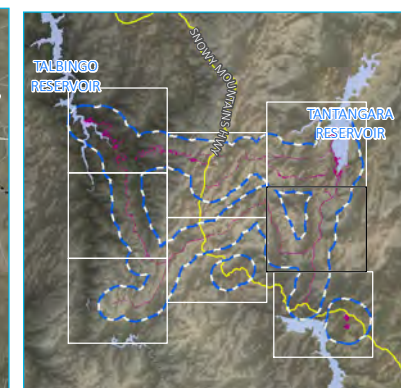
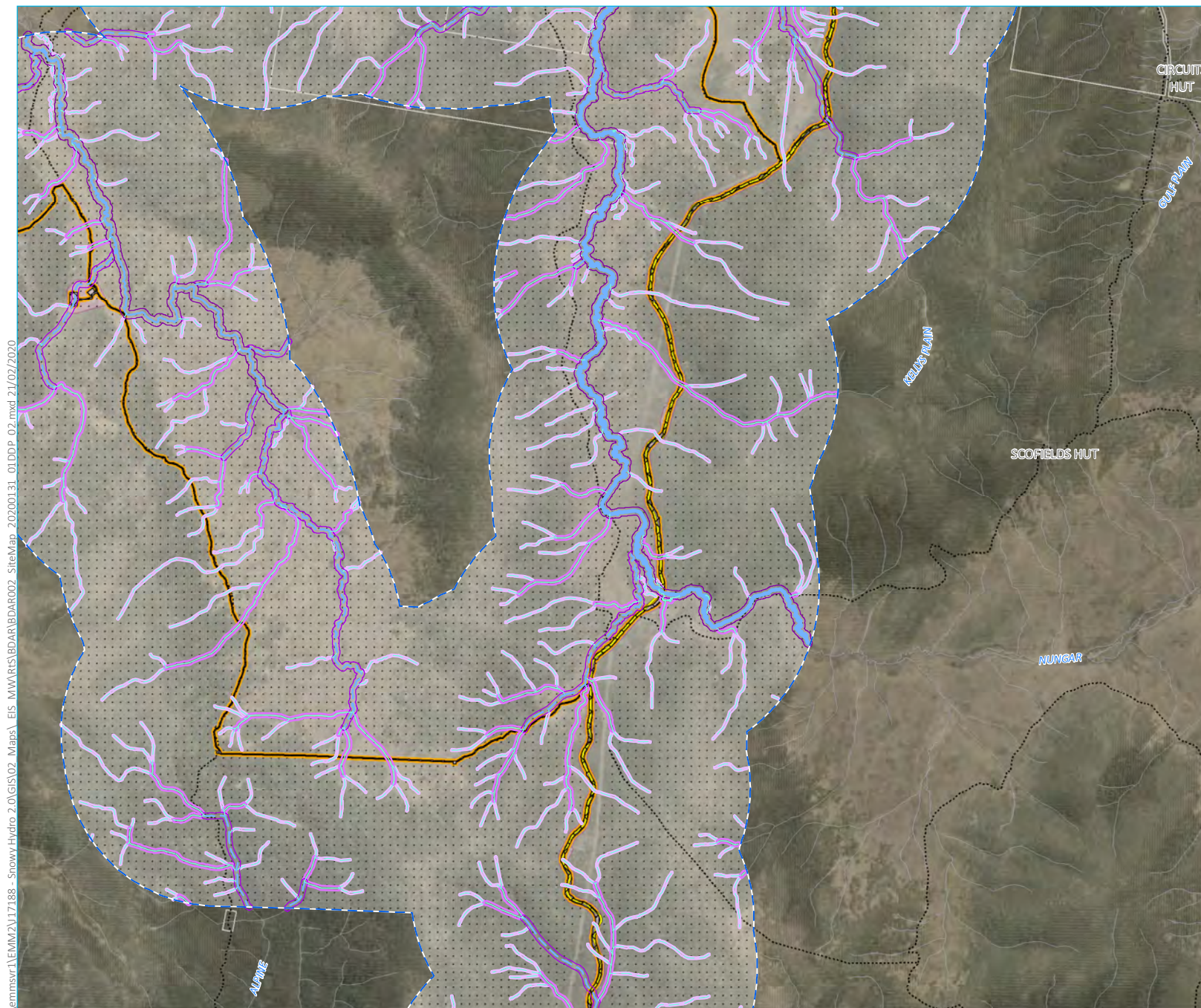
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- Indirect disturbance area
- Construction envelope
- 1500 m buffer
- Native vegetation
- Cadastral
- Main road
- Local road
- Vehicular track
- Watercourse
- Strahler stream order
 - 1st order
 - 2nd order
 - 3rd order
 - 4th order
 - 5th order
 - 6th order
 - 7th order
- Riparian buffer
 - 10 m
 - 20 m
 - 30 m
 - 40 m
 - 50 m

Site map, Main Works

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 3.2.7

Source: EMM (2020); Snowy Hydro (2019); LPI (2019); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011); OEH (2014, 2016); DPI (2013)





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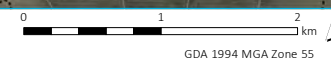
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- Indirect disturbance area
- Construction envelope
- 1500 m buffer
- Native vegetation
- Cadastral
- Main road
- Vehicular track
- Watercourse
- Strahler stream order
 - 1st order
 - 2nd order
 - 3rd order
 - 4th order
 - 5th order
- Riparian buffer
 - 10 m
 - 20 m
 - 30 m
 - 40 m

Site map, Main Works

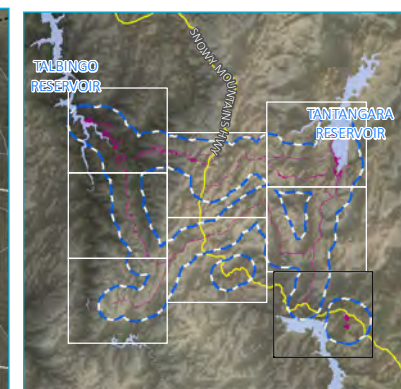
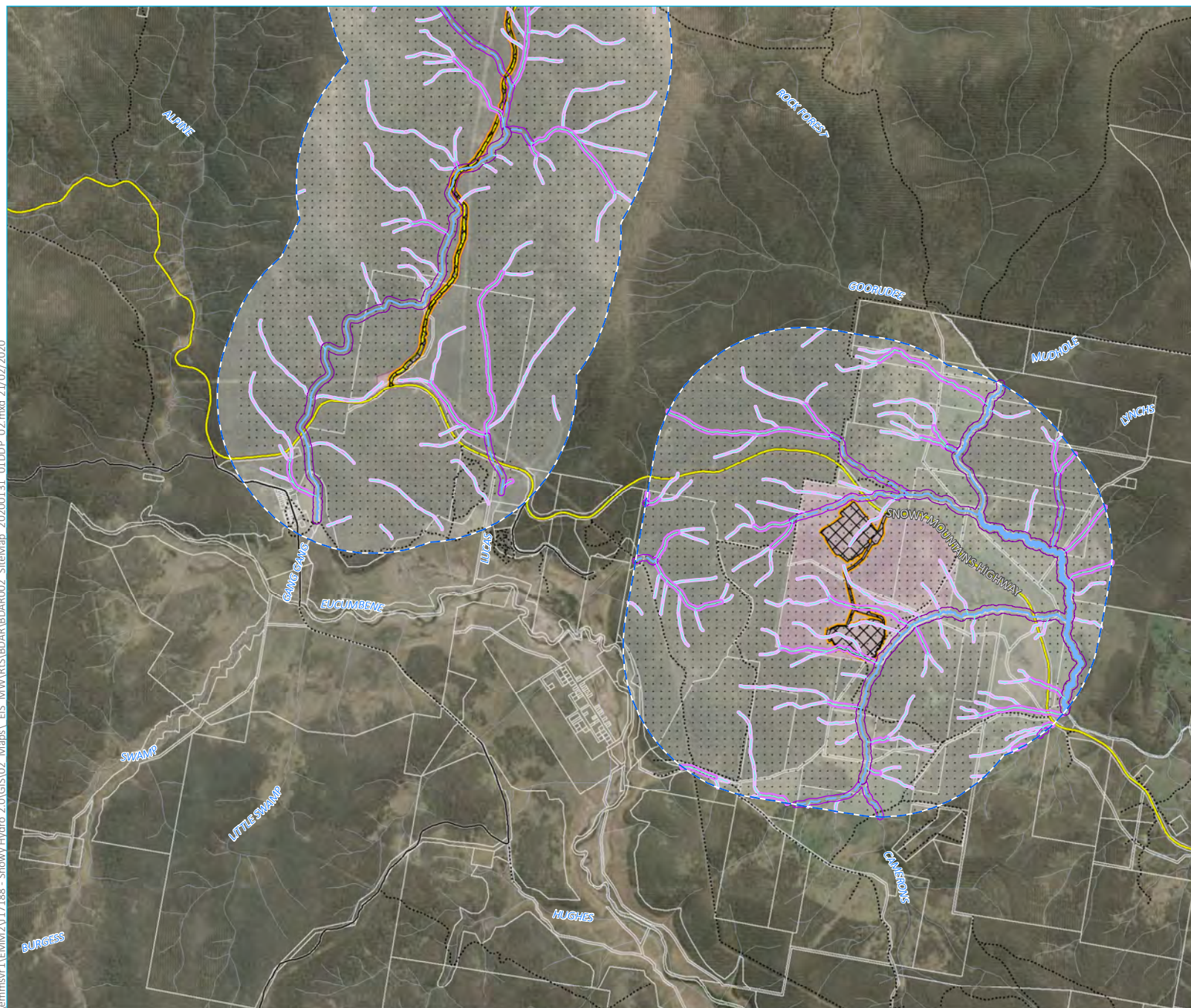
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 3.2.8



Source: EMM (2020); Snowy Hydro (2019); LPI (2019); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011); OEH (2014, 2016); DPI (2013)



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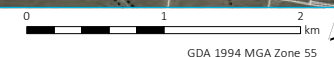


- KEY**
- Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - 1500 m buffer
 - Native vegetation
 - Cadastre
 - Main road
 - Local road
 - Vehicular track
 - Watercourse
 - Strahler stream order
 - 1st order
 - 2nd order
 - 3rd order
 - 4th order
 - 5th order
 - Riparian buffer
 - 10 m
 - 20 m
 - 30 m
 - 40 m

Site map, Main Works

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 3.2.9

Source: EMM (2020); Snowy Hydro (2019); LPI (2019); SMEC (2019); DFSI (2017); GA (2015); LPMA (2011); OEH (2014, 2016); DPI (2013)



4 Native vegetation

The extent of native vegetation within the Main Works was determined using Section 5 of the BAM (OEH 2017a), as summarised within this chapter.

4.1 Background review

A review of regional vegetation mapping was undertaken to inform the site survey. OEH (2016a) and OEH (2015) identify 27 PCTs within the Main Works survey area:

- PCT 277 - Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion;
- PCT 290 - Red Stringybark - Red Box - Long-leaved Box - Inland Scribbly Gum tussock grass - shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion;
- PCT 295 - Robertson's Peppermint - Broad-leaved Peppermint - Norton's Box - stringybark shrub-fern open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion;
- PCT 296 - Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion;
- PCT 297 - Broad-leaved Peppermint - Norton's Box - Red Stringybark tall open forest on red clay on hills in the southern part of the NSW South Western Slopes Bioregion;
- PCT 299 - Riparian Ribbon Gum - Robertson's Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion;
- PCT 300 - Ribbon Gum - Narrow-leaved (Robertson's) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment;
- PCT 301 - Drooping She oak - Ricinocarpus bowmannii - grasstree tall open shrubland of the Coolac - Tumut Serpentine Belt;
- PCT 304 - Candlebark - Apple Box - Narrow-leaved Peppermint tall open forest on granite in the Tumbarumba region of the South Eastern Highlands Bioregion and upper NSW South Western Slopes Bioregion;
- PCT 305 - Apple Box - Broad-leaved Peppermint - Red Stringybark shrubby hill open forest in the upper NSW South Western Slopes Bioregion and adjacent South Eastern Highlands Bioregion;
- PCT 306 - Red Box - Red Stringybark - Norton's Box hill heath shrub - tussock grass open forest of the Tumut region;
- PCT 316 - Norton's Box - Red Box - Red Stringybark +/- Nodding Flax Lily forb-grass open forest mainly on the Tumut region;
- PCT 637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion;

- PCT 638 - Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 639 - Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion;
- PCT 643 - Alpine shrubland on scree, blockstreams and rocky sites of high-altitude areas of Kosciuszko National Park, Australian Alps Bioregion;
- PCT 644 - Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 939 - Montane wet heath and bog of the eastern tablelands, South Eastern Highlands Bioregion;
- PCT 953 - Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 1100 - Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion;
- PCT 1190 - Snow Gum - Candle Bark shrubby open forest in valleys of the southern ACT ranges, South Eastern Highlands Bioregion;
- PCT 1191 - Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion;
- PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 1224 - Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 1376 - Wallaby Grass - Redleg Grass low grassland of the South Eastern Highlands; and
- PCT 1377 - Kangaroo Grass - Snowgrass tussock grassland on slopes and ridges of the tablelands, South Eastern Highlands.

4.2 Methods

The following sections outline the methods employed to map vegetation, and to assess the vegetation integrity of native vegetation within the survey area.

4.2.1 Detailed vegetation mapping and habitat assessment

An assessment of the survey area was undertaken between August and October 2017, with additional mapping undertaken in February and March 2018 due to the inclusion of additional survey areas. These initial assessments included detailed vegetation mapping and habitat assessments. The survey area was traversed on foot and by vehicle, with vegetation mapped and aligned with NSW PCTs.

Revision and refinement of this preliminary vegetation mapping was undertaken in November and December 2018, in response to additional plots being undertaken and review of the PCTs across the Snowy 2.0 survey area. Additional vegetation mapping was completed after the exhibition of the Main Works EIS between October 2019 and January 2020 as a result of project refinement and improvements.

PCTs were stratified into vegetation zones based on broad condition state using the definitions in Table 4.1.

Table 4.1 Definitions used in delineation of vegetation zones

Condition class	Description
High	Largely intact with all stratum present and minimal disturbance
Medium	Some elements or stratum missing or immature, but minimal disturbance
Other	Regeneration is occurring due to previous human impacts, such as clearing or fire, but minimal to moderate disturbance to other stratum
Poor	Tree stratum present, but understorey vegetation degraded due to weeds or other major disturbance.
Derived grassland	Trees stratum missing, with sparse shrub layer. Native vegetation restricted to groundcover.
Low	Tree stratum and shrub stratum missing. Native vegetation restricted to groundcover

Where there was some uncertainty about correct PCT alignment, or to justify PCT alignment, a series of rapid vegetation assessments (RVAs) were undertaken, with the three dominant species in the overstorey, midstorey and groundcover recorded. This data was assessed against data held in the NSW Vegetation Information System (VIS) to confirm PCT alignment.

Vegetation was mapped in the field using GPS-enabled tablet computers using Collector for ArcGIS™. Field data was then aligned with a canopy height model (CHM) developed using Light Detection and Ranging (LiDAR) data in a geographic information system (GIS).

As a result of the recent bushfires, on-ground vegetation mapping of some areas was unable to be completed. Vegetation in these areas was mapped using a combination of a review of vegetation mapping of adjacent areas undertaken for Snowy 2.0, review of regional vegetation mapping (OEH 206a and OEH 2015) and aerial photo interpretation (API). Some areas within the groundwater drawdown extent were also mapped using regional vegetation mapping (OEH 2015 and OEH 2016a) and API.

4.2.2 Vegetation integrity assessment

Following the stratification of vegetation zones within the survey area, native vegetation integrity was assessed using data obtained via a series of plots, as per the methodology outlined in Section 5 of the BAM (OEH 2017a). Plot data was collected from the survey area between November 2017 and December 2019. At each plot location the following was undertaken:

- one 20 x 20 m plot, for assessment of composition and structure; and
- one 20 x 50 m plots for assessment of function, including a series of five 1 x 1 m plots to assess average leaf litter cover.

The assessment of composition and structure, based on a 20 x 20 m plot, recorded species name, stratum, growth form, cover and abundance rating for each species present within the plot. Cover (foliage cover) was estimated for all species rooted in or overhanging the plot, and recorded using decimals (if less than 1%, rounded to whole number (1-5%) or estimated to the nearest 5% (5- 100%). Abundance was counted (up to 20) and estimated above 20, and recorded using the following intervals: 1, 2, 3, 4, 5, 10, 20, 50, 100, 500, 1000, 1500, 2000 etc.

The assessment of function recorded the number of large trees, the presence of tree stem size class, tree regeneration, number of trees with hollows and length of fallen logs, as well as leaf litter cover within the 20 x 50 m plot and five 1 x 1 m subplots. The minimum number of plots and transects per vegetation zone was determined using Table 4 of the BAM (OEH 2017a). A total of 523 plots were undertaken as a part of the biodiversity assessment for Snowy 2.0, with 360 plots undertaken within or in close proximity (250 m) to the survey area and 135 plots used in determining vegetation integrity scores. Datasheets are provided in Annexure A while compiled plot data is provided in Annexure B.

A small number of plots were completed after flowering period for some species. As a result, some species were not identifiable to genus level. Species that were recorded to family level were recorded as native with the relevant growth form assigned, as a conservative approach.

Additional plots were to be collected in January 2020. However, as a result of recent bushfires within the survey area this data could not be collected and, as a result, some vegetation zones do not have the minimum number of plots required by the BAM (OEH 2017a). For zones which were missing additional plots (PCT 296 – Medium and PCT 1224 – Poor), collected plot data was duplicated. For zones where no plot data was collected (PCT 299 – Medium, PCT 303 – Medium, PCT 639 – Derived grassland and PCT 644 – Poor), plots within High condition class of the same PCT were used for the purposes of this assessment. In total, six plots were either duplicated or used a plot from High condition class.

The vegetation integrity score was calculated as per equation 1 in the BAM (OEH 2017a).

4.3 Results

4.3.1 Vegetation description

The Main Works survey area spans from north of Lobs Hole on Talbingo Reservoir, across to South Tantangara and down to Rock Forest.

Prior to European settlement of the area, Lobs Hole is likely to have been used regularly by Aboriginal people throughout the annual cycle of movement through country. Since European settlement, Lobs Hole has a long history of occupation, first used in the early 1800s for the movement of stock. Since this time Lobs Hole has been the site of prospecting, grazing, settlement, refuge from the winters of Kiandra, gardening and agriculture. From the 1860s to approximately 1917, Lobs Hole was the site of copper mining (Plate 5.1). During the construction of the Snowy Scheme, Lobs Hole was well used during surveying work. A major surveying camp was set up by Major Clews at Lobs Hole, believed to be at the junction of the Yarrangobilly and Tumut rivers and now under water, but this is not confirmed (Plate 5.2). The Wallace's Creek camp was apparently located near to the junction of Wallace's Creek and Yarrangobilly River (exact location unknown, NSW Archaeology 2019). Lobs Hole is now a public camping area (Ravine Campground) with an earthen boat ramp which is used to access the southern reaches of Talbingo Reservoir. These historical activities and past land uses have resulted in significant amounts of clearing and disturbance of vegetation in the area. Native vegetation, which includes fauna habitats have been modified by past disturbances associated with land clearing, livestock grazing and weed invasion. Native vegetation has re-established itself throughout Lobs Hole; however, Blackberry, a weed of national significance, has established itself to the point of infestation within the area, particularly in gullies and along the Yarrangobilly River.

Vegetation along the upper (southern) extent of Lobs Hole Ravine Road and in the Marica area is largely intact, with minimal disturbance evident. Vegetation comprises tall montane forests with large trees and a shrubby understorey. Weed invasion is minimal, and largely limited to road edges. The lower section of Lobs Hole Ravine Road, generally below 1,200 m, consists of dry sclerophyll forests with a shrubby to grassy understorey. In some area's disturbance due to past land use is evident and significant, while in other areas there is minimal disturbance. Weediness varies, depending on past land use, and is heavy in some areas particularly gullies and along watercourses.



Plate 4.1 **The Lobs Hole Copper Mine in ~1901, showing disturbance to native vegetation (photo taken by Ernest Clayton Andrews, source: Geological Survey of NSW)**



Plate 4.2 **Lobs Hole Survey Camp at the junction of the Yarrangobilly and Tumut Rivers (now under water). Source: Steve Brayshaw**

The plateau area, east of Wallace's Creek Firetrail, consists of a mix of dry grassy plains in cold air depressions, ringed by grassy woodlands of Black Sally (*Eucalyptus stellulata*) and Snow Gum (*Eucalyptus pauciflora*). In drainage lines, dry grasslands give way to wet grasslands. Alpine bogs and fens occur on drainage depressions and along major watercourses. In this area disturbance is limited to historical land use, for gold mining associated with Kiandra and construction of the Snowy scheme, along with impacts from recreational use such as horse-riding. Impacts from feral Horses are prevalent in the grassy plains, Alpine bogs and fens and along drainage lines.

Vegetation along Tantangara road comprises of grasslands and grassy woodlands, with minimal disturbance. Vegetation at the southern end of Tantangara Reservoir consists of grassy woodlands and grasslands, moderately disturbed as a result of fire damage, historical clearing, weed invasion and heavy recreational use. In 2003, a large-scale bushfire burnt thousands of hectares within the Australian Alps, particularly affecting the Tantangara area. Native vegetation has re-established itself throughout Tantangara, with natural regeneration occurring. The high threat weed Ox-eye Daisy (*Leucanthemum vulgare*) has established itself to the point of infestation within the southern part of Tantangara, in Kelly's Plain, and spanning west towards Nungar track. NPWS are currently undertaking weed control measures including spraying and track closures. The Tantangara area is used regularly by campers, four-wheel-drive enthusiasts and fisherman, with impacts from these activities evident, including clearing of vegetation, prolific track creation and weed invasion. Feral Horse numbers are also high in this area.

Rock Forest is located just outside of the KNP, on the southern boundary of the Park. Vegetation in this private property consists predominantly of derived grasslands as a result of historical clearing and grazing. Remnant patches of moderate to high quality forest and woodlands occur as a mosaic throughout the property on rocky rises.

4.3.2 Plant community types

Site investigations, including determination of vegetation communities using the methods described in Section 4.2.1, identified the presence of 19 PCTs within the Main Works study area. The PCTs found in the disturbance footprint, including vegetation formation and vegetation class (Keith 2004), are described within Table 4.2 and shown in Figure 4.1. Each of the 19 PCTs is described in further detail within the following section.

Table 4.2 Plant community types mapping within the Main Works study area

Plant community type	Vegetation formation	Vegetation class	Direct impacts (ha)	Indirect impacts (ha)	Study Area (ha)
PCT 285 – Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Upper Riverina Dry Sclerophyll Forests	6.85	0.06	6.91
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	25.60	14.12	39.72
PCT 299 – Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands	Dry Sclerophyll Forest (Shrubby sub-formation)	Southern Tableland Dry Sclerophyll Forests	1.04	0.50	1.54

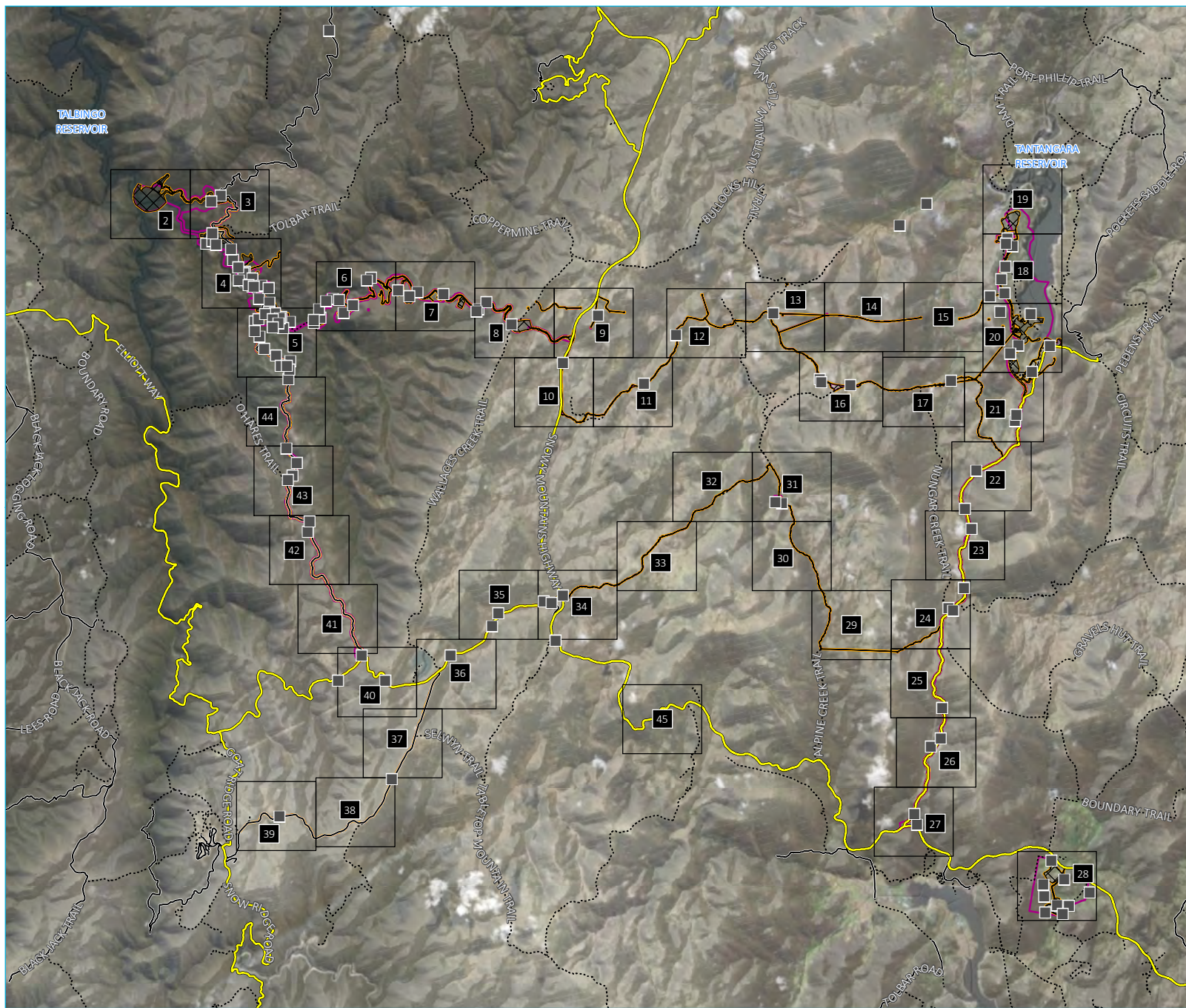
Table 4.2 Plant community types mapping within the Main Works study area

Plant community type	Vegetation formation	Vegetation class	Direct impacts (ha)	Indirect impacts (ha)	Study Area (ha)
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	34.74	29.32	64.06
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	2.83	3.22	6.05
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	Grassy Woodlands	Southern Tableland Grassy Woodland	26.66	30.85	57.51
PCT 311 – Red Stringybark - Broad-leaved Peppermint - Nortons Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Upper Riverina Dry Sclerophyll Forests	8.91	14.19	23.11
PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	Alpine Complex	Alpine Bogs and Fens	1.03	4.41	5.44
PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Wet Sclerophyll Forests (Grassy sub-formation)	Montane Wet Sclerophyll Forests	8.60	14.79	23.40
PCT 643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion	Alpine Complex	Alpine Heaths	0.08	0.08	0.16
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	Grassy Woodlands	Subalpine Woodlands	60.75	130.56	191.31
PCT 679 – Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion	Grassy Woodlands	Subalpine Woodlands	0.03	0.42	0.45
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	21.40	21.82	43.23

Table 4.2 Plant community types mapping within the Main Works study area

Plant community type	Vegetation formation	Vegetation class	Direct impacts (ha)	Indirect impacts (ha)	Study Area (ha)
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	7.98	7.34	15.32
PCT 999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion	Dry Sclerophyll Forests (Shrubby sub-formation)	Southern Tableland Dry Sclerophyll Forests	12.40	14.75	27.15
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	Grassy Woodlands	Subalpine Woodlands	9.24	5.56	14.79
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Grassy Woodlands	Subalpine Woodlands	108.18	144.79	252.97
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Grasslands	Temperate Montane Grasslands	80.83	132.55	213.38
PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Grasslands	Temperate Montane Grasslands	7.09	16.48	23.57
TOTAL			424.25	585.81	1,010.06

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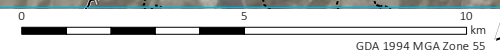


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 - Local road
 - Vehicular track
 - Page index
 - ⊗ Disturbance area
 - Indirect disturbance area
 - Construction envelope

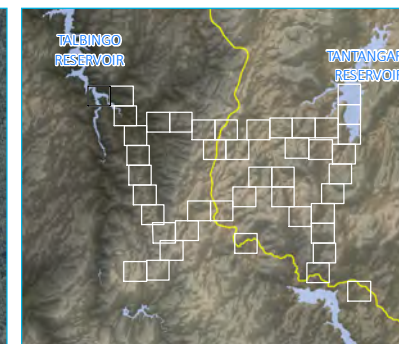
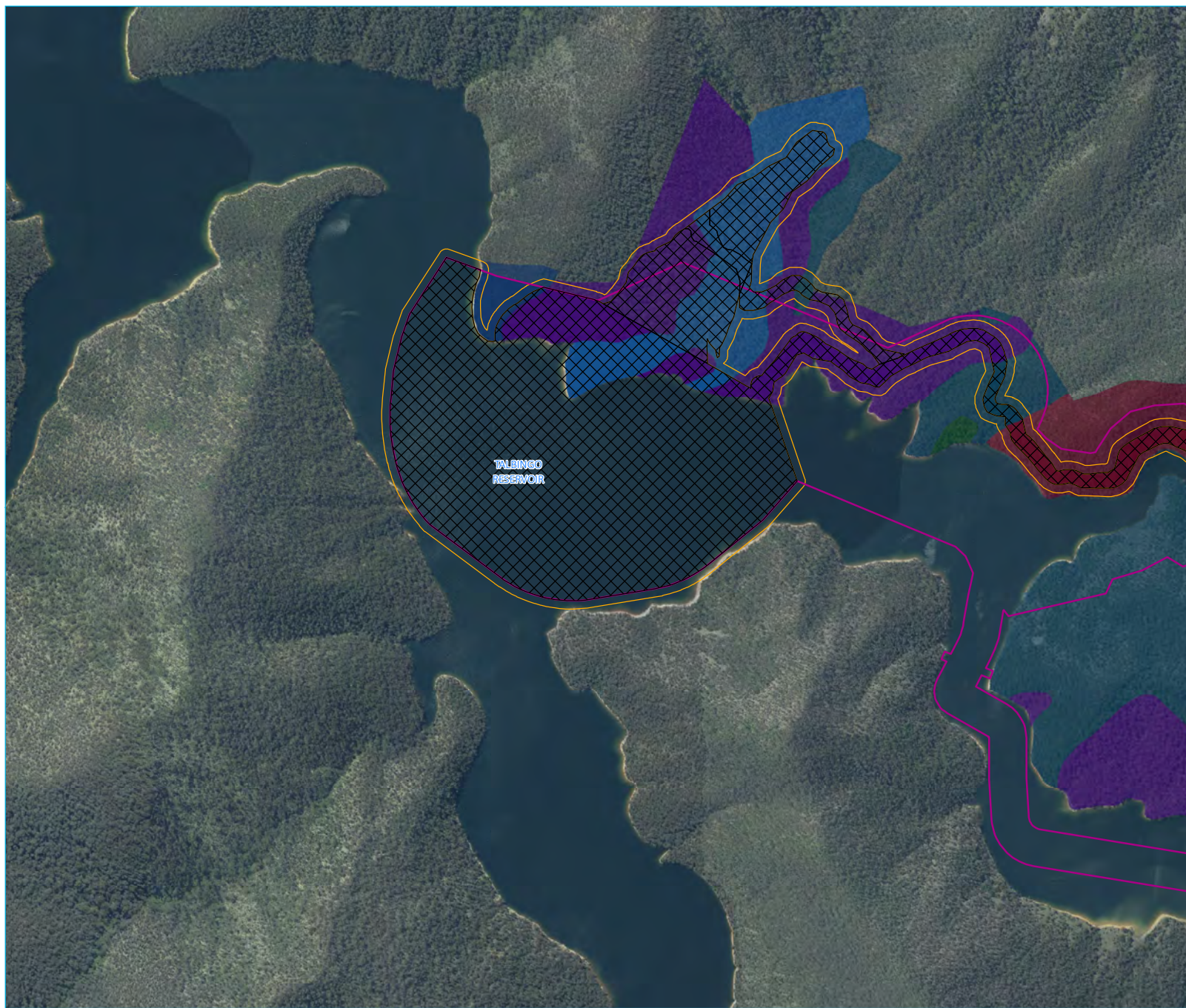
Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations - page index

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.1

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



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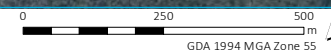
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Disturbance area	Medium
Indirect disturbance area	PCT 300
Construction envelope	High
PCT 299	PCT 311
High	High
PCT 296	PCT 729
High	High

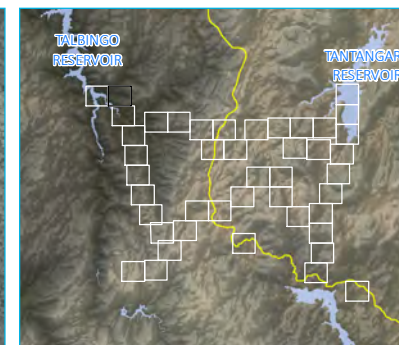
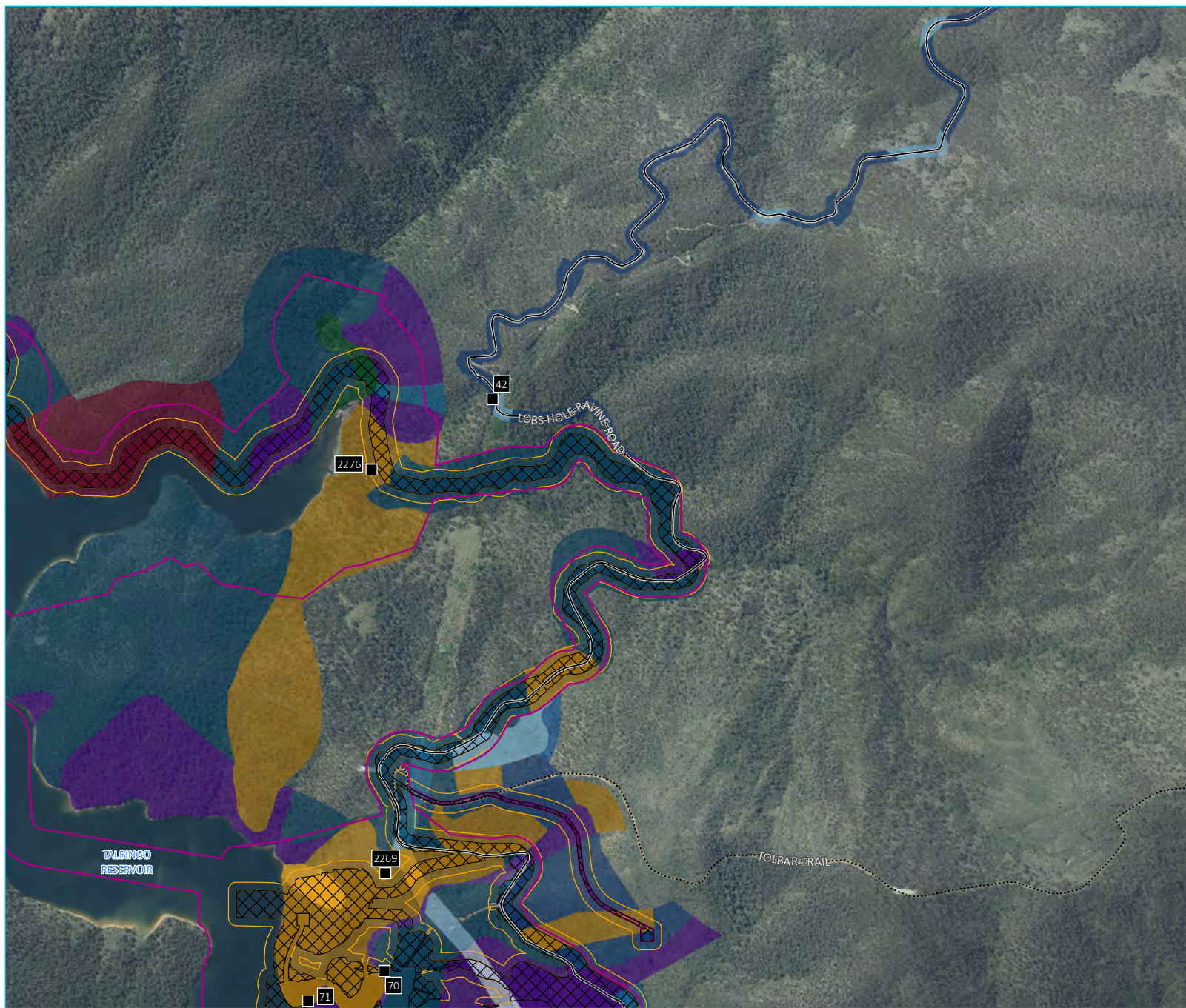
Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.2

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



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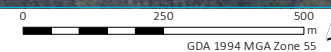
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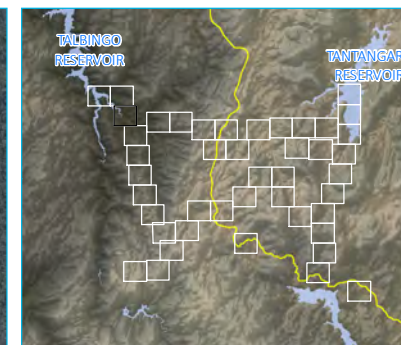
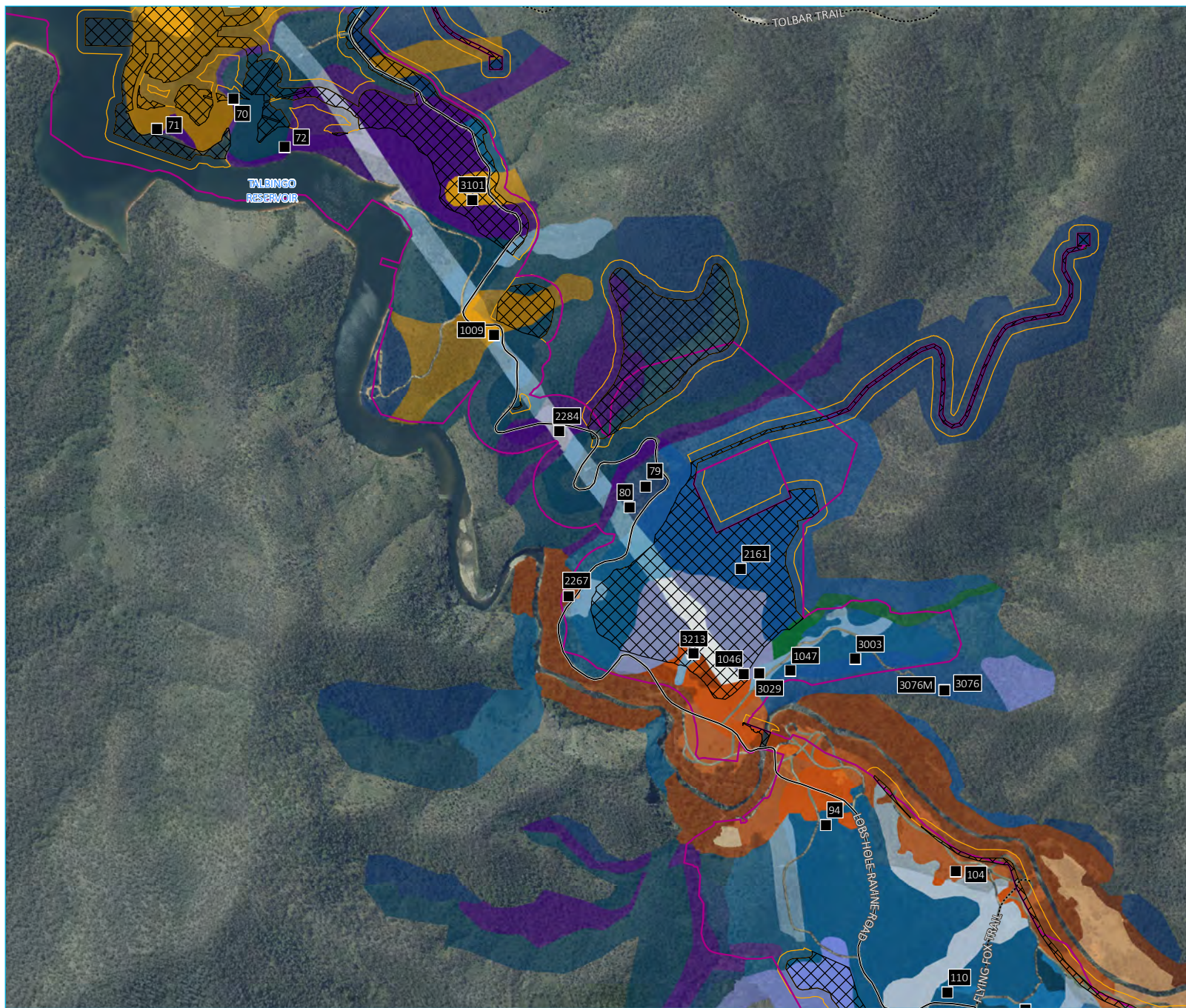
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|-----------------------------|---------------------|
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| — Local road | ■ High |
| Vehicular track | ■ Medium |
| ▨ Disturbance area | ■ Derived grassland |
| ▨ Indirect disturbance area | PCT 311 |
| ▨ Construction envelope | ■ High |
| PCT 299 | ■ High |
| ■ High | ■ Medium |
| PCT 296 | ■ Derived grassland |
| ■ High | PCT 729 |
| ■ Medium | ■ High |
| ■ Derived grassland | ■ Derived grassland |
| | PCT 1191 |
| | ■ High |
| | ■ Derived grassland |

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.3

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



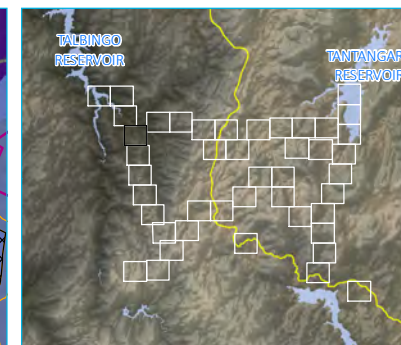
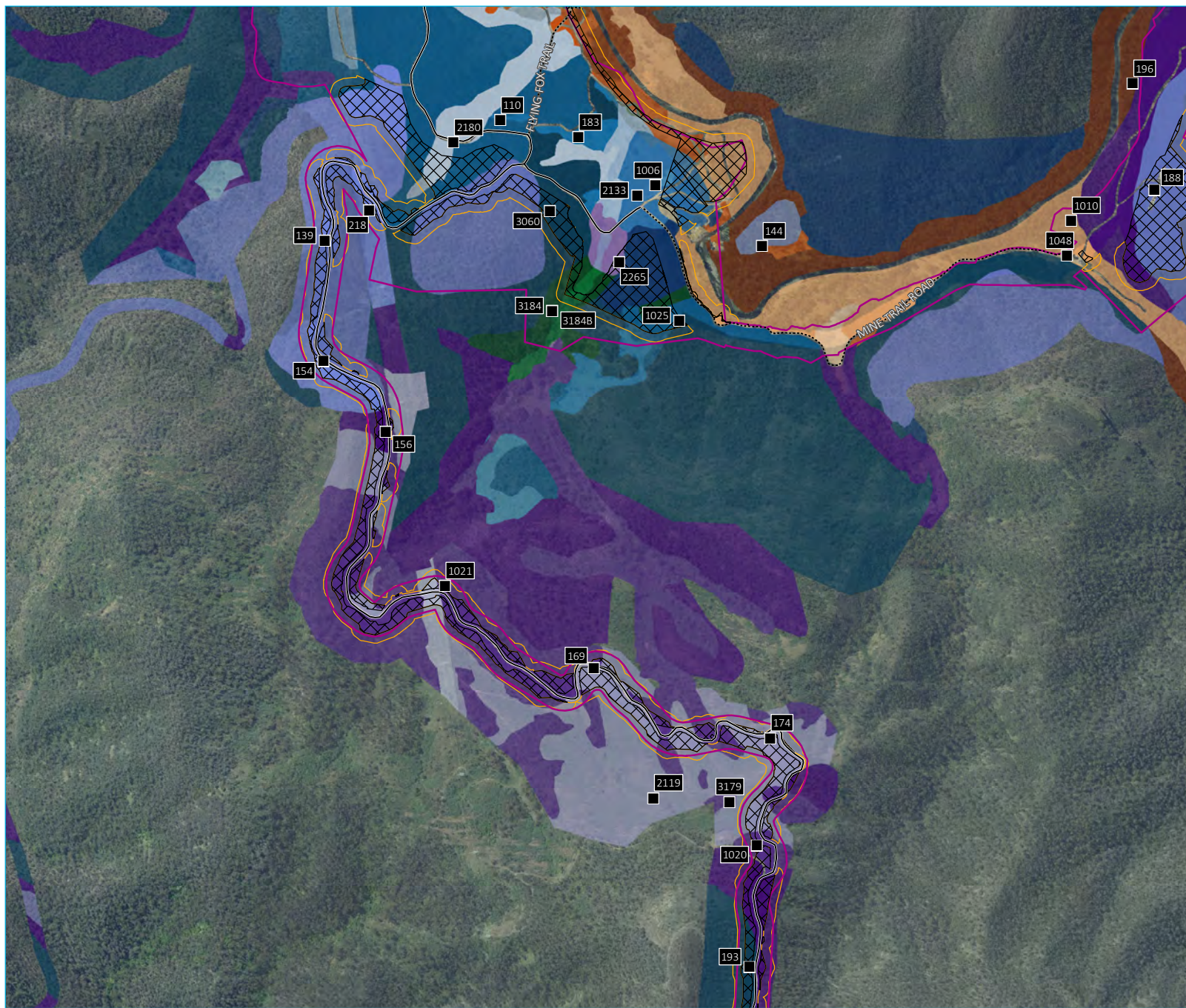


KEY

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

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.4

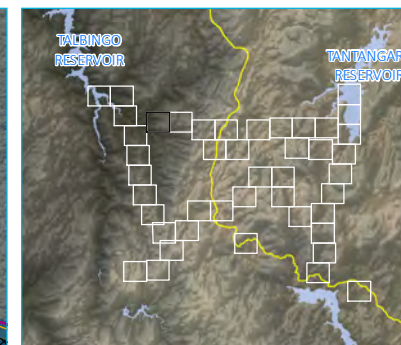
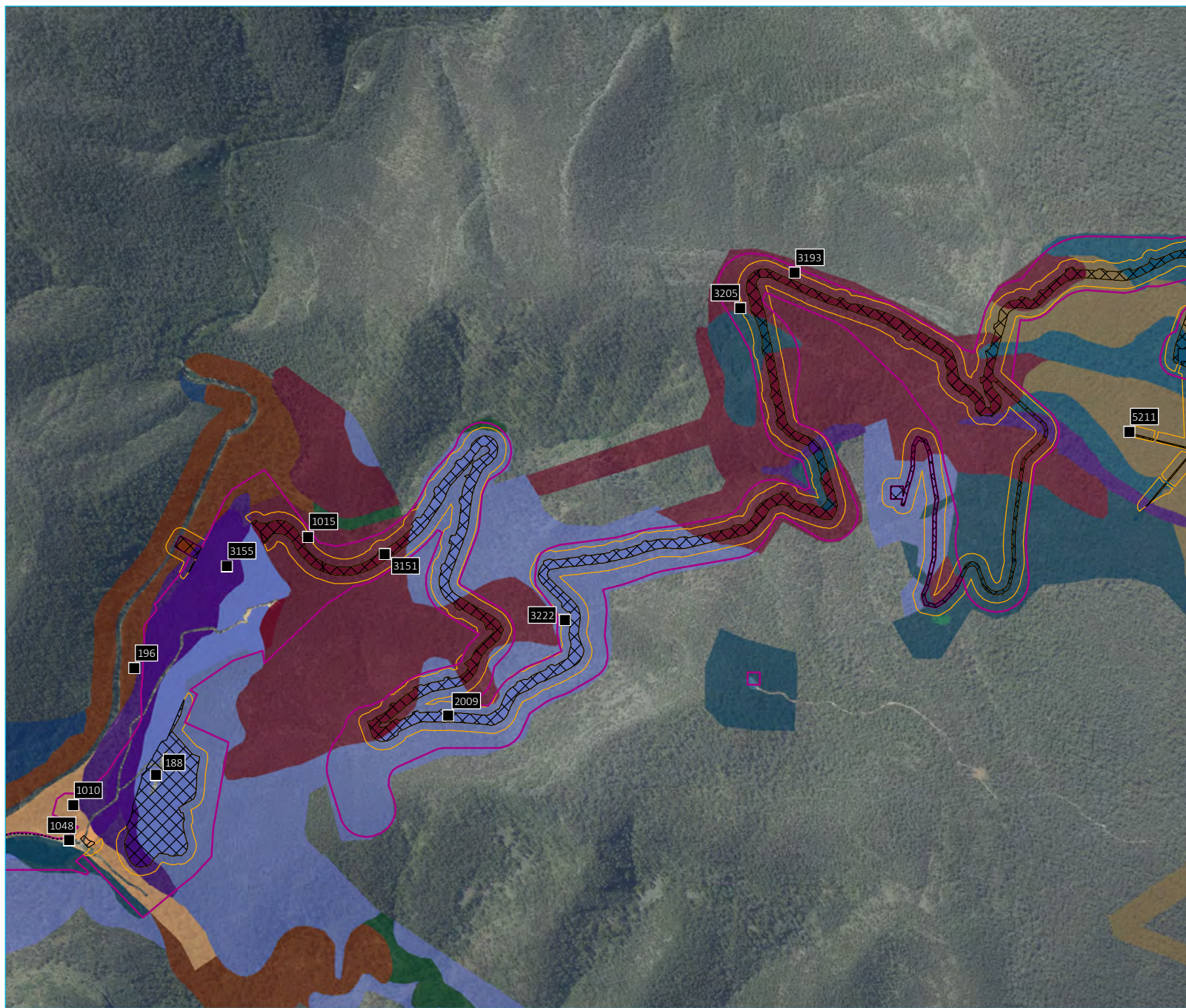


KEY

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

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.5



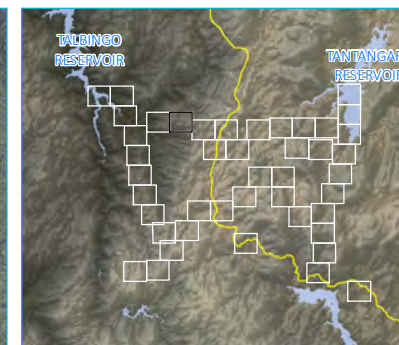
KEY

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

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.6

\\lemmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR003_PCTsAndPlots_20200203_DDP_02.mxd 20/02/2020



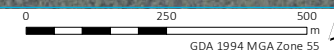
KEY

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

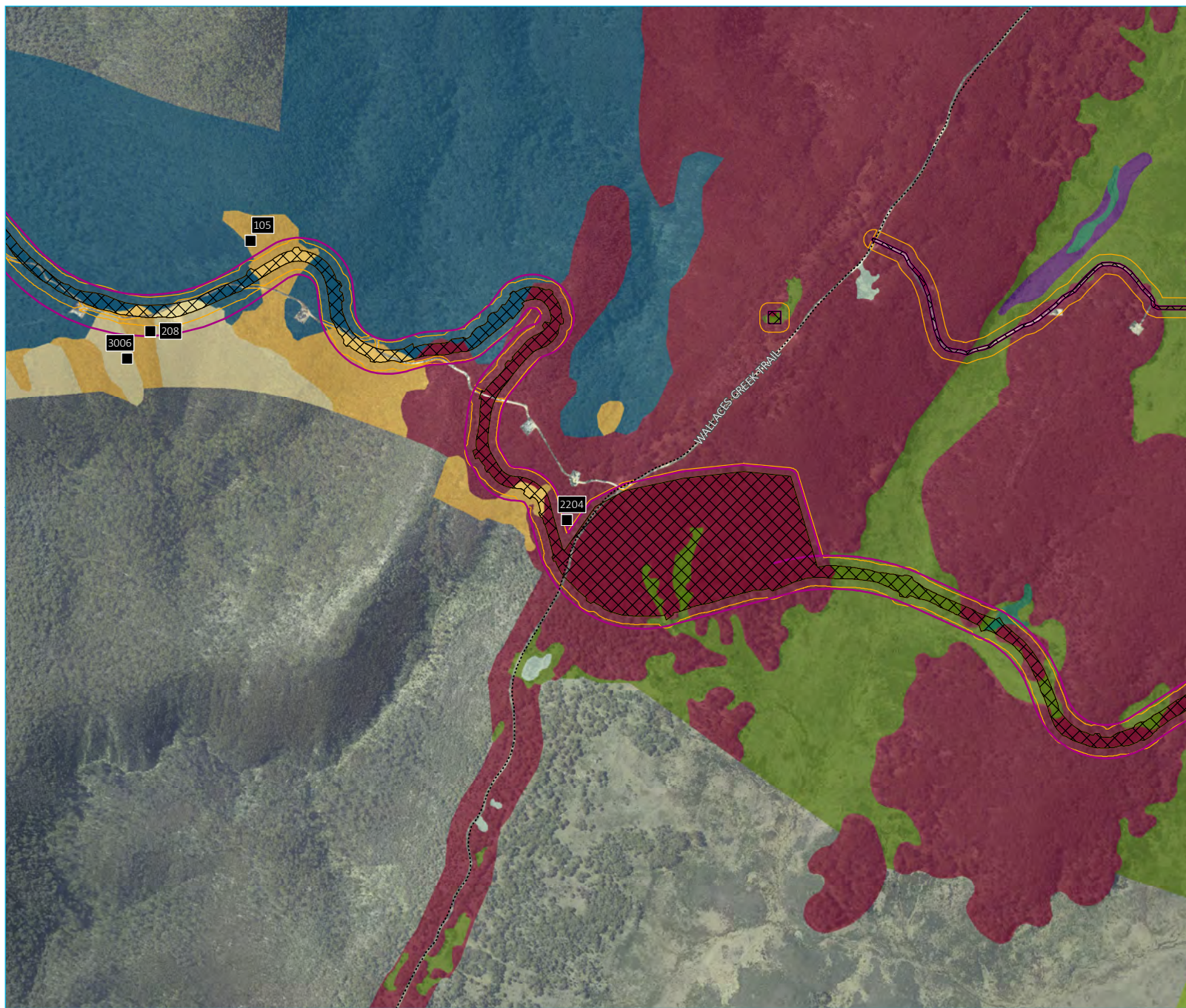
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.7

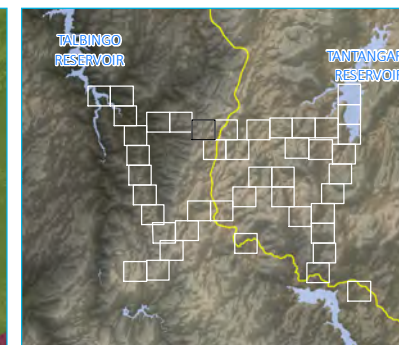
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MW\RIS\BDAR\BDAR003_PCTsAndPlots_20200203_DDP_02.mxd 20/02/2020



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



KEY

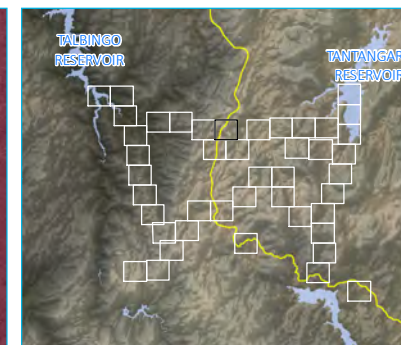
■ Plot location	PCT 788
..... Vehicular track	High
▨ Disturbance area	PCT 938
▨ Indirect disturbance area	High
▨ Construction envelope	PCT 1196
PCT 637	High
High	PCT 1224
PCT 639	High
High	Medium
Other	PCT 1225
PCT 644	High
High	

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.8



\\lemmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MW\RS\BDAR\BDAR003_PCTsAndPlots_20200203_DDP_02.mxd 20/02/2020



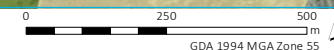
KEY

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

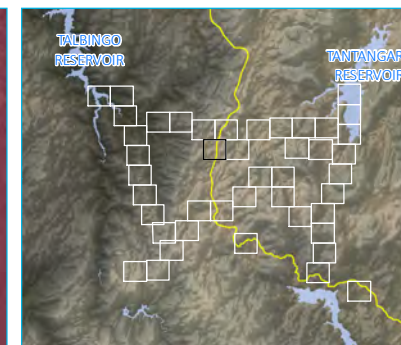
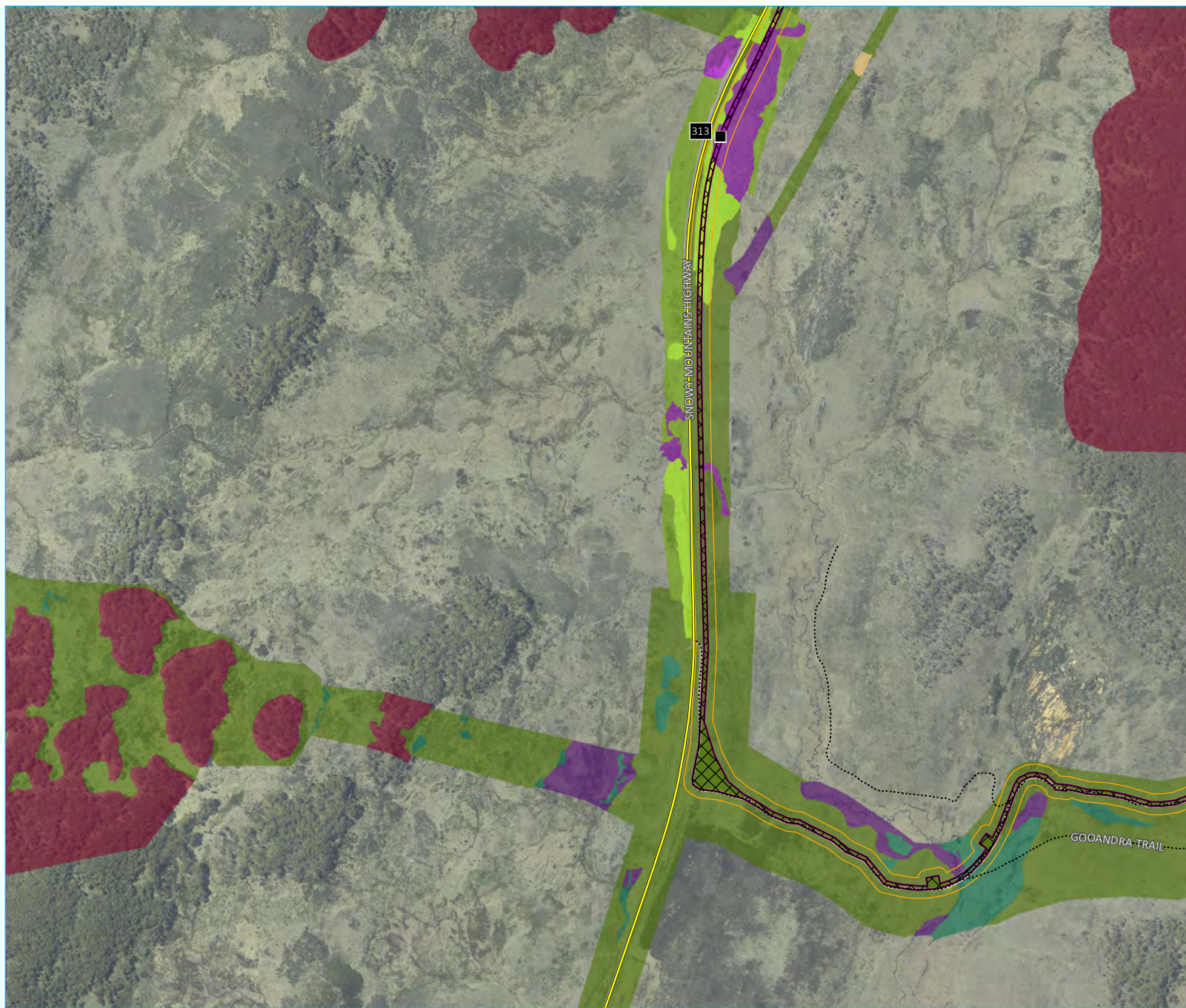
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.9

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



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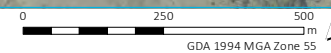
KEY

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

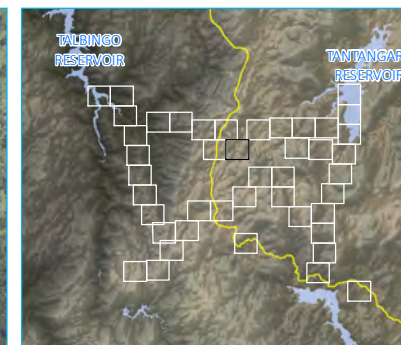
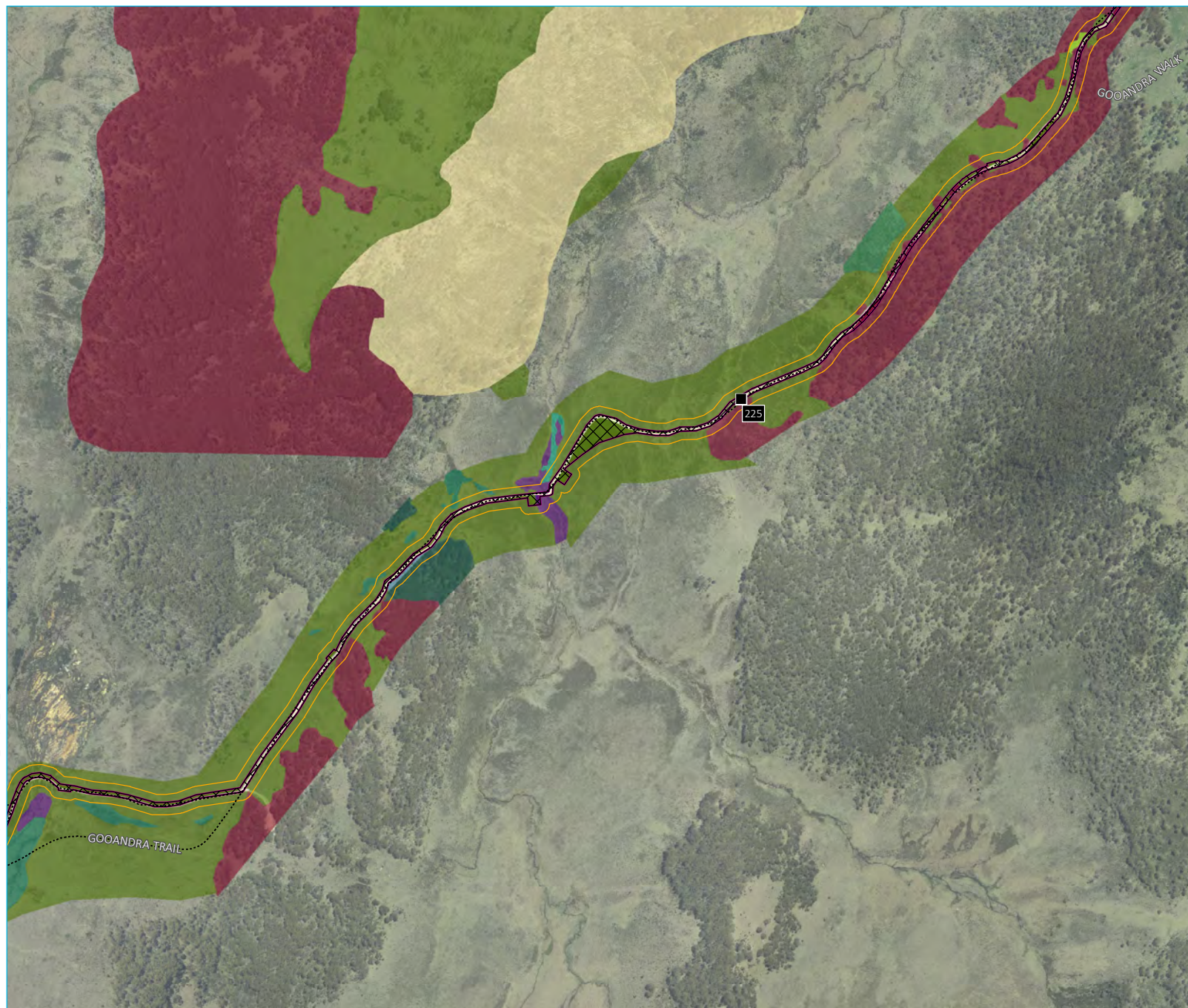
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.10

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



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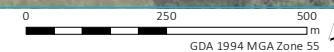
KEY

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

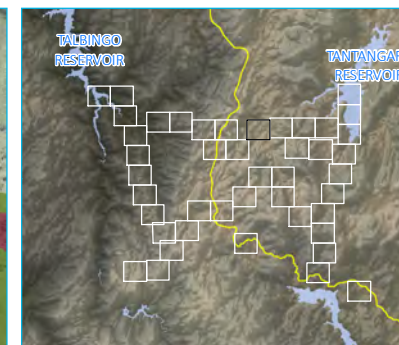
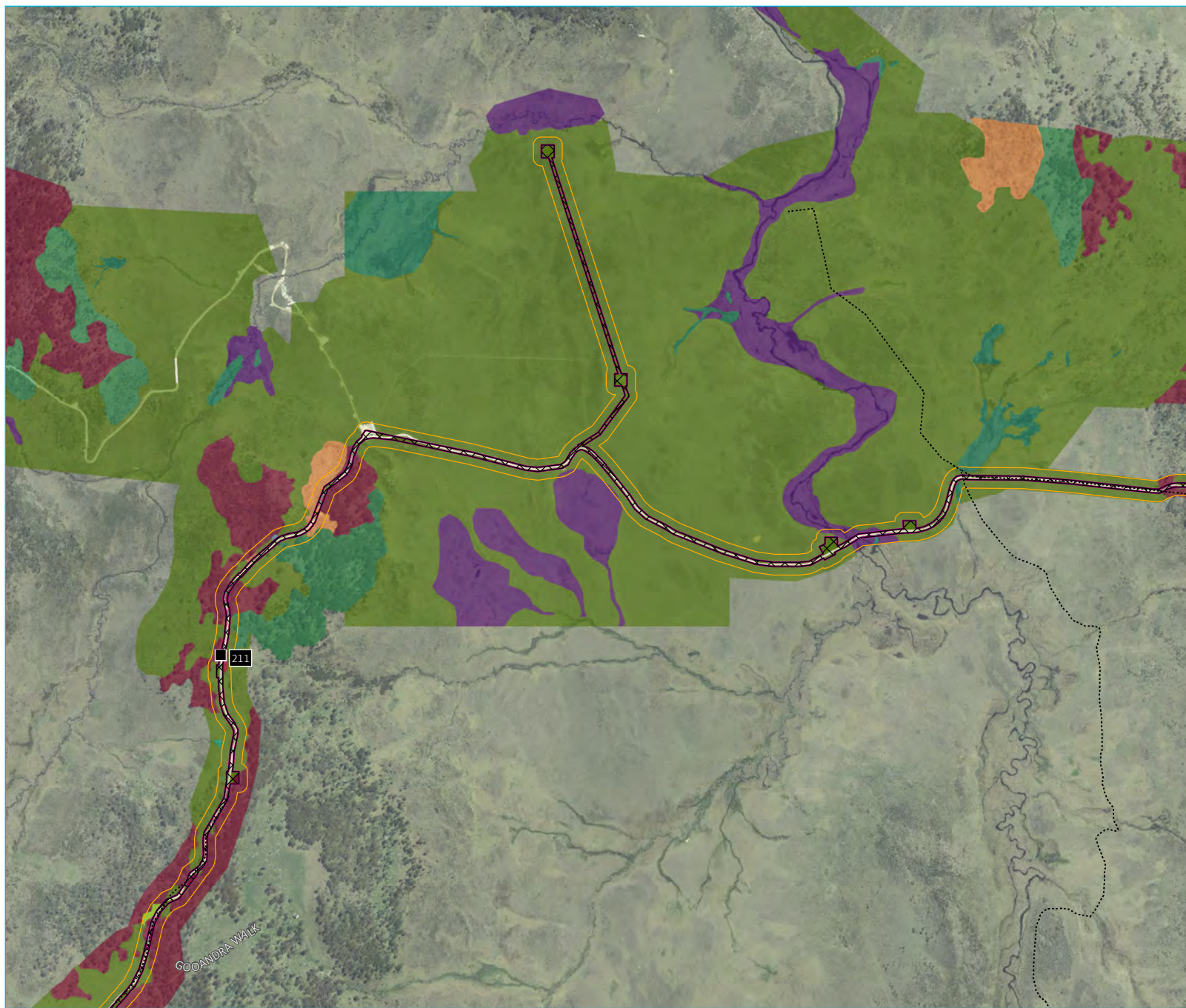
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.11

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



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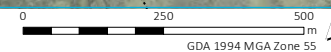
KEY

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

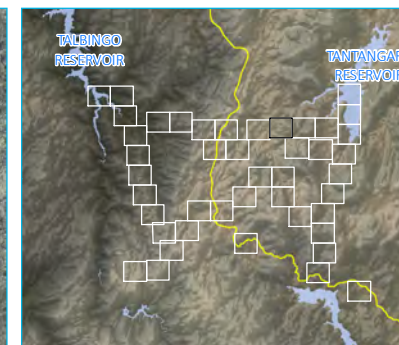
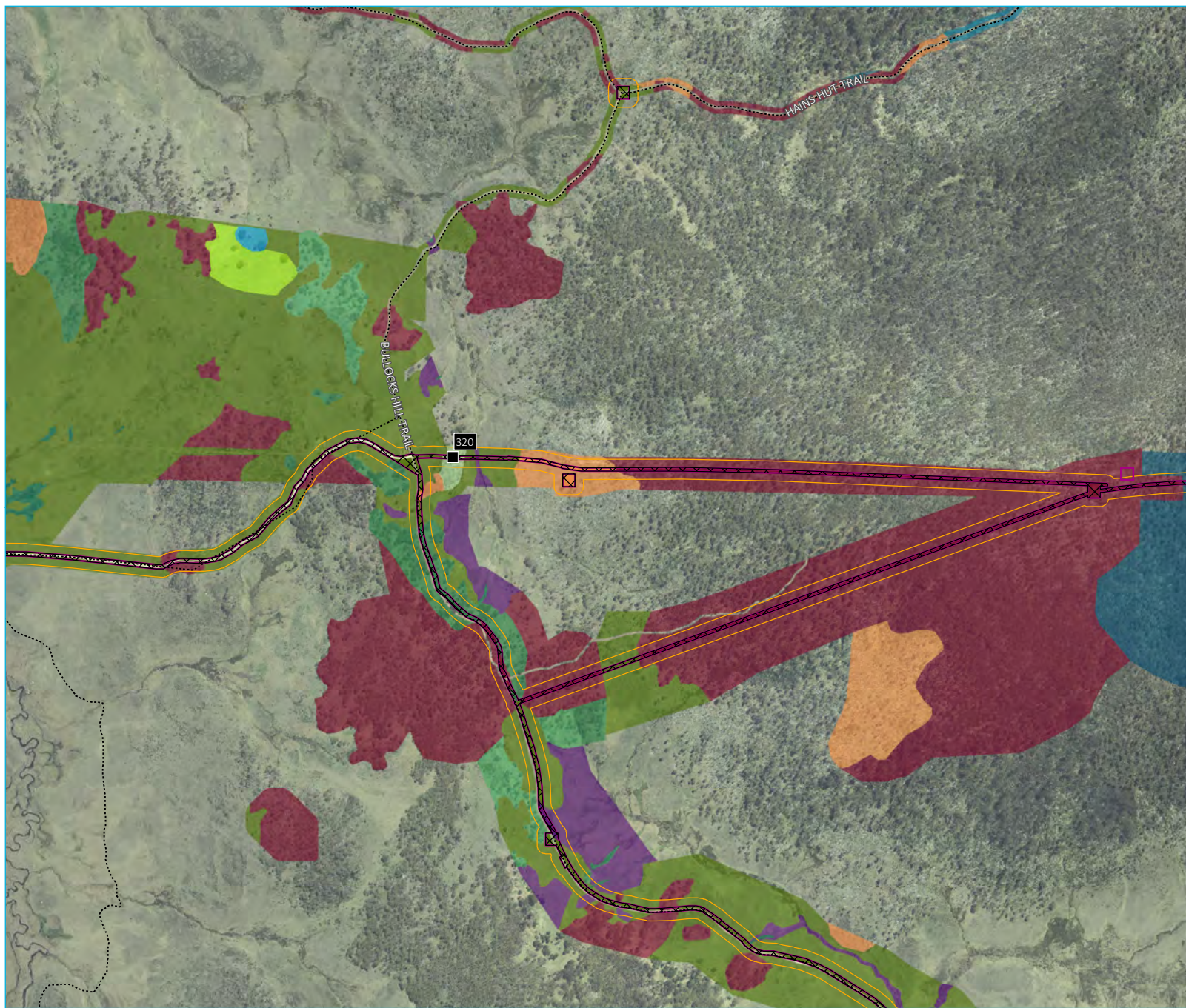
Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.12

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



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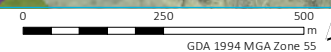


- KEY**
- Plot location
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - PCT 303
 - High
 - Medium
 - Other
 - PCT 637
 - High
 - PCT 644
 - High
 - Other
 - PCT 1196
 - High
 - Medium
 - PCT 1224
 - High
 - Poor
 - PCT 1225
 - High

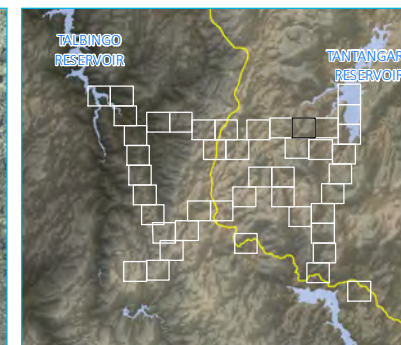
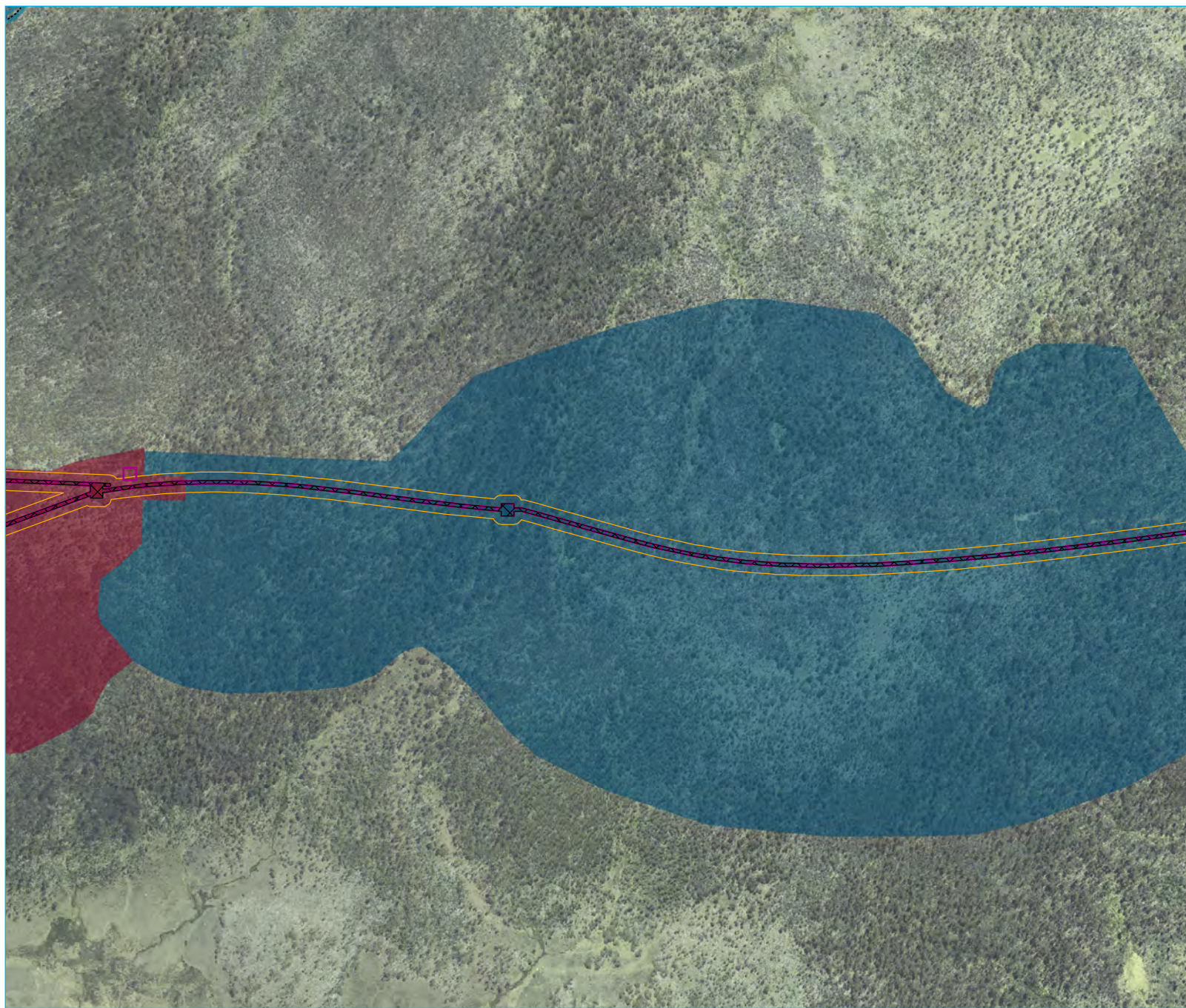
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.13

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



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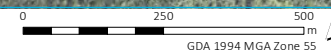


- KEY**
- Vehicular track
 - ⊗ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - High
 - PCT 1196
 - High
 - Medium
 - PCT 644

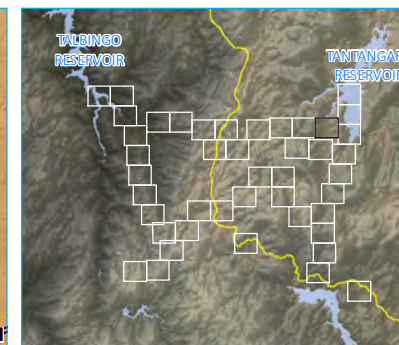
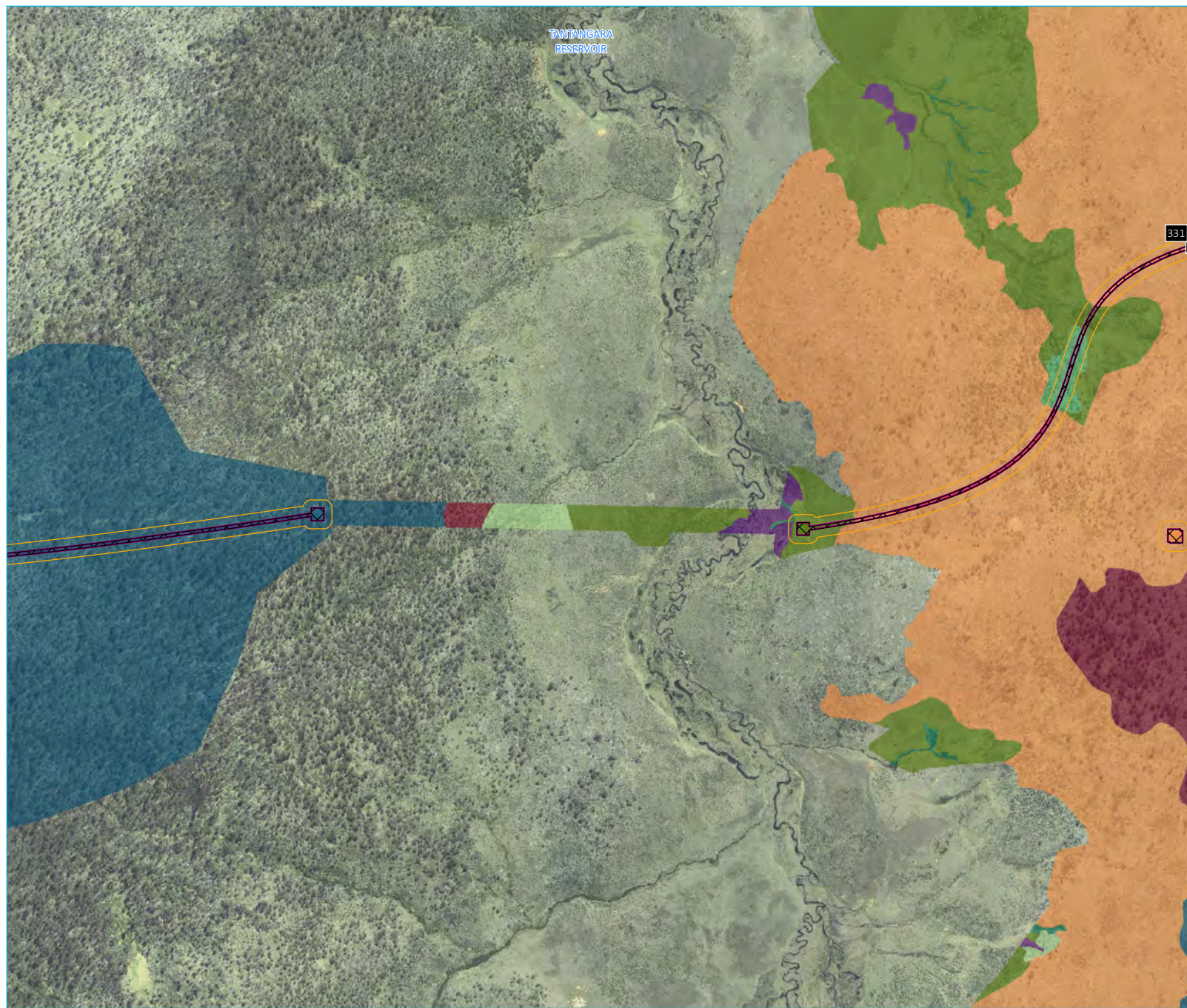
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.14

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



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KEY

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

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

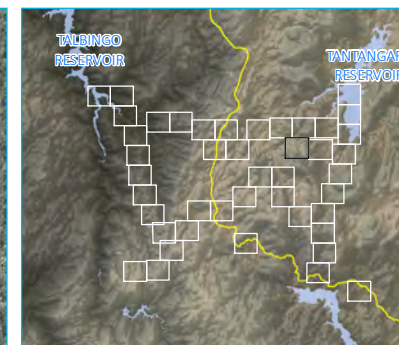
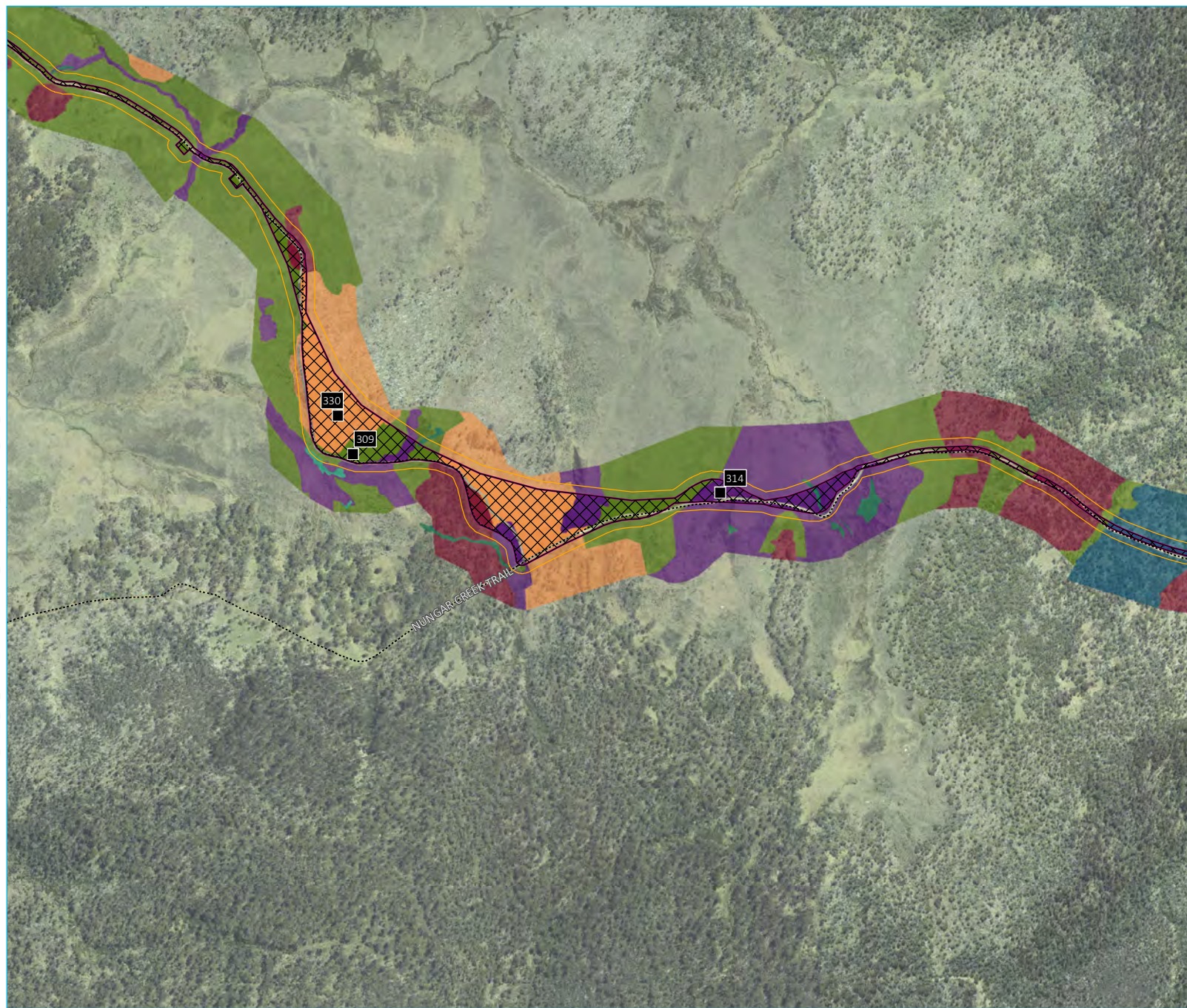
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.15

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

0 250 500
m
GDA 1994 MGA Zone 55



\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MW\BDR\BDR003_PCTsAndPlots_20200203_DDP_02.mxd 20/02/2020



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

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

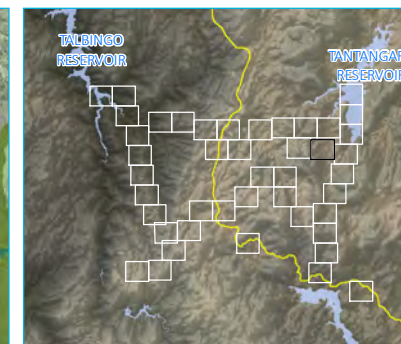
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.16

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

0 250 500
m
GDA 1994 MGA Zone 55



0 250 500 m
GDA 1994 MGA Zone 55



■ Plot location
 Vehicular track
 ⊠ Disturbance area
 □ Indirect disturbance area
 □ Construction envelope
 ■ High
 ■ Other
 ■ High
 ■ Other
 ■ High
 ■ High

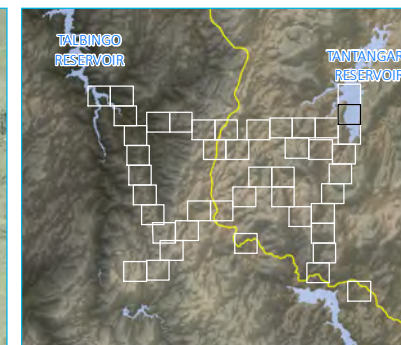
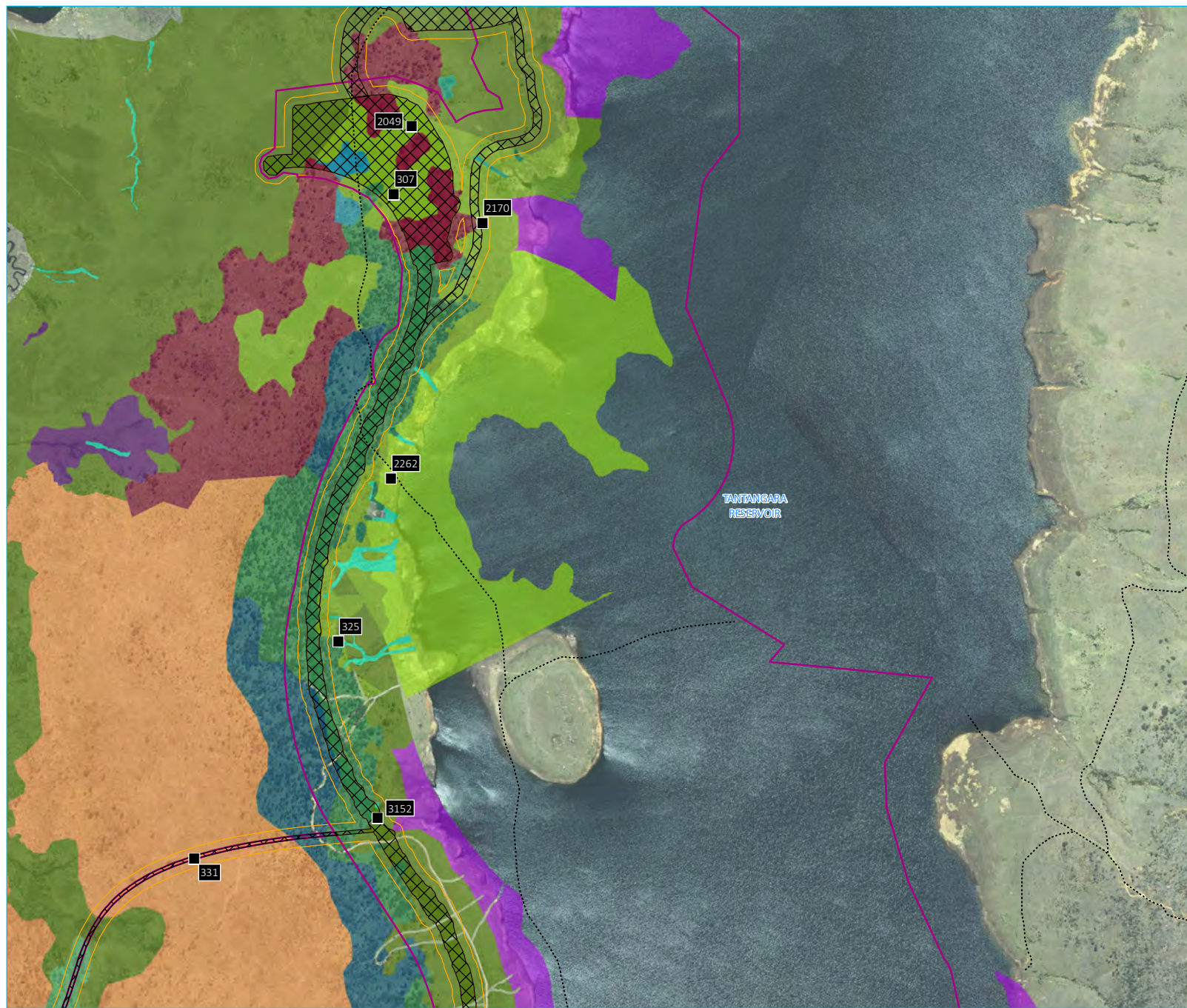
■ Medium
 PCT 644
 ■ High
 ■ Other
 PCT 1196
 ■ High
 PCT 1224
 ■ High
 PCT 1225
 ■ High

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.17



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

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

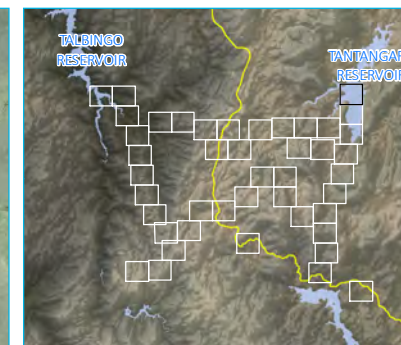
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.18

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

0 250 500
m
GDA 1994 MGA Zone 55



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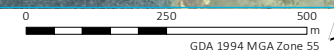
■ Plot location	PCT 644
..... Vehicular track	High
▣ Disturbance area	Other
▤ Indirect disturbance area	PCT 1224
▥ Construction envelope	High
PCT 637	Medium
High	Poor
Medium	Other
Poor	PCT 1225
	High
	Low

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

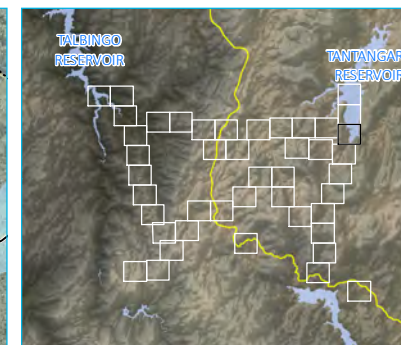
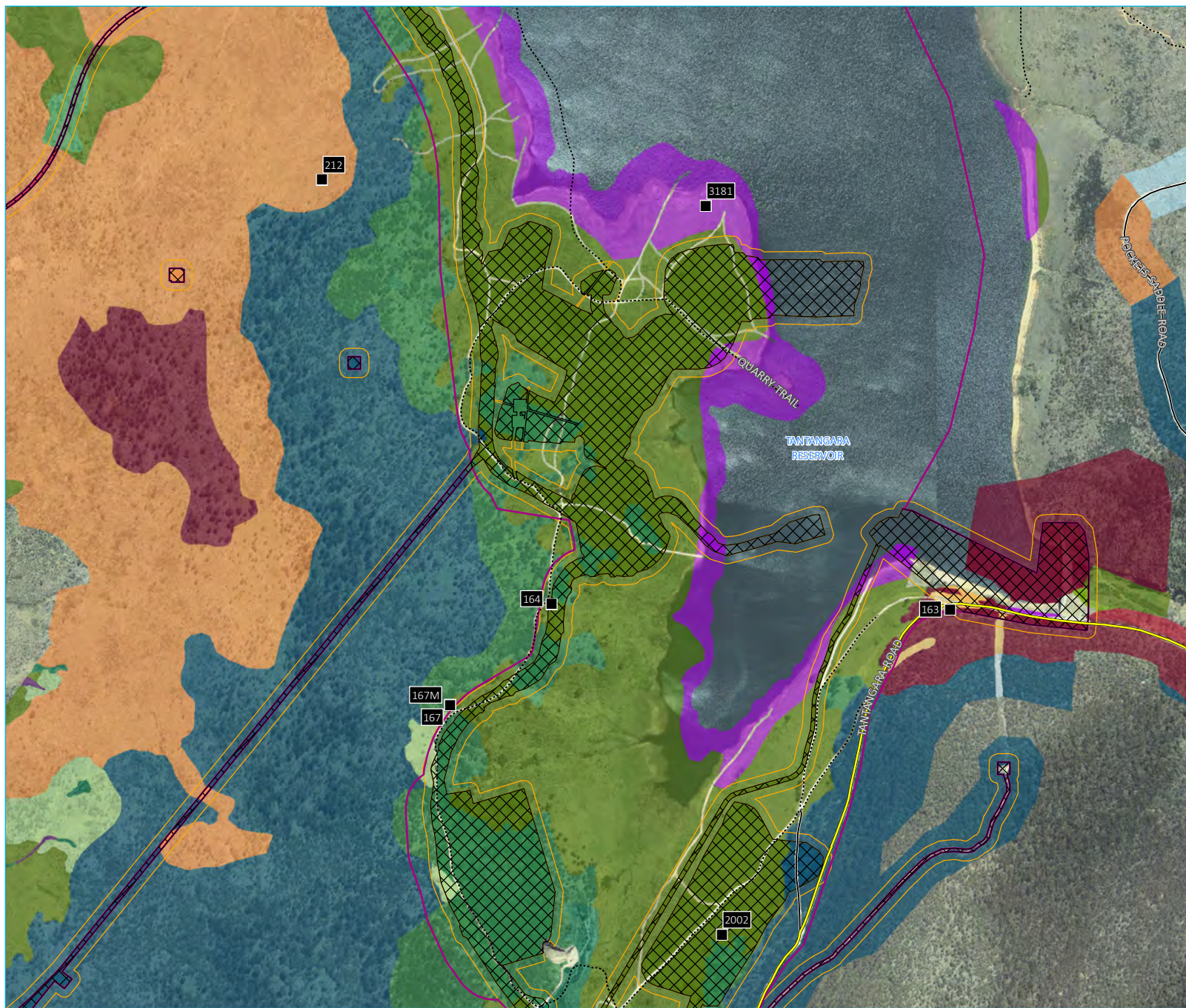
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.19



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



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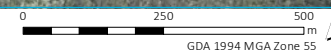
KEY

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

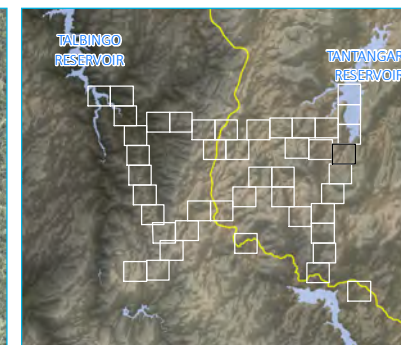
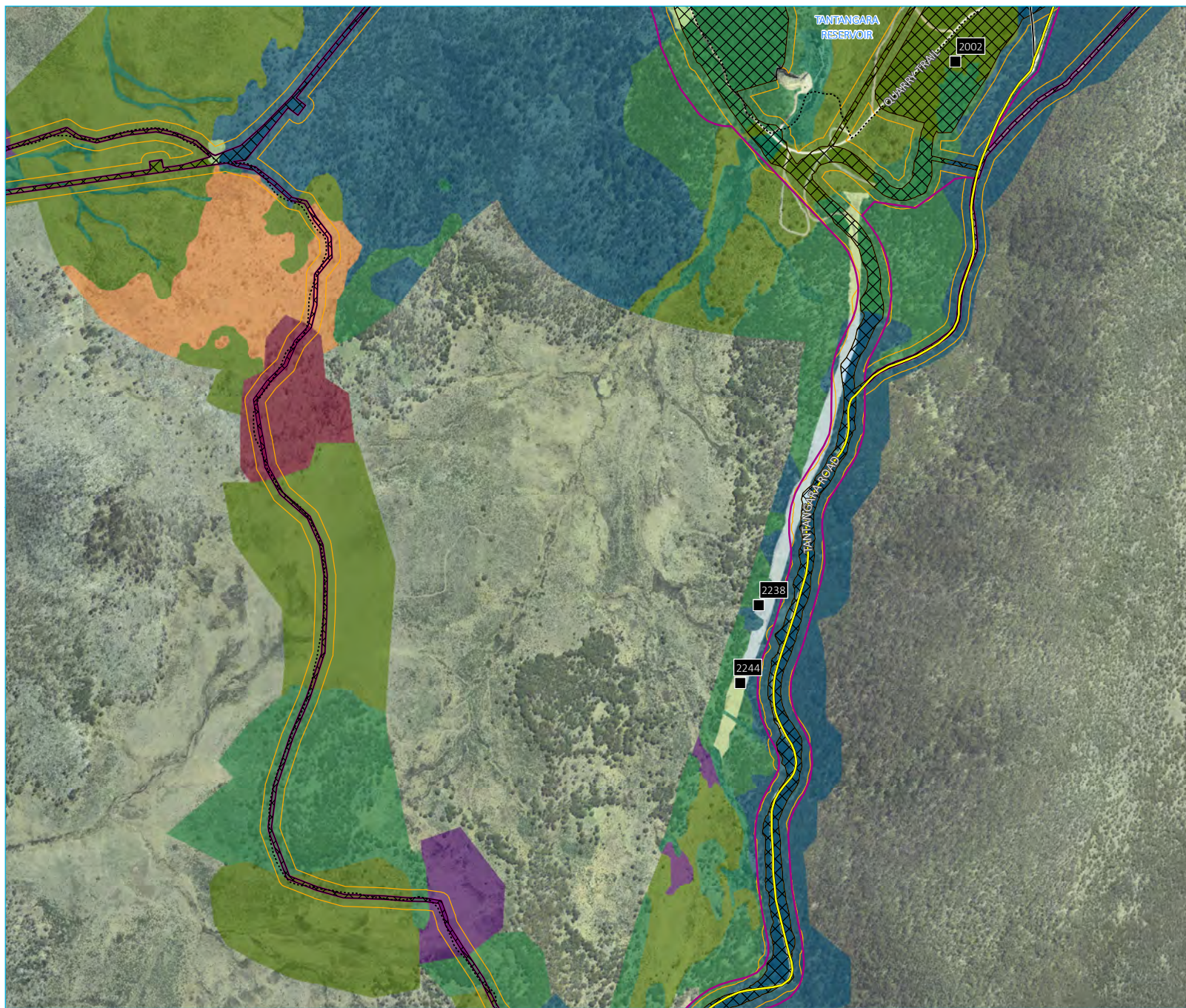
Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.20

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



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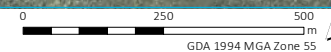
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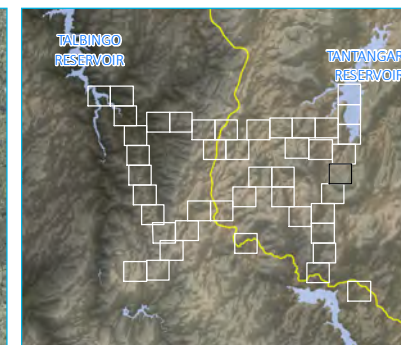
- | | |
|-----------------------------|-------------------|
| ■ Plot location | PCT 637 |
| — Main road | High |
| — Local road | PCT 644 |
| Vehicular track | High |
| ▨ Disturbance area | Other |
| ▨ Indirect disturbance area | PCT 1196 |
| ▨ Construction envelope | High |
| PCT 303 | Derived grassland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

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.21

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



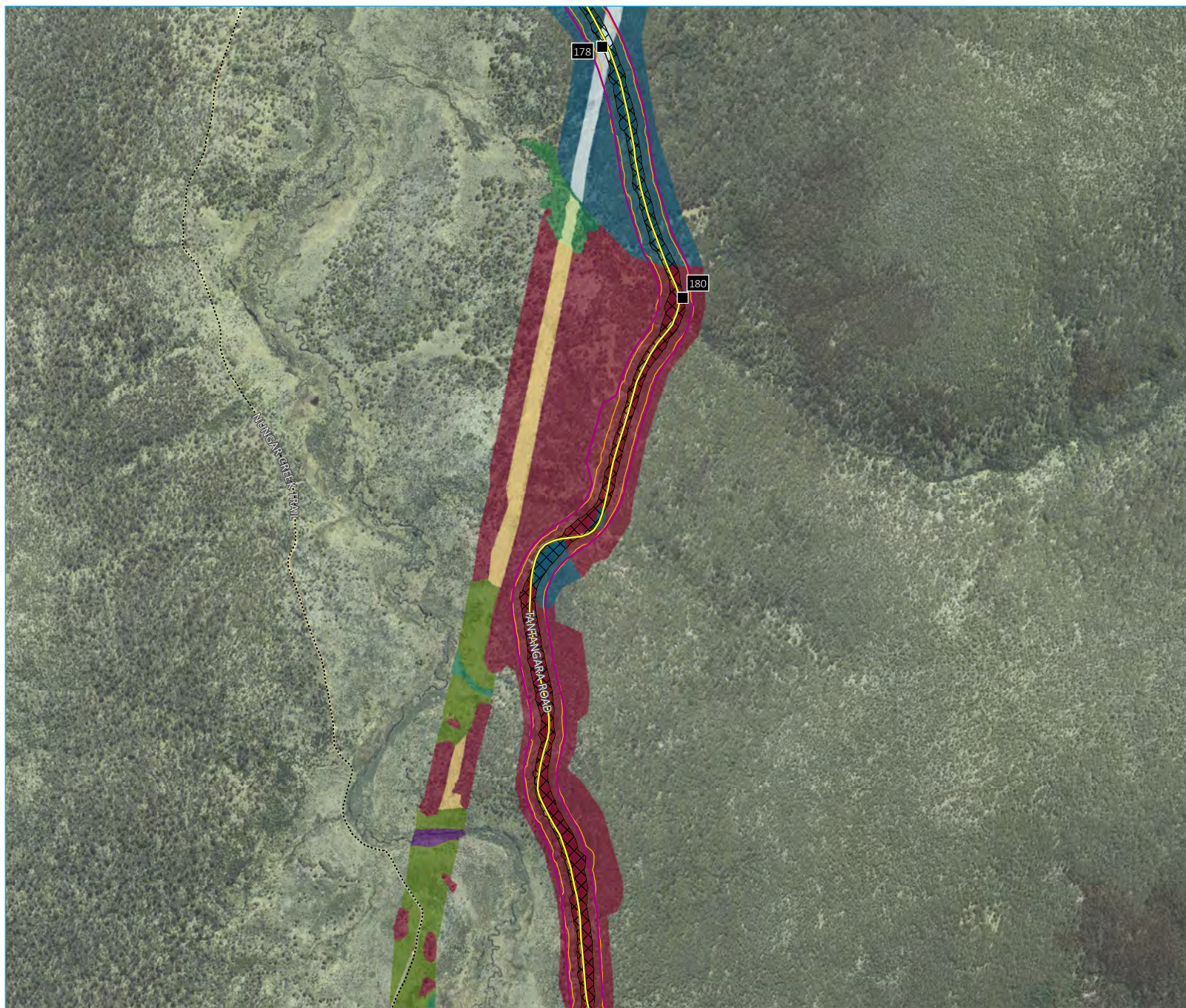


KEY

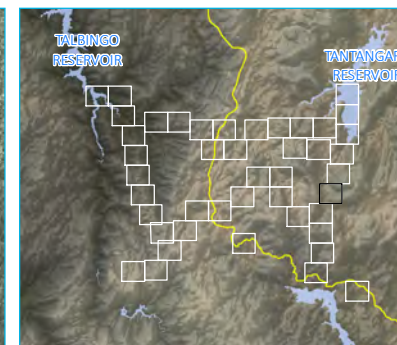
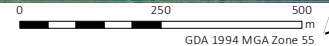
■ Plot location	PCT 637
— Main road	High
..... Vehicular track	PCT 1196
▨ Disturbance area	High
▨ Indirect disturbance area	Derived grassland
▨ Construction envelope	PCT 1224
PCT 303	High
High	PCT 1225
	High

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.22



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



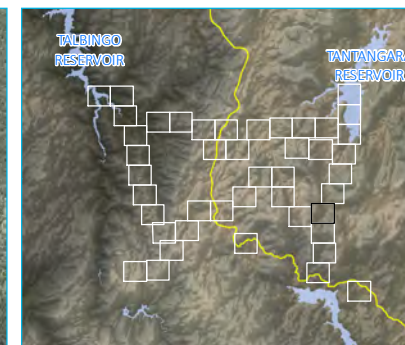
KEY

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

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.23





KEY

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

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

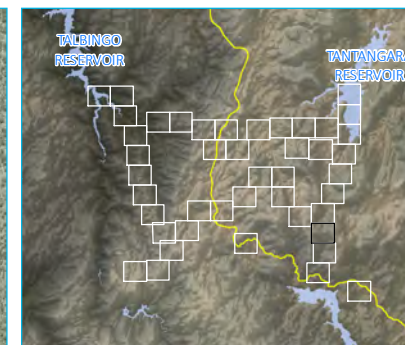
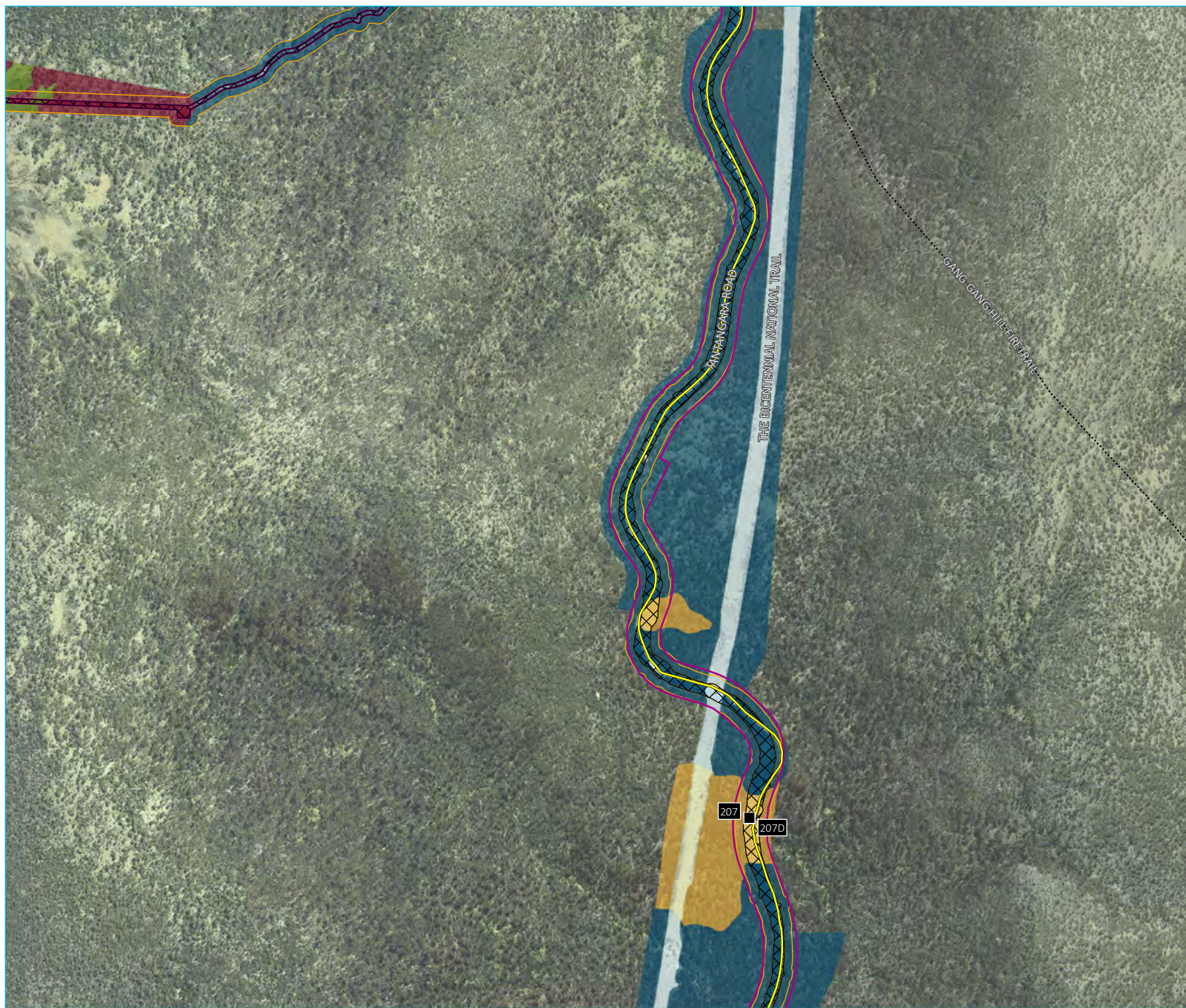
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.24

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

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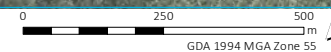
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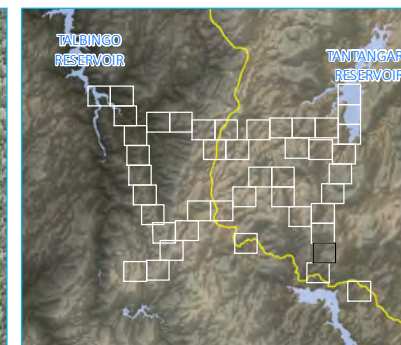
■ Plot location	Derived grassland
— Main road	PCT 644
..... Vehicular track	High
⊠ Disturbance area	PCT 1196
□ Indirect disturbance area	High
□ Construction envelope	Derived grassland
PCT 639	PCT 1224
High	High

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.25

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





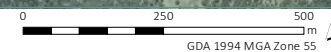
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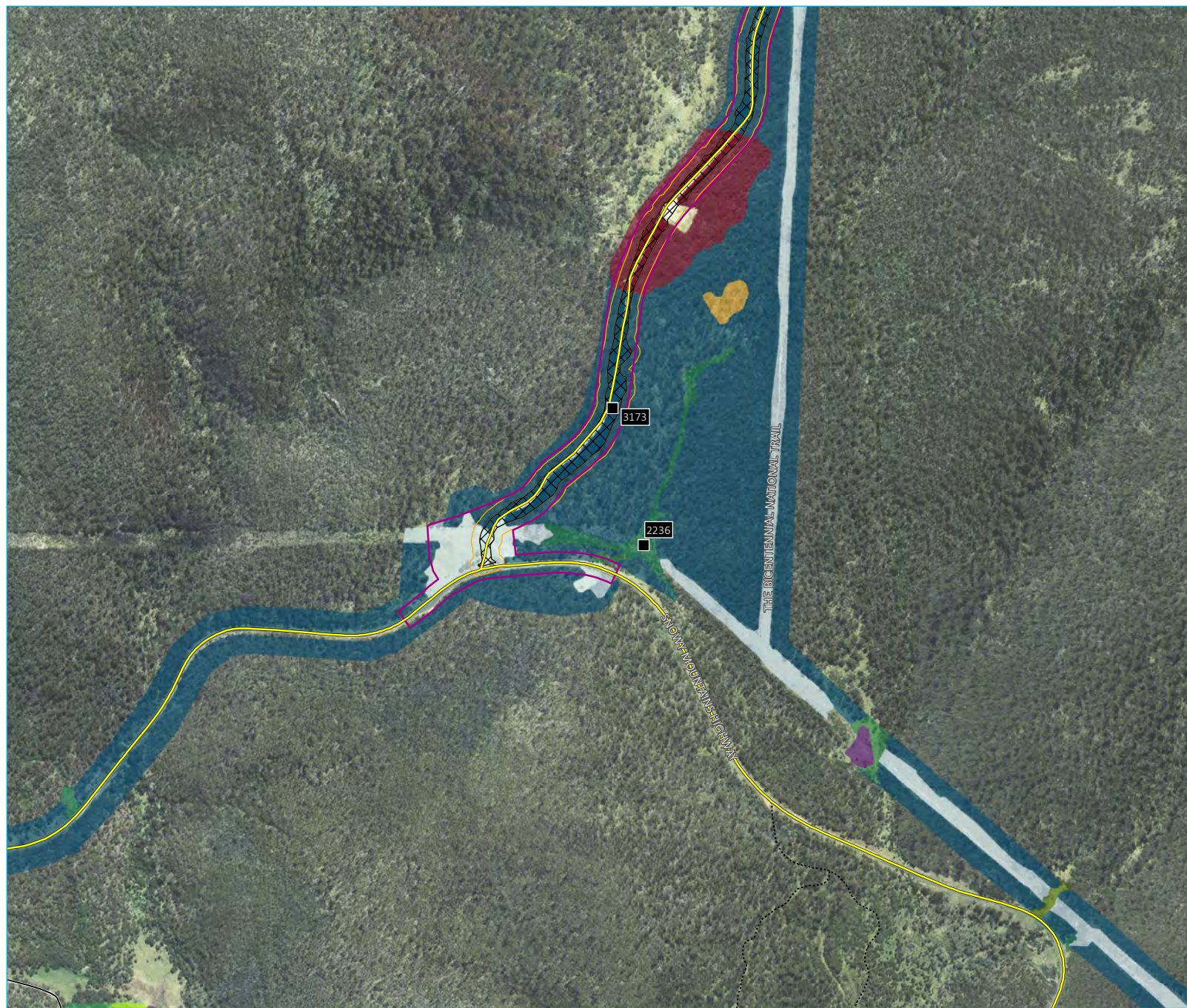
- | | |
|-----------------------------|-------------------|
| ■ Plot location | PCT 639 |
| — Main road | High |
| ⊗ Disturbance area | Derived grassland |
| ⊞ Indirect disturbance area | PCT 644 |
| — Construction envelope | High |
| PCT 303 | PCT 1196 |
| High | High |
| Derived grassland | Derived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

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

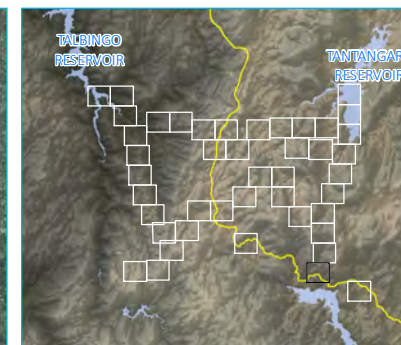
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.26

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





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



KEY

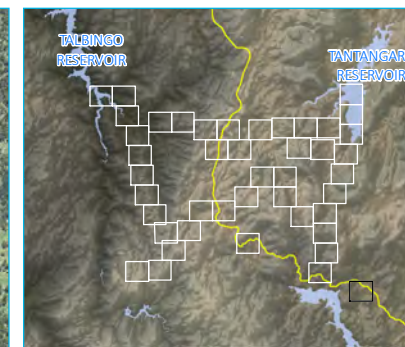
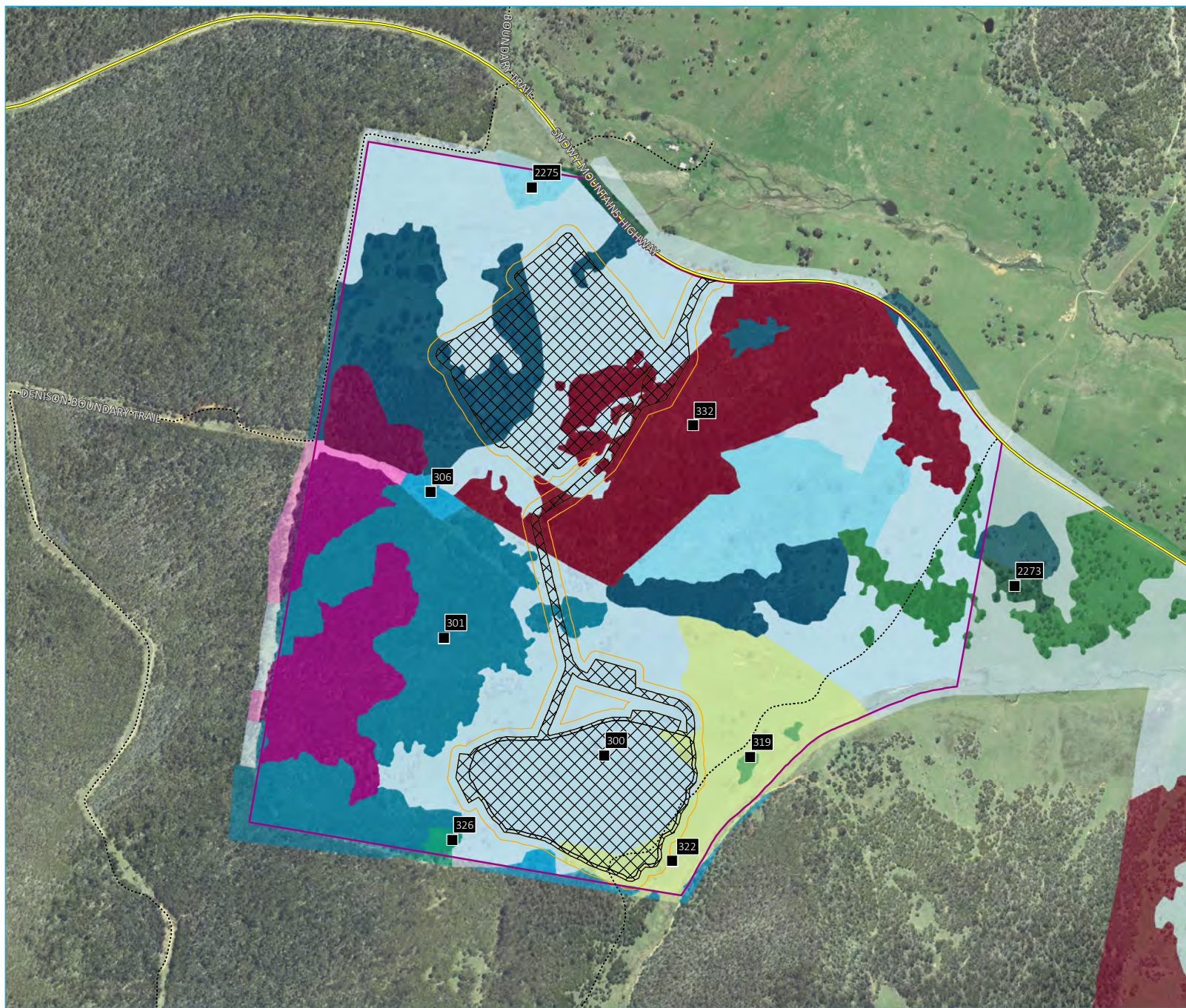
- | | |
|-----------------------------|-------------------|
| ■ Plot location | PCT 639 |
| — Main road | High |
| — Local road | PCT 644 |
| Vehicular track | High |
| ▨ Disturbance area | PCT 1196 |
| — Indirect disturbance area | High |
| — Construction envelope | Derived grassland |
| PCT 303 | PCT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

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.27



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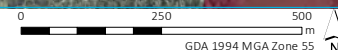
KEY

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

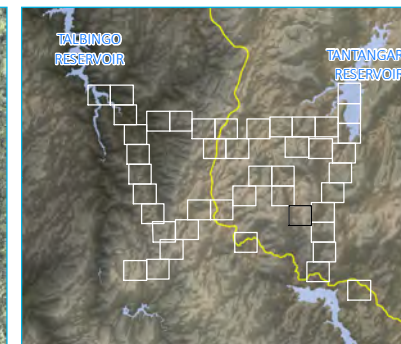
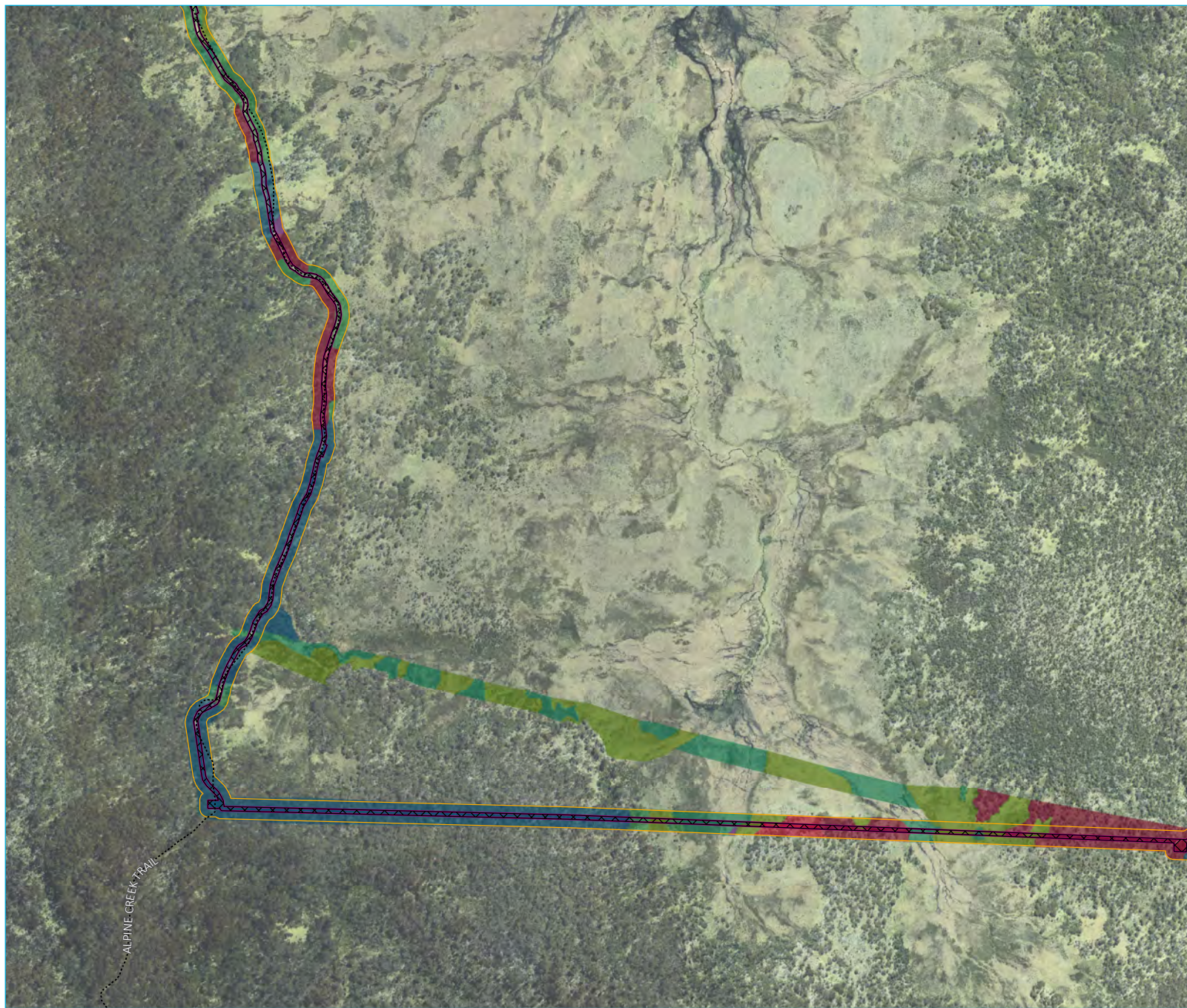
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.28

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



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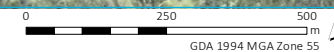
KEY

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

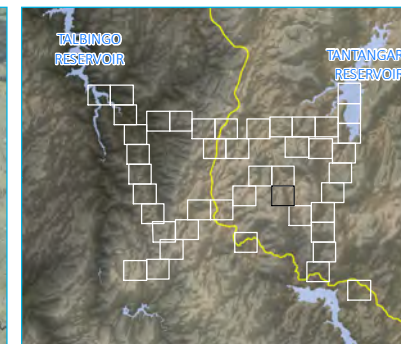
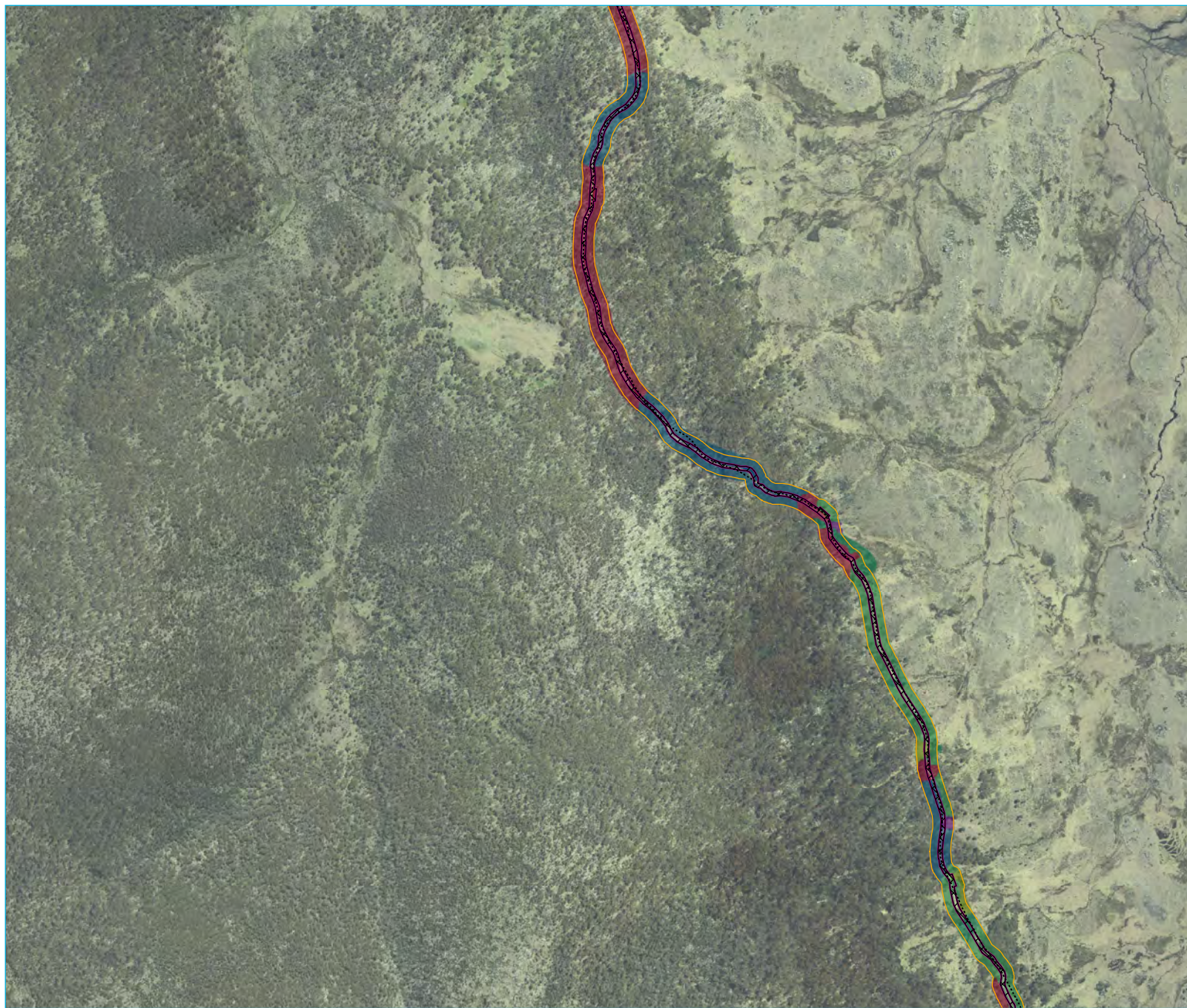
Plant Community Type and vegetation zone mapping within the Main Works disturbance footprint, including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.29

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



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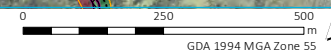
KEY

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

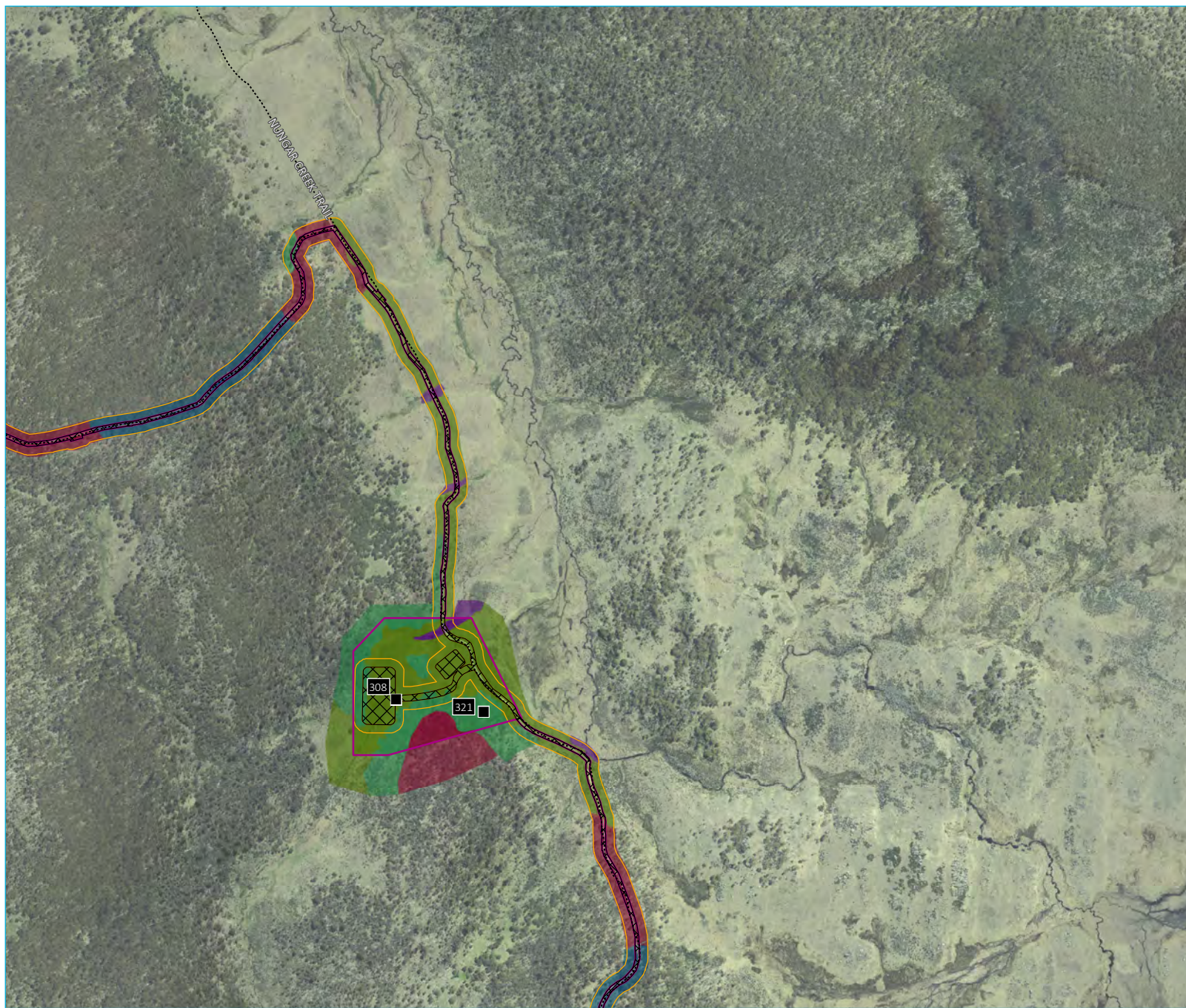
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.30

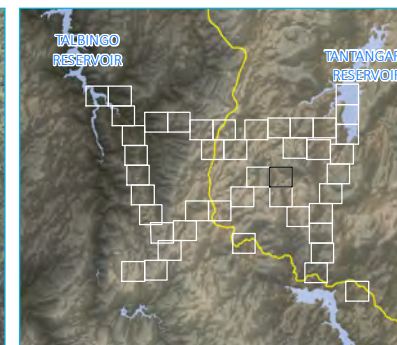
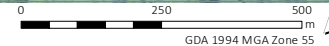
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



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



KEY

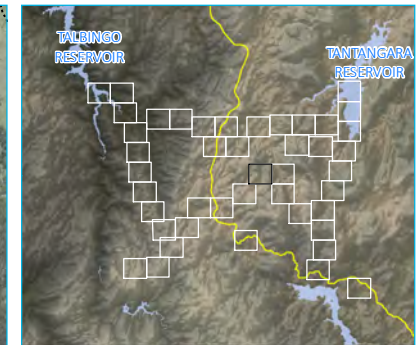
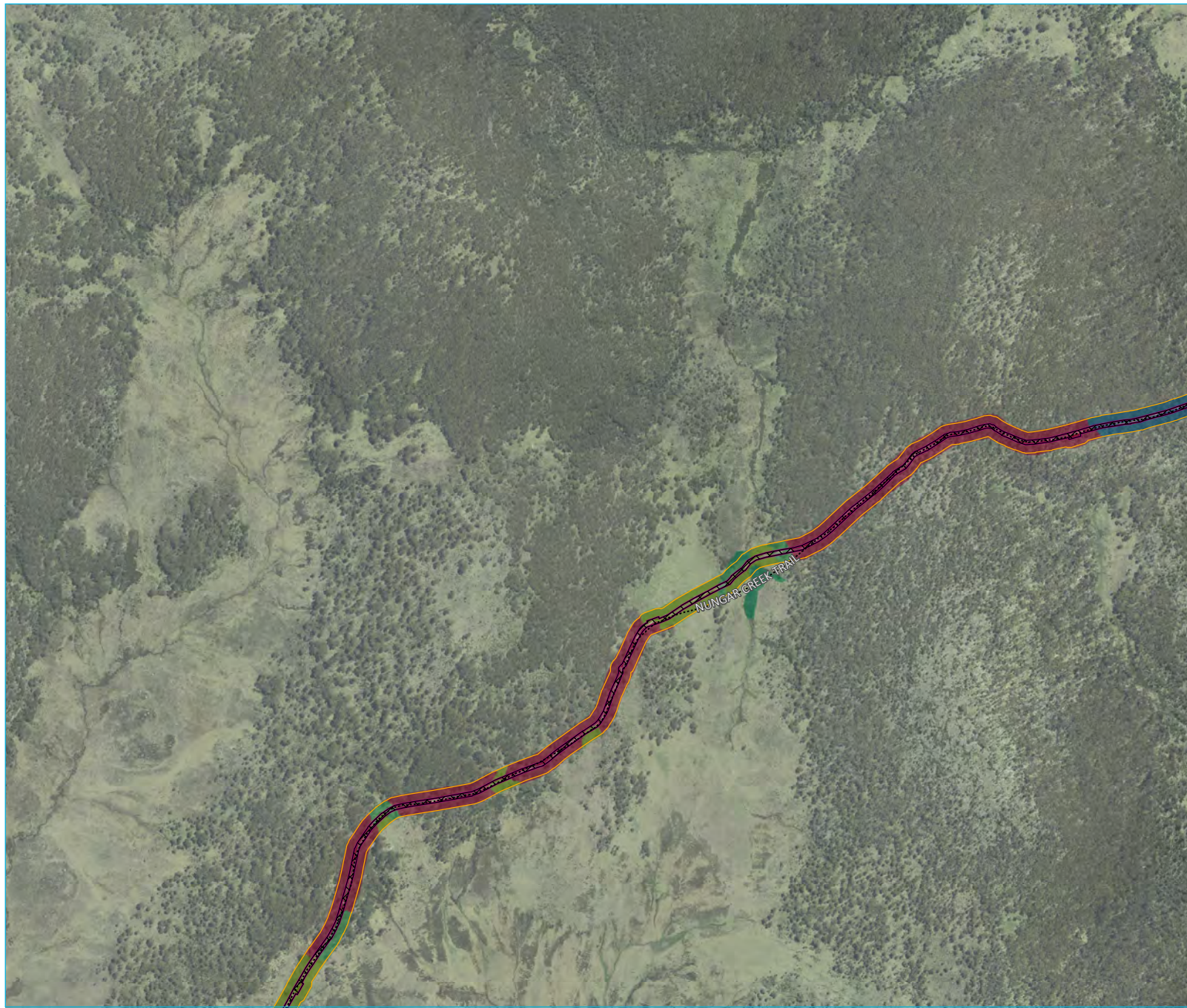
■ Plot location	PCT 644
..... Vehicular track	PCT 1196
⊠ Disturbance area	High
□ Indirect disturbance area	PCT 1224
□ Construction envelope	High
PCT 303	PCT 1225
High	High

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.31



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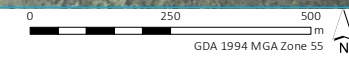


- KEY**
- Vehicular track
 - ⊗ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - PCT 303 High
 - PCT 637 High
 - PCT 644 High
 - PCT 1196 High
 - PCT 1224 High

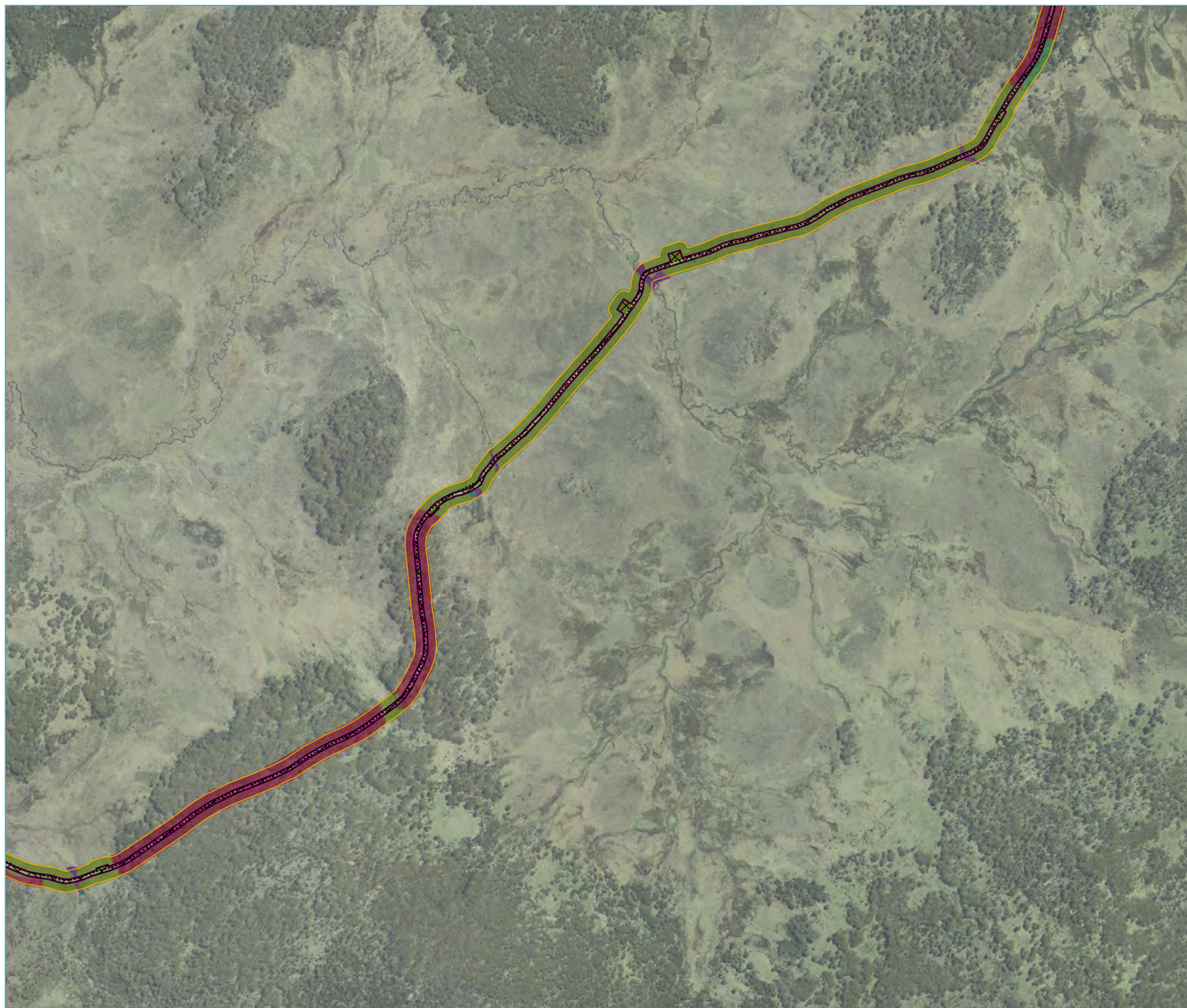
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.32

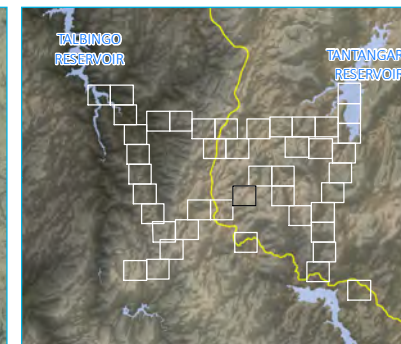
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



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



KEY

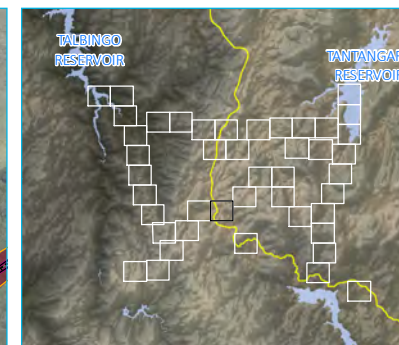
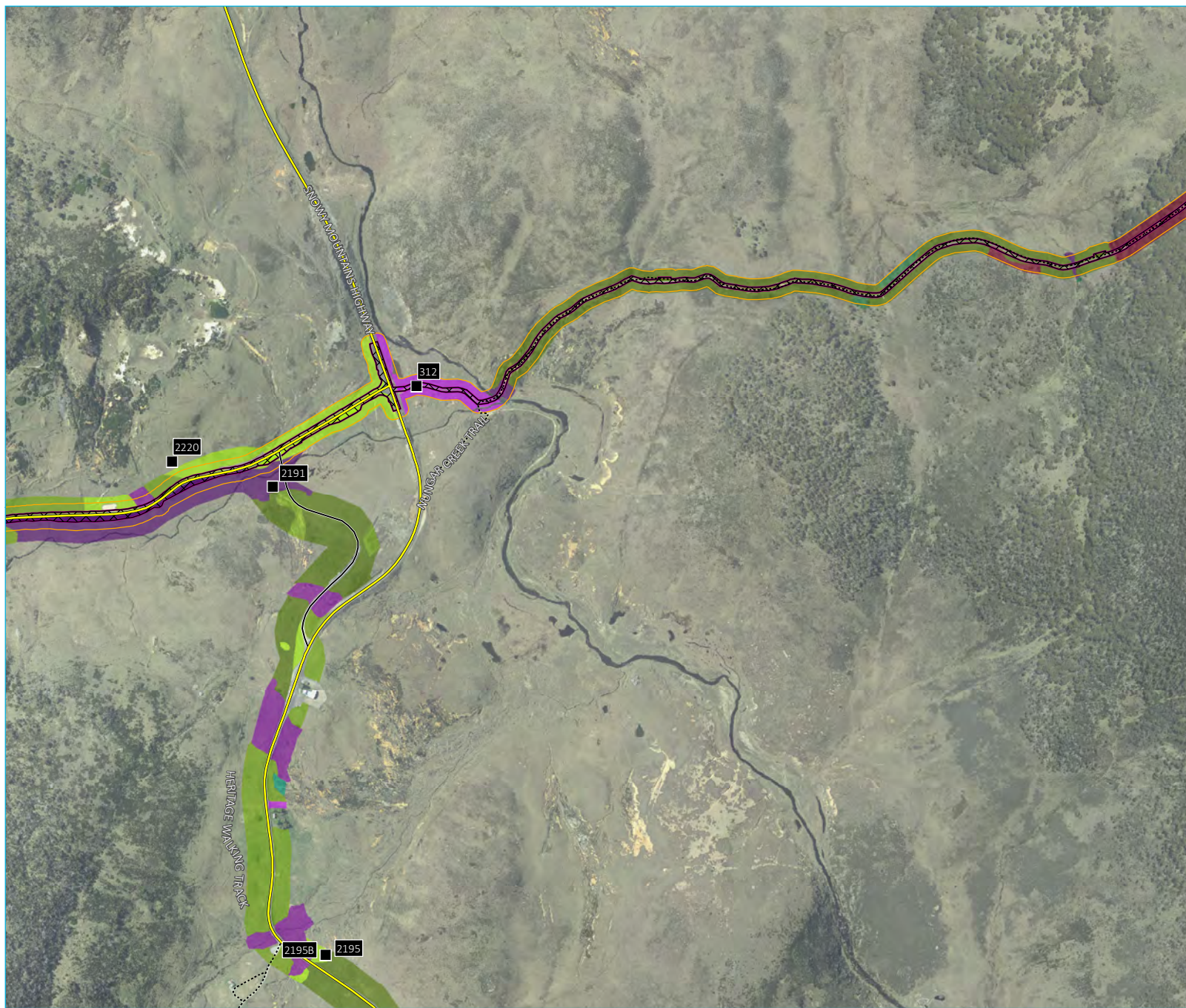
.....	Vehicular track	PCT 637	High
⊗	Disturbance area	PCT 644	High
□	Indirect disturbance area	PCT 1224	High
□	Construction envelope	PCT 1225	High
■	PCT 303		
■	High		

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.33



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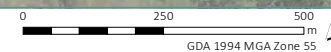
KEY

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

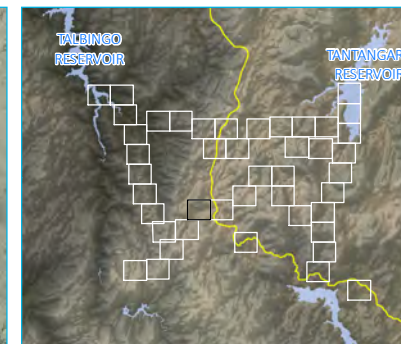
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.34

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



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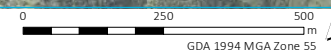
KEY

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

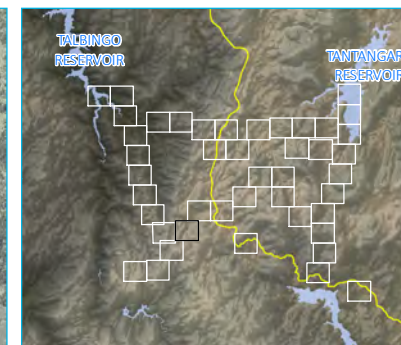
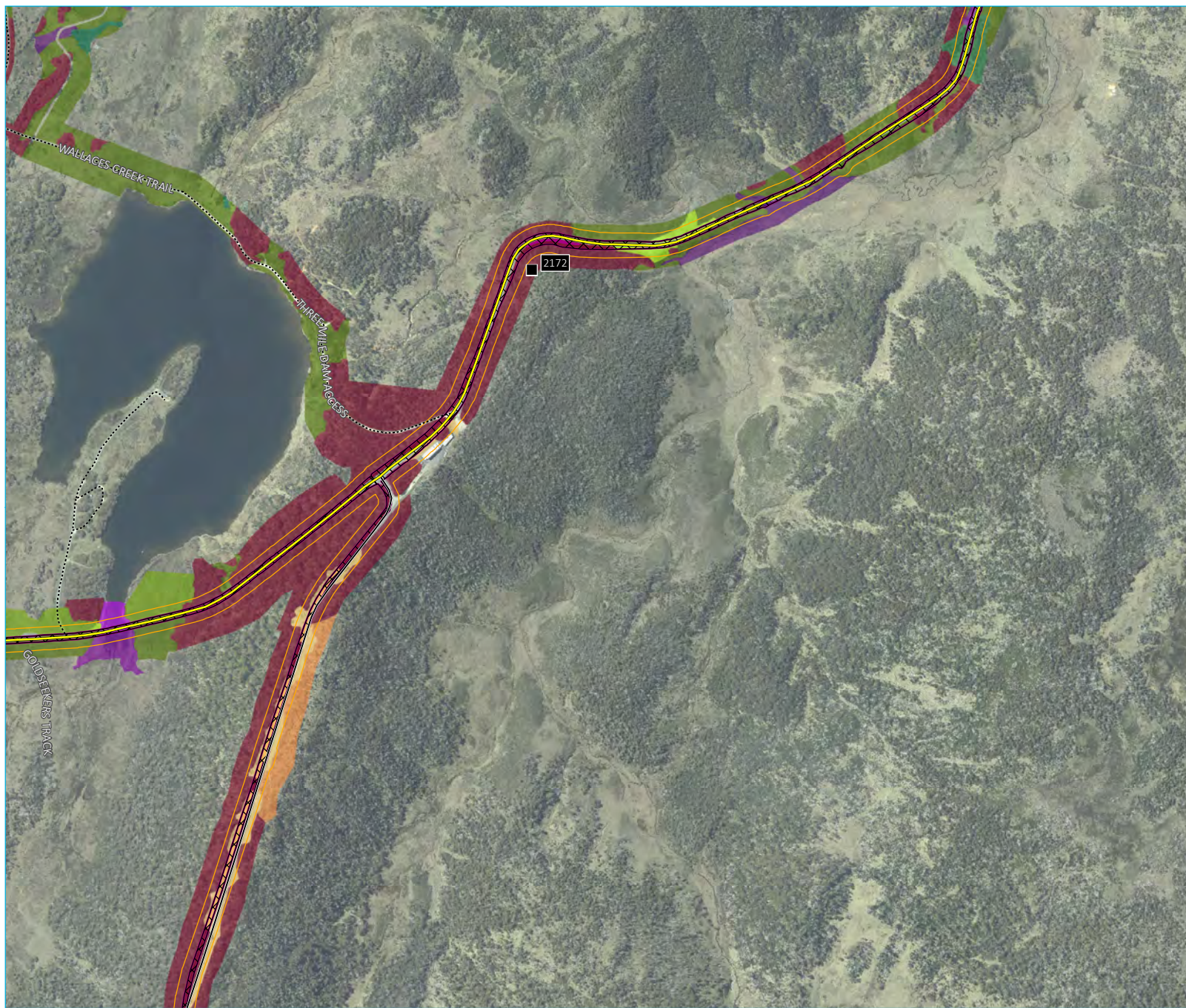
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.35

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



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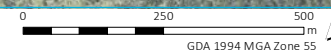
KEY

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

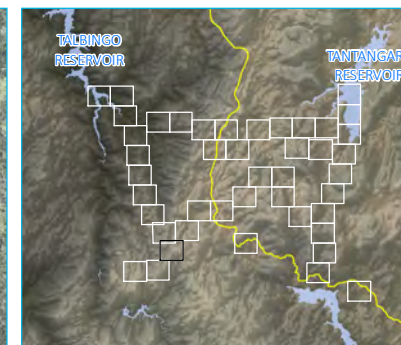
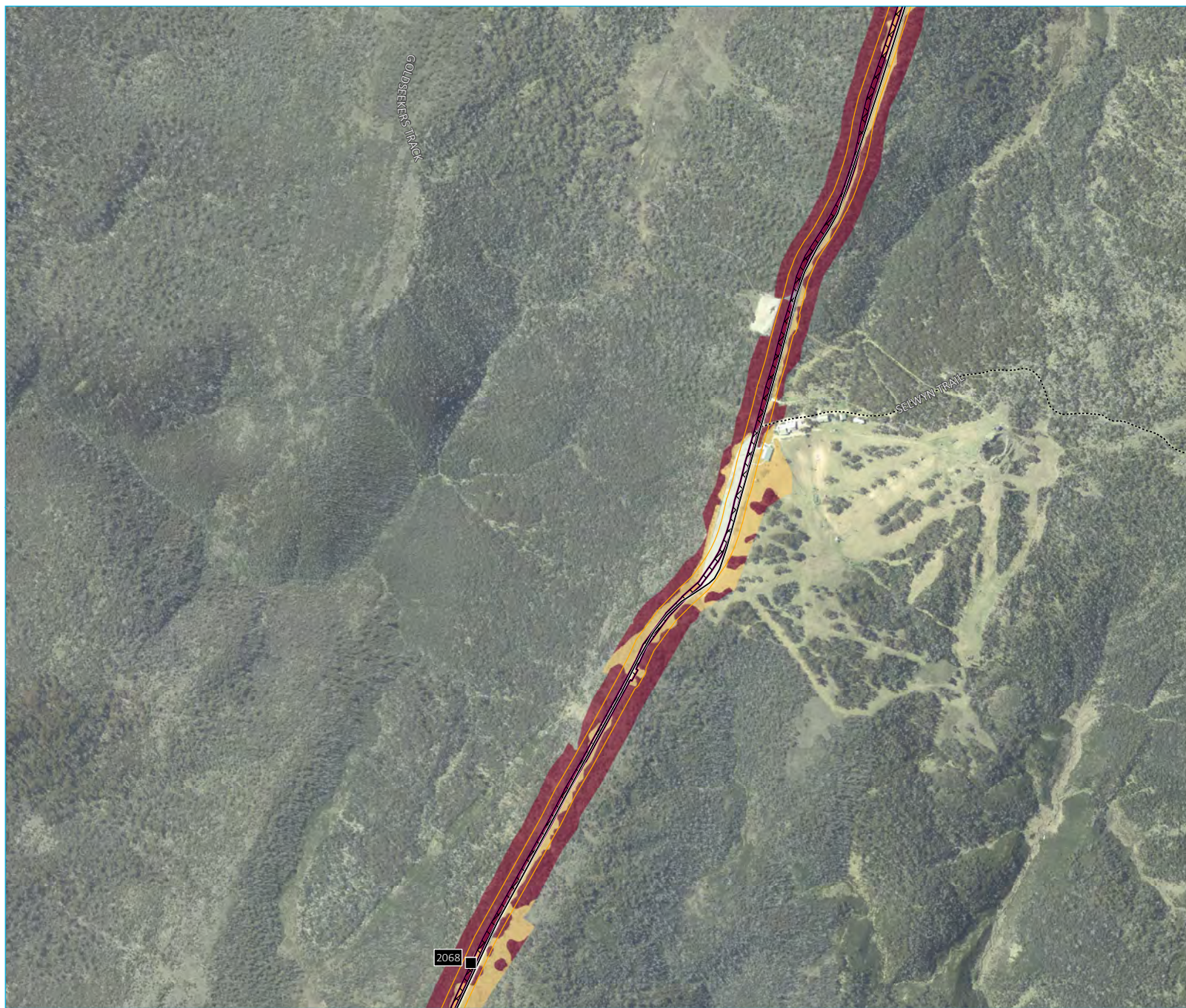
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.36

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



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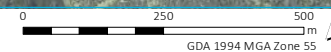


- KEY**
- Plot location
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - PCT 644
 - High
 - Derived grassland

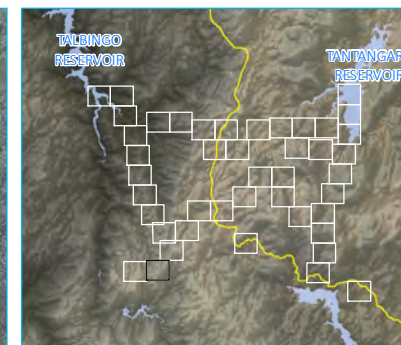
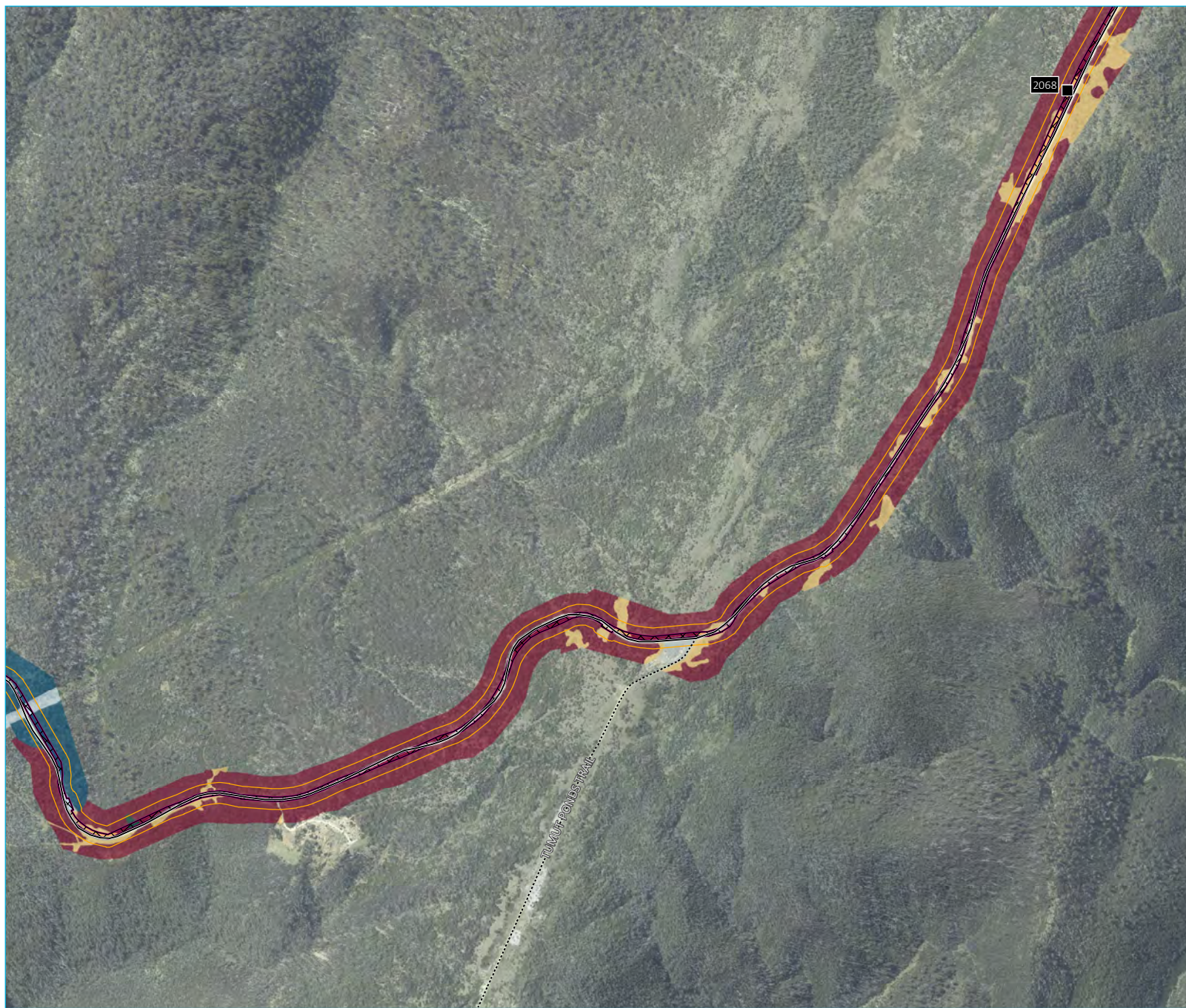
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.37

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



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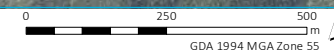
KEY

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

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.38

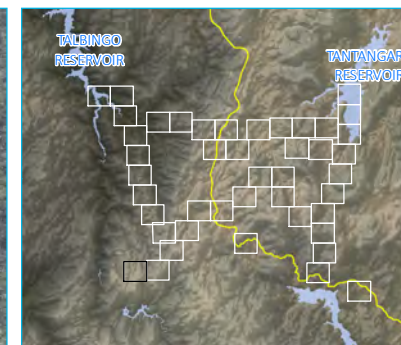
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



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



KEY

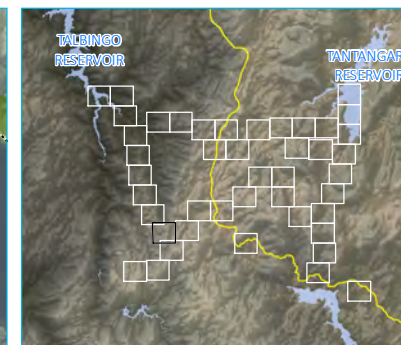
- | | |
|-----------------------------|---------------------|
| ■ Plot location | PCT 679 |
| — Main road | ■ High |
| — Local road | PCT 1196 |
| Vehicular track | ■ High |
| ⊠ Disturbance area | ■ Derived grassland |
| □ Indirect disturbance area | PCT 1224 |
| □ Construction envelope | ■ High |
|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

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.39



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KEY

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

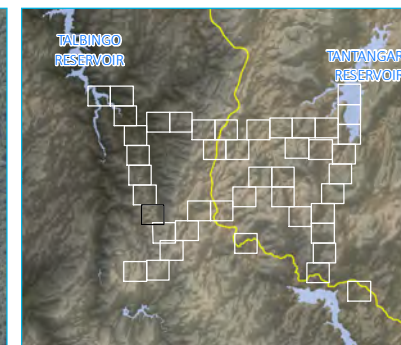
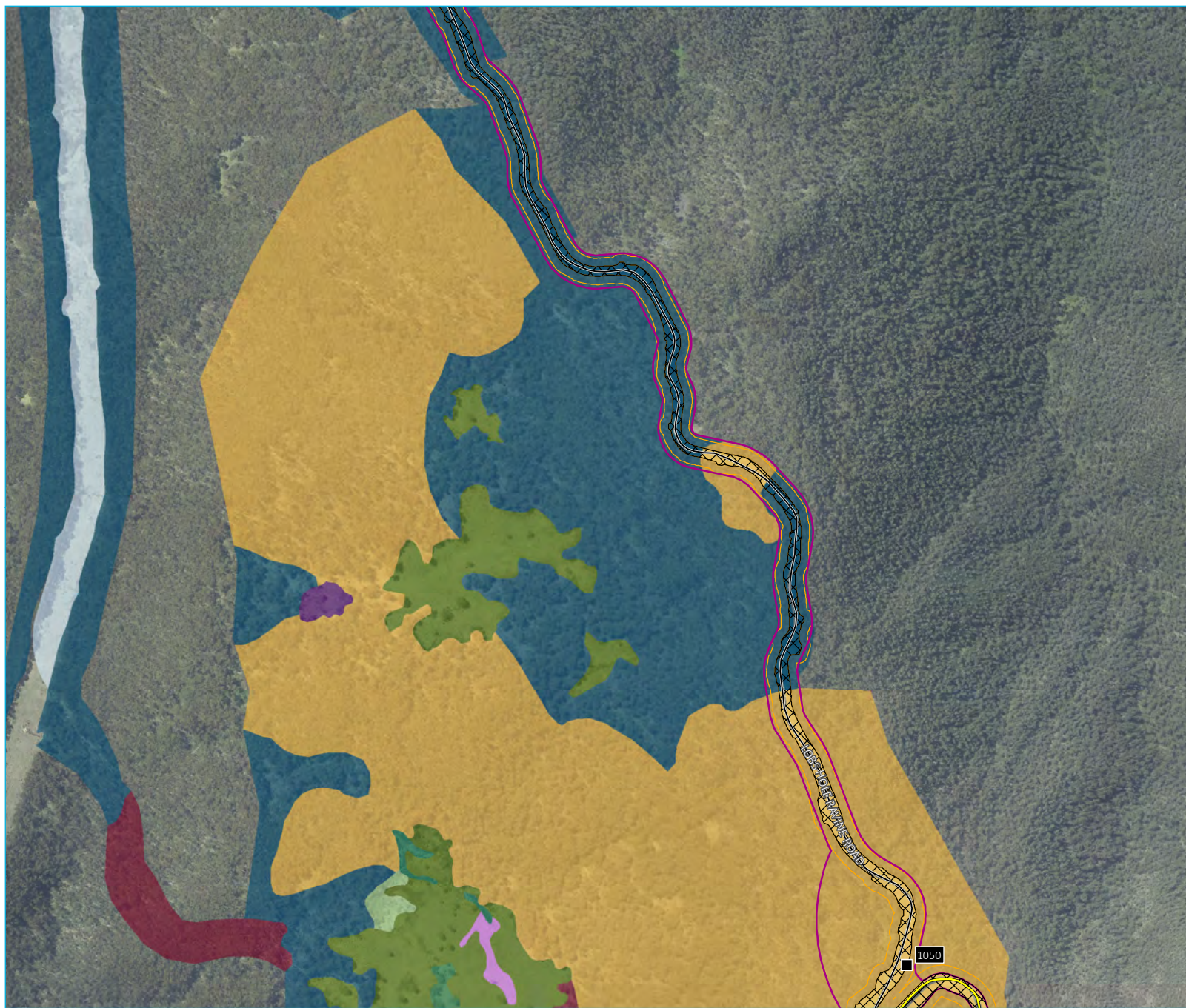
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.40

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

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GDA 1994 MGA Zone 55





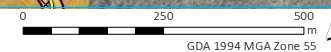
KEY

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

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

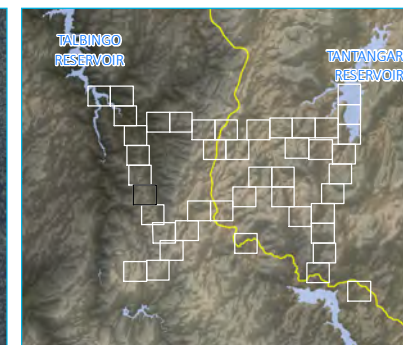
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.41

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





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

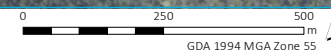


KEY

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

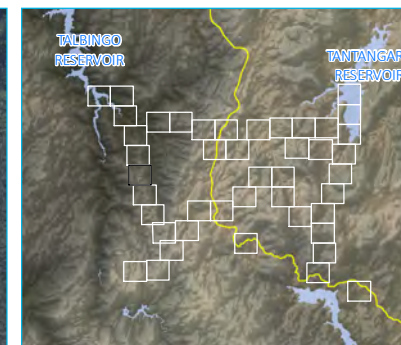
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.42





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



KEY

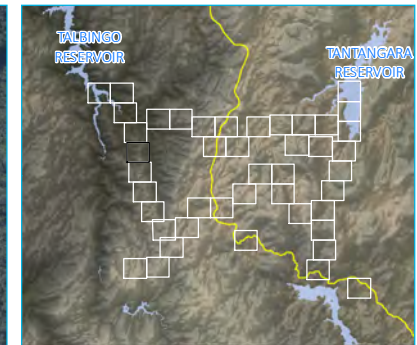
■ Plot location	PCT 643
— Local road	Low
..... Vehicular track	PCT 938
⊠ Disturbance area	High
□ Indirect disturbance area	PCT 953
□ Construction envelope	High
PCT 300	Derived grassland
High	PCT 1196
PCT 303	High
High	Derived grassland

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.43



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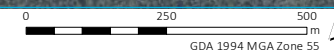


- KEY**
- Plot location
 - Local road
 - Vehicular track
 - ▨ Disturbance area
 - ▭ Indirect disturbance area
 - ▭ Construction envelope
 - PCT 729
 - PCT 300
 - High
 - High

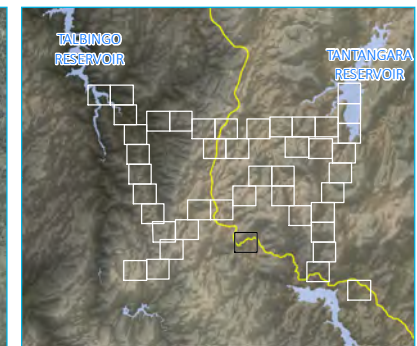
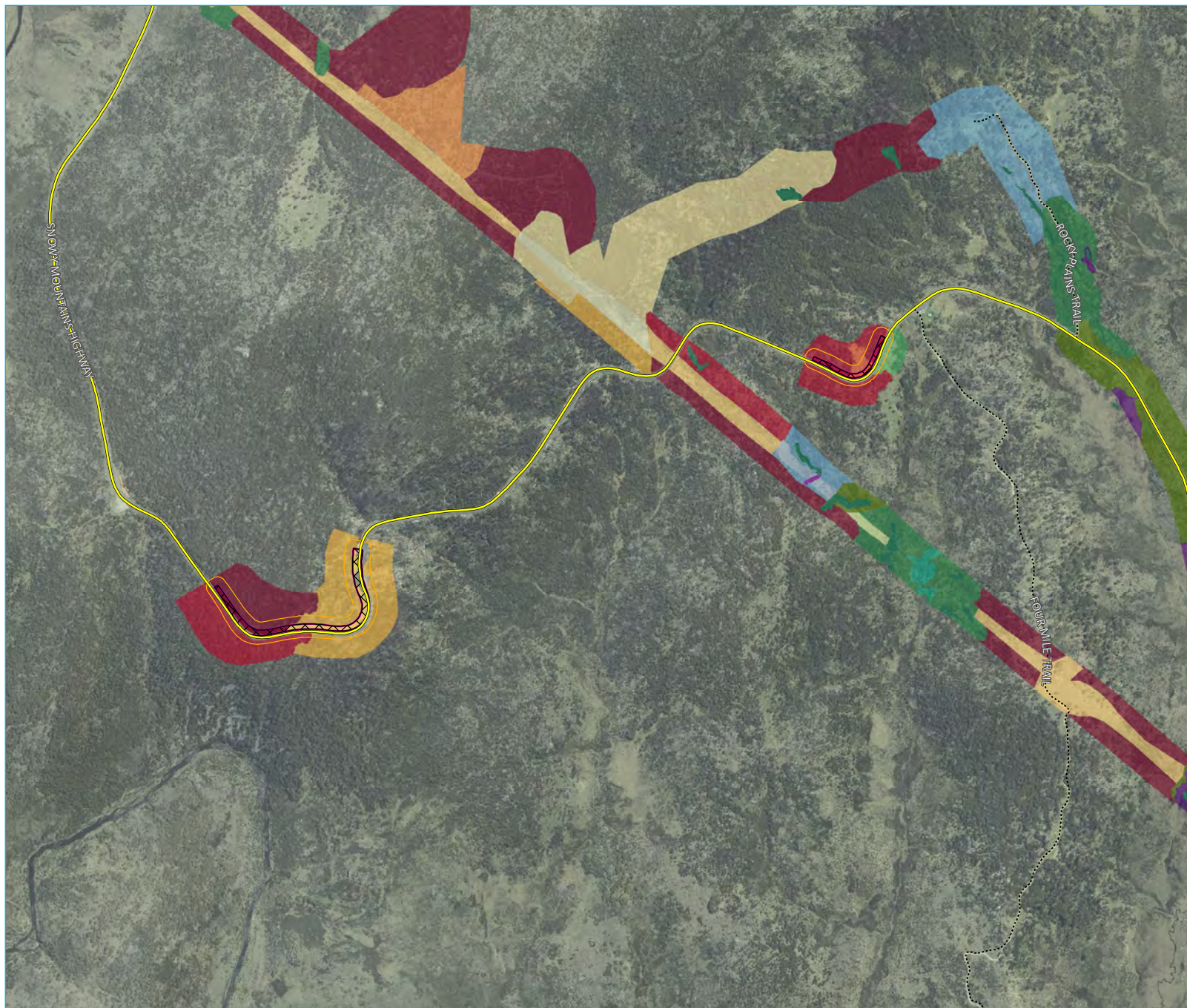
Plant Community Type and
vegetation zone mapping within the
Main Works disturbance footprint,
including plots locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.44

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



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KEY

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

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

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 4.1.45

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

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GDA 1994 MGA Zone 55



4.3.3 Vegetation zones

Each of the 19 PCTs identified within the Main Works study area was stratified into vegetation zones based on broad condition state, as per the method outlined in Section 4.2.1, and allocated a condition class as per the descriptions in Table 4.1. This process identified 64 vegetation zones within the study area, as outlined in Table 4.3.

Table 4.3 Vegetation zones mapped within the Main Works study area

Plant community type	Condition	Direct impacts (ha)	Indirect impacts (ha)	Study Area (ha)
PCT 285 – Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion	Low	<0.01	-	0.00
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	Derived grassland	1.51	-	1.51
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	Poor	0.41	0.06	0.47
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	4.78	-	4.78
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	High	0.14	-	0.14
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	Low	0.96	0.09	1.05
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	Derived grassland	0.42	<0.01	0.42
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	Poor	0.05	-	0.05
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	Medium	16.68	5.02	21.69
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	High	7.51	9.01	16.51
PCT 299 – Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands	Medium	0.09	0.09	0.19
PCT 299 – Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands	High	0.95	0.41	1.35
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	Derived grassland	0.39	0.72	1.11

Table 4.3 **Vegetation zones mapped within the Main Works study area**

Plant community type	Condition	Direct impacts (ha)	Indirect impacts (ha)	Study Area (ha)
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	Other	2.65	2.74	5.38
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	3.62	4.55	8.17
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	28.09	21.31	49.40
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	Low	1.05	0.85	1.90
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	Other	1.16	1.25	2.40
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	Medium	0.51	0.90	1.41
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	High	0.12	0.22	0.34
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	Derived grassland	2.15	2.14	4.29
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	Poor	-	0.10	0.10
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	Other	0.38	0.72	1.10
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	Medium	0.16	0.97	1.14
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	High	23.98	26.91	50.88
PCT 311 - Red Stringybark - Broad-leaved Peppermint - Nortons Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion	High	8.91	14.19	23.11

Table 4.3 **Vegetation zones mapped within the Main Works study area**

Plant community type	Condition	Direct impacts (ha)	Indirect impacts (ha)	Study Area (ha)
PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	Poor	0.01	0.02	0.03
PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	Medium	0.02	0.10	0.12
PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	1.01	4.29	5.29
PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	0.43	0.05	0.48
PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Other	0.29	0.36	0.65
PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	7.88	14.39	22.27
PCT 643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion	Low	0.08	0.08	0.16
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	2.57	10.87	13.44
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	Poor	0.07	0.10	0.17
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	Other	7.56	10.77	18.32
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	Medium	0.31	1.60	1.91
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	50.24	107.22	157.47
PCT 679 – Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion	Other	0.01	0.10	0.11
PCT 679 – Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	0.03	0.32	0.35
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	Low	-	0.01	0.01
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	Derived grassland	0.49	0.49	0.98
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	Medium	4.63	1.79	6.43

Table 4.3 **Vegetation zones mapped within the Main Works study area**

Plant community type	Condition	Direct impacts (ha)	Indirect impacts (ha)	Study Area (ha)
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	High	16.28	19.53	35.81
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	0.53	0.96	1.49
PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	7.45	6.39	13.83
PCT 999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion	Medium	2.15	2.17	4.31
PCT 999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion	High	10.26	12.58	22.84
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	Derived grassland	0.85	0.43	1.28
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	Medium	0.93	0.21	1.14
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	High	7.45	4.92	12.37
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	28.44	12.05	40.49
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Poor	-	0.07	0.07
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Other	0.05	0.22	0.27
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Medium	0.62	0.32	0.94
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	79.07	132.12	211.20
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Low	<0.01	0.22	0.22
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Poor	1.09	4.76	5.85
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Medium	5.30	4.57	9.87

Table 4.3 **Vegetation zones mapped within the Main Works study area**

Plant community type	Condition	Direct impacts (ha)	Indirect impacts (ha)	Study Area (ha)
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	High	74.44	123.00	197.44
PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Low	0.19	0.43	0.62
PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Poor	0.17	1.30	1.47
PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Medium	0.50	1.66	2.16
PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	High	6.23	13.09	19.32

Notes: Vegetation zones with an area less than 0.01 ha were not inputted into the BAM calculator.

Descriptions of each PCT are provided in the following tables. PCTs and vegetation zones are mapped in Figure 4.1.

Table 4.4 **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 description**

PCT 285 – Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion	
PCT ID	285
Common name	Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion
Condition classes	<p>Five vegetation zones were mapped within the study area:</p> <ul style="list-style-type: none"> • Low • Derived grassland • Poor • Medium • High
Extent within Main Works study area	<p>Low: <0.01 ha</p> <p>Derived grassland: 1.51 ha</p> <p>Poor: 0.47 ha</p> <p>Medium: 4.78 ha</p> <p>High: 0.14 ha</p> <p>The vegetation zone assigned a condition of Low was not inputted into the calculator as the area of this vegetation zone is less than 0.01 ha.</p>

Table 4.4 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 description

Description	<p>This PCT occurs on valley flats surrounding creeks at the bottom of Lobs Hole Ravine. Broad-leaved Sally (<i>Eucalyptus camphora</i> subsp. <i>humeana</i>) is the dominant canopy species with few Candlebark (<i>Eucalyptus rubida</i>) scattered throughout. Midstorey consists of Wedge-leaved Wattle (<i>Acacia pravissima</i>), Dwarf Cherry (<i>Exocarpos strictus</i>), Blackwood (<i>Acacia melanoxylon</i>) and Small-leaved Silver Wattle (<i>Acacia dealbata</i>), Mountain Mirbelia (<i>Mirbelia oxylobioides</i>), Hoary Guinea Flower (<i>Hibbertia obtusifolia</i>) and Sifton Bush (<i>Cassinia arcuata</i>). The ground cover includes a mix of native grasses, sedges, rushes and both native and exotic forbs. Grass species include Kangaroo Grass (<i>Themeda triandra</i>), <i>Poa sieberiana</i>, Tussock (<i>Poa labillardierei</i>), Weeping Grass (<i>Microlaena stipoides</i>), Wiry Panic (<i>Entolasia stricta</i>). Sedges and Rush species include Tall Sedge (<i>Carex appressa</i>), <i>Carex gaudichaudiana</i>, <i>Carex inversa</i> and Wattle Mat-rush (<i>Lomandra filiformis</i>). Native forbs include Poverty Raspwort (<i>Gonocarpus tetragynus</i>), Raspwort (<i>Gonocarpus teucroides</i>), Bidgee-widgee (<i>Acaena novae-zelandiae</i>), Daphne Heath (<i>Brachyloma daphnoides</i>), Native Raspberry (<i>Rubus parvifolius</i>) and <i>Oxalis perennans</i>. Blackberry is the dominating exotic species and was observed to be outcompeting many native forbs and grasses. Other exotic species include Sweet Briar, St John's Wort (<i>Hypericum perforatum</i>), Yorkshire Fog (<i>Holcus lanatus</i>) and Common Centaury (<i>Centaureum erythraea</i>).</p>
Survey effort	<p>Derived grassland: one plot (3213)</p> <p>Poor: one plot (2180)</p> <p>Medium: two plots (144, 1046)</p> <p>High: one plot (2265)</p>
Condition description	<p>This PCT occurs in a variety of condition states throughout the project area. The majority of this PCT within the project area is in medium condition with relatively high native cover, a simpler vegetation structure and some weeds present. Areas in high condition consist of relatively intact native vegetation with low exotic cover.</p> <p>Patches of this vegetation adjacent to Yarrangobilly River have been mapped as poor condition. These areas include isolated trees with a modified understorey and exotic species present. Cleared grassland areas derived from this PCT with a higher native component were mapped as derived grasslands; this primarily includes areas underneath managed powerline easements.</p>
Characteristic species used for identification of PCT	<p>Canopy species associated with this PCT were recorded within this community, these include Broad-leaved Sally and Candlebark. This communities midstorey predominantly aligns with the species listed in the NSW VIS Classification, including Small-leaved Wattle, Blackwood, Sifton Bush, Mountain Mirbelia and Hoary Guinea Flower. Groundcover also consists of associated grasses and forbs including Tall Sedge, Bidgee-widgee, Kangaroo Grass, Poverty Raspwort and Native Raspberry.</p>
Justification of evidence used to identify the PCT	<p>PCT 285 occurs within the South Eastern Highlands, NSW South Western Slopes and Australian Alps IBRA regions, in which the study area is located. The landscape position described within the VIS states the PCT occurs on valley flats surrounding creeks within mountain landscapes. This community has been mapped within these landforms. Characteristic species recorded within this community align with the VIS.</p>
Status	<p>Commonwealth EPBC Act: not listed</p> <p>NSW BC Act: not listed</p> <p>Justification: The PCT may relate to the Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion (BC Act) critically endangered ecological community (CEEC). The dominant species in the overstorey of the PCT, Broad-leaved Sally, is not characteristic species used to define the community (NSWTSSC 2019). The majority of this PCT occurs in the Australian Alps IBRA region, which is not included in the CEEC. Occurrences within the South Eastern Highlands IBRA region are outside the Monaro Tablelands or Tinderry-Gourock Ranges Physiographic regions. For these reasons, the PCT is considered unlikely to align with the CEEC.</p>
Estimate of percent cleared value of PCT across NSW	75%

Table 4.4 **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 description**



Photograph 4.1 **Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion – Plot 2265**

Table 4.5 PCT 296 - Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion description

PCT 296 - Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	
PCT ID	296
Common name	Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion
Condition classes	Five vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Low • Derived Grassland • Poor • Medium • High
Extent within Main Works study area	Low: 1.05 ha Derived grassland: 0.42 ha Poor: 0.05 ha Medium: 21.69 ha High: 16.51 ha
Description	This PCT occurs on steep hillslopes and mountain landforms within the bottom of Lobs Hole Ravine. The canopy consists of Brittle gum (<i>Eucalyptus mannifera</i> subsp. <i>mannifera</i>), Broad-leaved Peppermint (<i>Eucalyptus dives</i>) and Red Stringybark (<i>Eucalyptus macrorhyncha</i>). Robertson's Peppermint (<i>Eucalyptus robertsonii</i> subsp. <i>robertsonii</i>) was recorded scattered throughout. The midstorey varies between a fairly sparse to dense cover comprising of Silver Wattle, Native Blackthorn (<i>Bursaria spinosa</i>), Common Fringe-myrtle (<i>Calytrix tetragona</i>), Hoary guinea flower, Mountain Banksia (<i>Banksia canei</i>) and <i>Cassinia longifolia</i> . The groundcover consists of a variety of native grasses, forbs, rushes and sedges. Grasses including Tussock, Snowgrass (<i>Poa sieberiana</i> var. <i>sieberiana</i>), Silvertop Wallaby Grass (<i>Rytidosperma pallidum</i>) and <i>Poa sieberiana</i> var. <i>cyanophylla</i> while native forbs comprise of Raspwort, Grass Trigger plant (<i>Stylidium graminifolium</i>), Small St John's Wort (<i>Hypericum gramineum</i>) and Hairy Apple Berry (<i>Billardiera scandens</i>). Rushes and sedges include Wattle Mat-rush and Fluke Bogrush (<i>Schoenus apogon</i>). Exotic species recorded within this vegetation type include St John's Wort, Blackberry, Sweet Briar and Common Centaury.
Survey effort	Low: one plot (2133) Derived grassland: one plot (187) Poor: one plot (1006) Medium: four plots (2161, 3003, 3076, 3076B) High: three plots (42, 79, 80)
Condition description	This PCT occurs in a variety of condition states throughout the study area within the bottom of Lobs Hole Ravine and adjacent to Talbingo Reservoir. The majority of this PCT in the study area is in medium condition consisting of relatively high native cover but have a simpler vegetation structure and/or some weeds present. Several areas of high condition were identified within the bottom of Lobs Hole. These areas consist of relatively intact vegetation with high native cover, multiple vegetation strata, and low exotic cover. One area in Lobs Hole Ravine contains patches of poor and low condition PCT 296; the poor condition area consists of a small patch of isolated trees with a modified understorey, while the low condition area is the highly modified grassland that surrounds this poor condition patch of forest. Cleared grassland areas derived from this PCT with a higher native component were mapped as derived grasslands; this primarily includes areas of derived native grassland underneath managed powerline easements.

Table 4.5 **PCT 296 - Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion description**

Characteristic species used for identification of PCT	Canopy species associated with this PCT were recorded within this community, these include Brittle Gum, Broad-leaved Peppermint, Red Stringybark and Robertson's Peppermint. Aligning midstorey species include Silver Wattle and Hoary guinea flower. Understorey species that align with this PCT include Wattle Mat-rush, Small St John's Wort, Grass Trigger plant and Raspwort.
Justification of evidence used to identify the PCT	PCT 296 occurs within the NSW South Western Slopes, South Eastern Highlands and Australian Alps, in which the project area is located. The landscape position described within the VIS states the PCT occurs at altitudes over 500 m on steep hillslopes or mountain landform patterns; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed
Estimate of percent cleared value of PCT across NSW	40%



Photograph 4.2 **Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion – Plot 42**

Table 4.6 PCT 299 – Riparian Ribbon Gum – Robertson’s Peppermint – Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion description

PCT 299 – Riparian Ribbon Gum – Robertson’s Peppermint – Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion

PCT ID	299
Common name	Riparian Ribbon Gum - Robertson’s Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion
Condition classes	Two vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Medium • High
Extent within Main Works study area	Medium: 0.19 ha High: 1.35 ha
Description	This PCT occurs on valley flats and along streams within the bottom of Lobs Hole Ravine. The canopy is composed of Ribbon Gum (<i>Eucalyptus viminalis</i>), Robertson’s Peppermint and Red Stringybark. The midstorey comprises of Dwarf Cherry, Dolly Bush (<i>Cassinia aculeata</i>), Silver Wattle, Blackwood, <i>Cassinia longifolia</i> , Wedge-leaved Wattle and Native Blackthorn. Ground cover consists mainly of native forb species such as Native Geranium (<i>Geranium solanderi</i>), Prickly Starwort (<i>Stellaria pungens</i>), Poverty Raspwort, <i>Asperula</i> spp., and Kidney Weed (<i>Dichondra repens</i>). The groundcover also consisted of a small number of native grasses and sedges such as Tall Sedge, Spiny-headed Mat-rush (<i>Lomandra longifolia</i>), Many-flowered Mat-rush (<i>Lomandra multiflora</i>), Wheatgrass (<i>Anthosachne scabra</i>) and Kangaroo Grass. Exotic species such as Blackberry, St John’s Wort, Yorkshire Fog, Sweet Briar and Common Centaury.
Survey effort	Medium: one plot (3184M) High: one plot (3184)
Condition description	Several areas of this PCT occur in the study area, with two areas in the central and western parts of Lobs Hole Ravine in medium condition and one area in the eastern part of Lobs Hole Ravine in high condition. The medium condition areas occur in the parts of Lobs Hole Ravine that were subject to historical clearing, and as such are slightly degraded from weed invasion and past disturbance. The high condition area of PCT 299 occurs within a larger area of intact vegetation and has limited evidence of past disturbance and very low weed cover.
Characteristic species used for identification of PCT	Canopy species associated with this PCT were recorded within this community; including Ribbon Gum, Robertson’s Peppermint and Red Stringybark. Silver Wattle and Blackwood align with the midstorey species. Tall Sedge and Wheatgrass align with the groundcover species.
Justification of evidence used to identify the PCT	PCT 299 occurs within South Eastern Highlands, NSW South Western Slopes and Australian Alps IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs on valley flats and along streams in mountain landforms, generally between 350 and 850 m altitude; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed
Estimate of percent cleared value of PCT across NSW	50%

Table 4.6 **PCT 299 – Riparian Ribbon Gum – Robertson’s Peppermint – Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion description**



Photograph 4.3 **Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion – Plot 1036**

Table 4.7 PCT 300 –Ribbon Gum – Narrow-leaved (Robertsons) Peppermint montane fern – grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and Kosciuszko escarpment description

PCT 300 –Ribbon Gum – Narrow-leaved (Robertsons) Peppermint montane fern – grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and Kosciuszko escarpment	
PCT ID	300
Common name	Ribbon Gum – Narrow-leaved (Robertsons) Peppermint montane fern – grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and Kosciuszko escarpment
Condition classes	Four vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Derived Grassland • Other • Medium • High
Extent within Main Works study area	Derived Grassland: 1.11 ha Other: 5.38 ha Medium: 8.17 ha High: 49.40 ha
Description	This PCT occurs on sheltered hillslopes across the study area; this PCT is known to occur along Lobs Hole Ravine Road, at the bottom of Lobs Hole Ravine and across to the Marica area. The canopy is composed of Ribbon Gum and Narrow-leaved Peppermint. The midstorey comprises of, Silver wattle, Handsome Flat Pea (<i>Platylobium formosum</i>), Wedge-leaved Wattle, Narrow Leaf Hop Bush (<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>), Bulbine Lily (<i>Bulbine bulbosa</i>), <i>Cassinia longifolia</i> and River Lomatia (<i>Lomatia myricoides</i>). Ground cover includes a number of native grasses, rushes and forbs. Grasses recorded include Slender Wallaby Grass (<i>Rytidosperma penicillatum</i>), <i>Dichelachne rara</i> , Longhair Plume Grass (<i>Dichelachne crinita</i>), Tussock, and Speargrass (<i>Austrostipa scabra</i>). Native forbs include Bidgee-widgee, Tall Bluebell (<i>Wahlenbergia stricta</i> subsp. <i>stricta</i>), Small St John's Wort, Variable Glycine (<i>Glycine tabacina</i>), Prickly Woodruff (<i>Asperula scoparia</i>) and Native violet (<i>Viola betonicifolia</i>). The exotic species Delicate Hairgrass (<i>Aira elegantissima</i>), Common Centaury, St John's Wort and Blackberry were recorded within the community.
Survey effort	Derived Grassland: one plot (2284) Other: three plots (169, 174, 2119) Medium: three plots (1020, 1021, 3179) High: four plots (72, 156, 172, 3155)
Condition description	This PCT occurs in a variety of condition states throughout the study area where it primarily occurs on steep slopes and sheltered gullies within the Yarrangobilly River catchment. The majority of this PCT in the study area is in high and medium condition states, consisting of relatively intact vegetation with high native cover and relatively low exotic cover. Several areas of this PCT along Lobs Hole Ravine Road were classified as 'other'; these areas have been subject to past clearing and now consist of scattered mature trees but with regeneration of native canopy and midstorey species evident. The ground layer of this condition state is typically a mix of native and exotic species. Cleared grassland areas derived from this PCT with a relatively high native component were mapped as derived grasslands; this primarily includes areas of derived native grassland and shrublands underneath managed powerline easements in Lobs Hole Ravine.
Characteristic species used for identification of PCT	Canopy species associated with this PCT were recorded within this community, these include Ribbon Gum and Narrow-leaved Peppermint. Aligning midstorey species include Silver Wattle, Handsome Flat Pea, Wedge-leaved Wattle and River Lomatia. Understorey species aligning with the VIS include Bidgee-widgee, Small St John's Wort, Variable Glycine, Prickly Woodruff and Native Violet.

Table 4.7 **PCT 300 –Ribbon Gum – Narrow-leaved (Robertsons) Peppermint montane fern – grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and Kosciuszko escarpment description**

Justification of evidence used to identify the PCT	PCT 300 occurs within the South Eastern Highlands, NSW South Western Slopes and Australian Alps IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs on sheltered hillslopes in a mountain landform pattern; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed
Estimate of percent cleared value of PCT across NSW	20%



Photograph 4.4 **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 Kosciuszko escarpment – Plot 72**

Table 4.8 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 description

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	
PCT ID	302
Common name	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
Condition classes	Four vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Low • Other • Medium • High
Extent within Main Works study area	Low: 1.90 ha Other: 2.40 ha Medium: 1.41 ha High: 0.34 ha
Description	This PCT occurs adjacent to the Yarrangobilly River and Wallace's Creek in Lobs Hole Ravine. The canopy is composed of Ribbon Gum, Black Sally (<i>Eucalyptus stellulata</i>) and Broad-leaved Sally. Midstorey species include Wedge-leaved Wattle, Native Blackthorn, Dolly Bush, Hazel Pomaderris (<i>Pomaderris aspera</i>), <i>Pomaderris angustifolia</i> , Hoary Guinea Flower, Matted Parrot-pea (<i>Dillwynia sericea</i>), Blackwood, Dwarf Cherry (<i>Exocarpos stricta</i>), <i>Cassinia longifolia</i> , Rosemary Grevillea (<i>Grevillea rosmarinifolia</i>) and River Lomatia. Ground cover includes a number of native grasses, rushes and forbs. Grasses recorded include Kangaroo Grass, Common Couch (<i>Cynodon dactylon</i>), Tussock and <i>Poa sieberiana</i> , Bulbine Lily, Variable Glycine, Common Woodruff (<i>Asperula conferta</i>), Bracken Fern (<i>Pteridium esculentum</i>), Tall Sedge and Stinking Pennywort (<i>Hydrocotyle laxiflora</i>). A high number of exotic species were recorded in some vegetation zones, including Square Tail Fescue (<i>Vulpia bromoides</i>), Delicate Hairgrass, Common Centaury, St John's Wort, Catsear (<i>Hypochaeris radicata</i>), Common Sowthistle (<i>Sonchus oleraceus</i>), Sheep Sorrel (<i>Acetosella vulgaris</i>) and Blackberry.
Survey effort	Low: one plot (104) Other: two plots (1010, 1048) Medium: one plot (2267) High: one plot (196)
Condition description	This PCT occurs in a variety of condition states within the bottom of Lobs Hole Ravine, occurring within riparian areas near Yarrangobilly River and Wallace's Creek. The majority of this PCT within the study area has been mapped as 'other'; these areas have been subject to past clearing and now consist of scattered mature trees with native regeneration. Small patches of high condition consist of relatively intact vegetation with high native cover, multiple vegetation strata, and low exotic cover. Areas of medium condition were also identified, with relatively high native cover but have a simpler vegetation structure with a higher number of weeds present. Highly disturbed areas, as a result of human activity, are located adjacent to Yarrangobilly River. These areas have been mapped as Low, consisting of a high number of exotic species and lacking upper stratum species.
Characteristic species used for identification of PCT	Canopy species associated with this PCT were recorded within this community, these include Ribbon Gum and Broad-leaved Sally. Aligning midstorey species include Blackwood, Hazel Pomaderris, <i>Pomaderris angustifolia</i> and River Lomatia. Groundcover species aligning with this PCT include Kangaroo Grass, Tall Sedge and Common Couch.

Table 4.8 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 description

Justification of evidence used to identify the PCT	PCT 302 occurs within the South Eastern Highlands and NSW South Western Slopes IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs on brown to grey posolic loamy clays adjacent to creeks and on adjoining flats; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.
Status	<p>Commonwealth EPBC Act: not listed</p> <p>NSW BC Act: not listed</p> <p>Justification: The PCT may relate to the Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion (BC Act) critically endangered ecological community (EEC), while the VIS states the PCT likely a partial subset of White Box Yellow Box Blakely's Red Gum Woodland EEC/CEEC (BC Act and EPBC Act).</p> <p>The dominant species in the overstorey of the PCT, Ribbon Gum, is not a dominant characteristic species used to define the community (NSWTSSC 2019). For these reasons, the PCT is considered unlikely to align with the CEEC. The PCT is not considered part of the White Box Yellow Box Blakely's Red Gum Woodland EEC/CEEC as the characteristic tree species are not present.</p>
Estimate of percent cleared value of PCT across NSW	50%

Table 4.8 **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 description**



Photograph 4.5 **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 – Plot 108**

Table 4.9 PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands description

PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands	
PCT ID	303
Common name	Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion
Condition classes	Five vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Derived Grassland • Poor • Other • Medium • High
Extent within Main Works study area	Derived Grassland: 4.29 ha Poor: 0.10 ha Other: 1.10 ha Medium: 1.14 ha High: 50.88 ha
Description	This PCT occurs on valley bottoms across the project area; spanning from Rock Forest to Tantangara Reservoir and along Alpine Creek Fire Trail. The dominant canopy species within this community is Black Sally. The midstorey comprises of Tree Violet (<i>Hymenanthera dentata</i>), Small-fruit Hakea (<i>Hakea microcarpa</i>), <i>Pimelea pauciflora</i> and Mountain mireblia. Groundcover consists predominantly of native forbs and grasses. Forb species include Common Woodruff, Pale Vanilla-lily (<i>Arthropodium milleflorum</i>), <i>Cynoglossum australe</i> , Native Geranium, <i>Acaena ovina</i> , <i>Epilobium billardioreanum</i> subsp. <i>cinereum</i> , Bidgee-Widgee, Two-flowered Knawel (<i>Scleranthus biflorus</i>), Scaly Buttons (<i>Leptorhynchus squamatus</i>), Prickly Starwort and Bulbine Lily. Grass species include Kangaroo Grass, Tall Sedge, <i>Carex breviculmis</i> , Wheatgrass, <i>Dichelachne</i> spp., Snowgrass (<i>Poa sieberiana</i>), and <i>Poa sieberiana</i> . Exotic ground cover species included Sweet Vernal Grass (<i>Anthoxanthum odoratum</i>), White Clover (<i>Trifolium repens</i>), Yorkshire Fog and Sheep Sorrel (<i>Acetosella vulgaris</i>).
Survey effort	Derived Grassland: two plots (322, 2244) Poor: one plot (319) Other: one plot (320) Medium: one plot (167M) High: five plots (167, 321, 2063, 2145, 2238)
Condition description	<p>This PCT occurs in a variety of condition states throughout the study area where primarily occurring in valley bottoms and adjacent footslopes spanning from Rock Forest and up to Tantangara Reservoir. The majority of this PCT within the study area is in high condition state, with small patches occurring within Rock Forest and larger patches at the bottom of Tantangara Road adjacent to the reservoir. Small patches of medium condition are found across the study area. These areas consist of relatively high native components with some weeds.</p> <p>Several areas of this PCT adjacent to Tantangara Reservoir were classified as ‘other’; these areas have been subject to a past fire and now consist of regeneration of Black Sally. The ground layer of this condition state is typically a mixture of native and exotic species.</p> <p>Rock Forest predominantly consists of cleared grassland areas derived from this PCT as a result of historical clearing. These areas have been mapped as derived grassland.</p>

Table 4.9 PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands description

Characteristic species used for identification of PCT	Canopy species, Black Sally, associated with this PCT was recorded within this community. Tree Violet aligns with the PCTs midstorey species. Aligning understorey species includes Kangaroo grass, Bidgee-Widgee, Native Geranium and <i>Acaena ovina</i> .
Justification of evidence used to identify the PCT	PCT 303 occurs within the South Eastern Highlands, NSW South Western Slopes and Australian Alps IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs in valley bottoms or adjacent footslopes subject to cold air drainage; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed Justification: The PCT may relate to the Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion (BC Act) critically endangered ecological community (CEEC). The dominant species in the overstorey of the PCT, Black Sally, is not a dominant characteristic species used to define the community (NSWTSSC 2019). The majority of this PCT occurs in the Australian Alps IBRA region, which is not included in the CEEC. Occurrences within the South Eastern Highlands IBRA region are outside the Monaro Tablelands or Tinderry-Gourock Ranges Physiographic regions. For these reasons, the PCT is considered unlikely to align with the CEEC.
Estimate of percent cleared value of PCT across NSW	94%

Table 4.9 **PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands description**



Photograph 4.6 **Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion – Plot 321**

Table 4.10 PCT 311 –Red Stringybark - Broad-leaved Peppermint - Norton’s Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion description

PCT 311 – Red Stringybark - Broad-leaved Peppermint - Norton’s Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion	
PCT ID	311
Common name	Red Stringybark - Broad-leaved Peppermint - Norton’s Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion
Condition classes	A single vegetation zone was mapped within the study area: <ul style="list-style-type: none"> • High
Extent within Main Works study area	High: 22.11 ha
Description	This PCT occurs on upper hill slopes between Lobs Hole Ravine and the Marica area. The canopy is composed of Norton’s Box (<i>Eucalyptus nortonii</i>), Red Stringybark and Broad-leaved Peppermint. The midstorey comprises of Common Fringe-myrtle, Narrow-leaved Hopbush, Hoary guinea flower, Native Blackthorn, Cassinia longifolia, Dwarf Cherry, Silver wattle, Daphne Heath, Dillwynia sieberi and Creamy Candles (<i>Stackhousia monogyna</i>). This community has a diverse ground cover comprising of native forbs, sedges, rushes and grasses. Native grasses include Speargrass, Ringed Wallaby Grass (<i>Rytidosperma caespitosum</i>) and Plumegrass (<i>Dichelachne hirtella</i>). Native forbs, rushes and sedges recorded include Purple Coral Pea (<i>Hardenbergia violacea</i>), <i>Senecio bathurstianus</i> , Native Geranium, Poison Rock Fern (<i>Cheilanthes sieberi</i>), Poverty Raspwort, Stinking Pennywort, Twining glycine (<i>Glycine clandestina</i>), <i>Lomandra filiformis</i> subsp. <i>coriacea</i> , and <i>Carex breviculmis</i> . Several exotic species were recorded including Delicate Hairgrass, Common Centaury, St John’s Wort, Scarlet pimpernel (<i>Lysimachia arvensis</i>), Sweet Briar and Silver Grass.
Survey effort	High: four plots (1015, 3151, 3193, 3205)
Condition description	This PCT occurs in a single condition state of high within Lobs Hole. These areas consist of relatively intact vegetation with high native cover and relatively low exotic cover.
Characteristic species used for identification of PCT	Canopy species associated with this PCT were recorded within this community, these include Norton’s Box, Red Stringybark and Broad-leaved Peppermint. Aligning midstorey species include Daphne Heath, <i>Cassinia longifolia</i> , Native Blackthorn and Hoary Guinea Flower. <i>Lomandra filiformis</i> subsp. <i>coriacea</i> , Purple Coral Pea, Twining Glycine, and Stinking Pennywort align with the groundcover species for this PCT.
Justification of evidence used to identify the PCT	PCT 311 occurs within the South Eastern Highlands, NSW South Western Slopes and Australia Alps IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs on upper hill slopes and hill crests in hill landscapes; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed
Estimate of percent cleared value of PCT across NSW	40%

Table 4.10 **PCT 311 –Red Stringybark - Broad-leaved Peppermint - Norton’s Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion description**



Photograph 4.7 **Red Stringybark - Broad-leaved Peppermint - Norton’s Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion – Plot 3205**

Table 4.11 **PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion description**

PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	
PCT ID	637
Common name	Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion
Condition classes	Three vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Poor • Medium • High
Extent within Main Works study area	Poor: 0.03 ha Medium: 0.12 ha High: 5.29 ha
Description	This PCT occurs in small drainage areas across the project area. Spanning from Rock Forest, along Alpine Creek Fire Trail and near Tantangara Reservoir. This community does not contain any canopy species, comprising of only low shrubland and sedgeland. Midstorey is sparse mainly consisting of Swamp Heath (<i>Epacris paludosa</i>), Alpine Baeckea (<i>Baeckea gunniana</i>), <i>Leptospermum</i> spp., <i>Epacris</i> spp. and Small-fruited Hakea. Groundcover is predominately native forbs, grasses and rushes. Native forb species include <i>Brachyscome obovata</i> , Bog Carraway (<i>Oreomyrrhis ciliata</i>), Mountain Woodruff (<i>Asperula gunnii</i>), Native Violet and <i>Senecio gunnii</i> . Native grass species within this community include <i>Baloskion australe</i> , <i>Carex gaudichaudiana</i> , <i>Empodisma minus</i> , <i>Luzula modesta</i> , Bog Snowgrass (<i>Poa costiniana</i>), Tall Sedge, <i>Juncus</i> spp. and Bog snowgrass. <i>Sphagnum cristatum</i> is also present within this community. Exotic species such as White Clover, Yorkshire Fog, Sheep Sorrel and Sweet Vernal Grass were also recorded within this community.
Survey effort	Poor: one plot (325) Medium: one plot (326) High: three plots (2216, 2236, 2237)
Condition description	This PCT occurs in a variety of condition states throughout the study area, extending from Rock Forest up Tantangara Road and west of the Snowy Mountain Highway. The majority of this PCT in the study area is in high condition consisting of relatively intact vegetation with high native cover and multiple strata. Several small areas of medium condition were also identified; these areas also had relatively high native cover but have a simpler vegetation structure and/or some weeds present. One area adjacent to Tantangara Reservoir contains patches of poor condition state; these areas consists of some isolated trees with a modified understorey.
Characteristic species used for identification of PCT	Midstorey species recorded within this community which align include Swamp Heath and Alpine Baeckea. Aligning groundcover species listed within the VIS were include <i>Baloskion australe</i> , <i>Brachyscome obovata</i> , <i>Carex gaudichaudiana</i> , <i>Empodisma minus</i> , <i>Luzula modesta</i> , Bog Snowgrass and <i>Sphagnum cristatum</i> .
Justification of evidence used to identify the PCT	PCT 637 occurs within the South Eastern Highlands and Australian Alps IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs in areas with impeded drainage and peaty soils between 1,100 and 2,000 m; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.

Table 4.11 **PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion description**

Status	<p>Commonwealth EPBC Act: Alpine Sphagnum Bogs and Associated Fens</p> <p>NSW BC Act: Montane peatlands and swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions</p> <p>Justification: The VIS states the PCT likely relates to the TEC Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions EEC/EN. The floristic composition, landscape locations and organic soils align with the listing under both the BC Act and EPBC Act. This PCT is considered part of the EEC.</p>
Estimate of percent cleared value of PCT across NSW	5%



Photograph 4.8 **Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion – Plot 2216**

Table 4.12 PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion description

PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	
PCT ID	639
Common name	Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion
Condition classes	Three vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Derived grassland • Other • High
Extent within Main Works study area	Derived grassland: 0.48 ha Other: 0.65 ha High: 22.27 ha
Description	This PCT occurs across the project area, spanning from Tantangara Road across to Wallace’s Creek Fire Trail. The canopy is composed of Alpine Ash (<i>Eucalyptus delegatensis</i>), Snow Gum (<i>Eucalyptus pauciflora</i>) and Mountain Gum. The midstorey consists of <i>Leucopogon</i> spp., Pink-tip Daisy-bush (<i>Olearia erubescens</i>), Native Raspberry and Daphne Heath. Groundcover consists mainly of native forbs with some native grasses. Native forb species include Bidgee-widgee, Prickly Woodruff, <i>Brachyscome spathulata</i> , Small Poranthera, Prickly Starwort, Grass Trigger plant, <i>Veronica derwentiana</i> and Native Violet. Native grass species such as Snowgrass, Spiny-headed Mat-rush and Wheatgrass are also present within this community. Exotic species within this community include Sweet Vernal Grass, Yorkshire Fog and Spear Thistle (<i>Cirsium vulgare</i>).
Survey effort	Derived grassland: one plot (207D) Other: one plot (3006) High: four plots (105, 207, 208, 1050)
Condition description	This PCT occurs in three condition states throughout the project area extending from Tantangara Road to west of Wallace’s Creek Fire Trail. The majority of this PCT in the project area is in high condition consisting of relatively intact vegetation with high native cover, multiple vegetation strata, and low exotic cover. One area west of Wallace’s Creek Fire Trail contains patches of ‘other’ condition state. This area burnt during the 2003 fires and supports an immature canopy and increased woody debris due to fallen trees. Significant regeneration is occurring post-fire. Areas adjacent to Link Road have been mapped as derived grassland due to prehistoric clearing. These areas are relatively high in native cover but lack any canopy or midstorey species.
Characteristic species used for identification of PCT	Canopy and understorey species associated with this PCT were recorded within this community, these include Alpine Ash, Snow Gum and Mountain Gum. Groundcover was also consistent with PCT 639, including all native forb species listed within the VIS classification recorded in this community.
Justification of evidence used to identify the PCT	PCT 639 occurs within the Australian Alps and South Eastern Highlands IBRA regions, both of which occur within the project area. The landscape position described within the VIS states the PCT occurs in mountainous areas at high altitudes; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed
Estimate of percent cleared value of PCT across NSW	5%

Table 4.12 **PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion description**



Photograph 4.9 **Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion – Plot 208**

Table 5.14 PCT 643 –Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion description

PCT 643 –Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion	
PCT ID	643
Common name	Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion
Condition classes	A single vegetation zone was mapped within the study area: <ul style="list-style-type: none"> • Low
Extent within Main Works study area	Low: 0.16 ha
Description	This PCT was used to map granite blockstreams on Lobs Hole Ravine Road. While no canopy species are listed to be present in this PCT by the NSW VIS Classification Version 2, Ribbon Gum and Snow Gum were recorded due to the configuration of the 20m x 20m assessment plot, with these species overhanging the plot. The shrub layer is largely absent, with a low cover of <i>Casinia longifolia</i> , Small-fruited Hakea (<i>Hakea macrocarpa</i>), Blackwood, Silver Wattle and Matted Parrot Pea (<i>Dillwynia prostrata</i>) at the edges of the plot. Ground cover is sparse, but present in the accumulated debris and soils in the blockstream. Ground cover species include a number of native grasses, rushes and forbs. Grasses recorded include Kangaroo Grass, Rock Tussock-grass (<i>Poa petrophila</i>), Tussock, and <i>Poa sieberiana</i> var. <i>cyanophylla</i> . Native forbs include Bracken Fern, Australian Indigo (<i>Indigofera australis</i>), Blanket Leaf (<i>Bedfordia arborescens</i>), Native Geranium, Elderberry Ash (<i>Polyscias sambucifolia</i>), <i>Crypandra amara</i> var. <i>amara</i> , Grass Trigger plant and Bidgee-widgee. Blackberry was the only exotic species recorded within the community.
Survey effort	Low: one plot (173)
Condition description	The PCT consists largely of granite boulders. Little vegetation is present in the blockstream; however, this lack of cover is natural and it was assigned to the Low condition class. Minor occurrences of Blackberry were evident.
Characteristic species used for identification of PCT	Species were not used to identify the PCT.
Justification of evidence used to identify the PCT	PCT 643 occurs within South Eastern Highlands and Australian Alps IBRA regions, both of which occur within the project area. The landscape position described within the VIS states the PCT occurs in rocky areas above 1,300 m in the sub-alpine and alpine areas of Kosciuszko National Park. These landforms as well as the presence of blockstreams was used to justify the presence of this PCT.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed
Estimate of percent cleared value of PCT across NSW	0%

Table 5.14 **PCT 643 –Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion description**



Photograph 4.10 **Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion – Plot 173**

Table 4.13 PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion description

PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	
PCT ID	644
Common name	Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion
Condition classes	Five vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Derived Grassland • Poor • Other • Medium • High
Extent within Main Works study area	Derived Grassland: 13.44 ha Poor: 0.17 ha Other: 18.32 ha Medium: 1.91 ha High: 157.47 ha
Description	This PCT occurs at sub-alpine areas at high altitudes, spanning from Tantangara Road to Wallace's Creek Fire Trail and down along Kings Cross Road. The canopy is dominated by Snow Gum. Midstorey species include Gorse Bitter Pea, <i>Hovea montana</i> , Leafy Bossiaea (<i>Bossiaea foliosa</i>), Matted Rice-flower (<i>Pimelea biflora</i>) and Slender Rice Flower. Groundcover consists of native grasses, sedges and forbs. Grass and sedge species include Snowgrass, Woodrush, Knob Sedge, <i>Carex breviculmis</i> , Wheatgrass, <i>Poa helmsii</i> and Tussock. Native forb species within this community include Two-flowered Knawel (<i>Scleranthus biflorus</i>), Prickly Starwort, Button Everlasting (<i>Coronidium scorpioides</i>), Australian Carraway (<i>Oreomyrrhis eriopoda</i>), Bidgee-widgee, Prickly Woodruff, Native Violet and Small St John's Wort. Exotic species recorded within this community include Sweet Vernal Grass, Sheep Sorrel, Sear Thistle, Dandelion and Yorkshire Fog.
Survey effort	Derived Grassland: three plots (132, 329, 2068) Poor: one plot (210P) Other: three plots (212, 330, 331) Medium: one plot (211) High: six plots (163, 180, 210, 332, 2172, 2204)
Condition description	This PCT occurs in a variety of condition states throughout the study area. The majority of this PCT in the study area is in high condition states, consisting of relatively intact vegetation with high native cover and relatively low exotic cover. Small patches of medium condition were also identified. Several areas of this PCT near Tantangara Reservoir spanning across the Nungar Fire Trail were classified as 'other'; these areas have been subject to past fire damage and now consist of scattered mature trees with regeneration of native canopy and midstorey species present. Cleared grassland areas derived from this PCT with a relatively high native component were mapped as derived grasslands; this primarily includes areas adjacent to Kings Cross road.
Characteristic species used for identification of PCT	The canopy species, Snow Gum, associated with this PCT was dominant within this community. Aligning midstorey species include Gorse Bitter Pea, <i>Hovea montana</i> and Leafy Bossiaea. Groundcover species aligning with this PCT include <i>Poa</i> spp., Two-flowered Knawel, Prickly Starwort, Button Everlasting and Australian Carraway.
Justification of evidence used to identify the PCT	PCT 644 occurs within the South Eastern Highlands and Australian Alps IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs in sub-alpine areas between 1,500 and 1,700 m on free draining slopes, ridges and spurs. This community has been recorded on ridge tops and free draining slopes, mapped at altitudes lower than 1,500 m. Characteristic species recorded within this community align with the VIS.

Table 4.13 **PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion description**

Status	<p>Commonwealth EPBC Act: not listed</p> <p>NSW BC Act: not listed</p> <p>Justification: The PCT may relate to the Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion (BC Act) critically endangered ecological community (CEEC). The dominant species in the overstorey of the PCT, Snow Gum, is a dominant characteristic species used to define the community (NSWTSSC 2019). However, a dense midstorey is generally present, except where the community has been grazed, rather than an herbaceous ground stratum. The majority of this PCT occurs in the Australian Alps IBRA region, which is not included in the CEEC. Occurrences within the South Eastern Highlands IBRA region are outside the Monaro Tablelands or Tinderry-Gourock Ranges Physiographic regions. For these reasons, the PCT is considered unlikely to align with the CEEC.</p>
Estimate of percent cleared value of PCT across NSW	5%



Photograph 4.11 **Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion – Plot 2172**

Table 4.14 PCT 679 – Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion description

PCT 679 - Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion	
PCT ID	679
Common name	Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion
Condition classes	Two vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Other • High
Extent within Main Works study area	Other: 0.11 ha High: 0.35 ha
Description	This PCT occurs in small areas within the project area, along Gooandra Fire Trail and a small section at Rock Forest. The canopy is composed of Black Sally, Candlebark and Snow Gum. Midstorey species include Small-fruited Hakea, Slender Rice Flower, Native Raspberry and <i>Pimelea pauciflora</i> . Groundcover species include native grasses, sedges and forbs. Native grass and sedge species include Snowgrass, Slender Wallaby Grass, Tall Sedge, Wheatgrass and Tussock. Native forb species within this community include Bidgee-widgee, Prickly Woodruff, <i>Hydrocotyle</i> spp., Native Violet, Prickly Starwort, <i>Geranium</i> spp. and Sheep's Burr (<i>Acaena echinate</i>). Exotic species present within this community include Yorkshire Fog, Blackberry, Sheep Sorrel, Sweet Vernal Grass and White Clover.
Survey effort	Other: one plot (7) High: one plot (2273)
Condition description	This PCT occurs in two condition states throughout the study area; predominately occurring in high condition. These areas consist of relatively intact vegetation with high native cover, multiple vegetation strata, and low exotic cover. Small patches along Gooandra Fire Trail were classified as 'other'; these areas consist of regeneration of native canopy and midstorey species.
Characteristic species used for identification of PCT	Canopy species associated with this PCT were recorded within this community, these include Black Sally, Candlebark and Snow Gum. Small-fruited Hakea, Bidgee-widgee, Prickly Woodruff and Snowgrass also aligned with this PCT.
Justification of evidence used to identify the PCT	PCT 679 occurs within the South Eastern Highlands and Australian Alps IBRA regions, in which the project area is located. Characteristic species recorded within this community align with the VIS.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed Justification: The PCT may relate to the Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion (BC Act) critically endangered ecological community (CEEC). The dominant species in the overstorey of the PCT, Snow Gum and Black Sally, are both dominant characteristic species used to define the community (NSWTSSC 2019). However, a dense midstorey is generally present, except where the community has been grazed, rather than an herbaceous ground stratum. The majority of this PCT occurs in the Australian Alps IBRA region, which is not included in the CEEC. Occurrences within the South Eastern Highlands IBRA region are outside the Monaro Tablelands or Tinderry-Gourock Ranges Physiographic regions. For these reasons, the PCT is considered unlikely to align with the CEEC.
Estimate of percent cleared value of PCT across NSW	35%

Table 4.14 **PCT 679 – Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion description**



Photograph 4.12 **Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion – Plot 2273**

Table 4.15 PCT 729 – Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion description

PCT 729 – Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	
PCT ID	729
Common name	Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion
Condition classes	Four vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Low • Derived Grassland • Medium • High
Extent within Main Works study area	Low: 0.01 ha Derived Grassland: 0.98 ha Medium: 6.43 ha High: 35.81 ha
Description	This PCT occurs along Lobs Hole Ravine Road, at the bottom of Lobs Hole and with adjacent foothills of Talbingo Reservoir. The canopy is composed of Candlebark, Broad-leaved Peppermint and Robertson's Peppermint. The midstorey comprises of Common Fringe-myrtle, Hoary guinea, Mountain Banksia, Native Blackthorn, <i>Cassinia longifolia</i> , Dwarf Cherry, Wedge-leaved Wattle, Silver wattle, Daphne Heath, Pink Beard Heath (<i>Leucopogon ericoides</i>) and Showy Parrot Pea. Ground cover comprising of native forbs, sedges, rushes and grasses. Native grasses include Kangaroo Grass, Snowgrass, and <i>Dichelachne rara</i> . Native forbs, rushes and sedges recorded include Scaly Buttons (<i>Leptorhynchus squamatus</i>), Raspwort, Poverty Raspwort, Stinking Pennywort, Bears-ear (<i>Cymbonotus lawsonianus</i>), <i>Oxalis perennans</i> , Rough Bedstraw (<i>Galium gaudichaudii</i>), Tall Bluebell, Creeping Cudweed (<i>Euchiton japonicas</i>), Honeypots (<i>Acrotriche serrulata</i>), Small St Johns Wort, Wattle Mat-rush, Mat-rush (<i>Lomandra confertifolia</i>) and <i>Juncus usitatus</i> . A number of exotic species were recorded including Delicate Hairgrass, Common Centaury, St John's Wort, Catsear, Sweet Briar and Haresfoot Clover (<i>Trifolium arvense</i>).
Survey effort	Low: one plot (183) Derived Grassland: one plot (3029) Medium: three plots (95, 110, 1047) High: four plots (70, 193, 1025, 3060)
Condition description	This PCT occurs in a variety of condition states along Lobs Hole Ravine Road and at the bottom of Lobs Hole. The majority of this PCT in the study area is in high condition states, consisting of relatively intact vegetation with high native cover and relatively low exotic cover. Some areas consist of medium condition, consisting of relatively high native cover but have a simpler vegetation structure and/or some weeds present. Two areas in Lobs Hole Ravine contain patches of low condition. These areas are highly modified grassland. Cleared grassland areas derived from this PCT with a higher native component were mapped as derived grasslands; this primarily includes areas of derived native grassland underneath managed powerline easements.
Characteristic species used for identification of PCT	Canopy species associated with this PCT were recorded within this community, these include Candlebark, Broad-leaved Peppermint and Robertson's Peppermint. Aligning midstorey species include Daphne Heath, <i>Cassinia longifolia</i> and Silver Wattle. Snowgrass and <i>Dichelachne rara</i> align with this PCTs groundcover species.
Justification of evidence used to identify the PCT	PCT 729 occurs within the South Eastern Highlands and Australian Alps IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs on exposed dry slopes and foothills at intermediate altitudes; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.

Table 4.15 **PCT 729 – Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion description**

Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed
Estimate of percent cleared value of PCT across NSW	35%



Photograph 4.13 **Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion – Plot 94**

Table 4.16 PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion description

PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	
PCT ID	953
Common name	Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion
Condition classes	Two vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Derived Grassland • High
Extent within Main Works study area	Derived Grassland: 1.49 ha High: 13.83 ha
Description	This PCT occurs in montane areas along Lobs Hole Ravine Road and within the Marica area. The canopy is composed of Mountain Gum (<i>Eucalyptus dalrympleana</i>), Snow Gum and Broad-leaved Peppermint with occasional Robertson's peppermint. The midstorey mainly consists of Silver Wattle, Red-leaved Wattle (<i>Acacia rubida</i>), Daphne Heath, <i>Cassinia longifolia</i> , <i>Cassinia uncata</i> , <i>Daviesia latifolia</i> , Dwarf Cherry, Pink-tip Daisy-bush (<i>Olearia erubescens</i>), Common Shaggy Pea (<i>Oxylobium ellipticum</i>), <i>Daviesia mimosoides</i> subsp. <i>mimosoides</i> and Handsome Flat Pea. Ground cover comprises of native forbs, rushes, grasses and ferns. Native forbs include Prickly Woodruff, <i>Glycine clandestina</i> , <i>Senecio gunnii</i> , Creamy Candles, Grass Trigger-plant and Native Violet. Other ground stratum species include Spiny-head Mat-rush, Mountain Geebung (<i>Persoonia chamaepitys</i>) and Common Bracken (<i>Pteridium esculentum</i>).
Survey effort	Derived Grassland: one plot (1024) High: three plots (216, 5205, 5211)
Condition description	This PCT occurs in two condition states within the study area. The majority of this PCT is of high condition, consisting of relatively intact vegetation with high native cover, multiple vegetation strata, and low exotic cover. Cleared grassland areas derived from this PCT occur along Lobs Hole Ravine Road underneath managed powerline easements.
Characteristic species used for identification of PCT	Canopy species associated with this PCT were recorded within this community, these include Mountain Gum, Snowy Gum and Broad-leaved Peppermint. Aligning midstorey species include <i>Cassinia longifolia</i> , Silver Wattle, Red-leaved Wattle, <i>Daviesia mimosoides</i> subsp. <i>mimosoides</i> , Common Shaggy Pea and Pink-tip Daisy-bush. <i>Glycine clandestina</i> , <i>Senecio gunnii</i> , Creamy Candles, Prickly Woodruff and Native Violet align with this PCTs groundcover species.
Justification of evidence used to identify the PCT	PCT 953 occurs within the South Eastern Highlands and Australian Alps IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs in montane areas within the Kosciuszko area; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed Justification: The VIS states the PCT likely relates to the TEC Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions EEC. The project area is outside the known distribution. This community lacks suitable grassy understorey and does not occur on basalt; therefore, it is not considered to align with this TEC.
Estimate of percent cleared value of PCT across NSW	5%

Table 4.16 **PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion description**



Photograph 4.14 **Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion – Plot 112**

Table 4.17 PCT 999 – Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion description

PCT 999 – Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion	
PCT ID	999
Common name	Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion
Condition classes	Two vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Medium • High
Extent within Main Works study area	Medium: 4.31 ha High: 22.84
Description	This PCT occurs on lower slopes and valleys within the bottom of Lobs Hole Ravine. The canopy is composed of Norton's Box, and Broad-leaved Peppermint. The midstorey comprises of Common Fringe-myrtle, Hoary guinea flower, Native Blackthorn, <i>Cassinia longifolia</i> , <i>Cassinia aculeata</i> subsp. <i>aculeata</i> , <i>Cassytha pubescens</i> , <i>Pimelea curviflora</i> var. <i>sericea</i> , Dwarf Cherry, Mountain Hickory, Silver Wattle, Daphne Heath, <i>Leucopogon virgatus</i> and Showy Parrot Pea. Ground cover comprising of native forbs, sedges, rushes and grasses. Native grasses include Kangaroo Grass, Snowgrass, Wheatgrass, Plumegrass Smooth-flower Wallaby Grass (<i>Rytidosperma pilosum</i>) and <i>Austrostipa scabra</i> subsp. <i>falcate</i> . Native forbs, rushes and sedges recorded include Poverty Raspwort, Australian indigo, <i>Dianella longifolia</i> var. <i>longifolia</i> , Poison Rock Fern, Native Carrot (<i>Daucus glochidiatus</i>), Tufted Bluebell (<i>Wahlenbergia communis</i>), Tall Bluebell, Wattle Mat-rush, <i>Lepidosperma laterale</i> , Blue Flax Lily (<i>Dianella revolute</i> var. <i>revolute</i>) and Native Geranium. A number of exotic species were recorded including Delicate Hairgrass, Common Centaury, and St John's Wort.
Survey effort	Medium: three plots (154, 218) High: four plots (139, 188, 2009, 3222)
Condition description	This PCT occurs in two condition states within the study area at the bottom of Lobs Hole Ravine. The majority of this PCT within the study area is of high condition consisting of relatively intact vegetation with high native cover, multiple vegetation strata, and low exotic cover. Small areas of medium condition were also identified, with relatively high native cover but have a simpler vegetation structure with a higher number of weeds present.
Characteristic species used for identification of PCT	Canopy species associated with this PCT were recorded within this community, these include Norton's Box, and Broad-leaved Peppermint. Common Fringe-myrtle and <i>Cassinia longifolia</i> align with this PCTs midstorey species. Aligning groundcover species include Snowgrass, Wheatgrass, Kangaroo Grass, <i>Austrostipa scabra</i> subsp. <i>falcate</i> and Blue Flax Lily.
Justification of evidence used to identify the PCT	PCT 999 occurs within the South Eastern Highlands IBRA region, in which the project area is located. The landscape position described within the VIS states the PCT occurs on lower slopes and valleys, this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed
Estimate of percent cleared value of PCT across NSW	15%

Table 4.17 **PCT 999 – Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion description**



Photograph 4.15 **Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion – Plot 2009**

Table 4.18 PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion description

PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	
PCT ID	1191
Common name	Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion
Condition classes	Three vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Derived Grassland • Medium • High
Extent within Main Works study area	Derived Grassland: 1.28 ha Medium: 1.14 ha High: 12.37 ha
Description	This PCT occurs on footslopes along Lobs Hole Road and adjacent to Talbingo Reservoir. The canopy is composed of Snow Gum, Candlebark and Black Sally. The midstorey consists of Blackwood, Silver Wattle, Native Blackthorn, Dwarf Cherry, Mountain Banksia, Hoary Guinea Flower and Narrow Leaf Hop Bush. Ground cover predominantly consists of native grasses and forbs. Native grasses include Kangaroo Grass, Bog Snowgrass, Tall sedge, Wattle Mat-rush, Spiny-headed Mat-rush and Many-flowered Mat-rush. Forb species within this community include Poverty Raspwort, Stinking Pennywort, Kidney Weed, Small St John's Wort, Sheep's Burr, Austral Bugle (<i>Ajuga australis</i>), Prickly Starwort and Native Violet. Several exotic species were recorded including Sweet Briar, Blackberry, St Johns Wort, Sheep Sorrel and Catsear.
Survey effort	Derived Grassland: one plot (1009) Medium: one plot (3101) High: three plots (71, 2269, 2276)
Condition description	This PCT occurs in a variety of condition states within the study area. The majority of this PCT is of high condition consisting of relatively intact vegetation with high native cover, multiple vegetation strata, and low exotic cover. Small areas of medium condition were also identified, with relatively high native cover but have a simpler vegetation structure with a higher number of weeds present. Cleared grassland areas derived from this PCT with a higher native component were mapped as derived grasslands; primarily areas occurring underneath managed powerline easements.
Characteristic species used for identification of PCT	Canopy species associated with this PCT were recorded within this community, these include Snow Gum, Candlebark and Black Sally. Blackwood and Silver Wattle align with this PCT's midstorey species. Aligning groundcover species include Poverty Raspwort, Stinking Pennywort and Kangaroo Grass.
Justification of evidence used to identify the PCT	PCT 1191 occurs within the South Eastern Highlands, NSW South Western Slopes and Australian Alps, in which the project is located. The landscape position described within the VIS states the PCT occurs on frost-hollow flats and footslopes in undulating tableland areas between 600 and 1,000 m altitude. This community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed Justification: The PCT may relate to the Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion (BC Act) critically endangered ecological community (CEEC). The dominant species in the overstorey of the PCT, Snow Gum and Black Sally, are both dominant characteristic species used to define the community (NSWTSSC 2019). They co-occur with Candlebark. The majority of this PCT occurs in the South Eastern Highlands IBRA region but is located well outside the Monaro Tablelands or Tinderry-Gourock Ranges Physiographic regions. For these reasons, the PCT is considered unlikely to align with the CEEC.

Table 4.18 **PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion description**

Estimate of percent cleared value of PCT across NSW	95%
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Photograph 4.16 **Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion – Plot 71**

Table 4.19 PCT 1196 – Snow Gum – Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion

PCT 1196 – Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	
PCT ID	1196
Common name	Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion
Condition classes	<p>Five vegetation zones were mapped within the study area:</p> <ul style="list-style-type: none"> • Derived Grassland • Poor • Other • Medium • High
Extent within Main Works study area	<p>Derived Grassland: 40.49 ha</p> <p>Poor: 0.07 ha</p> <p>Other: 0.27 ha</p> <p>Medium: 0.94 ha</p> <p>High: 211.20 ha</p>
Description	<p>This PCT occurs widely within the project area on montane to sub-alpine ridges and slopes. This community is mapped within Rock Forest, along Tantangara Road and close to the Reservoir, along Lobs Hole Ravine Road and west of Wallace's Creek Fire Trail. The canopy is composed of Snow Gum, Mountain Gum and Robertson's Peppermint. This community consists of a diverse midstorey consisting of <i>Daviesia ulicifolia</i>, <i>Daviesia mimosoides</i> subsp. <i>mimosoides</i>, <i>Platylobium formosum</i> subsp. <i>formosum</i>, Dolly Bush, Mountain Hickory, Slender Rice-flower (<i>Pimelea linifolia</i> var. <i>linifolia</i>), Creamy Candles, River Lomatia, Coffee Berry (<i>Coprosma hirtella</i>), Dwarf Cherry, Leafy Bossiaea, Alpine Shaggy Pea and Blackwood. Groundcover consisted of native forbs, sedges, rushes and grasses. Native grasses include Snowgrass, <i>Poa induta</i> and Tussock. Native forbs, rushes and sedges recorded include Native Violet, Prickly Starwort, Variable Glycine, Native Geranium, Small Poranthera (<i>Poranthera microphylla</i>), Trailing Speedwell (<i>Veronica plebeia</i>), Spiny-headed Mat-rush, Common Woodruff, Grass Trigger plant, <i>Acaena agnipila</i>, Bulbine Lily, Swamp Dock (<i>Rumex brownii</i>), <i>Senecio gunnii</i>, Mountain Caladenia (<i>Caladenia alpine</i>), Common Buttercup (<i>Ranunculus lappaceus</i>), Slender Woodrush (<i>Luzula atrata</i>), Old Man's Beard, <i>Lomandra filiformis</i> subsp. <i>coriacea</i>, <i>Brachyscome spathulata</i> and Bidgewidgee. Exotic species such as Catsear, White Clover (<i>Trifolium repens</i>) and Blackberry were recorded within the community.</p>
Survey effort	<p>Derived Grassland: four plots (178, 300, 2250, 3303)</p> <p>Poor: one plot (306)</p> <p>Other: one plot (2275)</p> <p>Medium: one plot (301)</p> <p>High: six plots (177, 223, 1022, 2142, 3117, 3173)</p>
Condition description	<p>This PCT occurs in a variety of condition states across the study area. The majority of this PCT within the study area is of high condition consisting of relatively intact vegetation with high native cover, multiple vegetation strata, and low exotic cover. Small areas of medium condition were also identified, with relatively high native cover but have a simpler vegetation structure with a higher number of weeds present.</p> <p>Patches of the PCT within Rock Forest have been mapped as poor condition. These areas include isolated trees with a modified understorey and exotic species present. A large portion of cleared grassland areas within Rock Forest were mapped as derived grasslands; with areas historically cleared for agriculture. Several areas of this PCT were classified as 'other'; these areas have been subject to past clearing and now consist of scattered mature trees with native regeneration.</p>

Table 4.19 **PCT 1196 – Snow Gum – Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion**

Characteristic species used for identification of PCT	Canopy species associated with this PCT were recorded within this community, these include Snow Gum, Mountain Gum and Robertson's Peppermint. Aligning midstorey species include <i>Daviesia ulicifolia</i> , <i>Daviesia mimosoides</i> subsp. <i>mimosoides</i> , <i>Platylobium formosum</i> subsp. <i>formosum</i> and Coffee Berry. Aligning understorey species include Snowgrass, Prickly Starwort, Bidgee-widgee, <i>Senecio gunnii</i> , Small Poranthera, Spiny-headed Mat-rush, Native Violet and <i>Brachyscome spathulata</i> .
Justification of evidence used to identify the PCT	PCT 1196 occurs within the South Eastern Highlands, NSW South Western Slopes and Australian Alps IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs on montane to sub-alpine slopes and ridges; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.
Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed Justification: This VIS states that this PCT forms part of the Tablelands Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions EEC. Due to the lack of grassy understory throughout these woodlands it is not considered to align with the TEC above.
Estimate of percent cleared value of PCT across NSW	5%



Photograph 4.17 **Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion – Plot 3173**

Table 4.20 PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion description

PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	
PCT ID	1224
Common name	Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion
Condition classes	Four vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Low • Poor • Medium • High
Extent within Main Works study area	Low: 0.22 ha Poor: 5.85 ha Medium: 9.87 ha High: 197.44 ha
Description	This PCT occurs on flat valley bottoms across the project area; including areas adjacent to Tantangara Reservoir, west of Snowy Mountain Highway and along tracks east of Snowy Mountains Highway. This community does not contain any canopy species, comprising only of grasslands and heathlands, and including a high number of native midstorey and ground cover species. The midstorey consists predominantly of <i>Hakea microcarpa</i> , <i>Acrothamnus hookeri</i> , Hairy Anchor Plant (<i>Discaria pubescens</i>) and Slender Rice Flower (<i>Pimelea linifolia</i>). This community has a diverse ground cover comprising of native forbs and grasses. Native forbs include Bidgee-widgee, <i>Acaena ovina</i> , Native Violet, Common Woodruff, Native Geranium, Small St. John's Wort and Prickly Starwort. Native grasses include <i>Carex breviculmis</i> , Granite Buttercup (<i>Ranunculus graniticola</i>), <i>Luzula</i> sp., <i>Dichelachne</i> sp., Kangaroo Grass, Wheatgrass, <i>Poa sieberiana</i> and <i>Dichelachne rara</i> . Exotic species were recorded within the community include Sweet Vernal Grass (<i>Anthoxanthum odoratum</i>), Smooth Hawksbeard (<i>Crepis capillaris</i>), Spear Thistle (<i>Cirsium vulgare</i>) and Sheep Sorrel.
Survey effort	Low: one plot (2262) Poor: three plots (2195, 2195B, 2220) Medium: three plots (307, 2049, 2170) High: six plots (164, 225, 308, 309, 2002, 3152)
Condition description	This PCT occurs in a variety of condition states within the study area. The majority of this PCT is of high condition consisting of relatively intact vegetation with high native cover and low exotic cover. Small areas of medium condition were also identified, with relatively high native cover but have a simpler vegetation structure with a higher number of weeds present. On area adjacent to Tantangara Reservoir contains a patch of low condition PCT 1224. This area is highly modified due to high levels of disturbance from recreational uses, pest species and a high number of exotics. Areas mapped as poor occur along tracks, with a number of exotic species present.
Characteristic species used for identification of PCT	Aligning midstorey species include <i>Hakea microcarpa</i> , <i>Acrothamnus hookeri</i> and Slender Rice Flower. <i>Carex breviculmis</i> and Granite Buttercup align with this PCTs groundcover species.
Justification of evidence used to identify the PCT	PCT 1224 occurs within the South Eastern Highlands and Australian Alps IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs on broad, flat valley bottoms in montane to sub-alpine areas between 1,200 and 1,600 m; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.

Table 4.20 **PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion description**

Status	Commonwealth EPBC Act: not listed NSW BC Act: not listed
Estimate of percent cleared value of PCT across NSW	5%



Photograph 4.18 **Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion – Plot 308**

Table 4.21 PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion description

PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	
PCT ID	1225
Common name	Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion
Condition classes	Four vegetation zones were mapped within the study area: <ul style="list-style-type: none"> • Low • Poor • Medium • High
Extent within Main Works study area	Low: 0.62 ha Poor: 1.47 ha Medium: 2.16 ha High: 19.32 ha
Description	This PCT occurs on broad, flat valley bottoms across the project area. Spanning from Tantangara Reservoir to Nungar Fire Trail and over to Link Road. This community does not contain any canopy species, comprising of sub-alpine grasslands. The midstorey is sparse and lacking in most areas, with <i>Epacris gunnii</i> recorded in some areas. Groundcover consists mostly of native grasses, sedges and rushes as well as native forbs. Native grass and grasslike species include Tall sedge, <i>Carex gaudichaudiana</i> , <i>Empodisma minus</i> , Bog Snowgrass and Club-rush (<i>Isolepis inundata</i>). Native forb species recorded within this community include <i>Hypericum japonicum</i> , Gunn's Willow-herb (<i>Epilobium gunnianum</i>), <i>Neopaxia australasica</i> , Granite Buttercup (<i>Ranunculus graniticola</i>) and Pennywort (<i>Hydrocotyle algida</i>).
Survey effort	Low: three plots (45, 311, 3181) Poor: one plot (312) Medium: two plots (58, 313) High: four plots (314, 316, 2030, 2191)
Condition description	This PCT occurs in a variety of condition states across the study area, spanning from Tantangara Reservoir across Nungar Creek Fire Trail, Bullocks Hill Fire Trail and to Link Road. The majority of this PCT is in High condition consisting of relatively intact vegetation with high native cover and low exotic cover. Several small patches of medium condition were also identified; these areas also have a relatively high native cover with some weeds present. A small patch of poor condition occurs along Nungar Cree Fire Trail; consisting of a modified understorey. Areas mapped as low condition predominantly occur adjacent to Tantangara Reservoir. These areas consist of low species diversity and a high number of exotics due to high levels of disturbance from recreational uses and pest species.
Characteristic species used for identification of PCT	<i>Epacris gunnii</i> aligns with the midstorey species for this PCT. Aligning groundcover species include Tall sedge, <i>Carex gaudichaudiana</i> , <i>Empodisma minus</i> , Bog Snowgrass, <i>Hypericum japonicum</i> , Gunn's Willow-herb, <i>Neopaxia australasica</i> and Granite Buttercup.
Justification of evidence used to identify the PCT	PCT 1225 occurs within the South Eastern Highlands and Australian Alps IBRA regions, in which the project area is located. The landscape position described within the VIS states the PCT occurs on broad, flat valley bottoms in montane to sub-alpine areas between 1,200 and 1,600 m; this community has been recorded within these landforms. Characteristic species recorded within this community align with the VIS.

Table 4.21 **PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion description**

Status	<p>Commonwealth EPBC Act: not listed</p> <p>NSW BC Act: not listed</p> <p>Justification: Consultation with the Biodiversity and Conservation Division (BCD) indicated that PCT 1225 may form part of the Alpine Sphagnum Bogs and Associated Fens EEC listed under the EPBC Act (but not the Montane peatlands and swamps EEC listed under the BC Act. The Identification Key for Alpine Sphagnum Bogs and Associated Fens on the Mainland of Australia, produced by the team that worked on the National Recovery Plan (DoE 2015b), was provided by DoEE to allow assessment against the EEC. This assessment indicated that although the PCT is located above 1,000 m and an organic substratum is present, most of the the vegetation cover is not composed of three or more of the listed diagnostic species. Based on this, the PCT is not considered representative of the EEC.</p>
Estimate of percent cleared value of PCT across NSW	5%



Photograph 4.19 **Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion – Plot 120**

4.3.4 Assessment of patch size

For each vegetation zone within the Main Works study area, patch size was assessed using a select process in ArcGIS, using existing vegetation mapping and aerial imagery. All intact native vegetation separated by a distance of less than 100 m (woody vegetation ecosystems) or 30 m (non-woody vegetation ecosystems) was mapped sequentially.

This process showed that vegetation within the project area forms part of large patches of connecting vegetation throughout KNP, with patch sizes of greater than 100 ha. This patch size was used in the calculator.

4.3.5 Vegetation integrity score

The vegetation integrity score for each vegetation zone is presented in Table 4.22.

Table 4.22 **Vegetation integrity scores for all vegetation zones mapped within the Main Works study area**

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	Derived grassland	0.6
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	Poor	26.7
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	36.9
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	High	56.7
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	Low	4
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	Poor	4.2
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	Medium	71
PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	High	54
PCT 299 – Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands	Medium	65.4
PCT 299 – Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands	High	65.4
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	Derived grassland	4.3
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	Other	41.9
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	56.8

Table 4.22 **Vegetation integrity scores for all vegetation zones mapped within the Main Works study area**

Plant community type	Condition	Vegetation integrity score
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	61.6
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	Low	33.6
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	Other	53
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	Medium	66.4
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	High	64.9
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	Derived grassland	19.3
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	Poor	55.5
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	Other	87.1
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	Medium	66.8
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	High	80.9
PCT 311 - Red Stringybark - Broad-leaved Peppermint - Nortons Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion	High	62.4
PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	Poor	3.2
PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	Medium	31.4
PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	86
PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	69.2
PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Other	79.5
PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	77.2
PCT 643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion	Low	13
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	68.4

Table 4.22 **Vegetation integrity scores for all vegetation zones mapped within the Main Works study area**

Plant community type	Condition	Vegetation integrity score
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	Poor	47.6
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	Other	65.6
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	Medium	67.6
PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	74.1
PCT 679 – Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion	Other	81.1
PCT 679 – Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	54.5
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	Low	6
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	Derived grassland	22.7
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	Medium	76.9
PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	High	73.8
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	32
PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	88.5
PCT 999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion	Medium	46
PCT 999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion	High	73
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	Derived grassland	33.1
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	Medium	43.8
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	High	69.5
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Derived grassland	37.9
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Poor	58.1
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Other	58.7
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Medium	80.6
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	High	96.3

Table 4.22 **Vegetation integrity scores for all vegetation zones mapped within the Main Works study area**

Plant community type	Condition	Vegetation integrity score
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Low	67.9
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Poor	67
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Medium	88.4
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	High	89.1
PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Low	13
PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Poor	57.2
PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Medium	64.1
PCT 1225 – Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	High	91.8

5 Threatened species

5.1 Fauna habitat assessment

Concurrent with the vegetation mapping a habitat assessment was undertaken seeking to identify the following fauna habitat features within the Main Works survey area:

- habitat trees including large hollow-bearing trees;
- availability of flowering shrubs and feed tree species;
- waterway condition;
- quantity of ground litter and logs; and
- searches for indirect evidence.

The habitat assessment identified that in sections of the Main Works survey area where disturbance has been limited, fauna habitat features are abundant. In areas subject to disturbance, such as clearing and human activity, fauna habitat features are limited.

The upper section of Lobs Hole Ravine Road and the Marica area consists of tall wet sclerophyll forests to 40 m, dominated by Mountain Gum, Snow Gum and Alpine Ash, with a shrubby to grassy understorey. Hollow bearing trees are abundant within this area with large, old trees within undisturbed vegetation. Habitat complexity at ground level is high. Large logs, coarse woody debris and leaf litter are abundant on ground, providing shelter for a high number of fauna species. Watercourses are limited, and where they occur, are ephemeral and only found to flow for brief periods after heavy rains. Weed invasion is evident within creek lines, particularly with Blackberry.

Below approximately 1,200 m, vegetation transitions to drier sclerophyll forests with a shrubby understorey. Broad-leaved Peppermint, Robertson's Peppermint and Brittle Gum dominate the overstorey, with a sparse to moderately dense shrubby midstorey and sparse grassy groundcover. In these areas, hollows are limited to old, mature trees which tend to be rare. Large logs, coarse woody debris and leaf litter are also less common, providing more limited habitat for fauna species. Watercourses are more abundant on steep slopes but are even more highly ephemeral than other areas and only found to flow for brief periods after heavy rains. This vegetation extends down into Lobs Hole and includes areas outside the riparian zone and includes the northern end of Talbingo Reservoir.

Along intermittent and permanent watercourses in Lobs Hole a number of riparian communities occur. Where these communities are intact, large trees are moderately common and support large hollows. In many sections of the Main Works survey area, the midstorey and understorey are heavily disturbed, with significant weed invasion, particularly thickets of Blackberry. Where weeds are not present, a dense shrubby midstorey is present over a sparse groundcover. Coarse woody debris, logs and leaf litter varies from absent to moderately sparse, depending on past disturbance. There are limited areas considered to be of good quality for fauna species.

The plateau area supports a mix of grasslands and grassy woodlands. Grasslands on upper slopes provide an open to closed low grassland. Leaf litter is generally limited, but low cover is provided by moderate to dense cover of tussock grasses. Grasslands on lower slopes and drainage lines provide a dense cover of large tussock grasses, often over 100% cover. Grassy woodlands contain a mix of Snow Gum and Black Sallee, generally lacking hollows or with very limited small hollows. They support a moderate to sparse shrub layer and grassy groundcover. Fallen timber and coarse woody debris are generally moderate to sparse.

Vegetation directly adjacent to the edge of Tantangara Reservoir mainly consists of grasslands and adjacent grassy woodlands. Tree cover within these areas is limited including Black Sally. In some areas a moderate midstorey is present. Groundcover consists of tussock grasses, with limited large logs, coarse woody debris or leaf litter. These areas have been impacted by feral Horses, recreational use, and show moderate weed cover, and erosion due to use of the area by vehicles.

Areas east of Tantangara Reservoir consist of grassy woodlands with regeneration as a result of past fires. Groundcover consists of grass understorey with high amounts of fallen timber and large logs. These areas have been impacted by invasive weeds and pest species. West of Tantangara Reservoir a high number of riparian communities occur along intermittent and permanent watercourses. These areas include sub-alpine grasslands and grassy woodlands.

5.2 Ecosystem credit species assessment

Ecosystem credits species are threatened species that can be reliably predicted to use an area of land based on habitat surrogates. For the purposes of the BAM (OEH 2017a), ecosystem credit species are deemed to be offset through the habitat surrogates (PCTs) in which they occur. A list of ecosystem credit species predicted to occur within the Main Works survey area, based on the PCTs present and generated by the calculator associated within the BAM (OEH 2017a) is provided in Table 5.1. The potential for these species to occur within the Main Works disturbance footprint was assessed in accordance with Section 6.2 of the BAM (OEH 2017a).

Table 5.1 Assessment of ecosystem credit species within the Main Works disturbance footprint

Scientific name	Common name	Justification for exclusion
<i>Anthochaera phrygia</i>	Regent Honeyeater (Foraging)	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (Foraging)	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (Foraging)	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Chthonicola sagittate</i>	Speckled Warbler	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Circus assimilis</i>	Spotted Harrier	Not excluded.
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	Not excluded.
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Foraging)	The White-bellied Sea-Eagle feeds on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion, using a perch near water. Species excluded from all PCTs not associated with the Yarrangobilly River, Talbingo Reservoir or Tantangara Reservoir (all PCTs except PCTs 296, 300, 302, 303, 311, 644, 1191, 1196, 1224 and 1225).
<i>Hieraaetus morphnoides</i>	Little Eagle (Foraging)	Not excluded.

Table 5.1 Assessment of ecosystem credit species within the Main Works disturbance footprint

Scientific name	Common name	Justification for exclusion
<i>Lophoictinia isura</i>	Square-tailed Kite (Foraging)	Not excluded.
<i>Melanodryas cucullata cucullate</i>	Hooded Robin (south-eastern form)	Excluded from Low condition vegetation zones.
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat (Foraging)	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Neophema pulchella</i>	Turquoise Parrot	Not excluded.
<i>Ninox connivens</i>	Barking Owl (Foraging)	Not excluded.
<i>Ninox strenua</i>	Powerful Owl (Foraging)	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Pachycephala olivacea</i>	Olive Whistler	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Petaurus australis</i>	Yellow-bellied Glider	Excluded from cleared vegetation zones (condition class Low or Derived grassland) due to lack of hollow bearing trees.
<i>Petroica boodang</i>	Scarlet Robin	Excluded from Low condition vegetation zones.
<i>Petroica phoenicea</i>	Flame Robin	Excluded from Low condition vegetation zones.
<i>Phascolarctos cinereus</i>	Koala (Foraging)	Excluded from all PCTs as the species is rare in KNP and no evidence was observed during targeted surveys.
<i>Stagonopleura guttata</i>	Diamond Firetail	Not excluded.
<i>Suta flagellum</i>	Little Whip Snake	Not excluded.
<i>Tyto novaehollandiae</i>	Masked Owl (Foraging)	Excluded from cleared vegetation zones (condition class Low or Derived grassland).
<i>Varanus rosenbergi</i>	Rosenberg's Goanna	Not excluded.

5.3 Species credit species assessment

5.3.1 Habitat constraints assessment (Step 2)

Species credit species are threatened species that cannot be reliably predicted to occur based on habitat surrogates. For the purposes of the BAM (OEH 2017a), species credit species require detailed assessment and, if present, additional offsets to ecosystem credits. An assessment of habitat constraints for threatened species credit species was undertaken in accordance with Step 2 of Section 6.4 of the BAM (OEH 2017a). For those threatened species credit species predicted to occur, for which habitat constraints are listed, an assessment was undertaken of the presence of the habitat features within the Main Works survey area.

The species generated by the calculator with habitat constraints, as well as the results of the habitat constraints assessment, are shown in Table 5.2.

Table 5.2 **Assessment of geographic and habitat constraint features within the Main Works survey area**

Scientific name	Common name	Feature	Sensitivity to gain class	Habitat/geographic constraint present in development site	Justification
<i>Anthochaera phrygia</i>	Regent Honeyeater	<ul style="list-style-type: none"> As per mapped areas. 	High	No	The project area is not within mapped Regent Honeyeater habitat.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	<ul style="list-style-type: none"> Hollow bearing trees. Eucalypt tree species with hollows greater than 9 cm diameter. 	High	Yes	The project area contains suitable hollow bearing trees.
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	<ul style="list-style-type: none"> Hollow bearing trees. Living or dead tree with hollows greater than 15 cm diameter and greater than 5 m above ground. 	High	Yes	The project area contains suitable hollow bearing trees.
<i>Discaria nitida</i>	Leafy Anchor Plant	<ul style="list-style-type: none"> Riparian areas or within 50 m of riparian areas. Kosciuszko National Park. 	High	Yes	The project area contains riparian areas and is located within Kosciuszko National Park.
<i>Euphrasia scabra</i>	Rough Eyebright	<ul style="list-style-type: none"> Montane bogs or within 50 m. 	High	Yes	The project area contains montane bogs.
<i>Grevillea iaspicula</i>	Wee Jasper Grevillea	<ul style="list-style-type: none"> Rocky areas. Limestone rock substrate. Confined to an area between 0 and 10 km west of the Goodradigbee River and extending 5 km to the south and 15 km to the north of Wee Jasper. 	High	No	The project area is not located in any of the areas identified in the calculator.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	<ul style="list-style-type: none"> Living or dead mature trees within suitable vegetation within 1 km of a river, lakes, large dams or creeks, wetlands and coastlines. 	High	Yes	The project area contains suitable vegetation within 1 km of a large water body.
<i>Hieraaetus morphnoides</i>	Little Eagle	<ul style="list-style-type: none"> Nest trees- live (occasionally dead) large old trees within vegetation. 	Moderate	Yes	The project area contains large old trees within suitable vegetation.

Table 5.2 **Assessment of geographic and habitat constraint features within the Main Works survey area**

Scientific name	Common name	Feature	Sensitivity to gain class	Habitat/geographic constraint present in development site	Justification
<i>Litoria spenceri</i>	Spotted Tree Frog	<ul style="list-style-type: none"> Waterbodies. River environments with rocky habitat or with 500 m of rocky river. 	Very high	Yes	The project area contains waterbodies and river environments with rocky habitat.
<i>Lophoictinia isura</i>	Square-tailed Kite	<ul style="list-style-type: none"> Nest trees. 	Moderate	Yes	The project area contains potential raptor nests.
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	<ul style="list-style-type: none"> Caves, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code IC – in cave observation type code E nest – roost with numbers of individuals >500. 	Very High	No	The project area does not contain any caves, tunnels, mines, culverts or other structures known to be used for breeding.
<i>Myotis macropus</i>	Southern Myotis	<ul style="list-style-type: none"> Hollow bearing trees. Within 200 m of riparian zone. Bridges, caves or artificial structures within 200 m of riparian zone. This includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200 m of the site. 	High	Yes	The project area contains hollow bearing trees within 200 m of a riparian zone.
<i>Ninox connivens</i>	Barking Owl	<ul style="list-style-type: none"> Hollow bearing trees. Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground. 	High	Yes	The project area contains hollow bearing trees with hollows greater than 20 cm diameter.
<i>Ninox strenua</i>	Powerful Owl	<ul style="list-style-type: none"> Hollow bearing trees. Living or dead trees with hollows greater than 20 cm diameter. 	High	Yes	The project area contains hollow bearing trees with hollows greater than 20 cm diameter.
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	<ul style="list-style-type: none"> Hollow bearing trees. 	High	Yes	The project area contains hollow bearing trees.

Table 5.2 **Assessment of geographic and habitat constraint features within the Main Works survey area**

Scientific name	Common name	Feature	Sensitivity to gain class	Habitat/geographic constraint present in development site	Justification
<i>Phascolarctos cinereus</i>	Koala	<ul style="list-style-type: none"> Areas identified via surveys as important habitat. 	High	Yes	Although the species is rare in KNP surveys were undertaken on a precautionary basis.
<i>Pomaderris cotoneaster</i>	Cotoneaster Pomaderris	<ul style="list-style-type: none"> South of northern Kosciuszko National Park boundary. 	High	Yes	The project area is located to the south of the northern boundary of KNP.
<i>Prasophyllum retroflexum</i>	Kiandra Leek Orchid	<ul style="list-style-type: none"> Treeless vegetation above 1,000m in altitude. 	High	Yes	The project area contains treeless vegetation above 1,000m.
<i>Pseudophryne pengilleyi</i>	Northern Corroboree Frog	<ul style="list-style-type: none"> Above 700 m above sea level (ASL). 	Very high	Yes	The majority of the project area is located above 700 m ASL.
<i>Thesium australe</i>	Austral Toadflax	<ul style="list-style-type: none"> Kosciuszko National Park. 	Moderate	Yes	The project area is located within KNP.
<i>Tyto novaehollandiae</i>	Masked Owl	<ul style="list-style-type: none"> Hollow bearing trees. Living or dead trees with hollows greater than 20 cm diameter. 	High	Yes	The project area contains hollow bearing trees with hollows greater than 20 cm diameter.

Using the process outlined in Step 2 of Section 6.4 of the BAM (OEH 2017a) three species, including Regent Honeyeater, Wee Jasper Grevillea and Large Bent-winged Bat, were excluded from requiring further consideration. No further assessment is required as per Section 6.4.1.13 of the BAM (OEH 2017a).

All other species have not been excluded on the basis of the identified geographic or habitat constraints. Further consideration is given to these species in Section 6.3.2.

5.3.2 Identifying candidate species credit species for further assessment (Step 3)

To develop a list of species credit species for further assessment, an assessment was undertaken in accordance with Step 3 of Section 6.4 of the BAM (OEH 2017a), as shown in Table 5.3.

Table 5.3 Species credit species and status and habitat suitability assessment

Scientific name	Common name	Candidate species	Justification
Flora			
<i>Caladenia montana</i>	-	Yes	<p>Terrestrial orchid restricted to high montane areas 700-1,000 m ASL. The species grows in well-drained loam on slopes and ridges of montane forest among an understorey of shrubs. The species occurs mainly in the east alps section of the Alpine National Park in Victoria. It may occur in southern Kosciuszko National Park adjacent to Victoria.</p> <p>The project area contains suitable habitat for this species and the species was recorded within the survey area.</p>
<i>Calotis glandulosa</i>	Mauve Burr-daisy	Yes	<p>Sprawling, branched herb confined to the Monaro and Kosciuszko regions. Colonizes bare patches and along roadsides at higher altitudes in Temperate Montane Grasslands, Subalpine Woodlands, Tableland Clay Grassy Woodlands and Southern Tableland Wet Sclerophyll Forests.</p> <p>The project area contains suitable habitat for this species and the species was recorded within the survey area.</p>
<i>Calotis pubescens</i>	Max Mueller's Burr-daisy	Yes	<p>Perennial herb limited to three sites in the Snowy Mountains south-east of Mount Hotham. Grows on subalpine treeless plains in herb rich grasslands subject to periodic rainfall in Temperate Montane Grasslands.</p> <p>The project area contains suitable habitat for this species and the species was recorded within the survey area.</p>
<i>Carex raleighii</i>	Raleigh Sedge	Yes	<p>Small perennial sedge confined to elevations over 1,000 metres above sea level on the Southern Tablelands with most populations occurring in Mount Kosciuszko National Park. Grows in scattered sphagnum bogs, swampy wetlands, damp grasslands and subalpine stream edges in Alpine Bogs and Fens and Temperate Montane Grasslands.</p> <p>The project area contains suitable habitat for this species and the species was recorded within the survey area.</p>
<i>Discaria nitida</i>	Leafy Anchor Plant	Yes	<p>Leafy Anchor Plant generally occurs on or close to stream banks and on rocky areas near small waterfalls. The species occurs in both woodland with heathy riparian vegetation and on treeless grassy sub-alpine plains. The Leafy Anchor Plant is confined to the far south of the Southern Tablelands of NSW and north-east highlands of Victoria.</p> <p>The project area contains suitable habitat for this species and the species was recorded within the survey area.</p>

Table 5.3 Species credit species and status and habitat suitability assessment

Scientific name	Common name	Candidate species	Justification
<i>Euphrasia scabra</i>	Rough Eyebright	Yes	<p>Rough Eyebright occurs in or at the margins of swampy grassland or in sphagnum bogs, often in wet, peaty soil. The species appears to be self-fertilising but seed production is variable, perhaps depending on season. There are three known populations in NSW: Bondi State Forest, South East Forests National Park and near Nunnock Swamp.</p> <p>Although unlikely to occur, based on the species known populations, the survey area contains sphagnum bogs and fens that are considered suitable habitat to support this species.</p>
<i>Glycine latrobeana</i>	Clover Glycine	Yes	<p>Low growing herb endemic to south-eastern Australia with a wide distribution from Port Pirie in South Australia through Victoria to near Hobart in Tasmania. Recently discovered in Kosciuszko National Park. Grows up to elevations of ~1,300 m in Subalpine Woodlands and Temperate Montane Grasslands. Grows in a variety of soils including alluvial, sandstone, mudstone, granite and basalt derived soils.</p> <p>The project area contains suitable habitat for this species and the species was recorded within the survey area.</p>
<i>Irenepharsus magicus</i>	Elusive Cress	No	<p>The distribution of the Elusive Cress is not known, with information provided with a single collection within the vicinity of Geehi Dam. The record of the species in NSW includes the habitat note "growing on mineral soil of embankment". The species was also recorded in a rocky limestone area in eastern Victoria.</p> <p>The project area does not contain suitable habitat for this species; therefore, it is unlikely to occur.</p>
<i>Pomaderris cotoneaster</i>	Cotoneaster Pomaderris	Yes	<p>Cotoneaster Pomaderris has a very disjunct distribution, being known from the Nungatta area, northern KNP (near Tumut). Cotoneaster Pomaderris has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs.</p> <p>Although unlikely to occur, based on the species geographic distribution, the survey area contains forest and rocky forested slopes that are considered suitable habitat to support this species based on the limited understanding of the species ecology.</p>
<i>Prasophyllum innubum</i>	-	Yes	<p>Terrestrial orchid restricted to a single population comprising of seven small colonies totalling 400 individuals in a small area 30 kilometres north-west of Cabramurra and 17 kilometres south of Talbingo including Bago State Forest. Found growing in streamside habitat amongst Sphagnum hummocks at elevations between 1,150-1,180 metres in Temperate Montane Grasslands. A cryptic species which is most visible when flowering from January to February. Grows in moist sandy soils over sandstone substrates.</p> <p>The project area contains suitable habitat for this species and the species was recorded within the survey area.</p>
<i>Prasophyllum retroflexum</i>	Kiandra Leek Orchid	Yes	<p>Terrestrial orchid restricted to the Long Plain, Kiandra and Tantangara areas of Kosciuszko National Park. Found growing in subalpine meadows, subalpine grasslands and Snow Gum Eucalyptus pauciflora subsp. pauciflora woodlands in Temperate Montane Grasslands. This species is cryptic and most visible when flowering between October and December.</p> <p>The project area contains suitable habitat for this species and the species was recorded within the survey area.</p>

Table 5.3 Species credit species and status and habitat suitability assessment

Scientific name	Common name	Candidate species	Justification
<i>Pterostylis alpina</i>	-	Yes	The Alpine greenhood grows in moist forests on foothills and ranges, extending to montane areas in New South Wales. Occurring in the Southern Tablelands south from Bondo State Forest. It is often found on sheltered southern slopes near streams in rich loam. The species flowers from August to October. The project area contains suitable habitat for this species and the species was recorded within the survey area.
<i>Pterostylis foliata</i>	Slender Greenhood	Yes	The Slender Greenhood grows in eucalypt forests amongst an understorey of shrubs, ferns and grasses. It's known to occur on loam or clay loam soils, found on sheltered slopes. The species is endemic to south-eastern Australia. This species was not predicted to occur but was added manually. The project area contains suitable habitat for this species and the species was recorded within the survey area.
<i>Rutidosia leiocarpis</i>	Monaro Golden Daisy	Yes	Low, tufted, perennial herb with a scattered distribution on the Monaro and subalpine plains of Kosciuszko National Park. Grows at high elevations in Temperate Montane Grasslands. Grows on basalt, granite and sedimentary substrates. The project area contains suitable habitat for this species and the species was recorded within the survey area.
<i>Thelymitra alpicola</i>	-	Yes	Glabrous terrestrial herb. In Kosciuszko National Park and the Bago plateau the species occurs in wet heaths and adjacent to Sphagnum bogs between 1,000-1,500 metres. Associated species include <i>Hakea microcarpa</i> , <i>Leptospermum myrtifolium</i> , <i>Baeckea utilis</i> , <i>Baeckia gunniana</i> , <i>Epacris breviflora</i> , <i>Epacris paludosa</i> , <i>Balioskion austral</i> and <i>Empodisma minus</i> . Flowering occurs from late November to mid-December. The project area contains suitable habitat for this species and the species was recorded within the survey area.
<i>Thesium australe</i>	Austral Toadflax	Yes	Austral Toadflax occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast, often in association with Kangaroo Grass and often in wet areas. This species is a root parasite that takes water and some nutrients from other plants, especially Kangaroo Grass. This species is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands region. Suitable damp, grassy woodland habitat occurs but is likely to be restricted to PCT 285, PCT 1224 and damp areas of PCT 1196 within the project area.
Fauna			
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (Breeding)	Yes	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. The project area contains suitable breeding habitat to support this species and the species was recorded within the survey area.

Table 5.3 Species credit species and status and habitat suitability assessment

Scientific name	Common name	Candidate species	Justification
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo (Breeding)	No	<p>The Glossy Black-cockatoo inhabits coastal woodlands and drier forest areas, open inland woodlands, or timbered watercourses where its main food source, the casuarina (she-oak) is common. The species prefers to nest in hollows of large, old eucalypt trees, alive or dead, typically around 3 to 30 metres above the ground. The current known distribution within NSW covers areas from the coast to the tablelands, and as far west as the Riverina and Pilliga Scrub.</p> <p>The project area does not support suitable breeding habitat with dominant She-oak (<i>Allocasuarina</i> spp.) and is outside of the known range.</p>
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Yes	<p>The Eastern Pygmy-possum is found in a broad range of habitats from rainforest through sclerophyll forest and woodland to heath, but in most areas woodlands and heath appear to be preferred. Feeds largely on nectar and pollen collect from banksias, eucalypts and bottlebrushes. Also feeds on insects throughout the year. This feed source may be more important in habitats where flowers are less abundant such as wet forests. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (<i>Pseudocheirus peregrinus</i>) dreys or thickets of vegetation (eg grass-tree skirts). Nest-building appears to be restricted to breeding females. Tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks.</p> <p>The project area supports suitable habitat for this species and the species was recorded within the survey area.</p>
<i>Cyclodomorphus praealtus</i>	Alpine She-oak Skink	Yes	<p>The Alpine She-oak Skink is found in treeless or very lightly treed areas that contain tussock grasses, low heath or a combination of both. The species preferences areas with litter, rocks, logs and other ground debris to use as shelter. Within NSW it has been observed in alpine to sub-alpine grasslands in flat to gently sloping areas. This species was not predicted to occur, but was added manually.</p> <p>The project area supports suitable habitat for this species and the species was recorded within the survey area.</p>
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Breeding)	Yes	<p>Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass.</p> <p>A breeding nest was observed during targeted surveys within the survey area.</p>
<i>Hieraaetus morphnoides</i>	Little Eagle (Breeding)	Yes	<p>The Little Eagle occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. The species nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.</p> <p>The project area supports suitable habitat for this species with potential raptor nests.</p>

Table 5.3 Species credit species and status and habitat suitability assessment

Scientific name	Common name	Candidate species	Justification
<i>Litoria booroolongensis</i>	Booroolong Frog	Yes	<p>The Booroolong Frog is associated with permanent streams in a variety of vegetation types. Primary habitat requirements are extensive rock bank structures along permanent rivers with the key feature of these rock structures being rock crevices in relatively shallow, slow to medium-flowing sections of stream.</p> <p>Suitable habitat for this species was identified along the Yarrangobilly River and Wallace's Creek within the project area during the habitat assessment. The species was recorded within the survey area.</p>
<i>Litoria spenceri</i>	Spotted Tree Frog	No	<p>The Spotted Tree Frog is extremely rare and occurs in scattered, geographically isolated populations. Historically it was known from two streams in southern NSW on the north-west side of the Great Dividing Range; however both populations appeared to have become locally extinct. One population has been re-established via a reintroduction program. It occurs among boulders or debris along naturally vegetated, rocky fast flowing upland streams and rivers.</p> <p>Due to extremely limited population distribution in NSW this species is considered unlikely to occur within the project area.</p>
<i>Litoria verreauxii alpina</i>	Alpine Tree Frog	Yes	<p>The Alpine Tree Frog occurs in the south-eastern NSW and Victorian high country (alpine and sub-alpine zones) generally above 1,100 m ASL. Most locations are within the KNP and some are close to alpine resorts. Found in a wide variety of habitats including woodland, heath, grassland and herb fields. Breed in natural and artificial wetlands including ponds, bogs, fens, streamside pools, stock dams and drainage channels that are still or slow flowing.</p> <p>The project area supports suitable sub-alpine grasslands and steam habitat and the species was recorded within the survey area.</p>
<i>Lophoictinia isura</i>	Square-tailed Kite (Breeding)	Yes	<p>The Square-tailed Kite is found in a variety of timbered habitats including dry woodlands and open forests. The species shows a particular preference for timbered watercourses, where nests are constructed in a fork or on large, horizontal limbs.</p> <p>The project area supports suitable habitat for this species with potential raptor nests.</p>
<i>Mastacomys fuscus</i>	Broad-toothed Rat	Yes	<p>The Broad-toothed Rat occurs in two widely separated areas: the wet alpine and subalpine heaths and woodlands in KNP. The Broad-toothed Rat lives in a complex of runways through the dense vegetation of its wet grass, sedge or heath environment, and under the snow in winter. Food is mostly, gathered at night, in summer and autumn and during the afternoon and early evening in winter. The diet consists almost solely of greenery - grass and sedge stems, supplemented by seeds and moss spore cases. The habitat assessment recorded the scats of the species as abundant in dense tussock grasslands, including PCT 1225 and 637.</p> <p>The project area contains suitable wet alpine and subalpine heaths with dense vegetation and the species was recorded within the survey area.</p>

Table 5.3 Species credit species and status and habitat suitability assessment

Scientific name	Common name	Candidate species	Justification
<i>Myotis macropus</i>	Southern Myotis	Yes	<p>This species roost in groups close to water in caves, mine shafts, hollow-bearing trees, storm water channels, building, under bridges and in dense foliage. The Southern Myotis relies on waterways with pools of 3 m wide or greater for foraging, breeding and roosting.</p> <p>The project area contains suitable habitat for the species, as defined in OEH (2018a).</p>
<i>Ninox connivens</i>	Barking Owl (Breeding)	Yes	<p>Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. It typically breeds in hollows of large eucalypts or paperbarks, usually near watercourses or wetlands. Nest-hollow entrances are 2-35 m above the ground with a diameter of 20-46 cm and depth of 20-300 cm. During nesting season, the male perches in a nearby tree overlooking the hollow entrance.</p> <p>The project area contains suitable habitat. Suitable nesting habitat is limited to areas of mature trees that are mainly located along the Yarrangobilly River, the upper reaches of Lobs Hole Ravine Road and the Marica area.</p>
<i>Ninox strenua</i>	Powerful Owl (Breeding)	Yes	<p>The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest, requiring large tracts of forest or woodland habitat. The species nests in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. Nest in unburnt gullies and lower slopes within 100 m of streams.</p> <p>The project area contains suitable habitat. Suitable nesting habitat is limited to areas of mature trees that are mainly located along the Yarrangobilly River, the upper reaches of Lobs Hole Ravine Road and the Marica area.</p>
<i>Petaurus australis</i>	Yellow-bellied Glider population on the Bago Plateau	No	<p>Habitat on the Bago Plateau consists of tall wet sclerophyll forest dominated by Alpine Ash, Mountain Gum, Narrow-leaved Peppermint and Candlebark. The Yellow-bellied Glider feeds primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects. The species is very mobile and occupies large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources.</p> <p>The project area is outside of the Bago Plateau.</p>
<i>Petaurus norfolcensis</i>	Squirrel Glider	Yes	<p>The Squirrel Glider inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. The species prefers mixed species stands with a shrub or Acacia mid-storey. The species relies on large old trees with hollows for breeding and nesting; however, trees need to be less than 50 m apart.</p> <p>Suitable feed and nesting trees are limited to the habitat west of Wallace's Creek within the project area.</p>
<i>Petroica rodinogaster</i>	Pink Robin	Yes	<p>Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. Like most Robins, requires perching habitat from which it can predate insects and spiders, but does spend significant time on the ground.</p> <p>Potential for the species to occur within the project area.</p>

Table 5.3 Species credit species and status and habitat suitability assessment

Scientific name	Common name	Candidate species	Justification
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Yes	<p>The Brush-tailed Phascogale prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. The species also inhabits heath, swamps, rainforest and wet sclerophyll forest. Nests and shelters in tree hollows with entrances 2.5 - 4 cm wide. Known to use many different hollows over a short time span.</p> <p>The species is scarce in the KNP, with a single record. Potential suitable habitat occurs within the project area and therefore the species was retained as a candidate species.</p>
<i>Phascolarctos cinereus</i>	Koala (Breeding)	Yes	<p>Koalas live in eucalypt woodlands and forests. Home range size varies according to quality of habitat, ranging from less than two to several hundred hectares. The trees within the project area provide foraging or sheltering resources for Koala. Ribbon Gum, identified as a Koala feed tree, is present within the project area.</p> <p>Recent Koala records are scarce in KNP; however, as suitable habitat exists, the species is retained as a candidate species.</p>
<i>Pseudomys fumeus</i>	Smoky Mouse	Yes	<p>The precise habitat requirements of the Smoky Mouse are not clear. A wide range of vegetation communities are occupied, from damp coastal heath in East Gippsland, to sub-alpine heath. A characteristic of Smoky Mouse localities, except those in wet gullies, is a floristically diverse midstorey with members of the plant families Epacridaceae, Fabaceae and Mimosaceae well represented. Ground cover is also likely to be critical and can be in the form of dense low vegetation, such as occurs in heaths, or grass tussocks, rocks and logs in more open habitats. Soil conditions also need to be conducive to burrowing and growth of hypogeal fungi, a major component of the diet (Menkhorst and Broome 2006, 2008).</p> <p>Smoky Mouse has been recorded across the project area during targeted surveys.</p>
<i>Pseudophryne pengilleyi</i>	Northern Corroboree Frog	Yes	<p>The Northern Corroboree Frog occurs in forests, sub-alpine woodlands and tall heath in the Fiery Range from the Snowy Mountains Highway to Wee Jasper. Populations also occur in the pine plantations near Tumut. Summer breeding habitat includes pools and seepages in sphagnum bogs, wet heath, wet tussock grasslands and herbfields in low-lying depressions. Outside the breeding season adults move away from the bogs into the surrounding heath, woodland and forest to overwinter under litter, logs and dense groundcover. Areas above 700m ASL provide potential habitat for this species.</p>
<i>Tyto novaehollandiae</i>	Masked Owl (Breeding)	Yes	<p>The Masked Owl lives in dry eucalypt forests and woodlands from sea level to 1,100 m. The species requires old hollow-bearing eucalypts greater than 90 cm diameter at breast height, with hollows greater than 40 cm wide, greater than 100 cm deep and at least 3 m above the ground, for breeding. Will breed in a variety of topographic positions.</p> <p>The project area contains suitable habitat. Suitable nesting habitat is limited to areas of mature trees that are mainly located along the Yarrangobilly River, the upper reaches of Lobs Hole Ravine Road and the Marica area.</p>

Several threatened flora species and one fauna species have been recorded within survey area that did not appear in the BAM calculator for consideration as candidate species. This is because the South Eastern Highlands IBRA region and Bondo IBRA subregion was selected and the species are associated with the other IBRA regions and subregions (refer to Section 3.1.1). Species recorded during survey, but not included in the BAM calculator included:

- Alpine She-oak Skink;
- Clover Glycine;
- Kiandra Leek Orchid;
- Mauve Burr-daisy;
- Max Mueller's Burr-daisy;
- Monaro Golden Daisy;
- *Prasophyllum innubum*;
- Raleigh Sedge; and
- *Thelymitra alpicola*.

Despite the above species not appearing, they have been added to the BAM calculator manually and have been considered during targeted flora surveys.

This assessment identified 15 threatened flora and 19 threatened fauna as candidate species requiring further assessment. An additional 10 EPBC listed species (including migratory species) were included as candidate species for the purposes of the EPBC Act assessment process (Section 8). Candidate species (including EPBC listed species) are outlined below (Table 5.4), in order of assessment within Sections 5.3.3 and 5.3.4.

Table 5.4 **Candidate species**

Scientific name	Common name	BC Act	EPBC Act
Flora			
<i>Caladenia montana</i>	-	V	-
<i>Calotis glandulosa</i>	Mauve Burr-daisy	V	VU
<i>Calotis pubescens</i>	Max Mueller's Burr-daisy	E1	-
<i>Carex raleighii</i>	Raleigh Sedge	E1	-
<i>Colobanthus curtisiae</i>	Curtis' Colobanth	-	VU
<i>Discaria nitida</i>	Leafy Anchor Plant	V	-
<i>Euphrasia scabra</i>	Rough Eyebright	E1	-
<i>Glycine latrobeana</i>	Clover Glycine	E4A	VU
<i>Leucochrysum albicans</i> var. <i>tricolor</i>	Hoary Sunray	-	EN
<i>Pomaderris cotoneaster</i>	Cotoneaster Pomaderris	E1	EN
<i>Prasophyllum innubum</i>	-	E4A	CE
<i>Prasophyllum retroflexum</i>	Kiandra Leek Orchid	V	VU
<i>Pterostylis alpina</i>	-	V	-
<i>Pterostylis foliata</i>	Slender Greenhood	V	-
<i>Pterostylis oreophila</i>	Blue-tongued Greenhood	E4A	CE
<i>Rutidosia leirolepis</i>	Monaro Golden Daisy	V	VU
<i>Thelymitra alpicola</i>	-	V	-
<i>Thesium australe</i>	Austral Toadflax	V	VU
<i>Xerochrysum palustre</i>	Swamp Everlasting	-	VU

Table 5.4 **Candidate species**

Scientific name	Common name	BC Act	EPBC Act
Diurnal birds			
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (breeding habitat only)	V	-
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Breeding)	V	-
<i>Hieraaetus morphnoides</i>	Little Eagle (Breeding)	V	-
<i>Gallinago hardwickii</i>	Latham's Snipe	-	Mi
<i>Lophoictinia isura</i>	Square-tailed Kite (Breeding)	V	-
<i>Hirundapus caudacutus</i>	White-throated Needletail	-	VU
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	-	Mi
<i>Petroica rodinogaster</i>	Pink Robin	V	-
<i>Rhipidura rufifrons</i>	Rufous Fantail	-	Mi
Nocturnal birds			
<i>Ninox connivens</i>	Barking Owl (breeding habitat only)	V	-
<i>Ninox strenua</i>	Powerful Owl (breeding habitat only)	V	-
<i>Tyto novaehollandiae</i>	Masked Owl (breeding habitat only)	V	-
Small terrestrial mammals			
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-
<i>Mastacomys fuscus</i>	Broad-toothed Rat	V	VU
<i>Pseudomys fumeus</i>	Smoky Mouse	E4A	CE
Large terrestrial mammals			
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	EN
Arboreal mammals			
<i>Petauroides volans</i>	Greater Glider	-	V
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-
<i>Phascolarctos cinereus</i>	Koala	V	VU
Microchiropteran bats			
<i>Myotis Macropus</i>	Southern Myotis	V	-
Amphibians			
<i>Litoria booroolongensis</i>	Booroolong Frog	E1	EN
<i>Litoria verreauxii alpina</i>	Alpine Tree Frog	E1	VU
<i>Pseudophryne pengilleyi</i>	Northern Corroboree Frog	E4A	CE
Reptiles			
<i>Cyclodomorphus praealtus</i>	Alpine She-oak Skink	E1	EN

Notes: 1. BC Act status: E4A – critically endangered, E1 – endangered, E2 – endangered population, V – vulnerable
2. EPBC Act status: CE- critically endangered, EN – endangered, VU – vulnerable

Targeted surveys were undertaken, and the presence or absence of these species in the Main Works survey area determined, in accordance with Section 6.4 of the BAM (OEH 2017a). Survey methods and outcomes are discussed further below.

5.3.3 Targeted survey methods

i Targeted flora surveys

Targeted flora surveys have been undertaken in accordance with OEH (2016c) and DoE (2013a) guidelines and included transects spaced at intervals of 10 m. Targeted surveys along roads were undertaken with an observer walking either side of the road 5 to 7 m from the road edge.

In the western section of the survey area, areas with basalt derived soils along Lobs Hole Ravine Road, and areas dominated by Kangaroo Grass, were targeted based on suitability of habitat for candidate species. As the likelihood of threatened flora species occurring in many montane PCTs is low due to a lack of suitable habitat, surveys focused on sub-alpine areas and suitable habitat, with targeted flora surveys in montane areas limited to key microhabitats, such as along riparian areas for *Cotoneaster Pomaderris*. In the eastern section of the study area all PCTs were considered to provide suitable habitat for threatened flora species and were subject to targeted surveys.

Targeted flora surveys were undertaken within the survey area between December 2017 and January 2018 and December 2018 and January 2019. These targeted surveys were undertaken prior to the final disturbance footprint being provided. Surveys were completed within a broader study area and are relevant to our assessment in providing results for candidate species. Where surveys have not been undertaken within the disturbance footprint, due to the provision of the final footprint outside of the seasonal survey requirements for some species, either presence has been assumed if the species has been recorded in similar habitats, or surveys will be undertaken prior to the response to submissions and an updated assessment and offset requirements provided. Targeted flora survey transect locations are illustrated in Figure 5.1.

ii Targeted fauna surveys

Targeted fauna surveys were conducted within the Main Works survey area between August 2017 and June 2019 in accordance with various NSW (DEC 2004, DECC 2009, OEH 2018a) and Commonwealth (DSEWPaC 2010a, 2010b, 2010c, 2011a, 2011b) guidelines.

Stratification units, as well as survey methods and effort are outlined for each fauna group below. Stratification units include areas of direct impact only. Fauna survey locations are illustrated in Figure 5.2. A summary of fauna surveys, including sites and survey effort is provided in Annexure C, while weather data for the survey period is provided in Annexure D.

a Diurnal birds

Diurnal bird surveys were undertaken for five species listed under the BC Act and four additional migratory species listed under the EPBC Act. Targeted bird species include:

- Gang-gang Cockatoo (breeding habitat);
- Pink Robin;
- Breeding habitat for birds of prey, including:
 - Little Eagle;
 - Square-tailed Kite;
 - White-bellied Sea-Eagle;
- White-throated Needletail;

- Latham's Snipe;
- Rufous Fantail; and
- Satin Flycatcher.

Stratification units and area of each survey unit in the survey area is shown in Table 5.5.

Table 5.5 Stratification units and survey area – diurnal birds

Vegetation class/survey area	Area (ha)
Montane Wet Sclerophyll Forests	8.60
Southern Tablelands Dry Sclerophyll Forests	68.42
Southern Tablelands Grassy Woodlands	26.66
Southern Tablelands Wet Sclerophyll Forests	34.74
Subalpine Woodlands	178.21
Upper Riverina Dry Sclerophyll Forests	18.59
TOTAL	335.22

Bird survey methods and survey effort have been developed in accordance with DEC (2004) and DSEWPac (2010a) guidelines. Methods include a mix of transect and areas searches, to record bird activity, and targeted nest searches for the Gang-gang Cockatoo, Pink Robin and birds of prey. Methods and survey effort are outlined in Table 5.6.

Table 5.6 Methods and survey effort – diurnal birds

Method	Survey description	Survey effort
Transect and area searches (Pink Robin)	<ul style="list-style-type: none"> • Land based areas searches and transects. • Surveyors walked transect (access tracks) or area searches within a 1-3 ha area (other areas). • All calls and habitat features were investigated. • Birds observed or heard were recorded. 	<p>DEC (2004) has not resolved bird survey requirements and does not provide guidance on survey effort. DSEWPac (2010a) was reviewed and sympatric species survey efforts indicated a requirement for 10 hours over 5 days (2 hours per day) for sites less than 50 ha. No survey effort for larger sites is provided.</p> <p>Based on the stratification units listed above, this requires a total of 100 hours over 50 days (2 hours per day).</p> <p>A total of 69 bird surveys have been completed within the disturbance footprint, with a total of 188 people hours between December 2017 and April 2019. An additional 40 surveys, with a total of 66 people hours, have been completed in adjacent areas during the same survey period.</p> <p>The minimum survey effort was exceeded.</p>

Table 5.6 Methods and survey effort – diurnal birds

Method	Survey description	Survey effort
Targeted nest searches (Gang-gang Cockatoo, White-bellied Sea-Eagle, Little Eagle)	Observers travelled across available habitat, seeking out habitat features including nest trees and hollows. Suitable nest or breeding hollows were marked and watched to determine if they are being used by the target species.	DEC (2004) has not resolved nest search requirements, and does not provide guidance on survey effort. DSEWPaC (2010a) was reviewed and sympatric species survey efforts indicated 8 hours over 4 days (2 hours per day) for sites less than 50 ha. Survey effort is outlined above.

b Nocturnal birds

Nocturnal bird surveys were undertaken to identify breeding habitat for three forest owl species listed under the BC Act. Targeted nocturnal bird species include:

- Barking Owl;
- Powerful Owl; and
- Masked Owl.

Table 5.7 Stratification units and survey area – nocturnal birds

Vegetation class/survey area	Area (ha)
Montane Wet Sclerophyll Forests	8.60
Southern Tablelands Dry Sclerophyll Forests	68.42
Southern Tablelands Wet Sclerophyll Forests	34.74
Subalpine Woodlands	178.21
Upper Riverina Dry Sclerophyll Forests	18.59
TOTAL	308.56

Bird survey methods and survey effort were developed in accordance with DEC (2004). Methods included call playback and spotlighting, with listening periods to listen for the call between roosting males and nesting females where appropriate. Methods and survey effort are outlined in Table 5.8.

Table 5.8 Methods and survey effort – nocturnal birds

Method	Survey description	Survey effort
Call playback and spotlighting	<p>DEC (2004) recommends call playback and spotlighting are undertaken to target these owl species.</p> <ul style="list-style-type: none"> Commence surveys with a 10-15 minute listening period. This will target the male and female calling back and forth to one another and is useful in identifying nesting trees. This will be followed by spotlighting for 10 minutes in the immediate vicinity. Call playback is then undertaken with the call of each target species played intermittently for a 5 minutes period followed by a 10 minute listening period. Following call playback a further 10 minutes of spotlighting is undertaken. <p>If forest owls were found to be present within the survey area, surveys would try to identify nesting sites by listening to roosting males calling to nesting females on dusk. Female calls would be triangulated and nest searches undertaken in identified areas over several nights.</p>	<p>DEC (2004) recommends at least 5 visits for the Powerful Owl and Barking Owl, 6 visits for the Sooty Owl and 8 visits for the Masked Owl. Sites should be separated by 1 km.</p> <p>Based on the above, and availability of suitable habitat, up to 24 survey sites were required to be completed for the Barking Owl, Powerful Owl and Masked Owl.</p> <p>Surveys have been completed at 29 sites within the disturbance footprint, with eight night visits at 27 of these sites, and four nights for the other two sites. An additional three sites were completed within adjacent areas.</p> <p>The minimum survey effort was exceeded.</p>

c Small terrestrial mammals

Small terrestrial mammal surveys were undertaken to target three small mammal species, including:

- Broad-toothed Rat;
- Eastern Pygmy-possum; and
- Smoky Mouse.

Stratification units and area of each survey unit in the survey area are shown in Table 5.9.

Table 5.9 Stratification units and survey area – small terrestrial mammals

Vegetation class/survey area	Area (ha)
Alpine Bogs and Fens	1.03
Alpine Heaths	0.08
Montane Wet Sclerophyll Forests	8.60
Southern Tablelands Dry Sclerophyll Forests	68.42
Southern Tablelands Wet Sclerophyll Forests	34.74
Subalpine Woodlands	178.21
Temperate Montane Grasslands	87.92
Upper Riverina Dry Sclerophyll Forests	18.59
TOTAL	397.59

Methods and survey effort have been developed in accordance with DEC (2004) and DSEWPaC (2011a), modified as per Nelson et al. (2009), and included a mix of terrestrial trapping and remote camera surveys. Methods and survey effort are outlined in Table 5.10.

Table 5.10 Methods and survey effort – small terrestrial mammals

Method	Survey description	Survey effort
Trapping	<p>20 Elliot A traps placed 10 m apart in two parallel lines separated by 25 m (access roads) or 25 Elliot A traps placed 10 m apart in a 5 x 5 grid (other areas):</p> <ul style="list-style-type: none"> • Traps were baited with a mixture of peanut butter, rolled oats and honey. • Traps were checked early in the morning and closed for the day. • Traps were opened and rebaited in the late afternoon. • Animals were temporarily marked to allow mark-recapture data to be collected. 	<p>DSEWPac (2011a) specifies two sites per 5 ha stratification unit with replication across habitat types in areas of greater than 5 ha. No level of replication is specified. Consultation was undertaken with Linda Broome (OEH) to determine a suitable survey effort per stratification unit. This consultation determined that a suitable effort would be 20-25 Elliot A traps placed out for 4 nights = 100 trap nights, per 50 ha site, with additional replicates for every additional 100 ha.</p> <p>Based on the areas above this required 12 survey sites equating to 1,200 trap nights.</p> <p>Trapping within the disturbance footprint was conducted between December 2017 to April 2019 at 22 sites, equating to 2,200 trap nights. An additional 57 sites were completed adjacent to the disturbance footprint, equating to 5,700 trap nights.</p> <p>The minimum survey effort was exceeded.</p>
Remote cameras	<p>Remote camera surveys were undertaken in accordance with the following guidelines:</p> <ul style="list-style-type: none"> • Cameras placed at least 100 m apart. • Cameras were attached to tree or stake and positioned approximately 25cm above ground with bait stations placed 1.5m away. • Bait stations were baited with a mixture of peanut butter, rolled oats and honey. <p>DSEWPac (2011a) recommends cameras are placed out for at least one week. However, Nelson et al. (2009) detected the Smoky Mouse on cameras on or before the tenth night of survey. As such, it was determined one week may not be sufficient to reliably detect the species, and surveys were extended to a minimum of 14.</p>	<p>DSEWPac (2011a) recommends that for the Smoky Mouse two cameras are placed out for one week, in areas up to 5 ha. Based on the areas above this required 83 survey sites. If surveys are undertaken for one week, as outlined in DSEWPac (2011a), this equates to 1,162 camera nights. No guidelines are available for the Broad-toothed Rat or Eastern Pygmy-possum.</p> <p>Remote camera surveys were undertaken between December 2017 and April 2019 at 24 sites (48 cameras) within the disturbance footprint, with a minimum of 14 nights per site and up to 31 nights for some sites. A total of 901 camera nights has been completed within the disturbance footprint. An additional 69 sites (138 cameras) with a total of 1835 camera nights were completed within adjacent areas.</p>
Regional surveys	<p>Regional surveys for the Smoky Mouse were undertaken to put findings of the Smoky Mouse on Lobs Hole Ravine Road and at Marica in context.</p> <p>Surveys were undertaken as per above, with two cameras placed out for a minimum of 14 nights, separated by 100m. Cameras baited as per above.</p> <p>Sites were selected based on a 1km grid of all areas above 1000m AHD.</p>	<p>A total of 66 sites were surveyed within and adjacent to the survey area. Two cameras were placed out per site for 14 nights. Sites where Smoky Mouse was not recorded during the first round of survey had an additional round of survey. This equates to a total of 5,808 nights (220 cameras placed out).</p> <p>Two sites (four cameras) were within the disturbance footprint, with a total of 102 nights.</p>

d Large terrestrial mammals

Large terrestrial mammal surveys were undertaken to target the Spotted-tail Quoll. Stratification units and area of each survey unit in the Main Works survey area are shown in Table 5.11.

Table 5.11 Stratification units and survey area – large terrestrial mammals

Vegetation class/survey area	Area (ha)
Montane Wet Sclerophyll Forests	8.60
Southern Tableland Dry Sclerophyll Forests	68.42
Southern Tablelands Grassy Woodlands	26.66
Southern Tableland Wet Sclerophyll Forests	34.74
Subalpine Woodlands	178.21
Upper Riverina Dry Sclerophyll Forests	18.59
TOTAL	335.22

Methods and survey effort have been developed in accordance with DSEWPaC (2011a), specifically the species profile for the Spotted-tailed Quoll, and the Victorian Survey Standard for the Spot-tail Quoll (DSE 2011a). Methods and survey effort are outlined in Table 5.12.

Table 5.12 Methods and survey effort – large terrestrial mammals

Method	Survey description	Survey effort
Remote Cameras	<p>Remote camera surveys were undertaken in accordance with the following guidelines for each 100 ha site:</p> <ul style="list-style-type: none"> • Two cameras placed out for one month. • Cameras placed at least 500 m apart. • Cameras were set for 24 hour operation. • Cameras placed out in associated with bait stations filled with chuditch bait (meat meal, sardines, fish oil, chicken oil and rolled oats). • Cameras were attached to either a tree or stake and placed approximately 1 m above the ground and 2-3 m from the bait station. 	<p>DSE (2011a) recommends two cameras per 100 ha sampling unit (or part thereof) placed out for 30 days. Based on the areas above, this equates to 7 survey sites (14 cameras) and 420 camera nights.</p> <p>Surveys were undertaken between February and April 2018 across three survey sites (six cameras) within the disturbance footprint, equating to 212 camera nights. An additional five sites (10 cameras) were completed within adjacent areas. A total of 313 camera nights was completed within the survey area.</p>

e Arboreal mammals

Arboreal mammal surveys were undertaken within the Main Works survey area to target four arboreal species listed under the EPBC Act and/or BC Act. Targeted arboreal mammal species include:

- Koala;
- Squirrel Glider;
- Brush-tailed Phascogale; and
- Greater Glider.

Stratification units and area of each survey unit in the survey area is shown in Table 5.13.

Table 5.13 Stratification units and survey area – arboreal mammals

Vegetation class/survey area	Area (ha)
Montane Wet Sclerophyll Forests	8.60
Southern Tablelands Dry Sclerophyll Forests	68.42
Southern Tablelands Wet Sclerophyll Forests	34.74
Subalpine Woodlands	178.21
Upper Riverina Dry Sclerophyll Forests	18.59
TOTAL	308.56

The Koala was deemed to have potential to occur in suitable Eucalypt forest and woodland below 800 m elevation (DSEWPaC 2012, DoE 2014a, TSSC 2012).

Methods and survey effort have been developed in accordance with DEC (2004), DSEWPaC (2011a), the Victorian Survey Standard for the Greater Glider (DSE 2011b) and Biolink (2008) for the Koala. Methods and survey effort is outlined in Table 5.14.

Table 5.14 Methods and survey effort – arboreal mammals

Method	Survey description	Survey effort
Trapping (Phascogale and Gliders)	<p>Ten Elliot B or cage traps were placed at 2-4 m above the ground, 50 m apart in two parallel lines separated by 50 m:</p> <ul style="list-style-type: none"> • Traps were baited with a mixture of peanut butter, rolled oats and honey. • A mixture of water and honey was sprayed on each tree trunk. • Traps were checked early in the morning and closed for the day. • Traps were re-opened and rebaited in the late afternoon. • Animals were temporarily marked to allow mark-recapture data to be collected. • Trapping was undertaken in conjunction with terrestrial mammal trapping where suitable habitat occurs. 	<p>DEC (2004) requires 24 trap nights over 3-4 consecutive days per 50 ha of stratification unit. Based on the above stratification units, this would equate to 9 surveys and 216 trap nights.</p> <p>Surveys were undertaken between December 2017 and April 2019 at 16 trapping sites within the disturbance footprint, equating to 640 trap nights. An additional 29 sites were completed adjacent to the disturbance footprint, equating to 1,160 trap nights.</p> <p>The minimum survey effort was exceeded.</p>

Table 5.14 Methods and survey effort – arboreal mammals

Method	Survey description	Survey effort
Spotlighting	<p>DSEWPac (2011a) recommends two parallel 200 m transects per 5 ha site. No survey effort for larger sites is specified.</p> <p>In line with DSE (2011b) and DEC (2004), a survey effort of two parallel 2,000 m transects per 100 ha site (half the survey effort, but over a larger area) was deemed suitable in consultation with OEH. Surveys included:</p> <ul style="list-style-type: none"> • 2,000 m transects were undertaken by 2 observers (4,000 m total transect), with 25 m between transects. • Observers moved at a speed of 10 m per minute (ie 200 minutes for a 2,000 m transect). • All animals observed were recorded, including the distance of the animals from the observer. 	<p>DSEWPac (2011a) recommends two parallel transects per 5 ha site, while DEC (2004) recommends 2 transects per 200 ha of stratification unit.</p> <p>Given the size of the survey area and the fact that no species-specific guidelines are available for the Greater Glider, a survey effort of two 2,000 m transects per 100 ha stratification unit, repeated on two separate occasions, was deemed appropriate based on DSE (2011b) and DEC (2004).</p> <p>Based on the above stratification units, this would equate to 12 x 2000m spotlighting surveys, repeated on two occasions (24 transects).</p> <p>Surveys were undertaken between December 2017 and June 2019, with 78 transects (2,000 m minimum distance) completed within the disturbance footprint, totalling 342,925.68 m in length. Some transects were less than 2,000 m as they were sited in infrastructure areas where a 2,000m transect was not appropriate. An additional 25 transects were completed adjacent to the disturbance footprint, totalling 146,056.05 m in length.</p> <p>The minimum survey effort was exceeded.</p>
Regularised Grid Based (RGB) Spot Assessment Technique (SAT) (Koala)	<p>The RGB SAT method requires application of a uniform assessment method across a broad area. A 350 m x 350 m grid was applied to the survey area to identify survey locations. At each grid point, the SAT (Phillips and Callaghan 2011) was undertaken, as follows:</p> <ul style="list-style-type: none"> • Centre tree was located and marked with flagging tape. • The 29 nearest trees to the centre tree were also identified and marked. • Koala faecal pellets were searched for beneath each of the 30 trees within a distance of 100 cm. Initial inspections were checked in undisturbed ground surface, followed by a more thorough inspection involving disturbance of leaf litter and ground cover (if no faecal pellets were initially detected). • An average of approximately two person minutes per tree were dedicated to the faecal pellet search. • Activity levels can be interpreted using Table 2 from Phillips and Callaghan (2011). 	<p>Grid points located below 800 m and in proximity to and surrounding the survey area were included for survey.</p> <p>A total of 71 grid locations have been surveyed, with nine grid locations within the disturbance footprint.</p>

Table 5.14 Methods and survey effort – arboreal mammals

Method	Survey description	Survey effort
Songmeters (Koala)	<p>Following recent use of acoustic recorders to document calling by male Koalas (Law et al. 2018) Songmeters were deployed during the breeding season to record males bellowing:</p> <ul style="list-style-type: none"> • Songmeters set to record between dusk and dawn. • Songmeters were deployed at sites separated by at least 3km, over a mix of landscape positions (ridge, valley, gully and flat). • Songmeters were deployed at each site for a minimum of seven nights. 	No survey effort has been determined for the use of Songmeters. Songmeters were placed out at five sites within the survey area for a minimum of 61 nights per site. This equates to 308 nights of survey.

f Microchiropteran bats

Microbat surveys were undertaken within the Main Works survey area to target the Southern Myotis. Stratification units and area of each survey unit in the survey area is shown in Table 5.15.

Table 5.15 Stratification units and survey area – microchiropteran bats

PCT	Area (ha)
PCT 299 – Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands	0.60
PCT 1191 – Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	2.12
TOTAL	2.72

Methods and survey effort have been developed in accordance with DEC (2004) and OEH (2018a). Methods and survey effort are outlined in Table 5.16.

Table 5.16 Methods and survey effort – Microchiropteran bats

Method	Survey description	Survey effort
Acoustic detection	<p>OEH (2018a) permits the use of acoustic devices to record presence of the Southern Myotis.</p> <ul style="list-style-type: none"> • Detectors were set out over waterways. • Detectors were placed out for a minimum of four nights. • Calls were analysed by a person experienced in bat call analysis. 	<p>OEH (2018a) specifies a total effort of 16 nights for each 2.5 km of suitable habitat. An initial habitat assessment indicated there are 10 waterways that may provide foraging habitat for the Southern Myotis, with twenty 2.5 km, or shorter, lengths.</p> <p>Acoustic detection was completed at 10 sites within the survey area, with a total of 43 nights survey effort. Two sites were within the disturbance footprint.</p> <p>Minimum survey effort was met.</p>

g Amphibians

Amphibian surveys were undertaken within the Main Works to target three amphibian species listed under the EPBC Act and BC Act. Targeted amphibian species include:

- Booroolong Frog;

- Alpine Tree Frog; and
- Northern Corroboree Frog.

Stratification units and area of each survey unit in the survey area is shown in Table 5.17.

Table 5.17 Stream lengths – amphibians (Booroolong Frog and Alpine Tree Frog)

Target species	Waterway	Length (m)
Booroolong Frog	Yarrangobilly 1	3363
	Yarrangobilly 2 and Wallace's	2125
	Yarrangobilly Trib 1	1128
	Yarrangobilly Trib 2	823
	Yarrangobilly Trib 3	656
TOTAL		8,095
Alpine Tree Frog	Bullock Creek	5145
	Eucumbene River 3	1099
	Black Waters Creek	762
	Nungar Creek 4	705
	Nungar Creek 5	1068
	Gulf Plain Creek	931
	Gulf Plain Creek Trib	908
	Little Gulf Creek	1107
	Tantangara Creek Trib 1	449
	Tantangara Creek Trib 2	512
	Tantangara Creek Trib 3	812
	Nungar Creek Trib	443
TOTAL		13,941

Table 5.18 Stratification units and survey area – Northern Corroboree Frog

Plant community type	Area (ha)
1225 - Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps	0.59
637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	0.15
TOTAL	0.74

Methods and survey effort have been developed in accordance with DECC (2009) and DSEWPac (2010b) and are outlined in Table 5.19.

Table 5.19 Methods and survey effort – amphibians

Method	Survey description	Survey effort
Habitat assessment	A habitat assessment was undertaken to identify suitable habitat along all watercourses within the survey area.	All streams were assessed for suitable habitat.
Nocturnal searches (visual encounter surveys (VES))	<p>VES were undertaken in accordance with the following:</p> <ul style="list-style-type: none"> • Surveys were undertaken in temperatures of greater than 10°C, and not during rain. • Two observers walked a 200 m transect along a stream. • Using a spotlight and head torch searches were completed for surrounding vegetation, rocks and other microhabitats. • All frogs observed or heard were recorded. • Hygiene protocols were followed to prevent the spread of chytrid fungus, with full wash down between streams. 	<p>DECC (2009) and DSEWPac (2010b) specify a minimum survey effort of one 200 m transect per stream, repeated on four nights (two nights in DECC 2009).</p> <p>Booroolong Frog:</p> <p>Based on the five streams within the survey area this would equate to five x 200 m transects repeated on four nights, equating to 4,000 m of transect survey.</p> <p>Surveys were undertaken in December 2017 to January 2019. All four watercourses have been surveyed for their entire length (rather than 200 m transects) to gain an understanding of the distribution of the species across these watercourses, with surveys repeated on four nights.</p> <p>Overall, 18 transects within the disturbance footprint were completed, equating to 117,723 m of transect survey. An additional four transects with 37,080 m of transect survey were completed adjacent to the disturbance footprint.</p> <p>The minimum survey effort was exceeded.</p> <p>Alpine Tree Frog:</p> <p>Based on the 12 streams adjacent to the survey area this would equate to 12 x 200m transects repeated on four nights, equating to 9,600 m transect surveys.</p> <p>Surveys were undertaken in January 2018 and between January to April 2019. Overall, a total of 20 transects were completed within the disturbance footprint, equating to 96,703 m of transect survey. An additional 19 transects with 90,822 m of transect survey were completed adjacent to the disturbance footprint.</p> <p>The minimum survey effort was exceeded.</p>
Egg mass and tadpole sampling surveys	<p>Egg mass and tadpole sampling was undertaken in accordance with the following:</p> <ul style="list-style-type: none"> • Egg mass were detected during VES listed above. • Tadpole sampling was undertaken using a dip net, with the net dragged along a transect for 1-2 minutes. • Any samples detected were keyed out using Anstis (2013). 	DECC (2009) and Commonwealth of Australia do not specify minimum survey requirements for tadpoles. One transect per stream was undertaken during VES surveys.

Table 5.19 Methods and survey effort – amphibians

Method	Survey description	Survey effort
Diurnal call surveys (Northern Corroboree Frog)	<p>Call surveys were undertaken in accordance with the following:</p> <ul style="list-style-type: none"> • Surveys were undertaken during the daytime. • Observers walked a minimum of a 200 m transect along a waterbody shouting “Hey frog!”. • All frogs observed or heard were recorded. • Hygiene protocols were followed to prevent the spread of chytrid fungus, with full wash down between streams. 	<p>DECC (2009) and DSEWPac (2010b) specify a minimum survey effort of one 200 m transect per stream, repeated on a minimum of two separate days.</p> <p>A number of sites were identified during habitat assessments undertaken as part of the biodiversity assessment for Snowy 2.0. Targeted surveys of all sites were undertaken, in consultation with Dave Hunter (DPIE, pers. comm.), with over 200 km of transects walked through suitable habitat.</p>

h Reptiles

Reptile surveys were undertaken to target the Alpine She-oak Skink. Stratification units and area of each survey unit in the Main Works survey area are shown in Table 5.20.

Table 5.20 Stratification units and survey area – reptiles

Plant community type	Area (ha)
PCT 637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	1.03
PCT 644 - Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	60.75
PCT 679 - Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion	0.03
PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	108.18
PCT 1224 - Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	80.83
PCT 1225 - Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	7.09
TOTAL	257.92

No specific survey guidelines for the Alpine She-oak Skink exist, and they are not included in Commonwealth of Australia (2011). A review of relevant literature indicates that shelter surveys are a productive survey technique. Survey methods have been adapted from the recommended survey effort for the Striped Legless Lizard (*Delma impar*) outlined in Commonwealth of Australia (2011) and following consultation with OEH in 2017. In 2018 tile grids were adapted to tile transects, following consultation with OEH. Methods and survey effort are outlined in Table 5.21.

Table 5.21 Methods and survey effort – reptiles

Method	Survey description	Survey effort
Tile grids	<p>Each tile grid was set out as follows:</p> <ul style="list-style-type: none"> • Tile grid, consisting of 25 tiles spaced at 5 m spacing between tiles in a 5 x 5 grid (N.Clemmens pers. comm.). • The corner of each grid was marked with a star picket, and each tile labelled A1 to E5. • Tile grids were checked at least twice a month, when temperatures were below 28°C. • If the species was detected at a tile grid, the grid was collected and moved to an alternate location to increase survey coverage. 	<p>Minimum survey requirements for the Striped Legless Lizard recommends that 10 tile grids are deployed for sites greater than 30 ha in size using a 5 x 10 grid. In consultation with species experts we proposed to use smaller 5 x 5 grids to increase survey coverage, with a minimum of 20 tile grids to be deployed (D.Hunter person comm., N.Clemmens pers. comm.).</p> <p>A total of 32 tile grids were deployed between December 2017 and October 2018. Two of these grids were within the disturbance footprint.</p>
Tile transects	<p>Each tile transect was set out as follows:</p> <ul style="list-style-type: none"> • Tile transect, consisting of 10 tiles spaced at 5 m spacing between tiles in a transect. • Tile transects were checked at least twice a month, when temperatures are below 28°C. • If the species was detected at a tile transect, the transect was collected and moved to an alternate location to increase survey coverage. 	<p>The tile transect survey effort extends the previous tile grid survey effort, which exceeded survey requirements specified.</p> <p>Fourteen tile grids, surveyed over 2017/18, have been converted to tile transects. Tile transects have been deployed at an additional 44 locations within the survey area. Ten sites are within the disturbance footprint.</p>

iii Additional surveys completed post Main Works EIS submission

Additional targeted flora and fauna surveys were conducted between October and December 2019 to address comments received from the BCD and NPWS. Due to recent design changes, parts of the disturbance footprint had not been previously assessed prior to the submission of the EIS. Flora and fauna survey locations completed during this period are illustrated in Figure 5.3.

a Targeted flora surveys

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. Targeted surveys were conducted during November 2019 across the survey area within high montane areas over 700 m AHD.

Additional surveys were conducted during December 2019 to cover areas within the disturbance footprint that have not been previously surveyed for targeted species. This included Link Road, Rock Forest, the northern section of Lobs Hole and areas to the west of Tantangara Road.

Targeted flora surveys were unable to be completed within parts of the Plateau and Tantangara due to the recent bushfires within Kosciuszko National Park.

b Targeted fauna surveys

Additional targeted fauna surveys were undertaken for the following species:

- Gang-gang Cockatoo;
- White-bellied Sea-Eagle;

- Little Eagle;
- Eastern Pygmy-possum;
- Smoky Mouse;
- Spotted-tailed Quoll;
- Brush-tailed Phascogale;
- Squirrel Glider;
- Greater Glider; and
- Southern Myotis.

Surveys were conducted within the disturbance footprint between October and December 2019 in accordance with various NSW (DEC 2004, OEH 2018a) and Commonwealth (DSEWPac 2010a, 2011a, 2011b) guidelines. A summary of fauna surveys, including sites and survey effort is provided in Annexure C, while weather data for the survey period is provided in Annexure D.

Table 5.22 Targeted fauna methods and survey effort

Targeted species	Method	Survey effort
Gang-gang Cockatoo, White-bellied Sea-Eagle, Little Eagle	Targeted nest searches	An additional 28 bird surveys were completed within the disturbance footprint, with a total of 64 people hours between October and December 2019.
Eastern Pygmy-possum, Smoky Mouse	Remote cameras	An additional 14 remote camera sites (28 cameras) were placed out. A total of 478 camera nights has been completed within the disturbance footprint.
Spotted-tailed Quoll	Remote cameras	Two additional sites (four cameras) were completed within the disturbance footprint, equating to 72 camera nights.
Brush-tailed Phascogale, Squirrel Glider, Greater Glider	Remote cameras	Areas that were difficult to access were surveyed for arboreal species using remote cameras. These surveys were limited to vegetation adjacent to Talbingo Reservoir. Remote camera surveys for arboreal species were undertaken at five sites (10 cameras). A total of 180 camera nights was completed within the disturbance area.
Brush-tailed Phascogale, Squirrel Glider, Greater Glider	Arboreal trapping	Additional trapping was conducted at six sites within the disturbance footprint, equating to 240 trap nights.
Brush-tailed Phascogale, Squirrel Glider, Greater Glider	Spotlighting	Additional spotlighting was conducted at 10 sites within the disturbance footprint, totalling 40,054 m in length.
Southern Myotis	Acoustic detection	An additional four sites were completed within the disturbance footprint, with a total of 25 nights survey effort.

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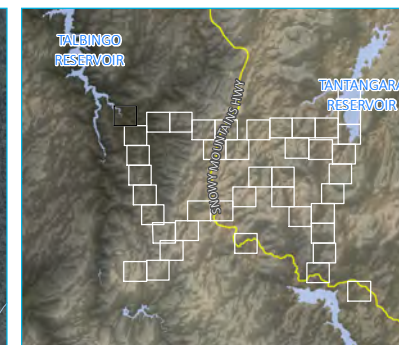
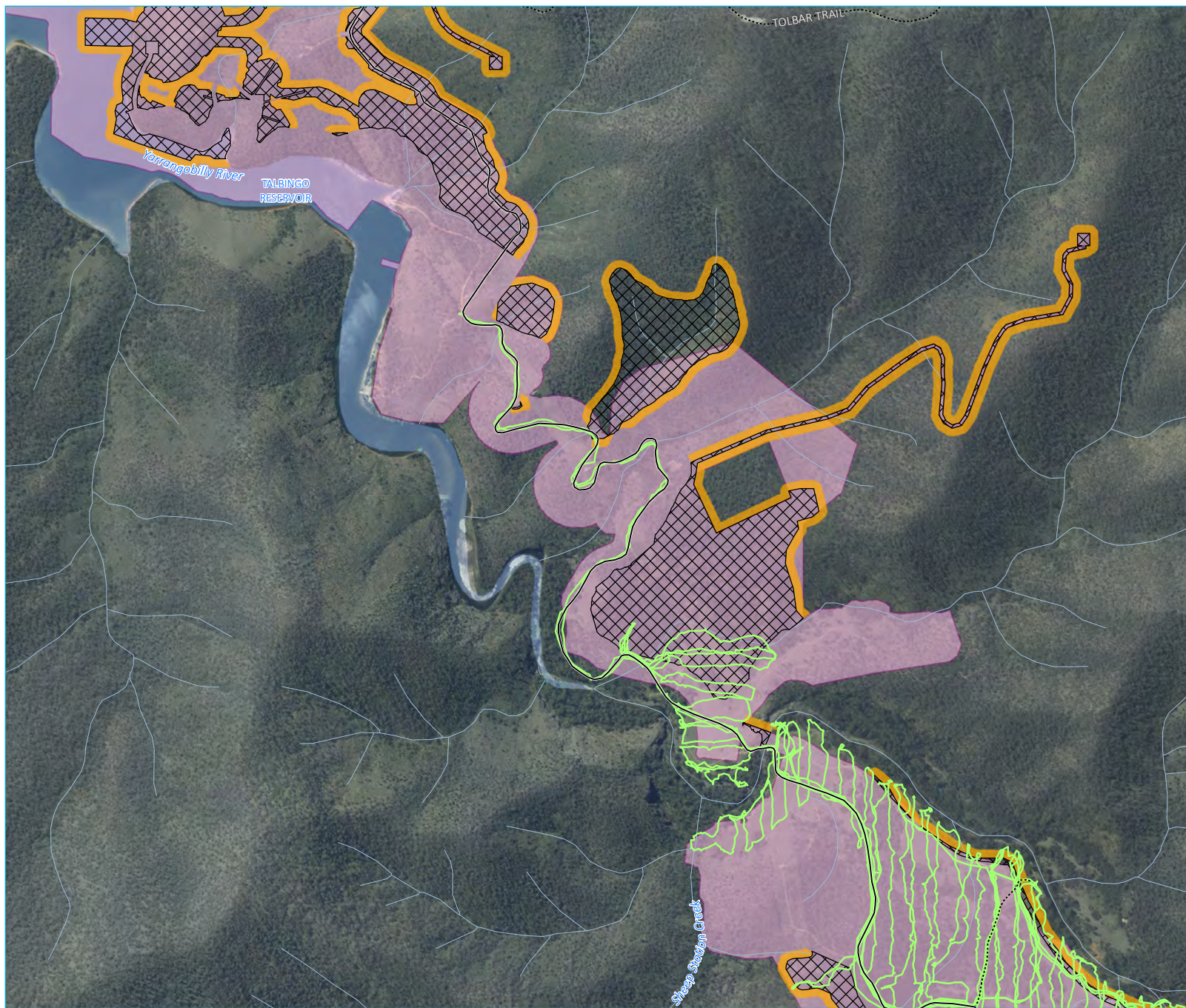
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- Main road
- Local road
- Vehicular track
- Flora survey transect
- Page index
- Disturbance area
- Indirect disturbance area
- Construction envelope

Flora survey locations - page index

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.1.1



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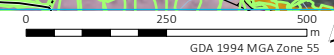
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Flora survey locations

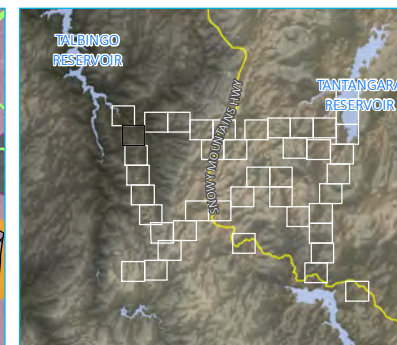
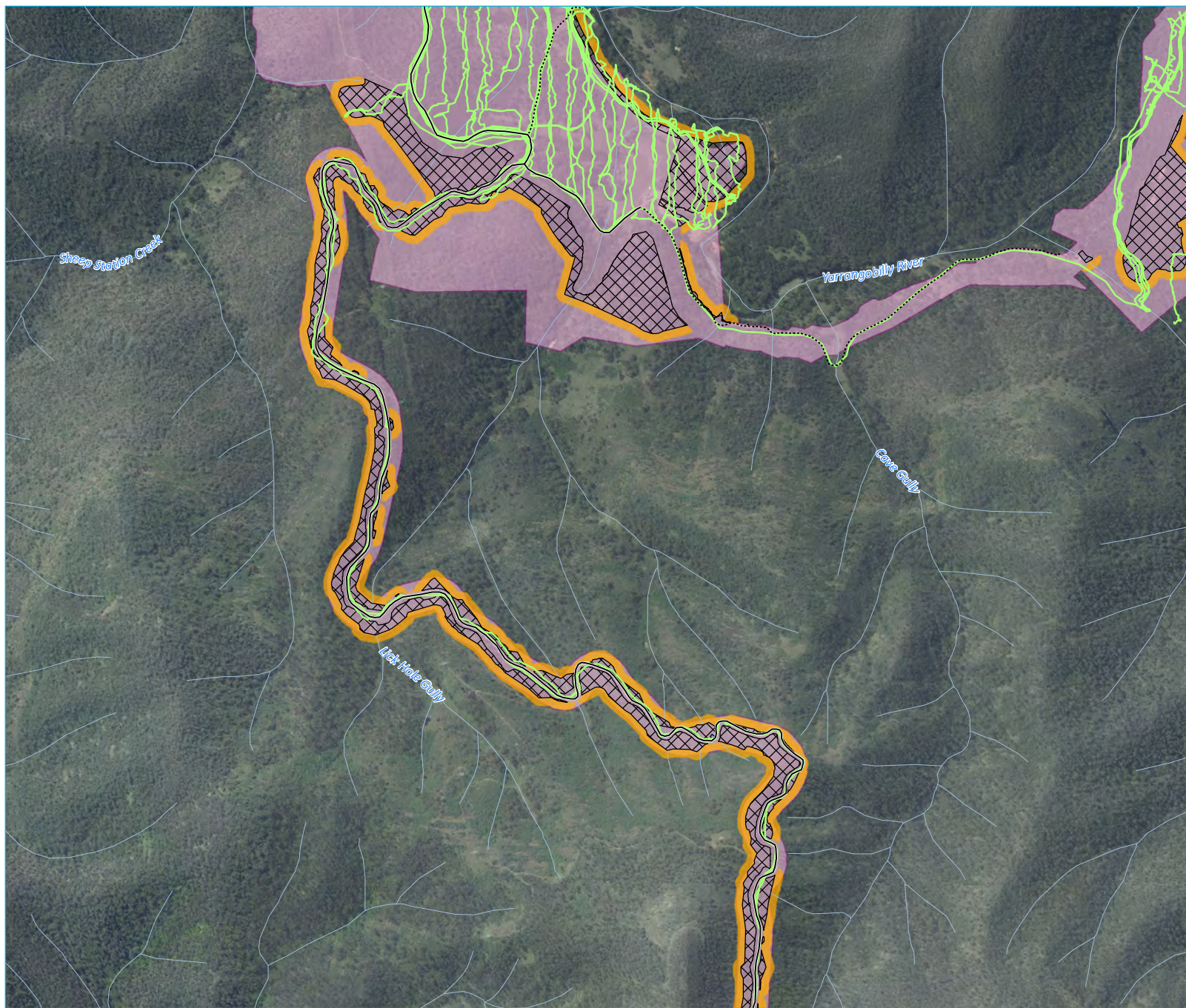
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Figure 5.1.2



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



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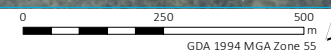


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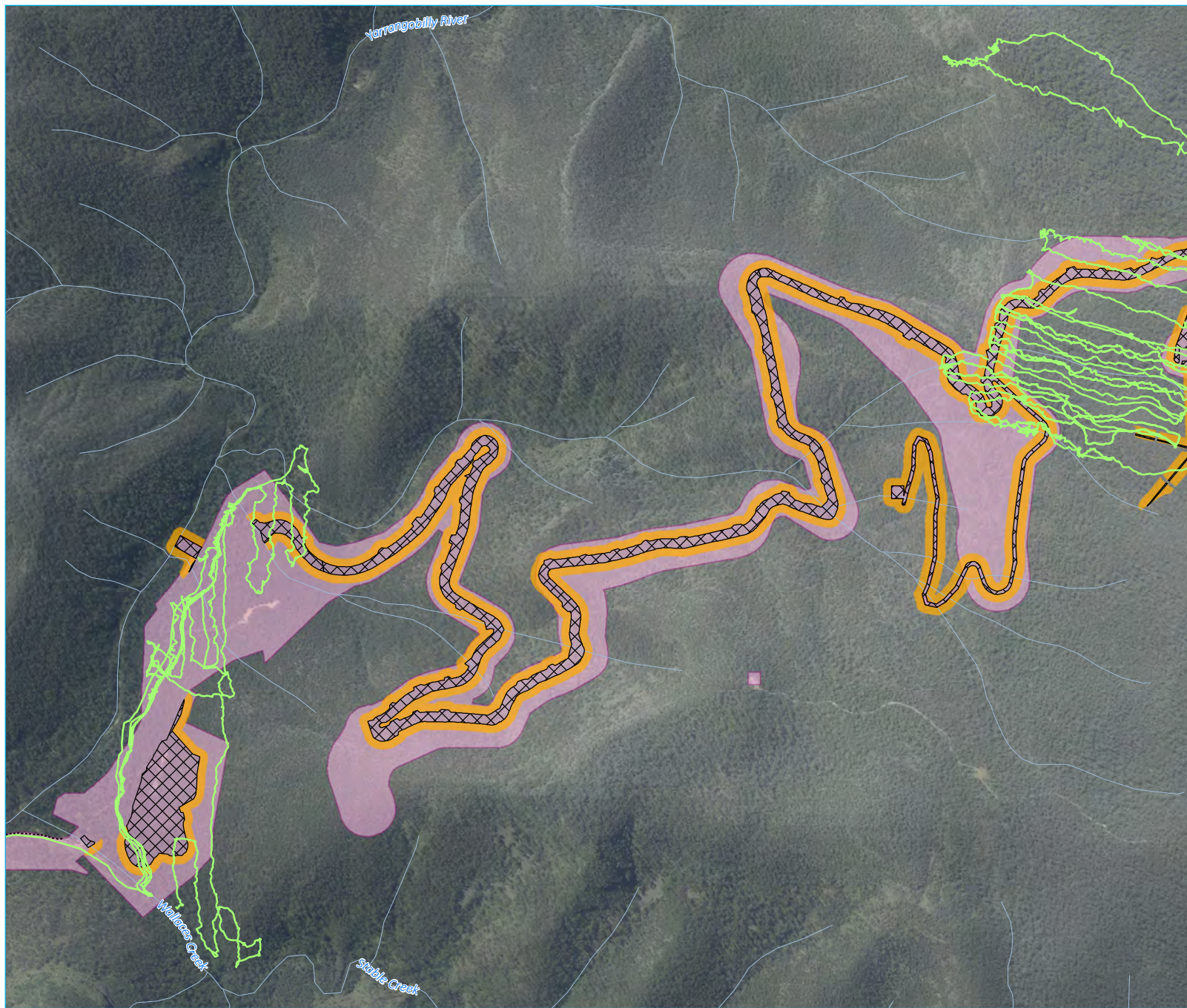
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.1.3

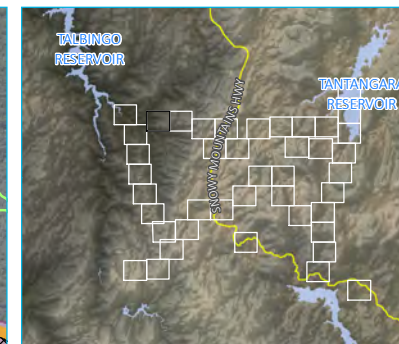
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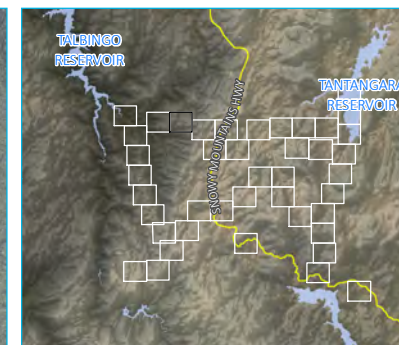
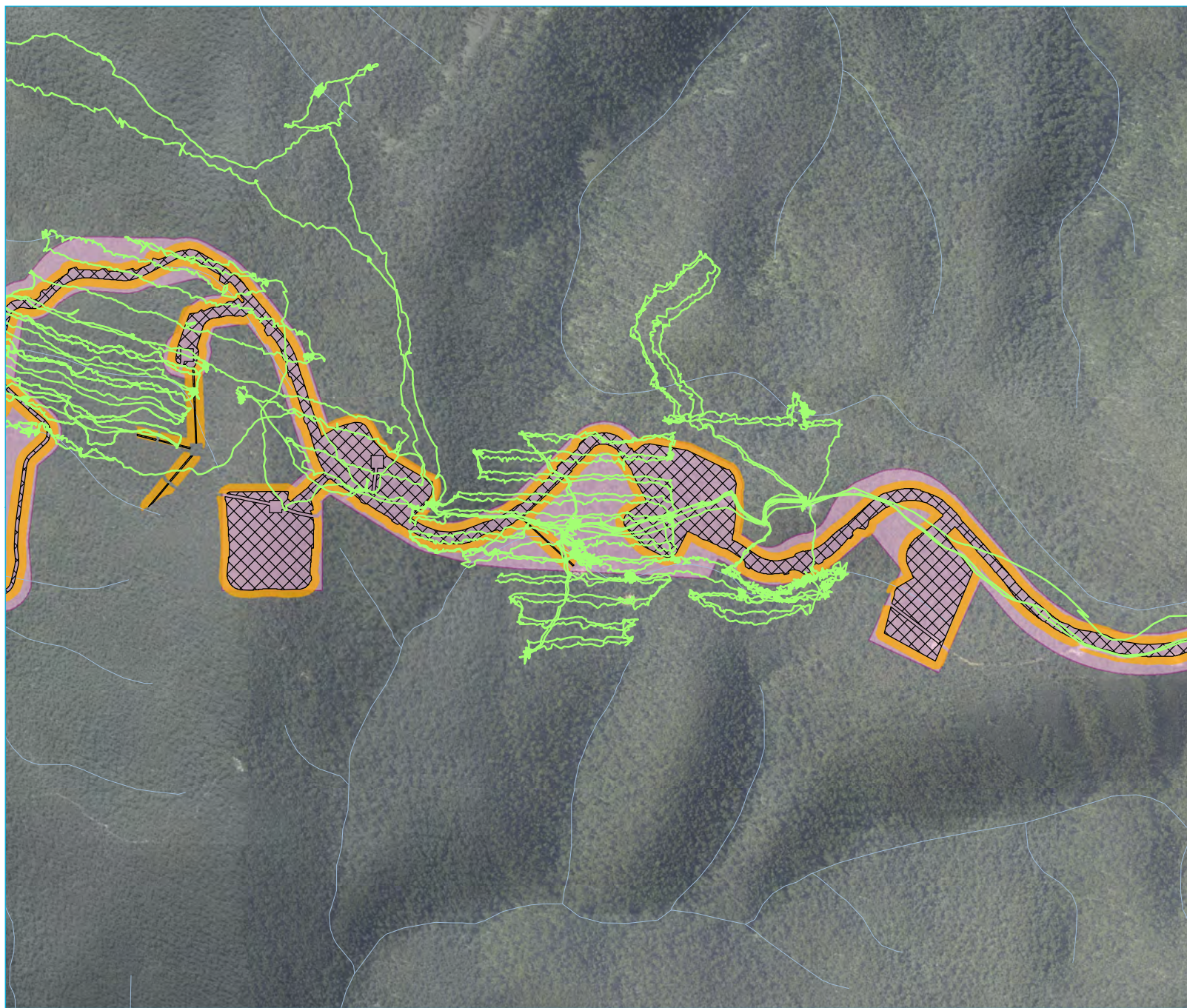
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- Construction envelope

Flora survey locations

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Figure 5.1.4



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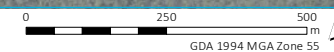
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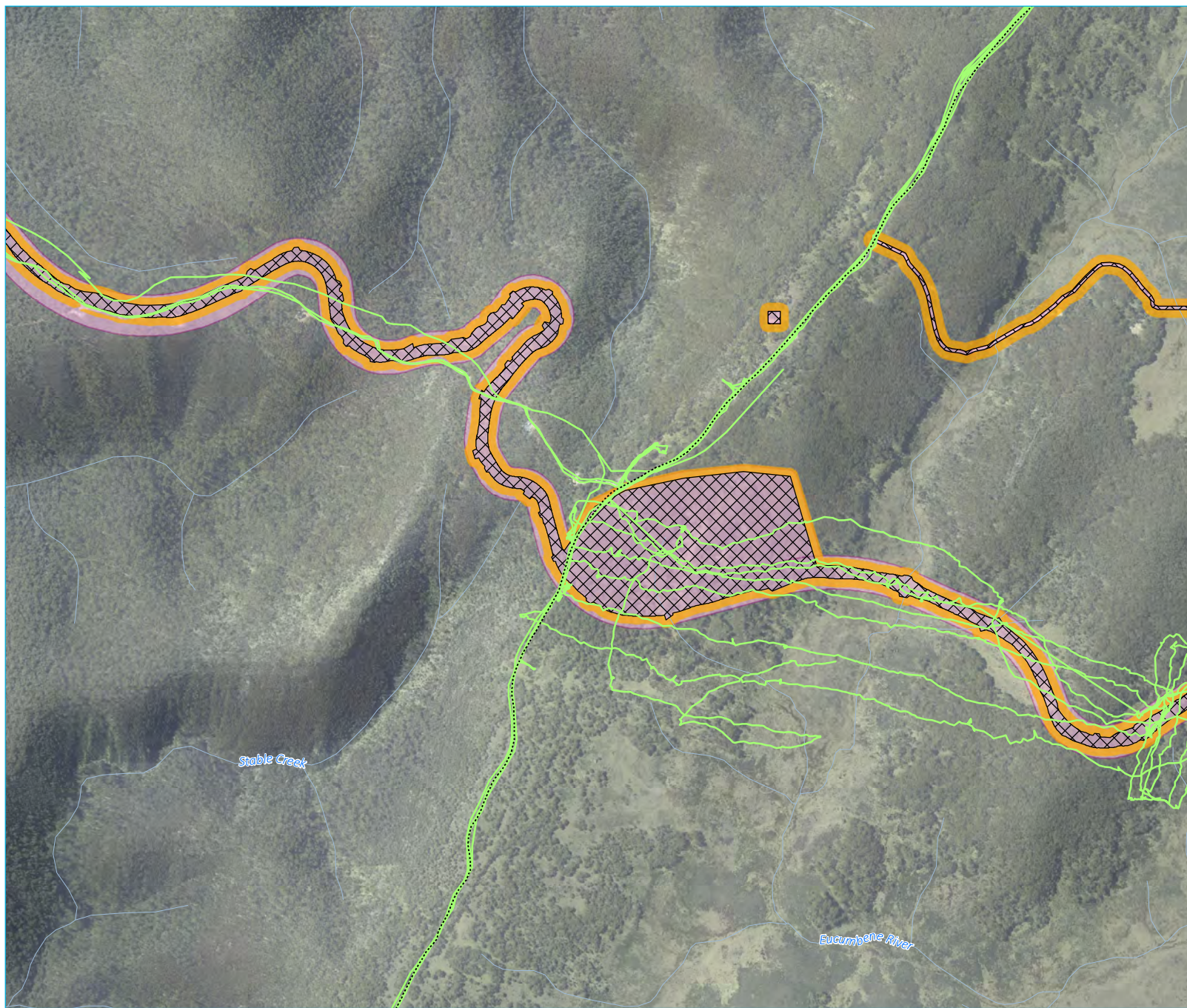
Flora survey locations

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Main Works
Figure 5.1.5

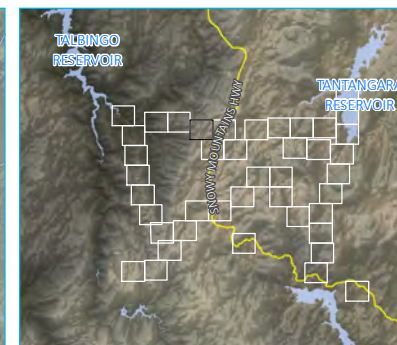
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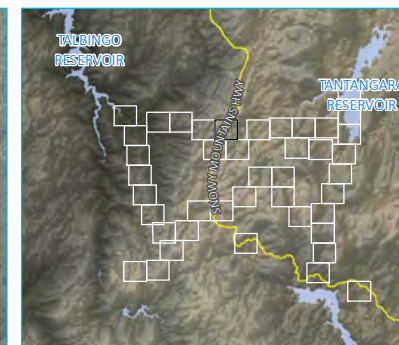
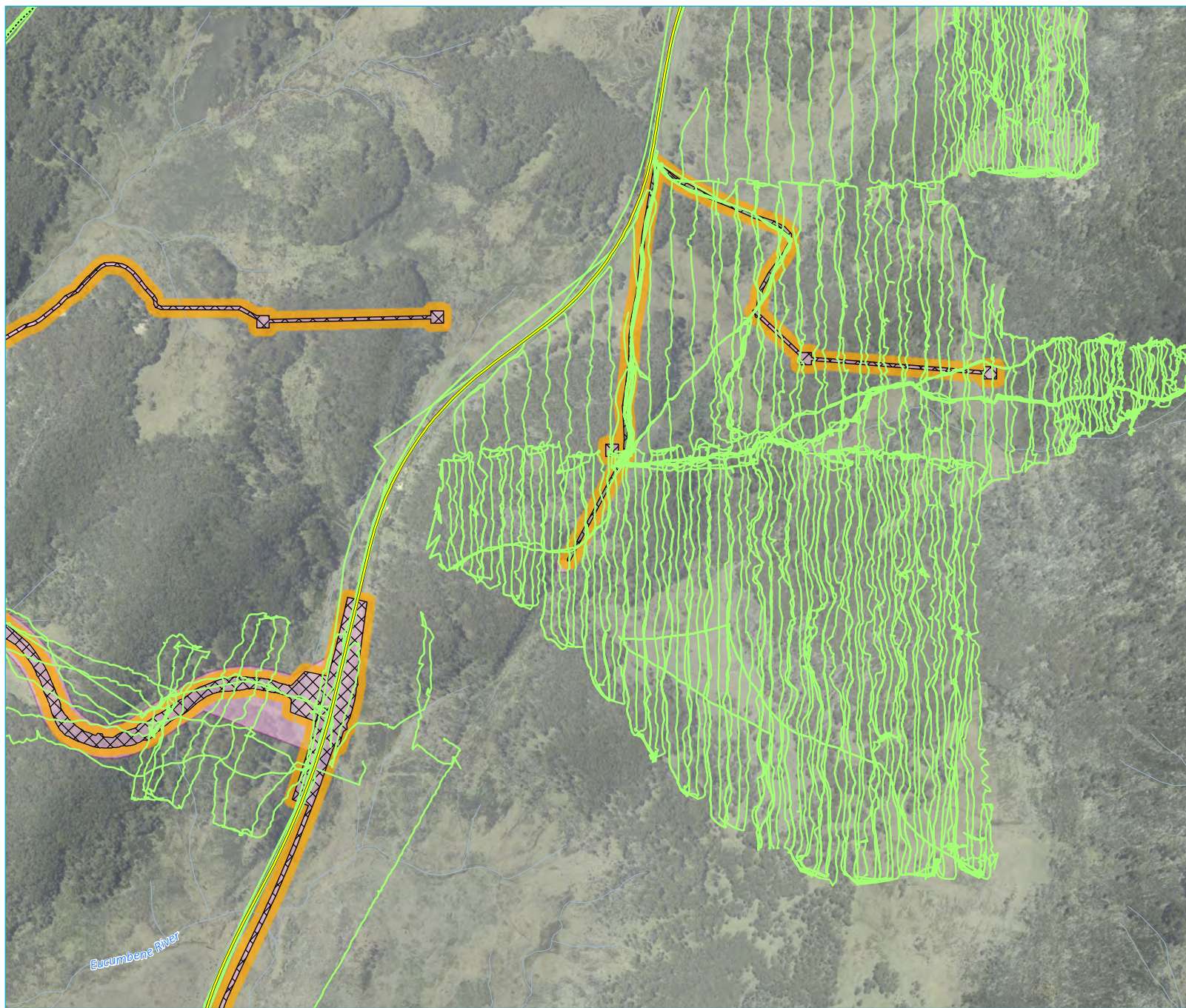
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Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.6



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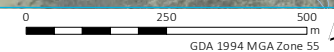


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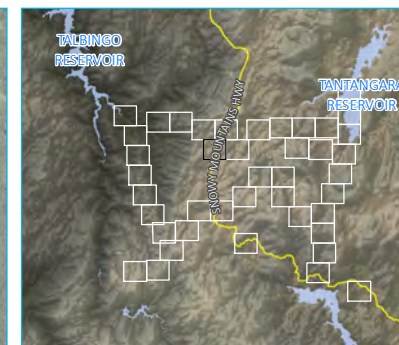
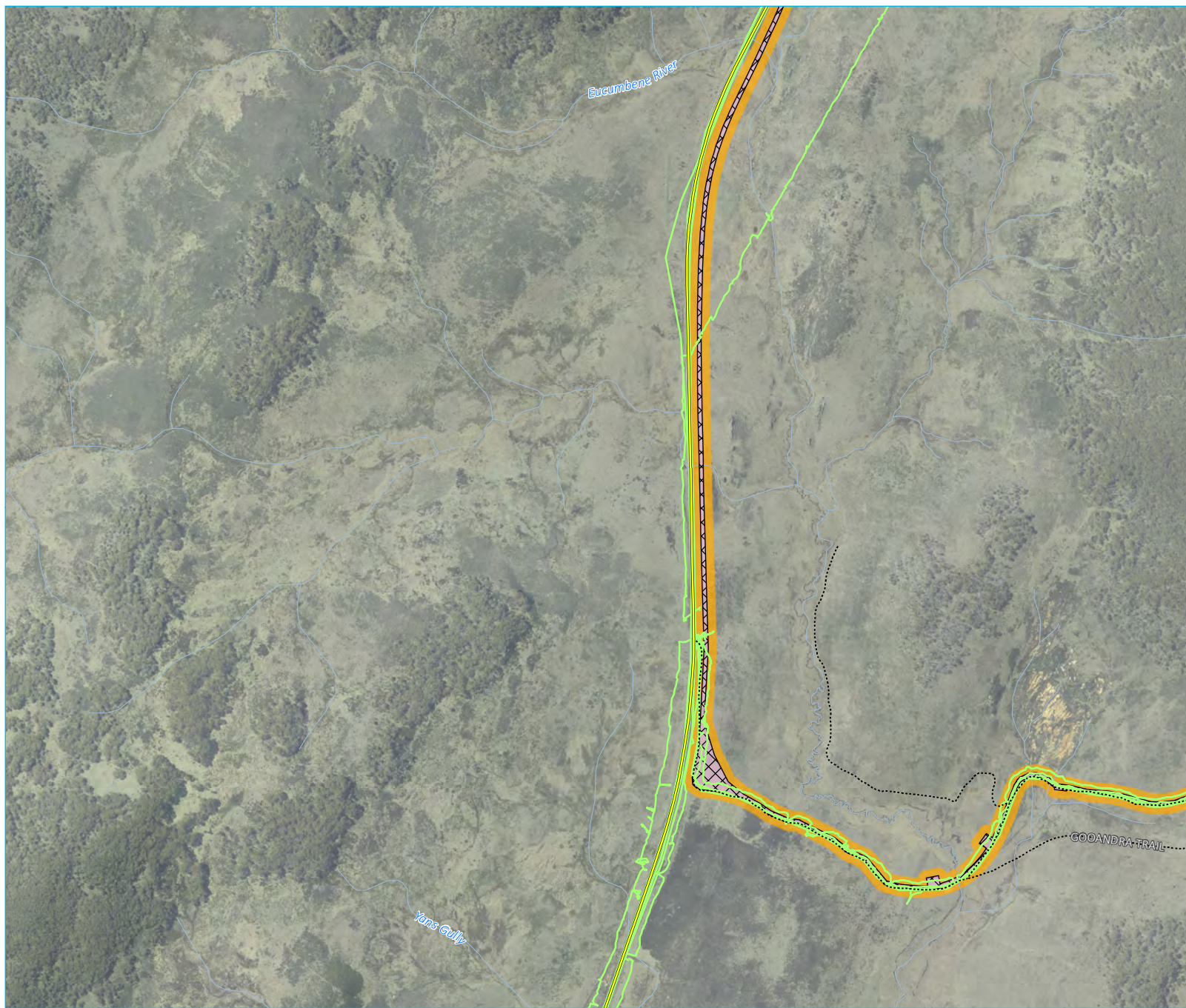
Flora survey locations

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Figure 5.1.7

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



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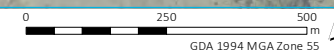


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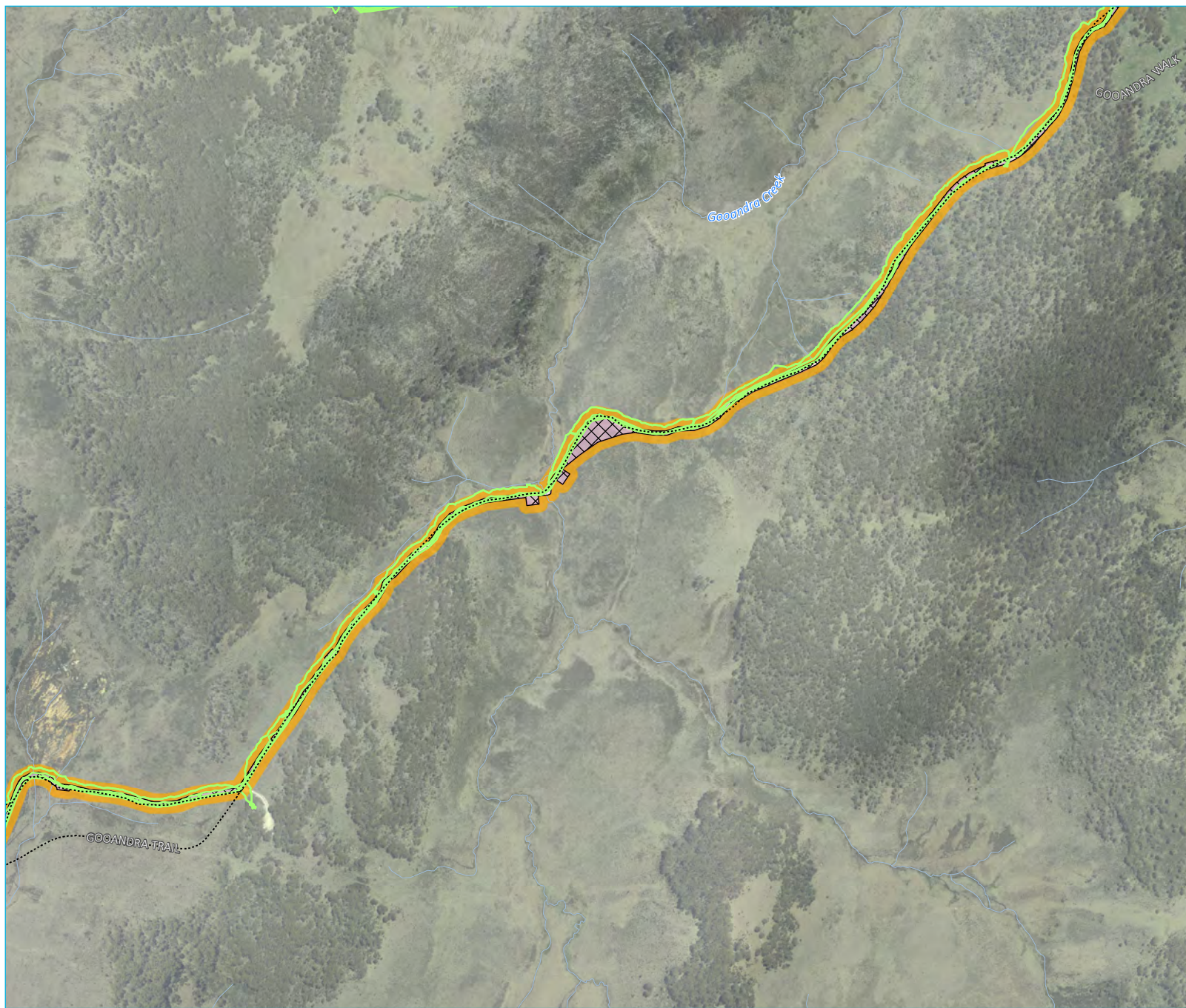
Flora survey locations

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Figure 5.1.8

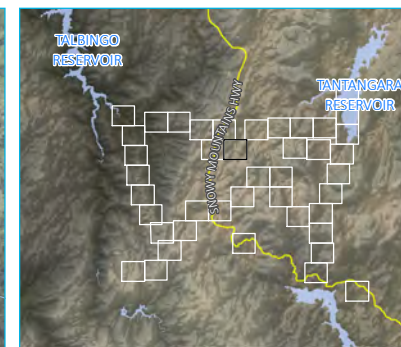
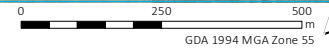
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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



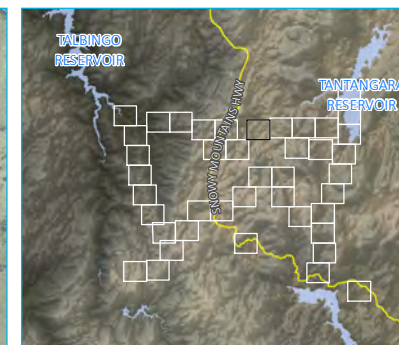
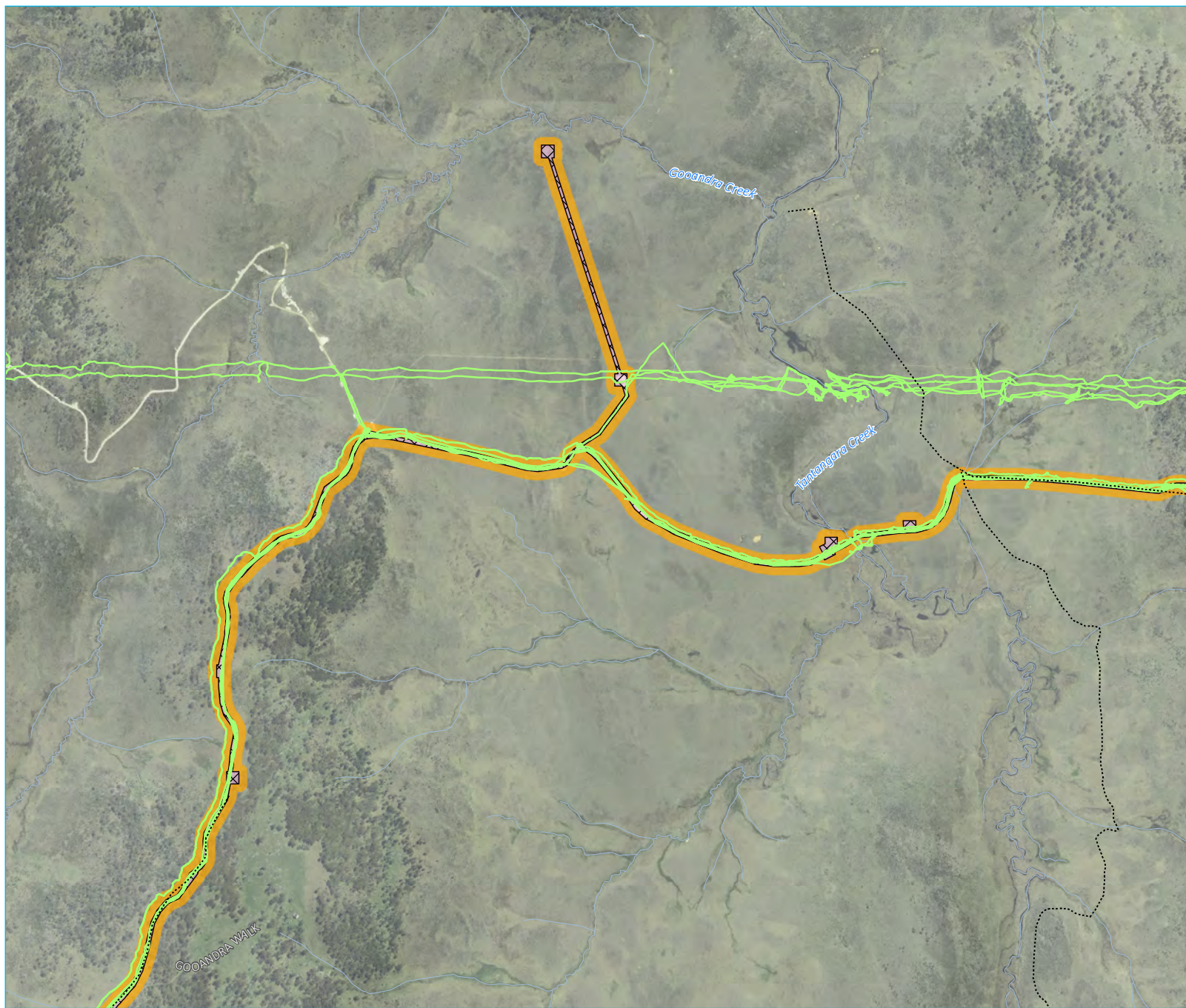
- KEY**
- Watercourse / drainage line
 - Vehicular track
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.9



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR004_FloraSurveyLocations_20200203_DDP_02.mxd 20/02/2020



KEY

- Watercourse / drainage line
- Vehicular track
- Flora survey transect
- ⊗ Disturbance area
- Indirect disturbance area
- Construction envelope

Flora survey locations

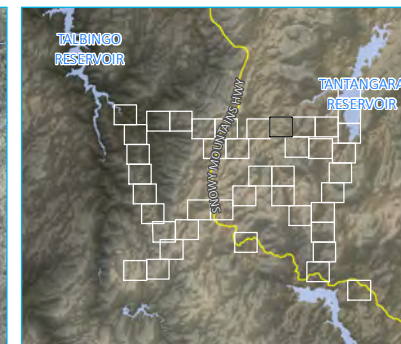
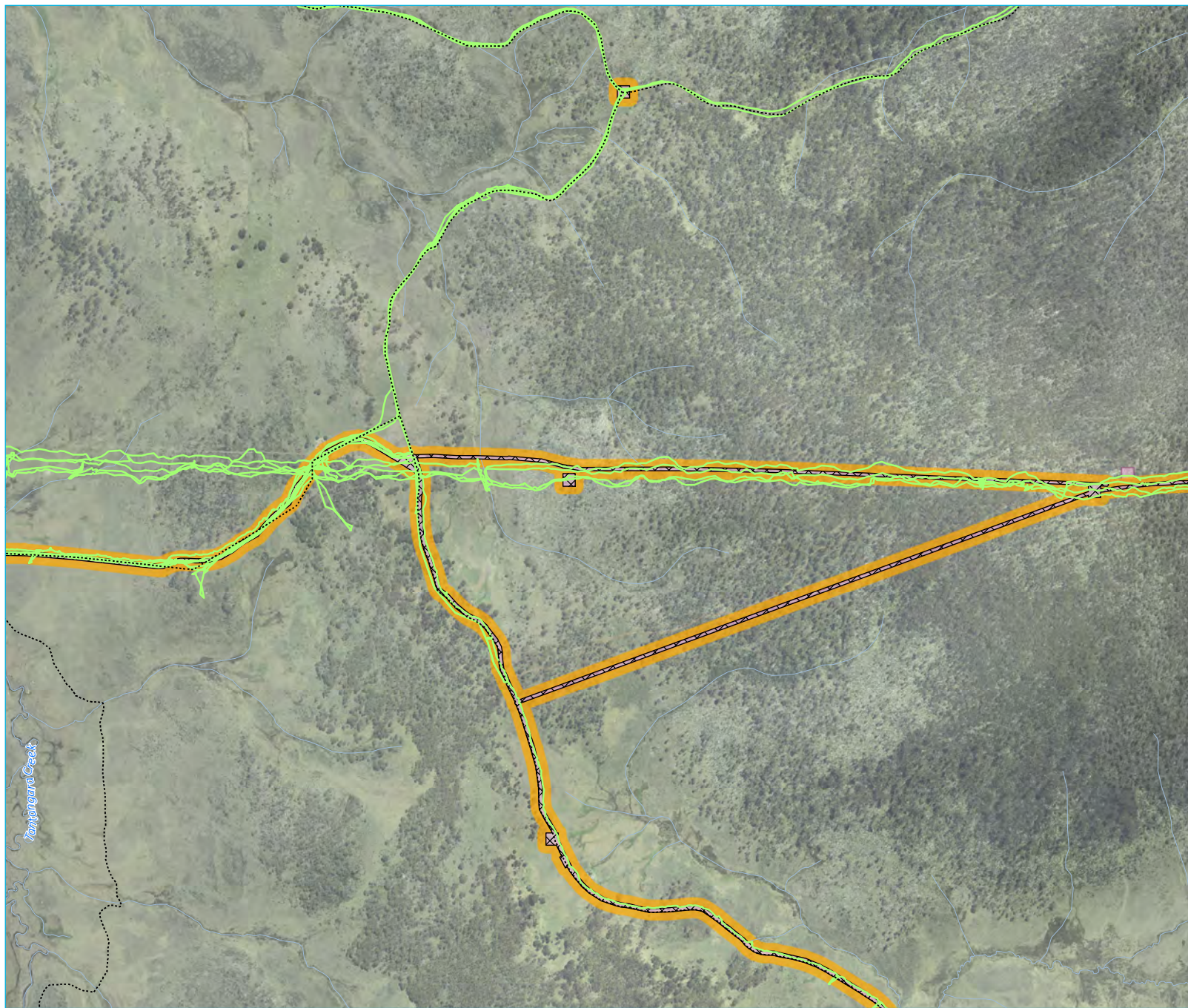
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.10



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

0 250 500
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GDA 1994 MGA Zone 55

\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR004_FloraSurveyLocations_20200203_DDP_02.mxd 20/02/2020



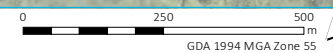
KEY

- Watercourse / drainage line
- Vehicular track
- Flora survey transect
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope

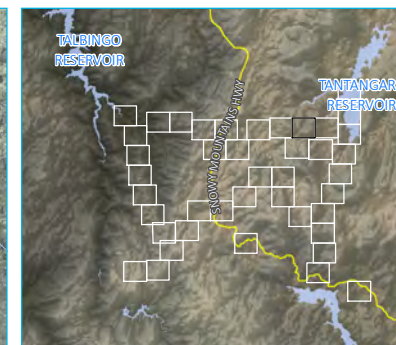
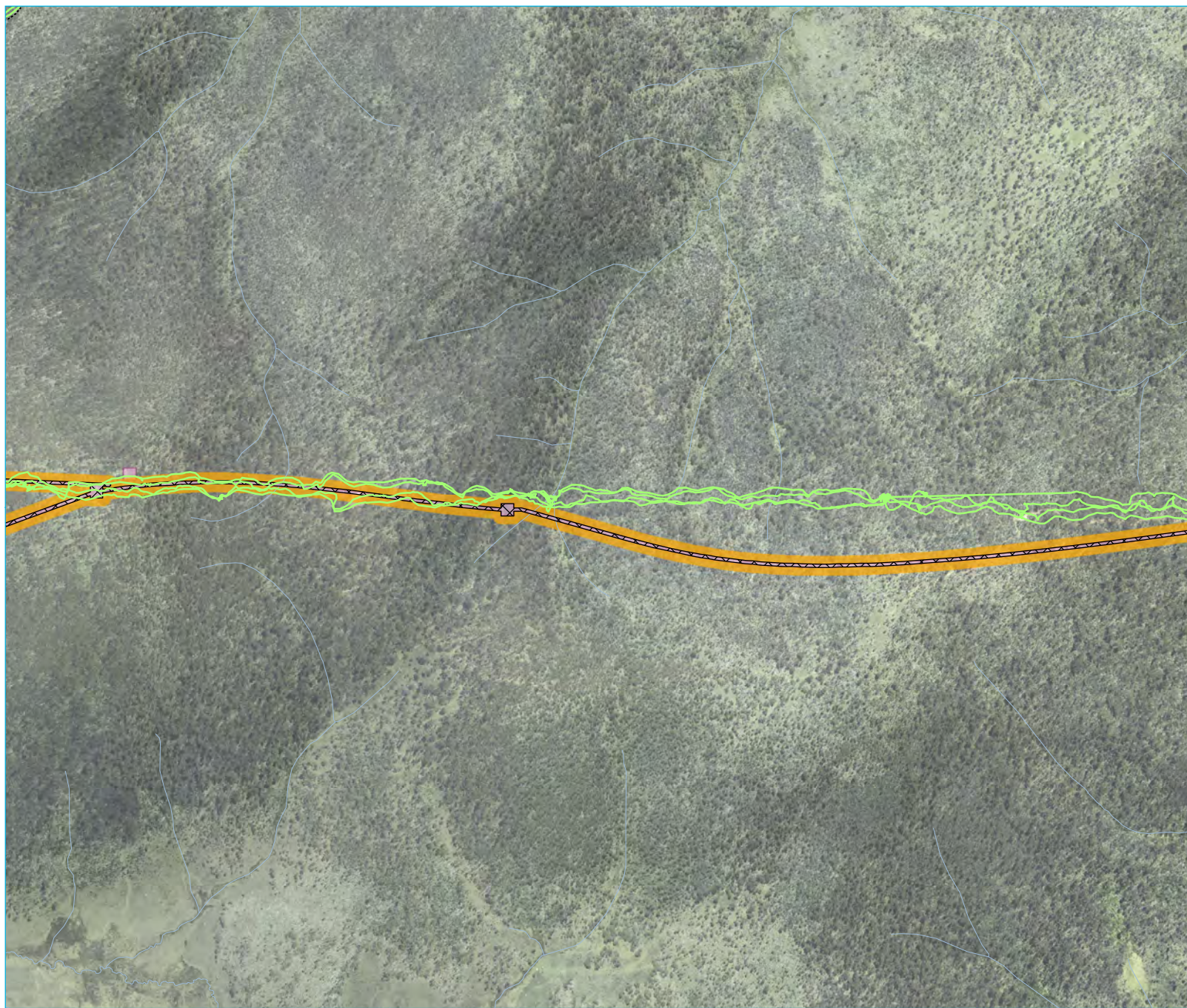
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.11

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



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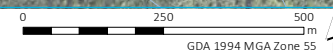
KEY

- Watercourse / drainage line
- Vehicular track
- Flora survey transect
- ⊗ Disturbance area
- Indirect disturbance area
- Construction envelope

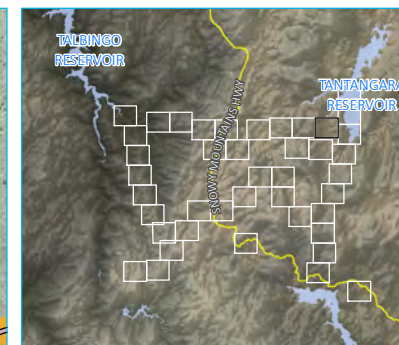
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.12

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



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- KEY
- Watercourse / drainage line
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

Flora survey locations

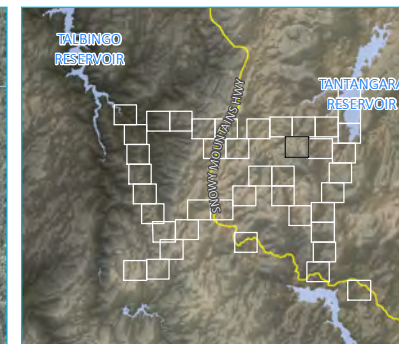
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.13

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

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GDA 1994 MGA Zone 55



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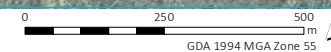


- KEY**
- Watercourse / drainage line
 - Vehicular track
 - Flora survey transect
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope

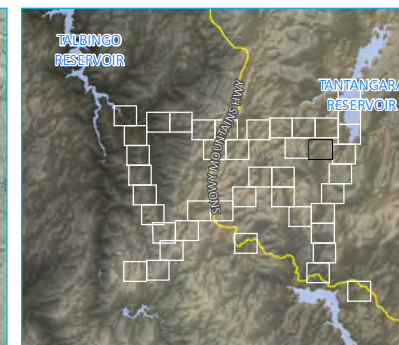
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.14

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



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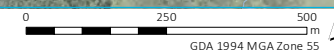


- KEY**
- Watercourse / drainage line
 - Vehicular track
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

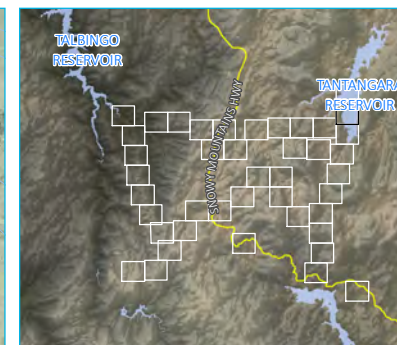
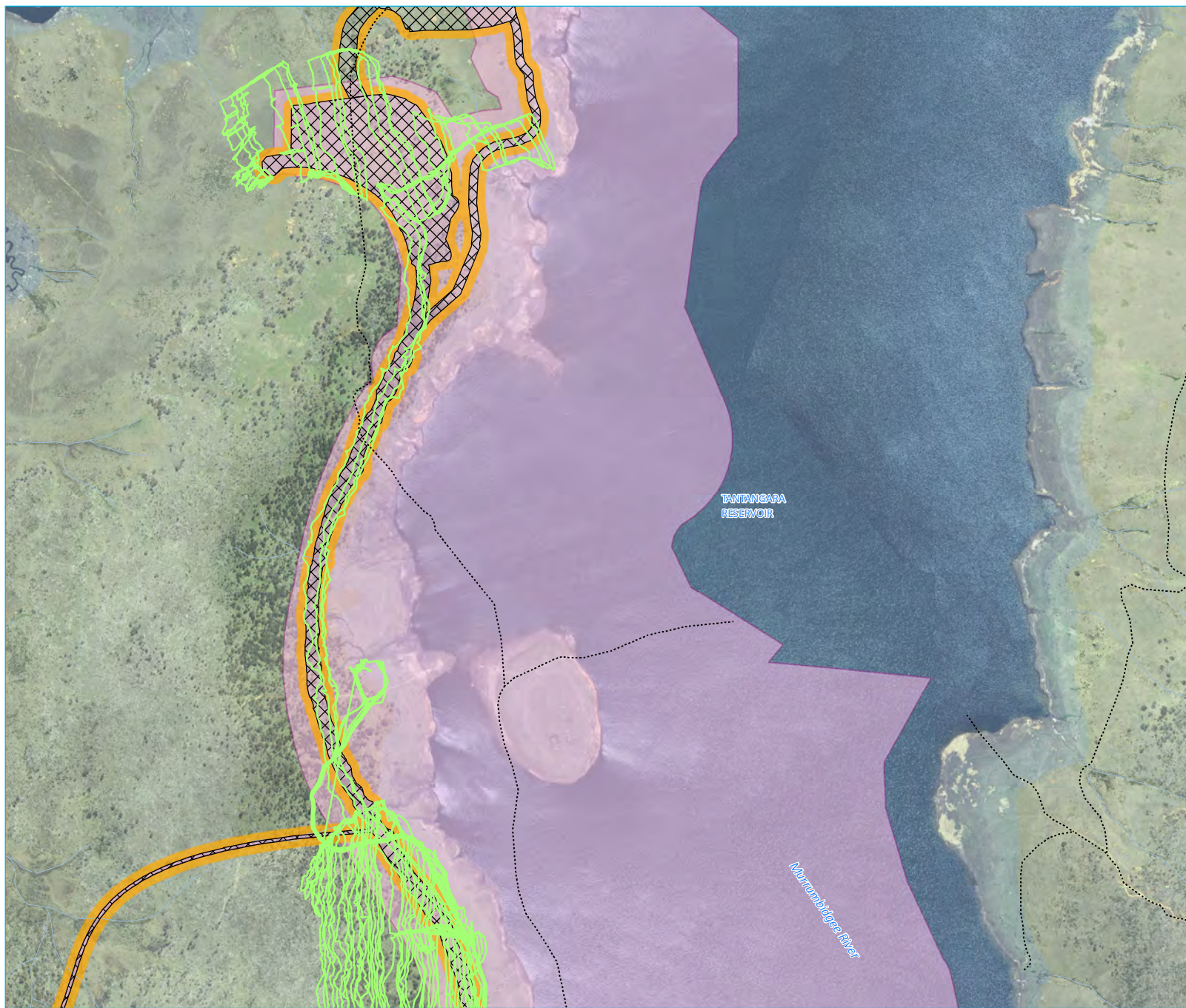
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.15

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



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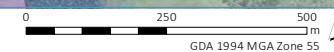
KEY

- Watercourse / drainage line
- Vehicular track
- Flora survey transect
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope

Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.16

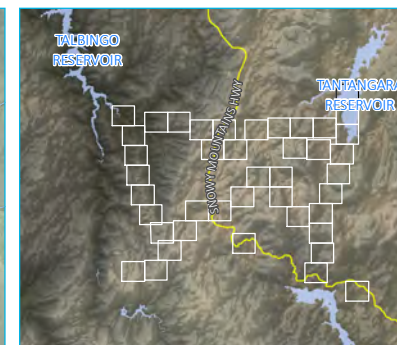
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR004_FloraSurveyLocations_20200203_DDP_02.mxd 20/02/2020



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



KEY

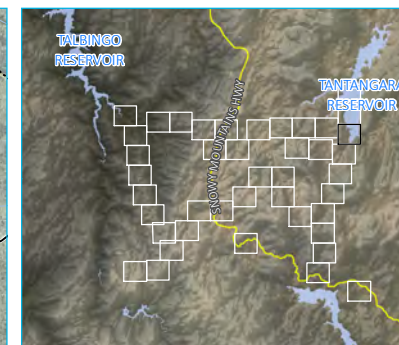
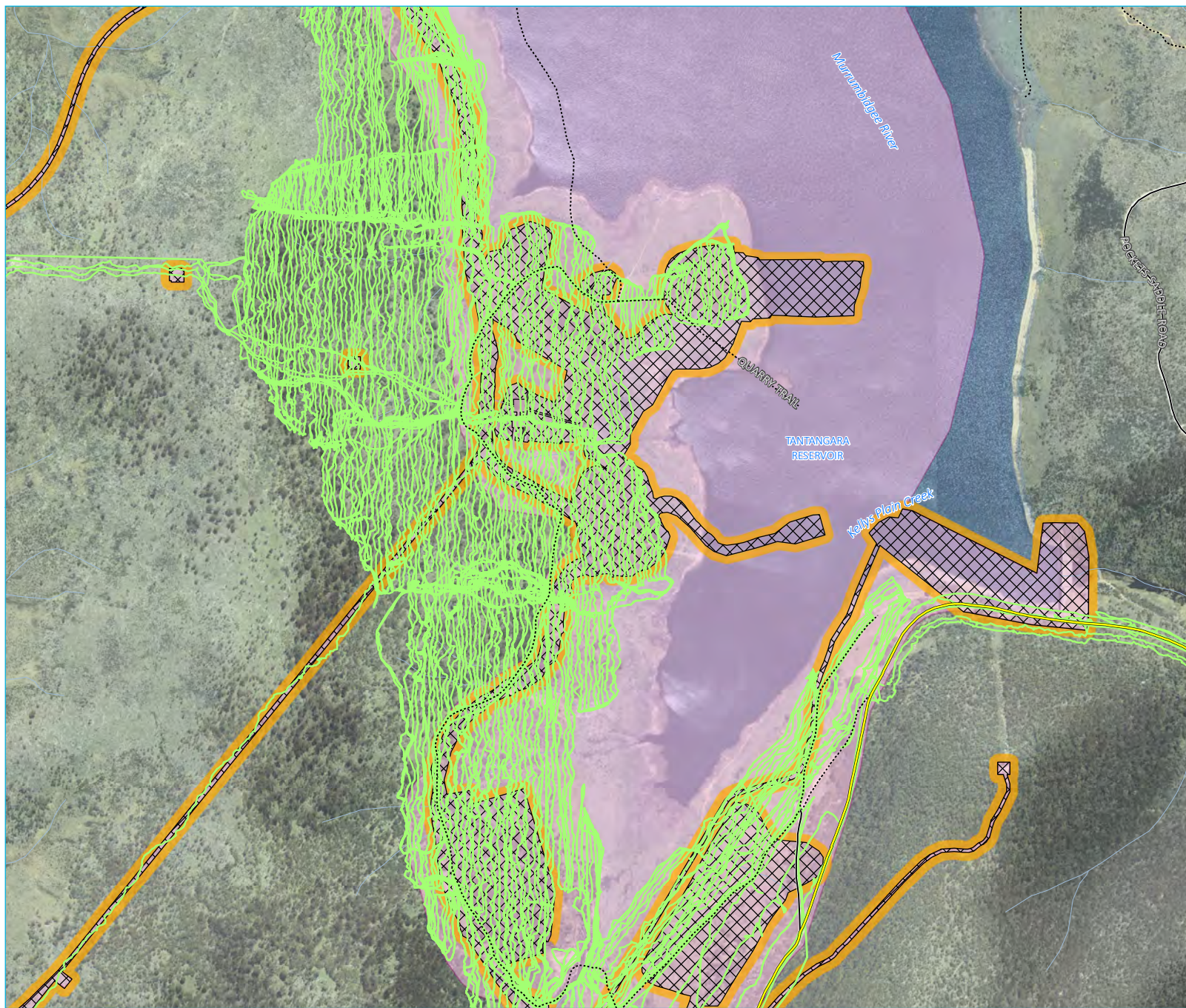
- Watercourse / drainage line
- Vehicular track
- Flora survey transect
- ▣ Disturbance area
- ▣ Indirect disturbance area
- ▣ Construction envelope

Flora survey locations

Snowy 2.0
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Main Works
Figure 5.1.17



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- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

Flora survey locations

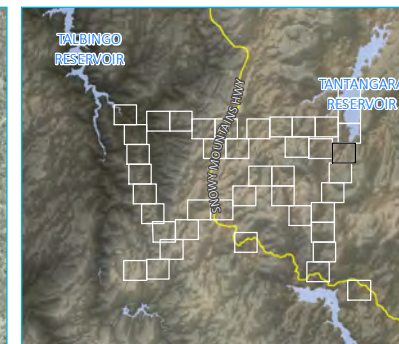
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.18



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

0 250 500
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GDA 1994 MGA Zone 55

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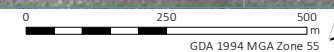
KEY

- Watercourse / drainage line
- Main road
- Local road
- Vehicular track
- Flora survey transect
- ▣ Disturbance area
- Indirect disturbance area
- Construction envelope

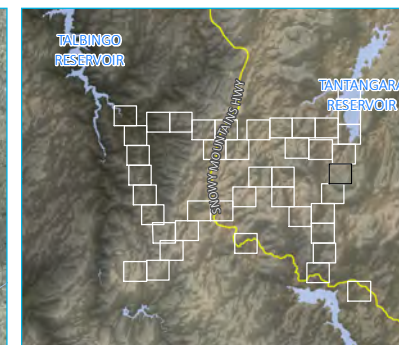
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.19

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



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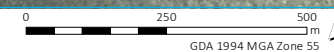


- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - Flora survey transect
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope

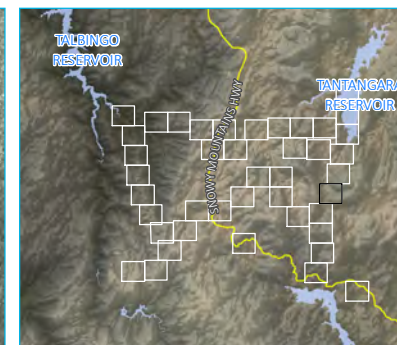
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.20

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



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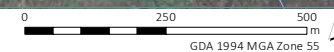


- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

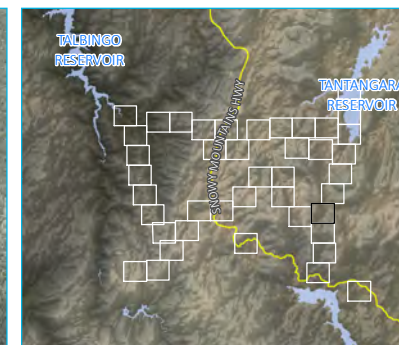
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.21

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



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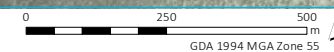


- KEY
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - Flora survey transect
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope

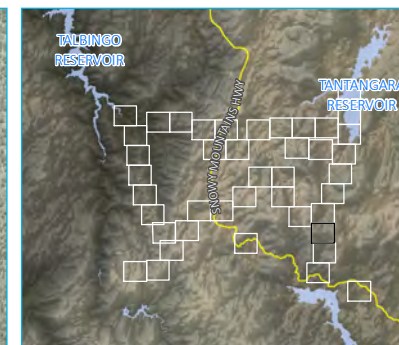
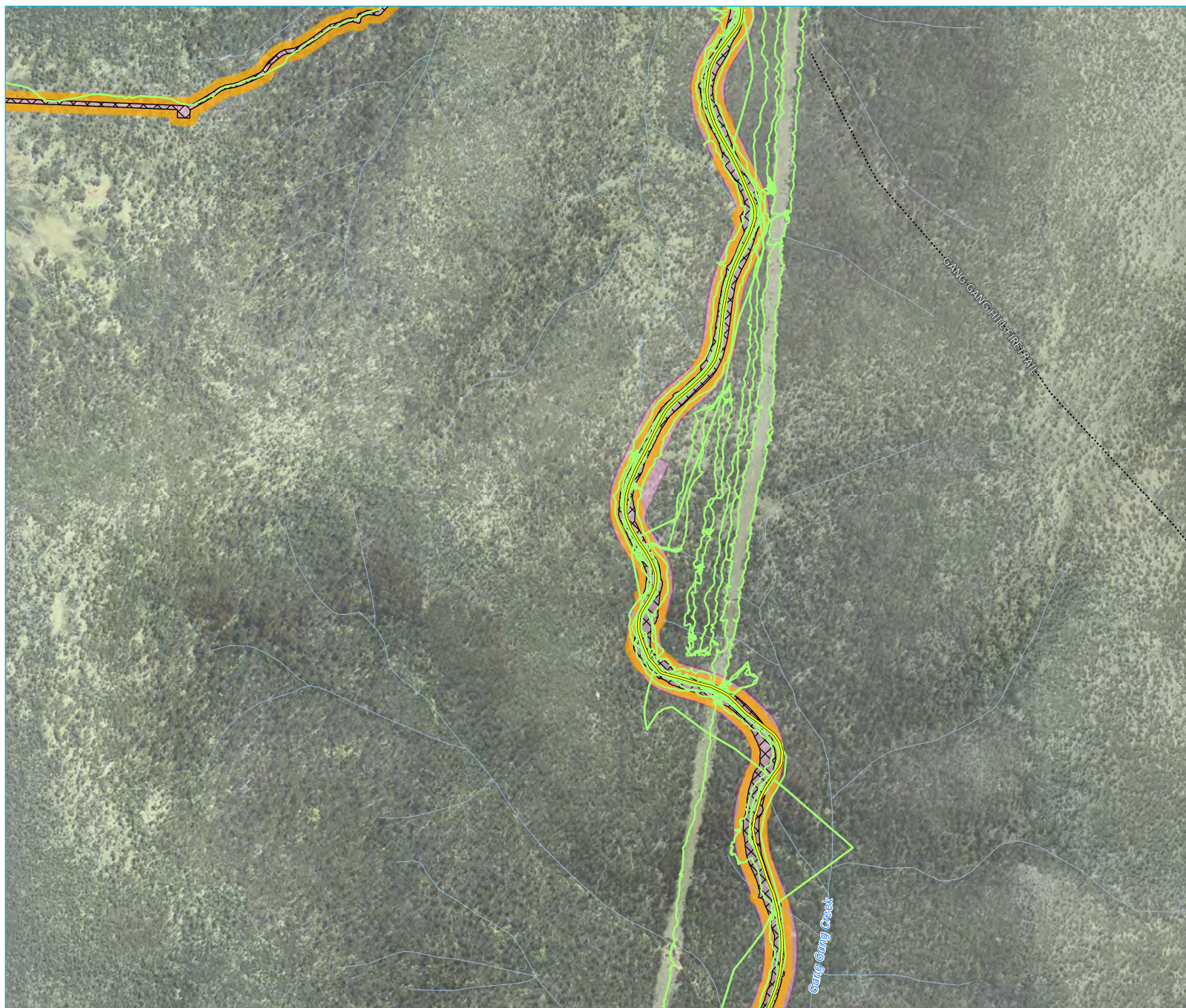
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.22

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



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- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

Flora survey locations

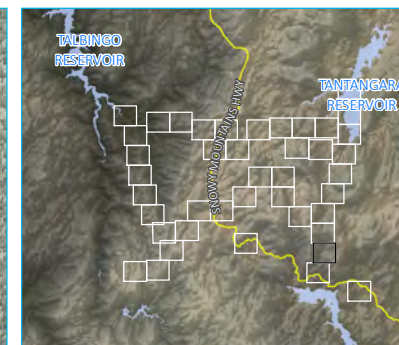
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.23



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

0 250 500
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GDA 1994 MGA Zone 55

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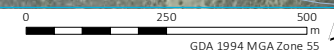


- KEY**
- Watercourse / drainage line
 - Main road
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

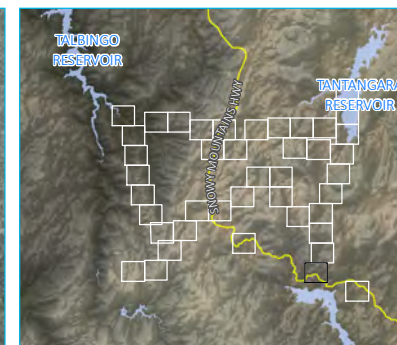
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.24

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



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- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

Flora survey locations

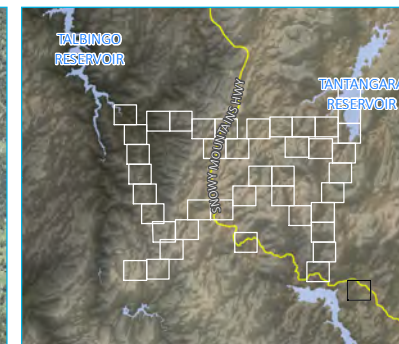
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.25



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

0 250 500
m
GDA 1994 MGA Zone 55

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KEY

- Watercourse / drainage line
- Main road
- Vehicular track
- Flora survey transect
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope

Flora survey locations

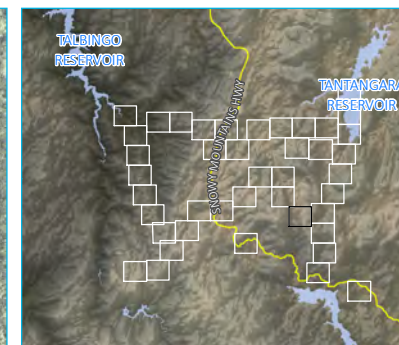
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.26



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

0 250 500
m
GDA 1994 MGA Zone 55

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KEY

- Watercourse / drainage line
- Vehicular track
- Flora survey transect
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope

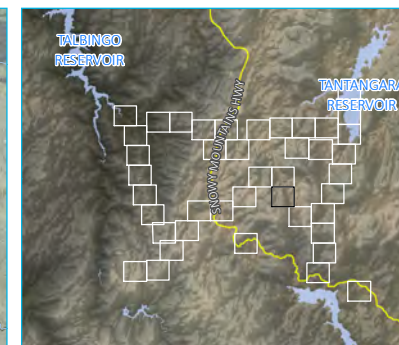
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.27



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

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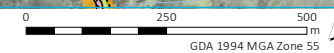
- KEY**
- Watercourse / drainage line
 - Vehicular track
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.28



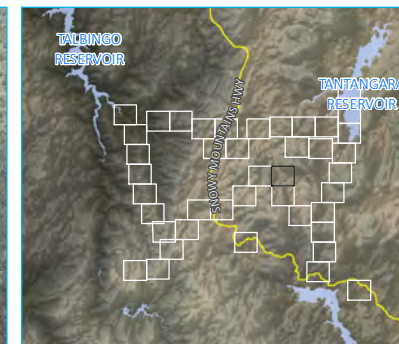
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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



KEY

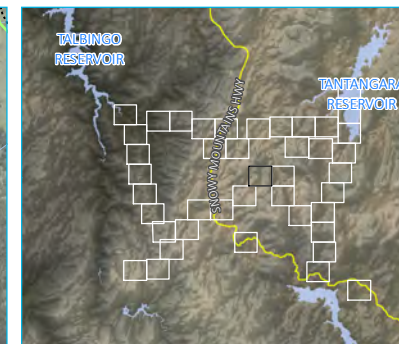
- Watercourse / drainage line
- Vehicular track
- Flora survey transect
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope

Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.29



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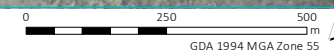
KEY

- Watercourse / drainage line
- Vehicular track
- Flora survey transect
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope

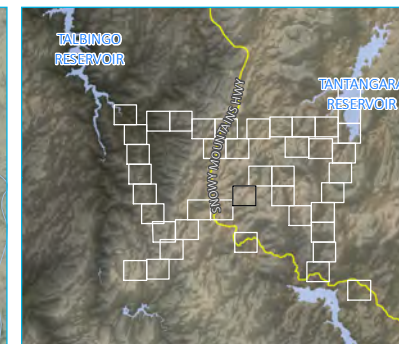
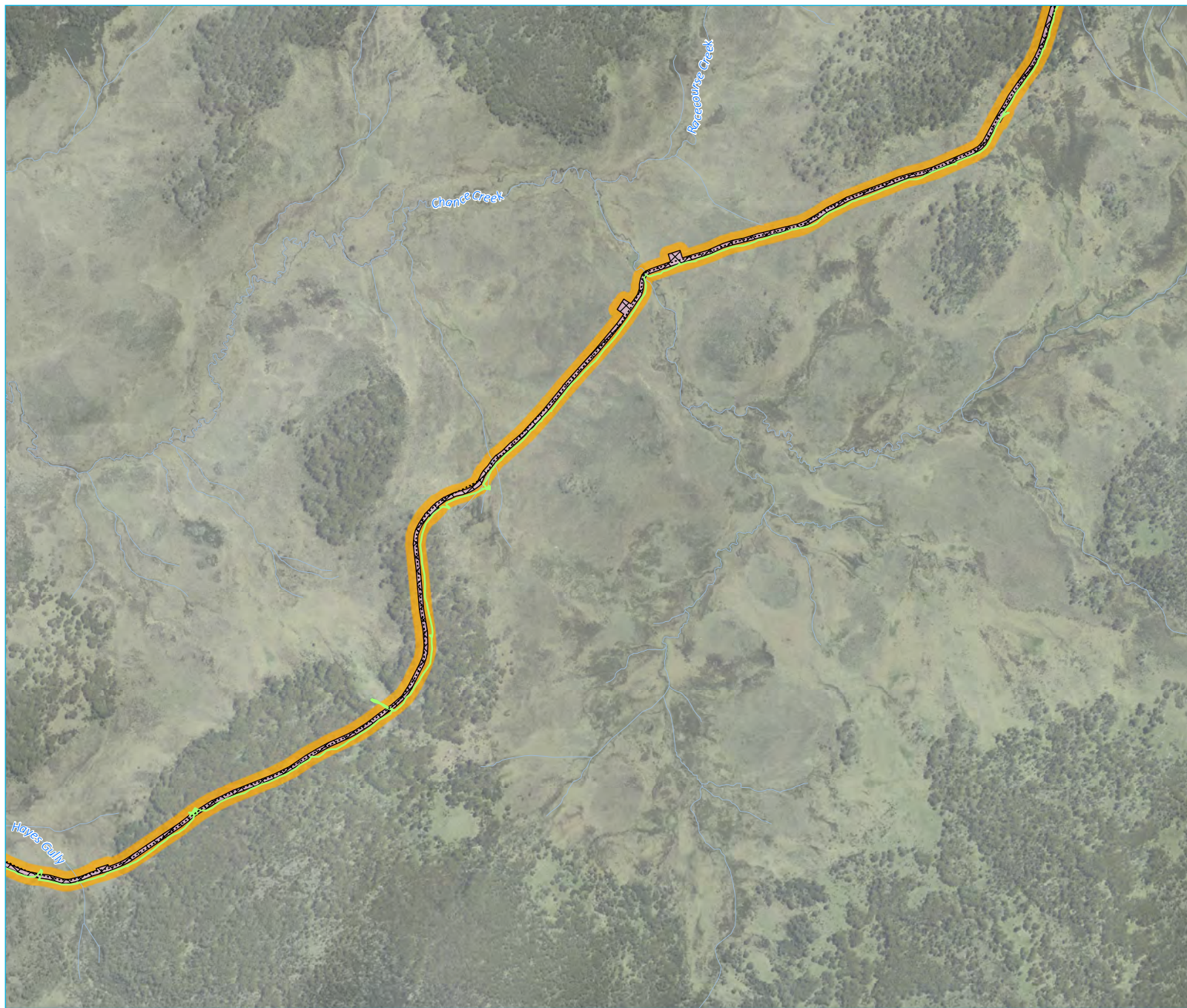
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.30

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



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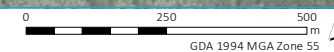


- KEY**
- Watercourse / drainage line
 - Vehicular track
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

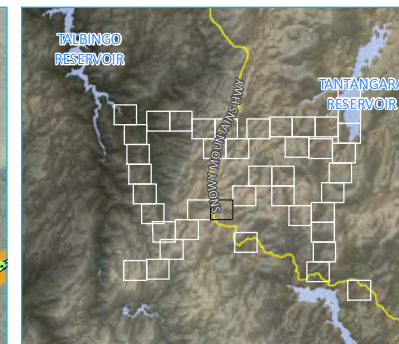
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.31

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



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- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.32

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

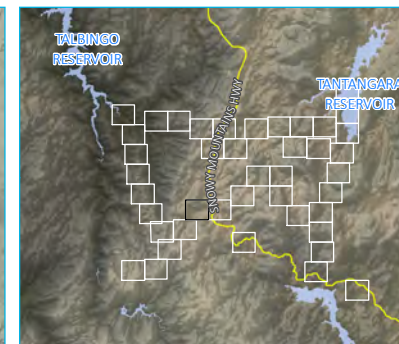
0 250 500
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GDA 1994 MGA Zone 55



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



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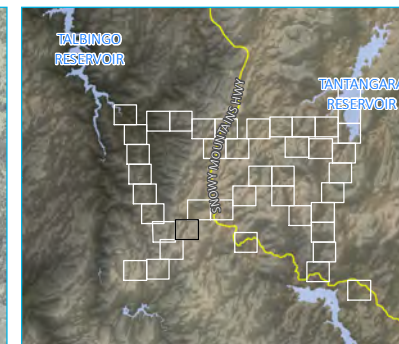
- Watercourse / drainage line
- Main road
- Flora survey transect
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope

Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.1.33



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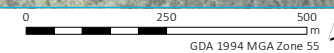
KEY

- Watercourse / drainage line
- Main road
- Local road
- Vehicular track
- Flora survey transect
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope

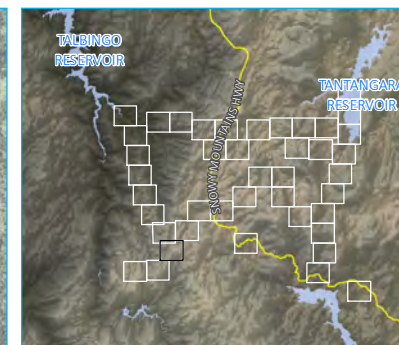
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.1.34

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



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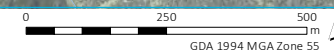
- Watercourse / drainage line
- Local road
- Vehicular track
- Flora survey transect
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope

Flora survey locations

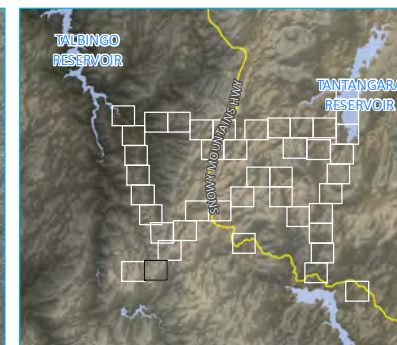
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.35



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



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RIS\BDAR\BDAR004_FloraSurveyLocations_20200203_DDP_02.mxd 20/02/2020

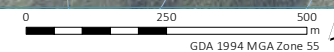


- KEY**
- Watercourse / drainage line
 - Local road
 - Vehicular track
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

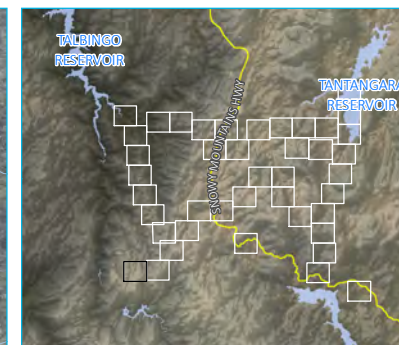
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.1.36

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



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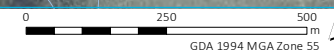
- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

Flora survey locations

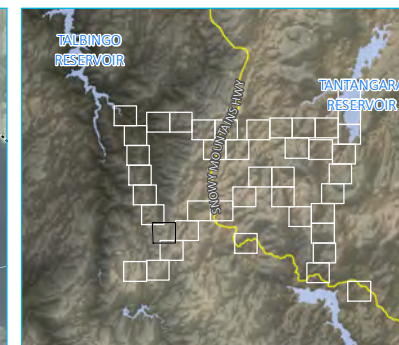
Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.1.37



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



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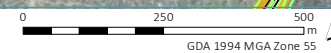
- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - Flora survey transect
 - ▣ Disturbance area
 - Indirect disturbance area
 - Construction envelope

Flora survey locations

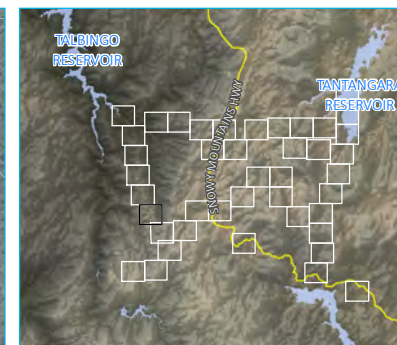
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.38



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



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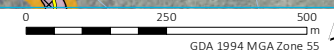


- KEY
- Watercourse / drainage line
 - Main road
 - Local road
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

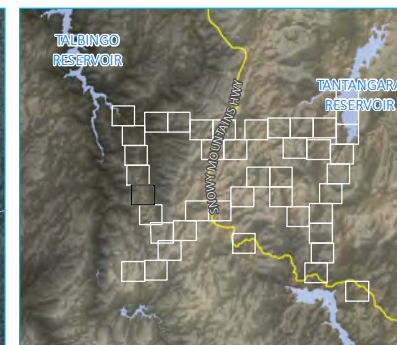
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.1.39

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



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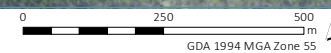


- KEY**
- Watercourse / drainage line
 - Local road
 - Flora survey transect
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope

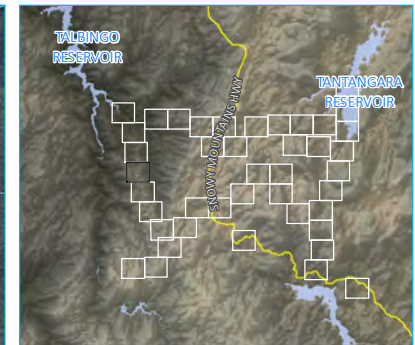
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.1.40

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



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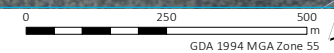


- KEY**
- Watercourse / drainage line
 - Local road
 - Vehicular track
 - Flora survey transect
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope

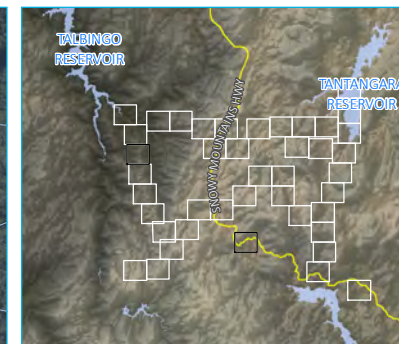
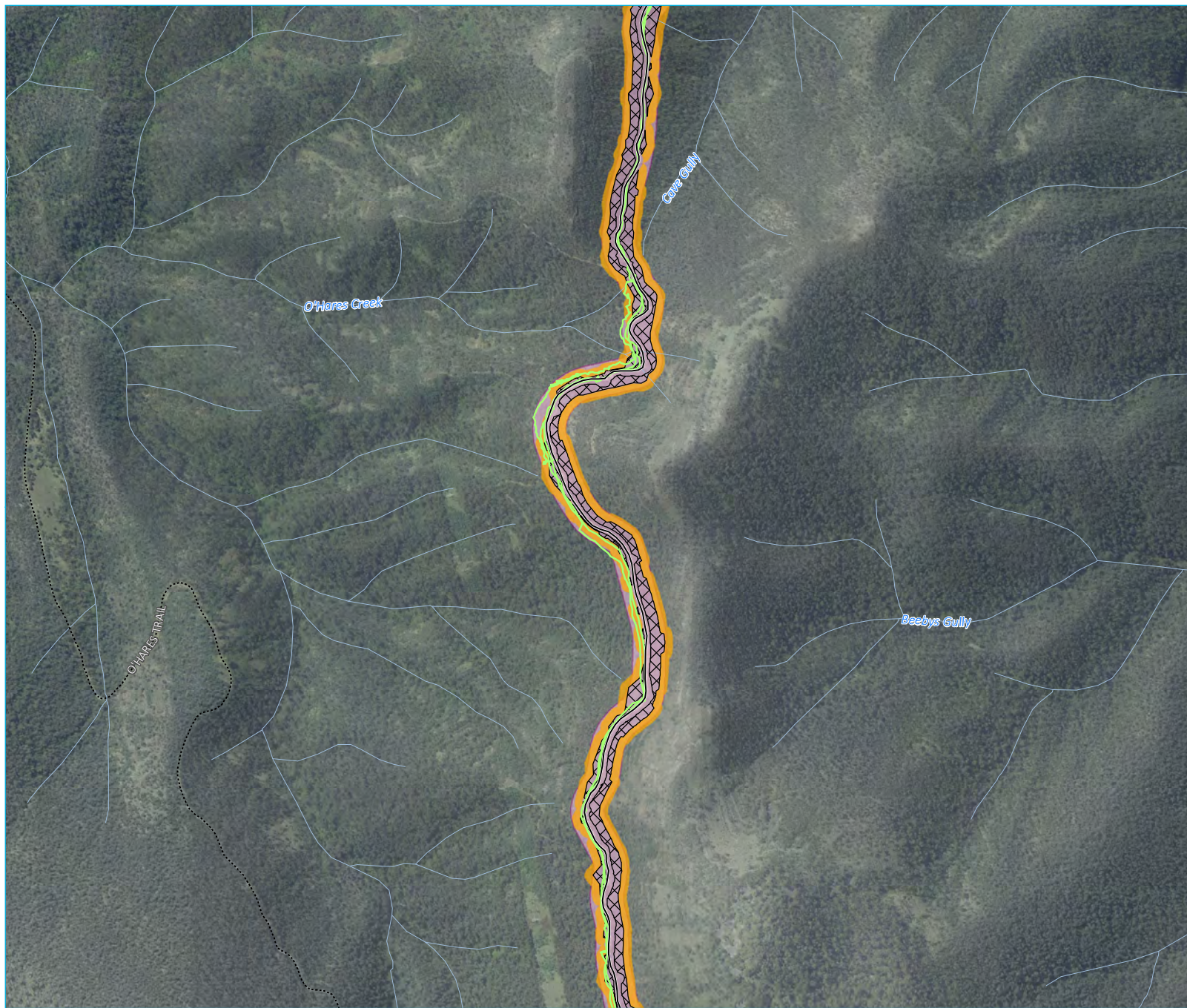
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.1.41

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



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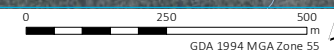
KEY

- Watercourse / drainage line
- Local road
- Vehicular track
- Flora survey transect
- Disturbance area
- Indirect disturbance area
- Construction envelope

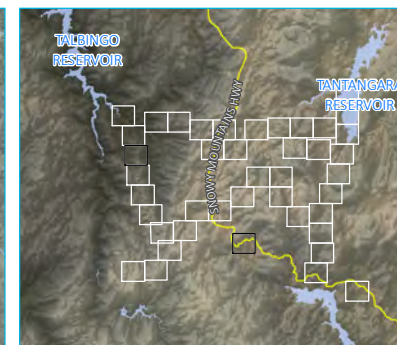
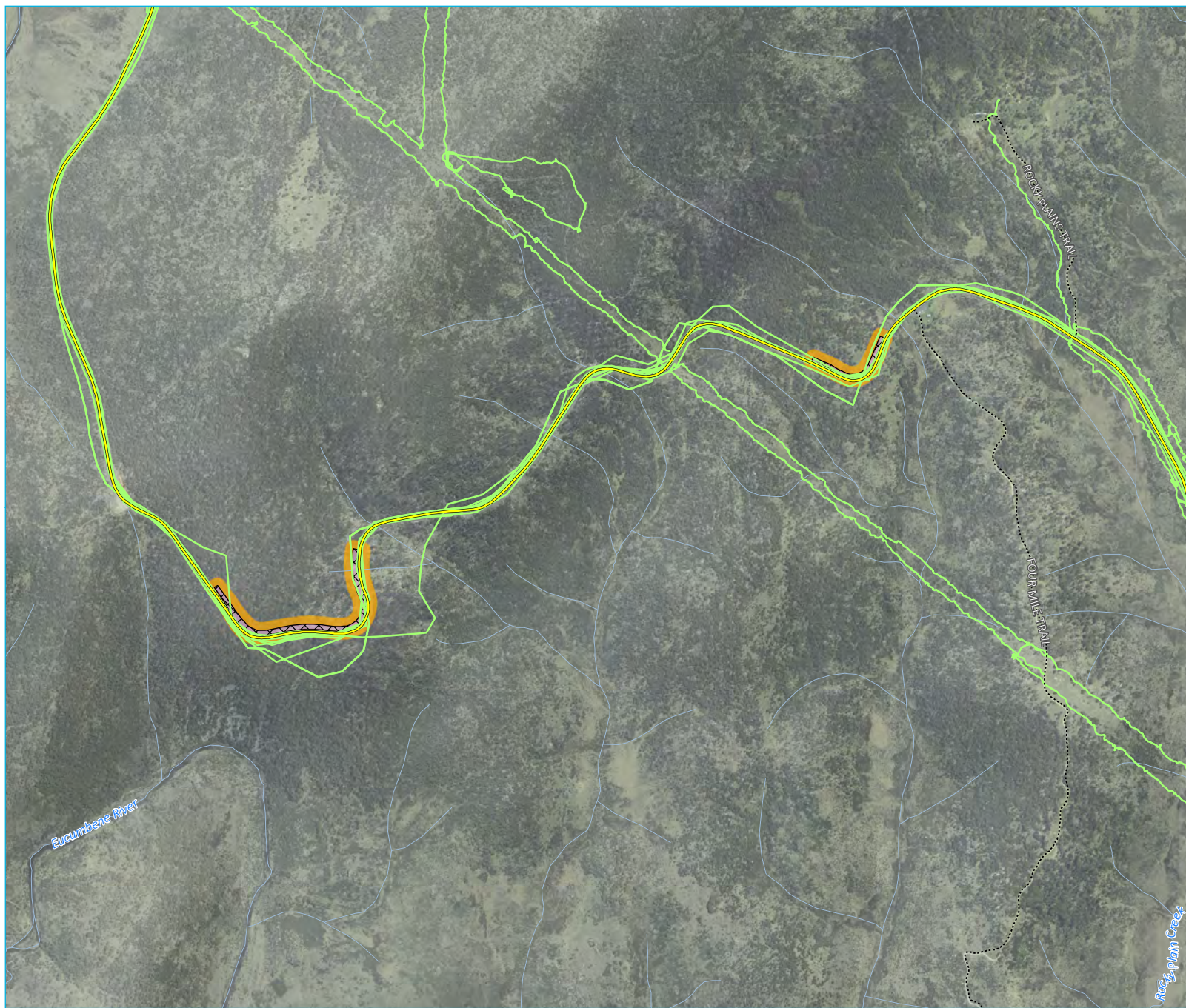
Flora survey locations

Snowy 2.0
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Figure 5.1.42

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



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KEY

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

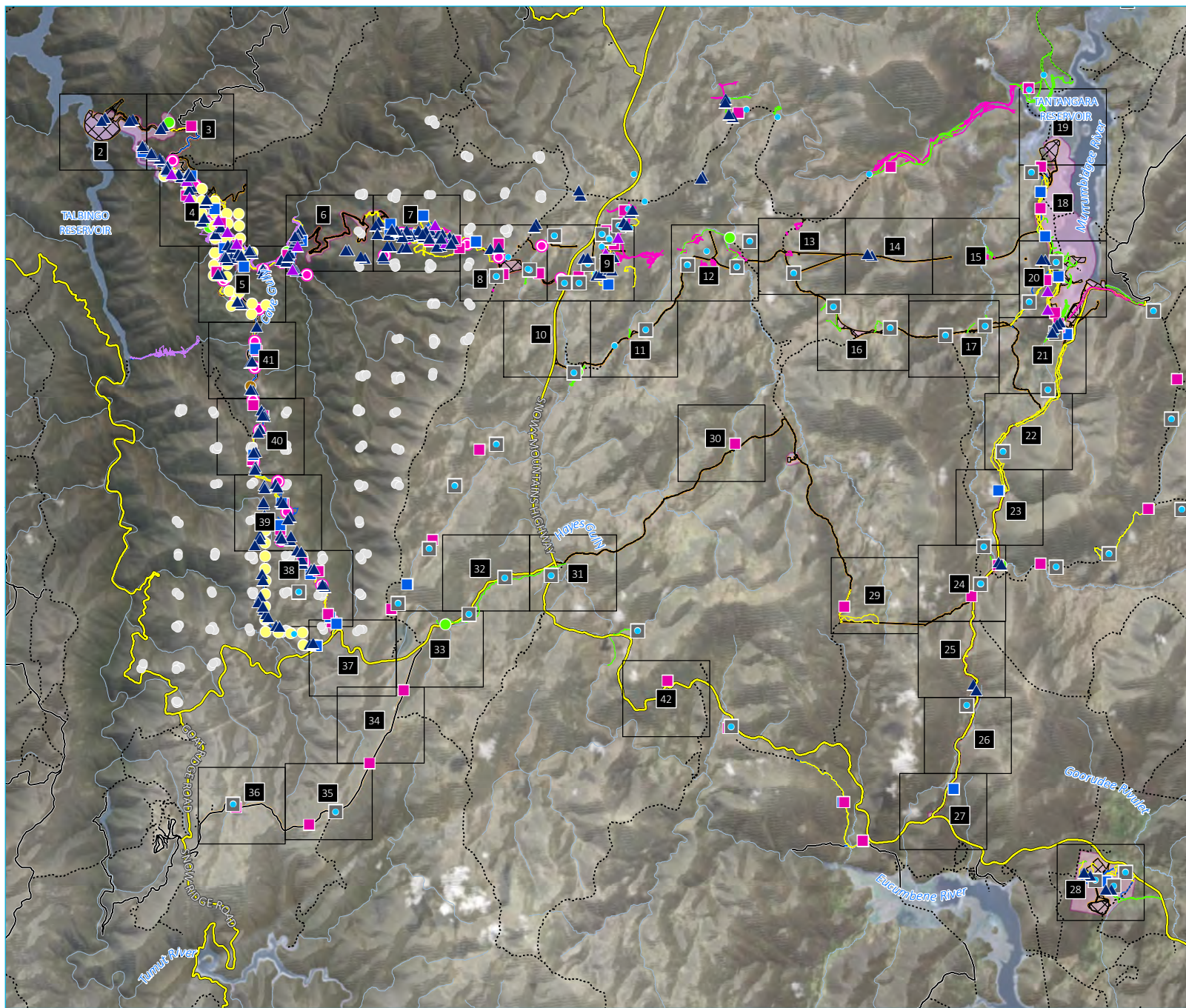
Flora survey locations

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.1.42

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

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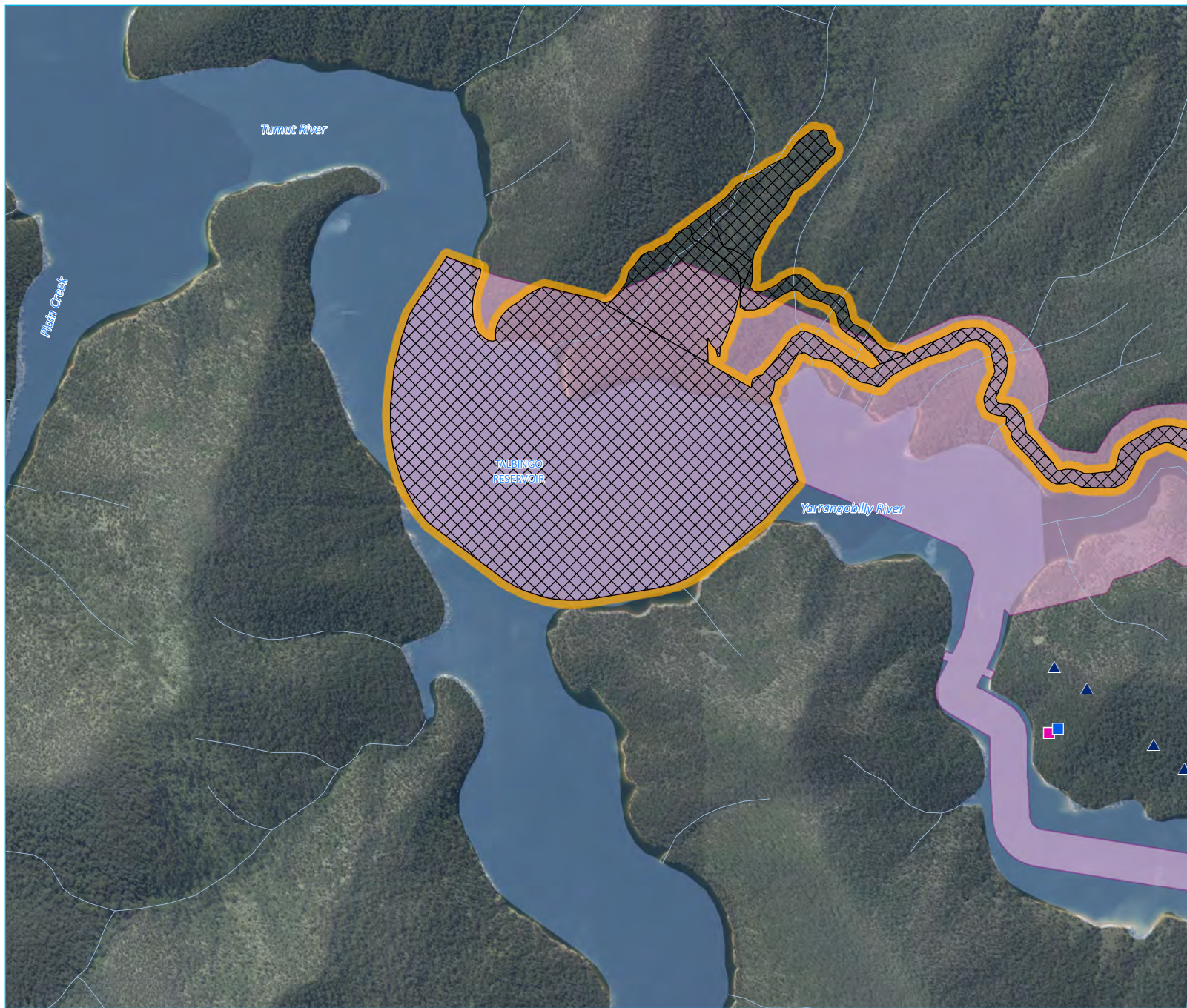
- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - Page index
 - Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Remote camera - small mammal
 - Remote camera - large mammal
 - Owl surveys
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Koala spot assessment technique (SAT)
 - Koala songmeter
 - Tile grid
 - Tile transect
 - Anabat acoustic detection
 - Smoky Mouse camera
 - Fauna survey transect
 - Bird survey
 - Booroolong Frog survey
 - Alpine Tree Frog survey
 - North Corroboree Frog survey
 - Spotlighting

Fauna survey locations - page index

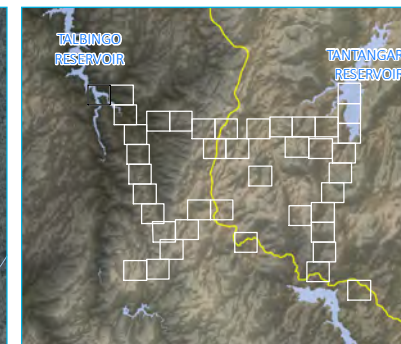
Snowy 2.0
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Figure 5.2.1



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



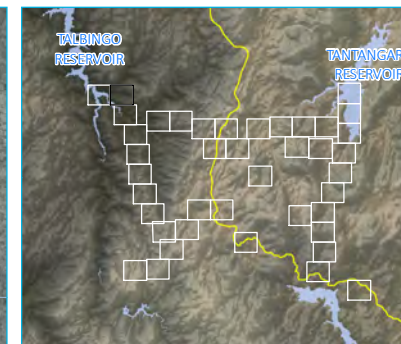
- KEY**
- Watercourse / drainage line
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping

Fauna survey locations

Snowy 2.0
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Figure 5.2.2



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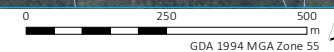
KEY

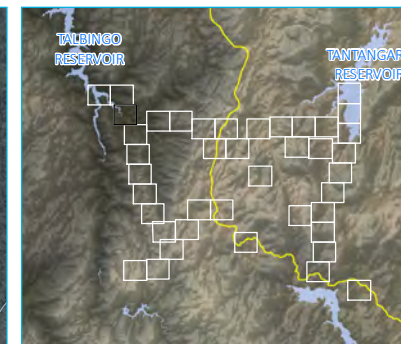
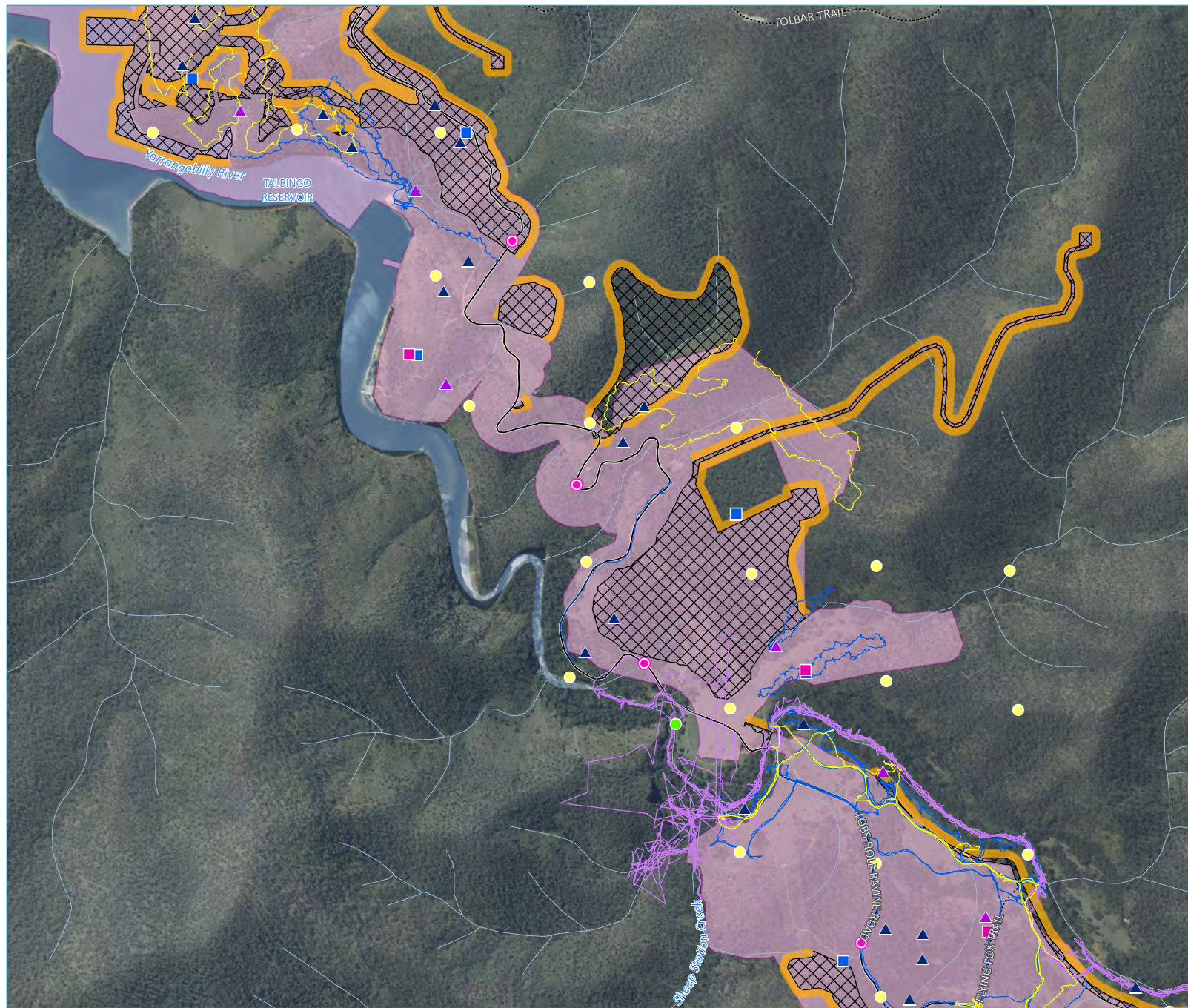
- Watercourse / drainage line
- Local road
- Vehicular track
- ▣ Disturbance area
- ▣ Indirect disturbance area
- ▣ Construction envelope
- ▲ Remote camera - small mammal
- ▲ Remote camera - large mammal
- Small mammal terrestrial trapping
- Arboreal trapping
- Koala spot assessment technique (SAT)
- Anabat acoustic detection
- Owl surveys
- Fauna survey transect
- Bird survey
- Spotlighting

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.2.3

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





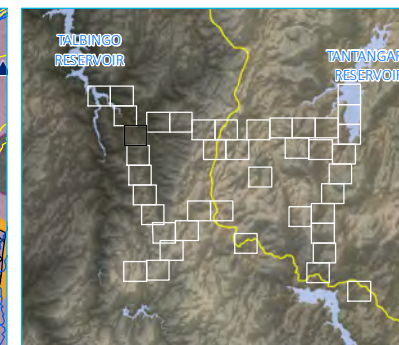
- KEY**
- Watercourse / drainage line
 - Local road
 - Vehicular track
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - ▲ Remote camera - large mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Koala spot assessment technique (SAT)
 - Anabat acoustic detection
 - Owl surveys
 - Fauna survey transect
 - Bird survey
 - Booroolong Frog survey
 - Spotlighting

Fauna survey locations

Snowy 2.0
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Figure 5.2.4



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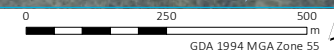
- KEY**
- Watercourse / drainage line
 - Local road
 - Vehicular track
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - ▲ Remote camera - large mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Koala spot assessment technique (SAT)
 - Koala songmeter
 - Anabat acoustic detection
 - Owl surveys
 - Fauna survey transect
 - Bird survey
 - Booroolong Frog survey
 - Spotlighting

Fauna survey locations

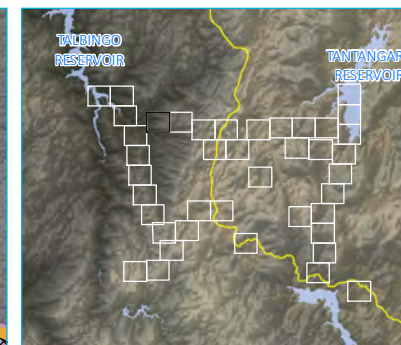
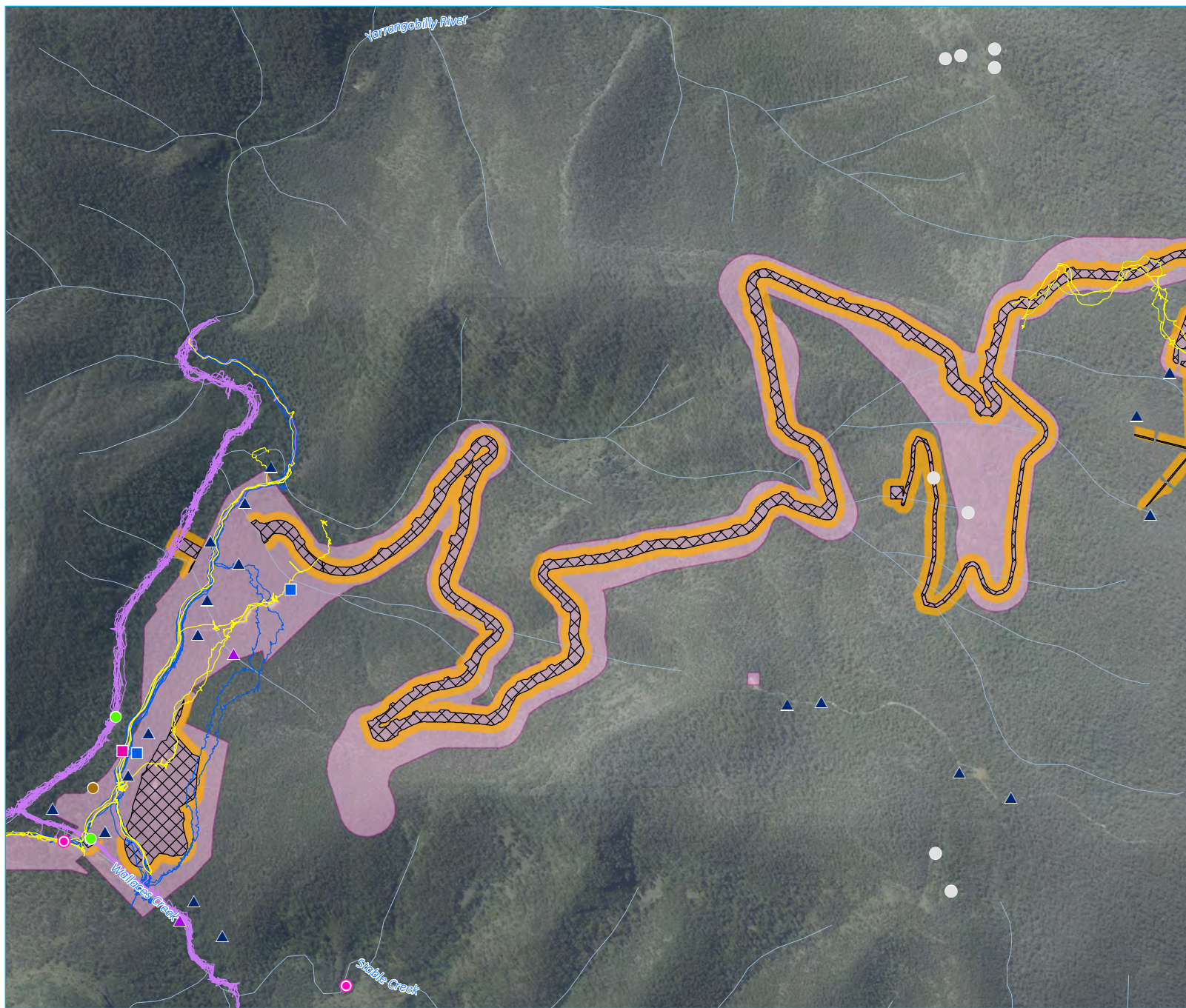
Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.2.5



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



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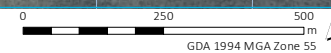
- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - ▲ Remote camera - large mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Koala songmeter
 - Anabat acoustic detection
 - Owl surveys
 - Smoky Mouse camera
 - Fauna survey transect
 - Bird survey
 - Booroolong Frog survey
 - Spotlighting

Fauna survey locations

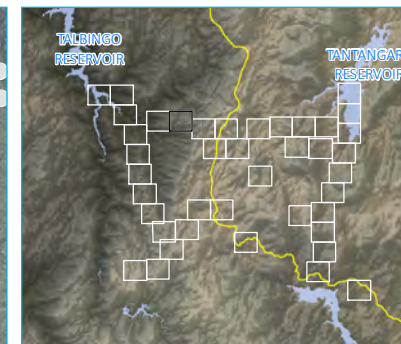
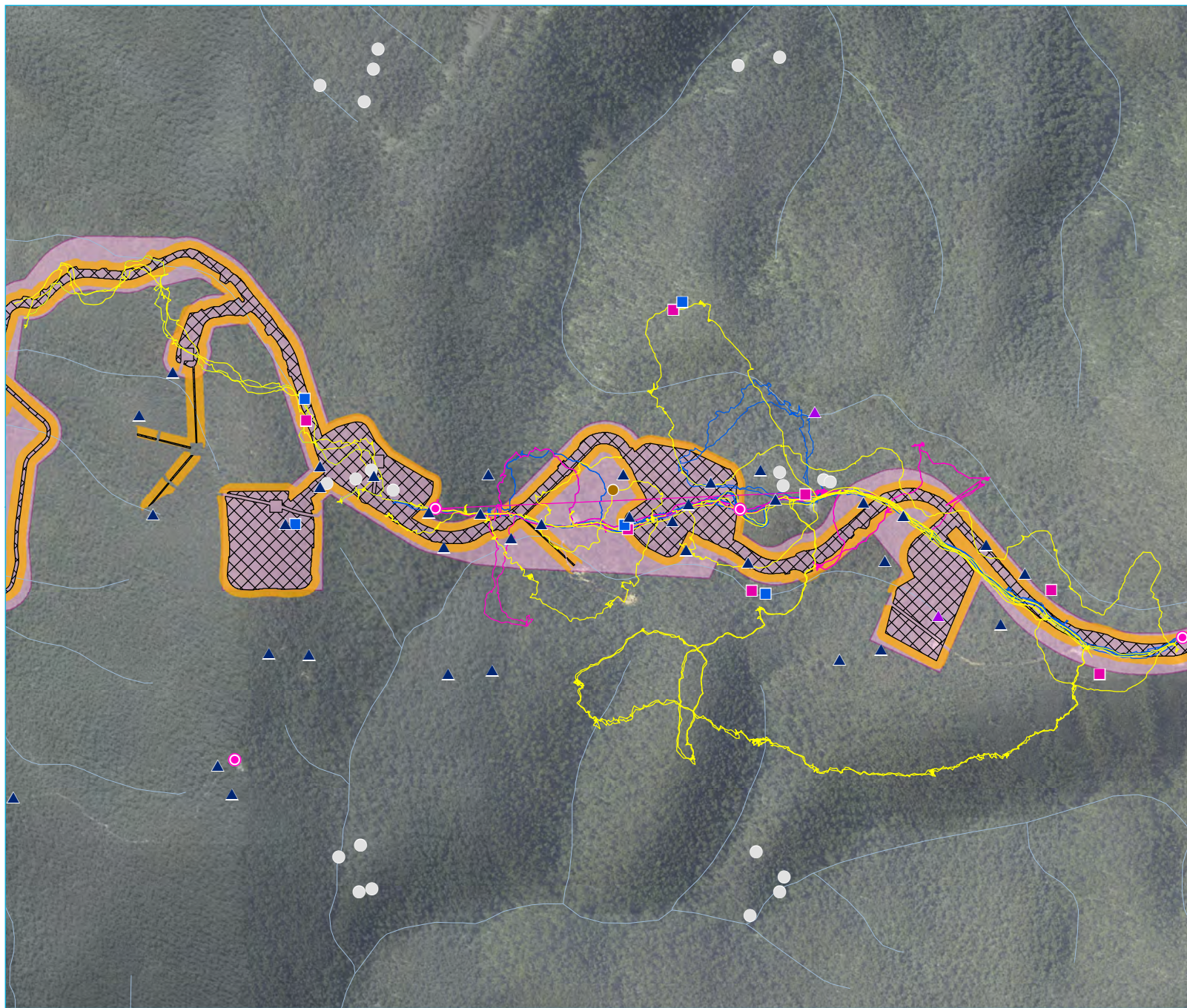
Snowy 2.0
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Figure 5.2.6



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



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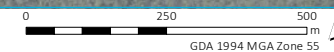


- KEY**
- Watercourse / drainage line
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - ▲ Remote camera - large mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Koala songmeter
 - Owl surveys
 - Smoky Mouse camera
 - Fauna survey transect
 - Bird survey
 - North Corroboree Frog survey
 - Spotlighting

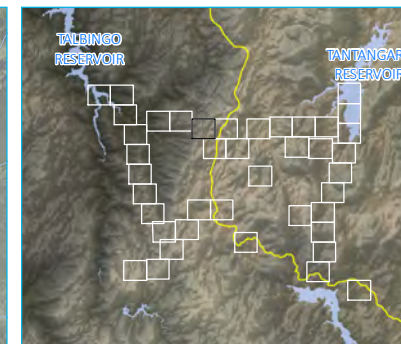
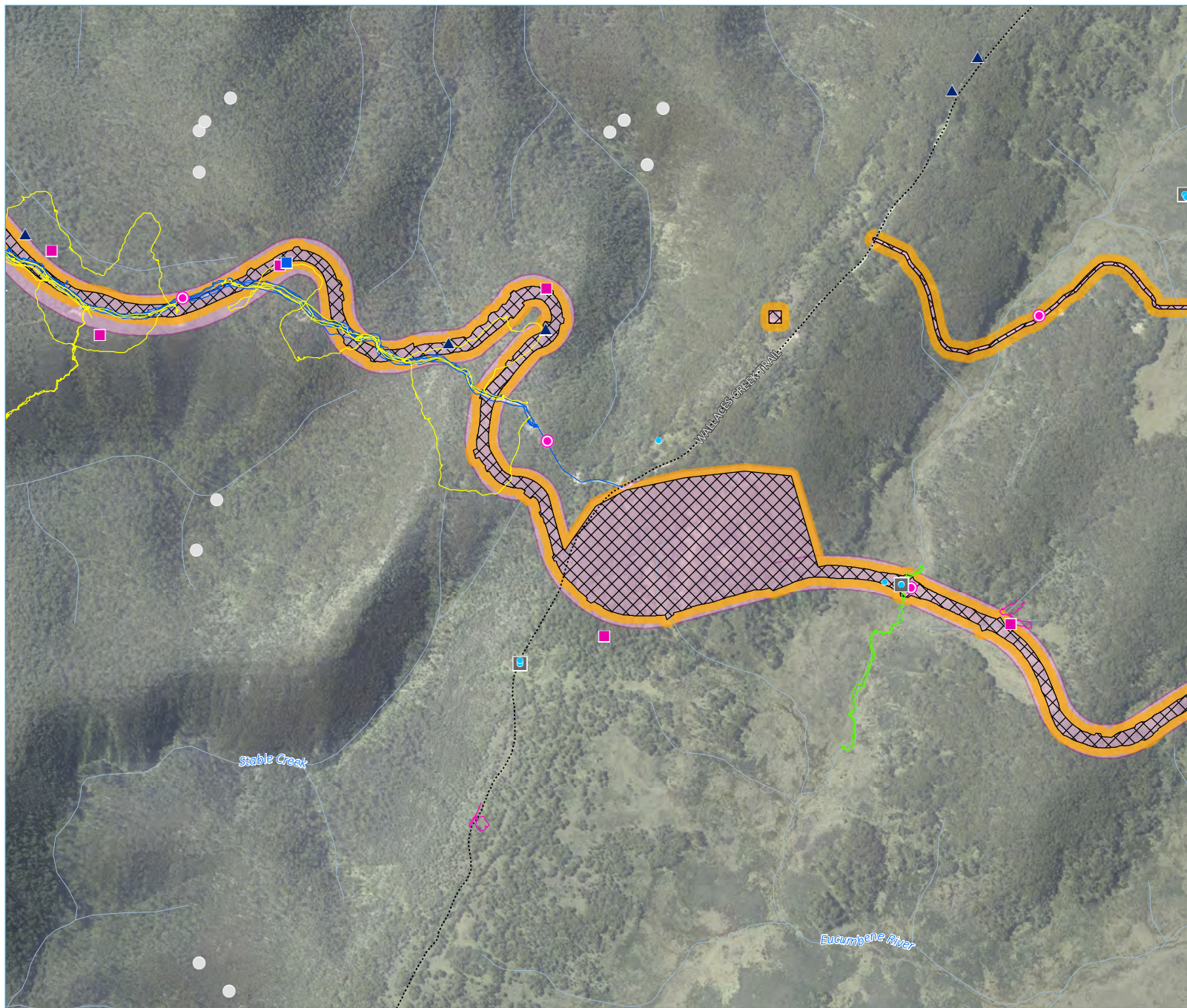
Fauna survey locations

Snowy 2.0
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Main Works
Figure 5.2.7

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



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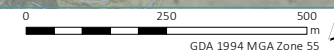
- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ▣ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Tile grid
 - Tile transect
 - Owl surveys
 - Smoky Mouse camera
- Fauna survey transect**
- Bird survey
 - Alpine Tree Frog survey
 - North Corroboree Frog survey
 - Spotlighting

Fauna survey locations

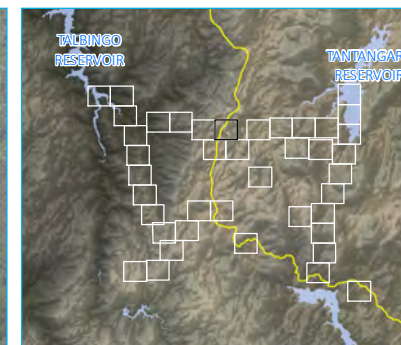
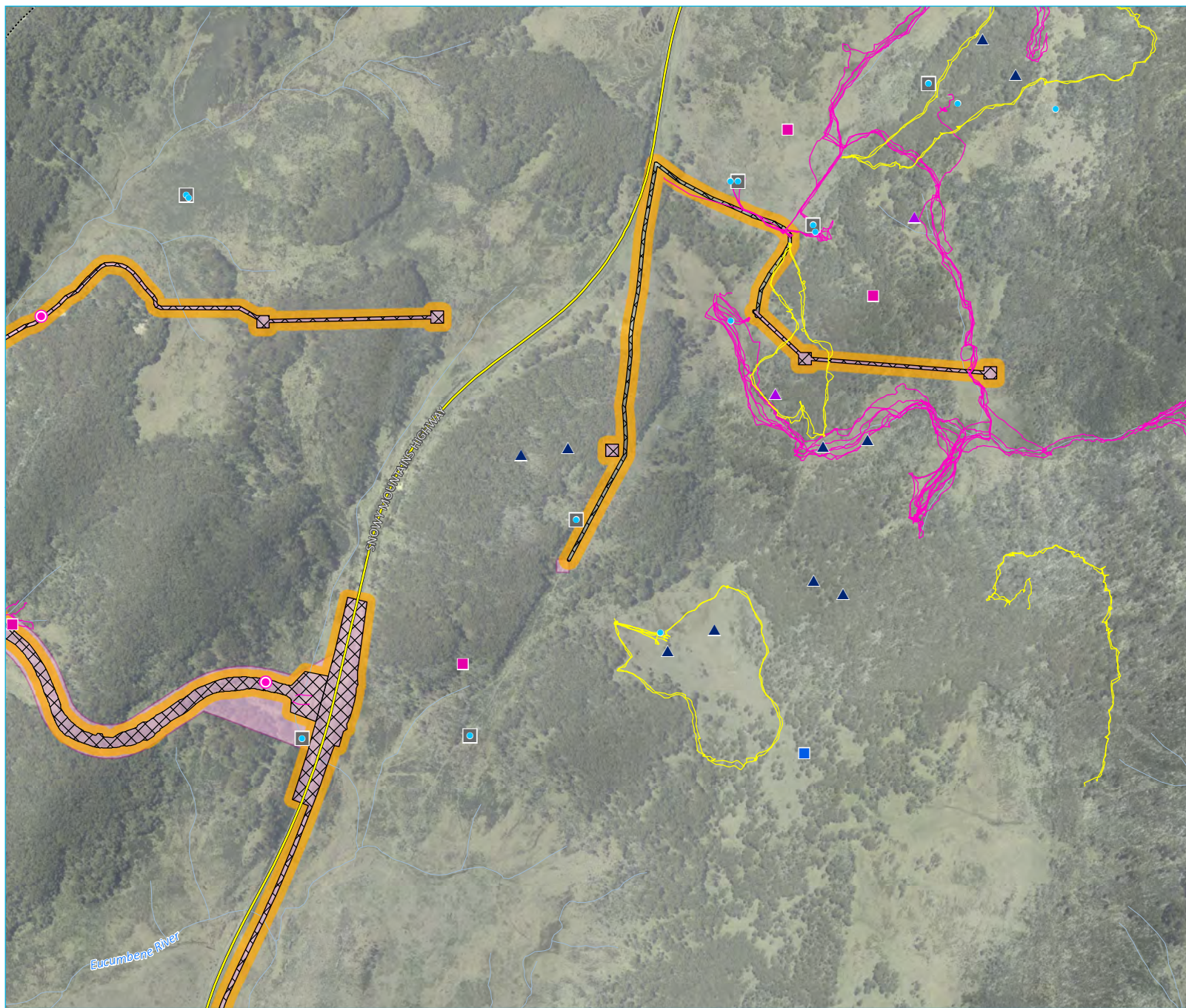
Snowy 2.0
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Main Works
Figure 5.2.8



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



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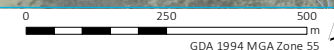
- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - ▲ Remote camera - large mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Tile grid
 - Tile transect
 - Owl surveys
 - Fauna survey transect
 - Bird survey
 - North Corroboree Frog survey

Fauna survey locations

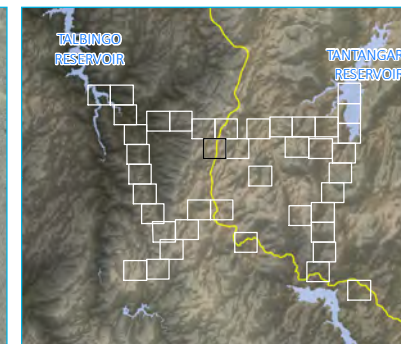
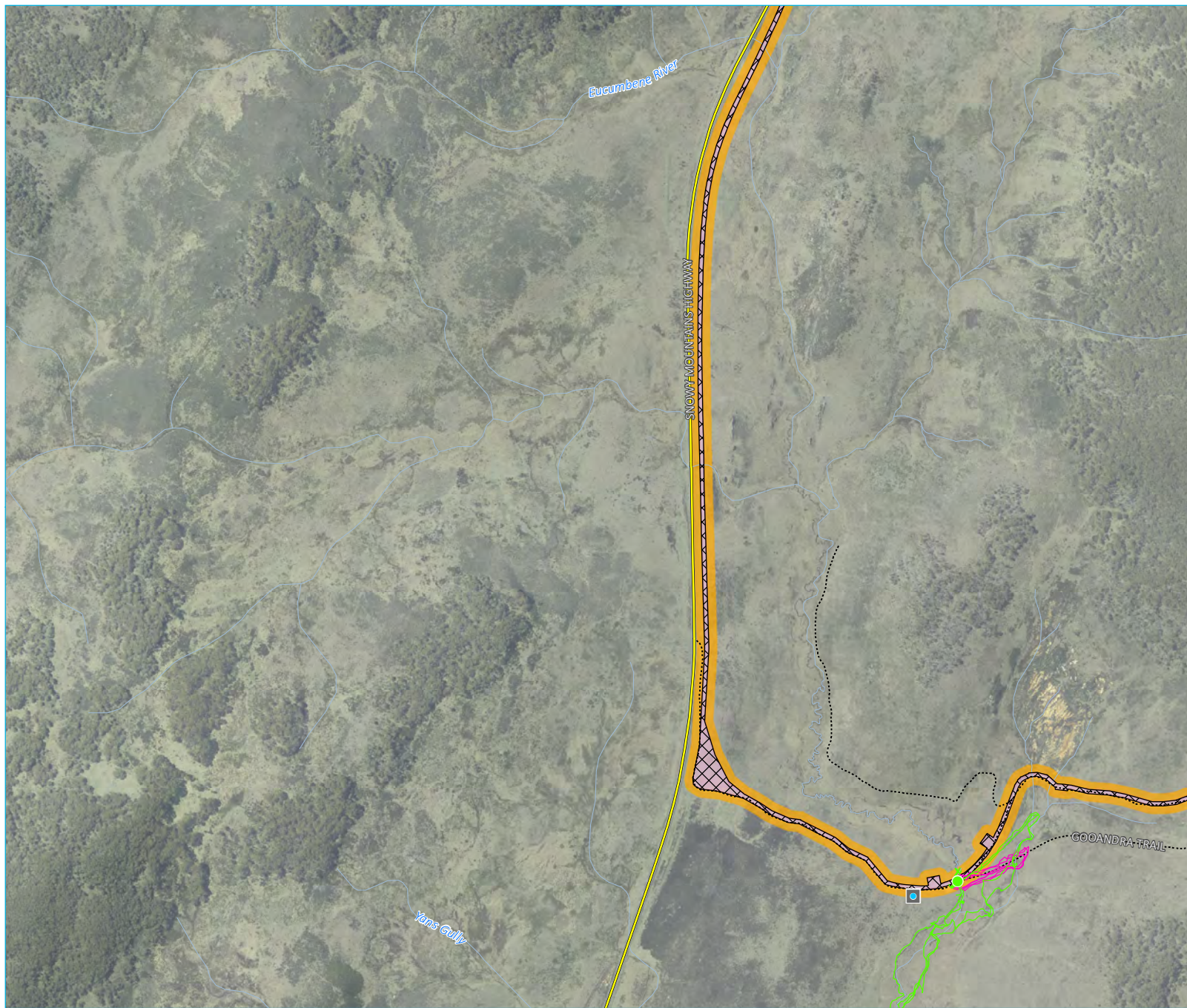
Snowy 2.0
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Main Works
Figure 5.2.9



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



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- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Tile grid
 - Tile transect
 - Anabat acoustic detection
 - Alpine Tree Frog survey
 - North Corroboree Frog survey

Fauna survey locations

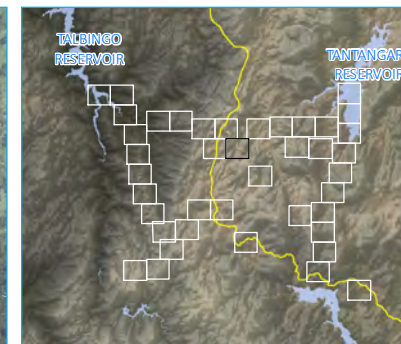
Snowy 2.0
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Main Works
Figure 5.2.10



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

0 250 500
m
GDA 1994 MGA Zone 55

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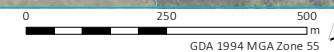


- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Tile grid
 - Tile transect
 - Alpine Tree Frog survey
 - North Corroboree Frog survey

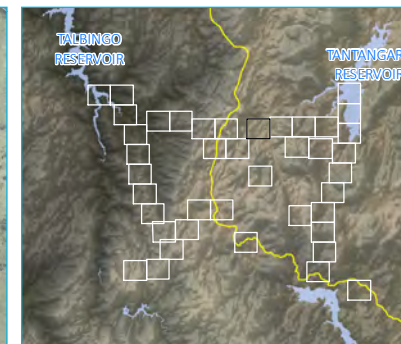
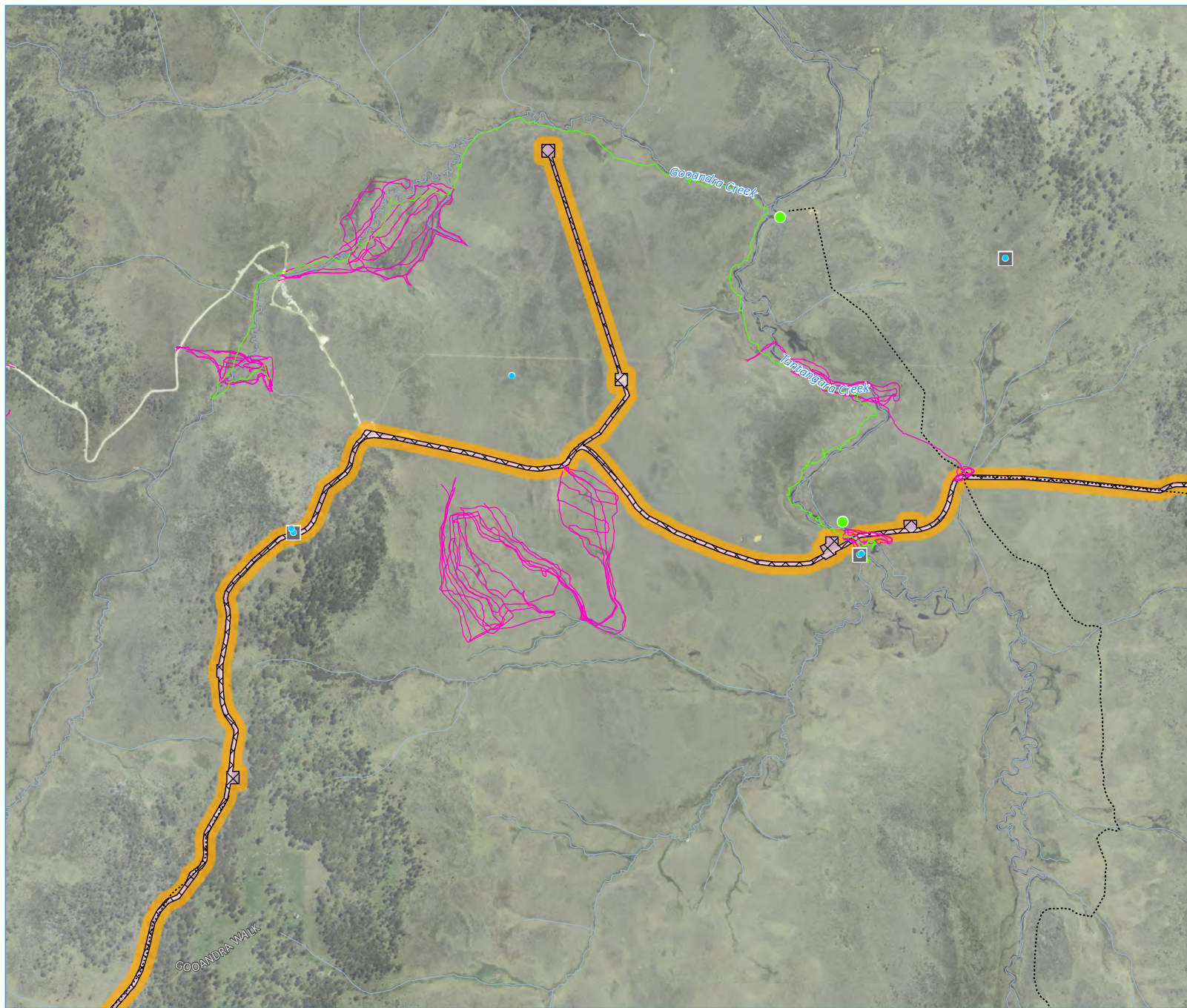
Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.11

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



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- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Tile grid
 - Tile transect
 - Anabat acoustic detection
 - Alpine Tree Frog survey
 - North Corroboree Frog survey

Fauna survey locations

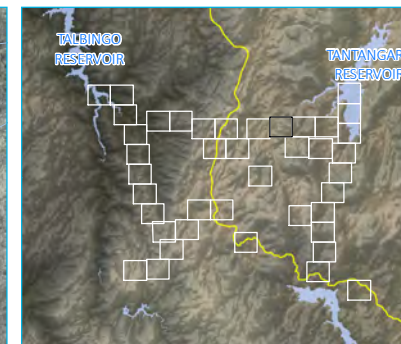
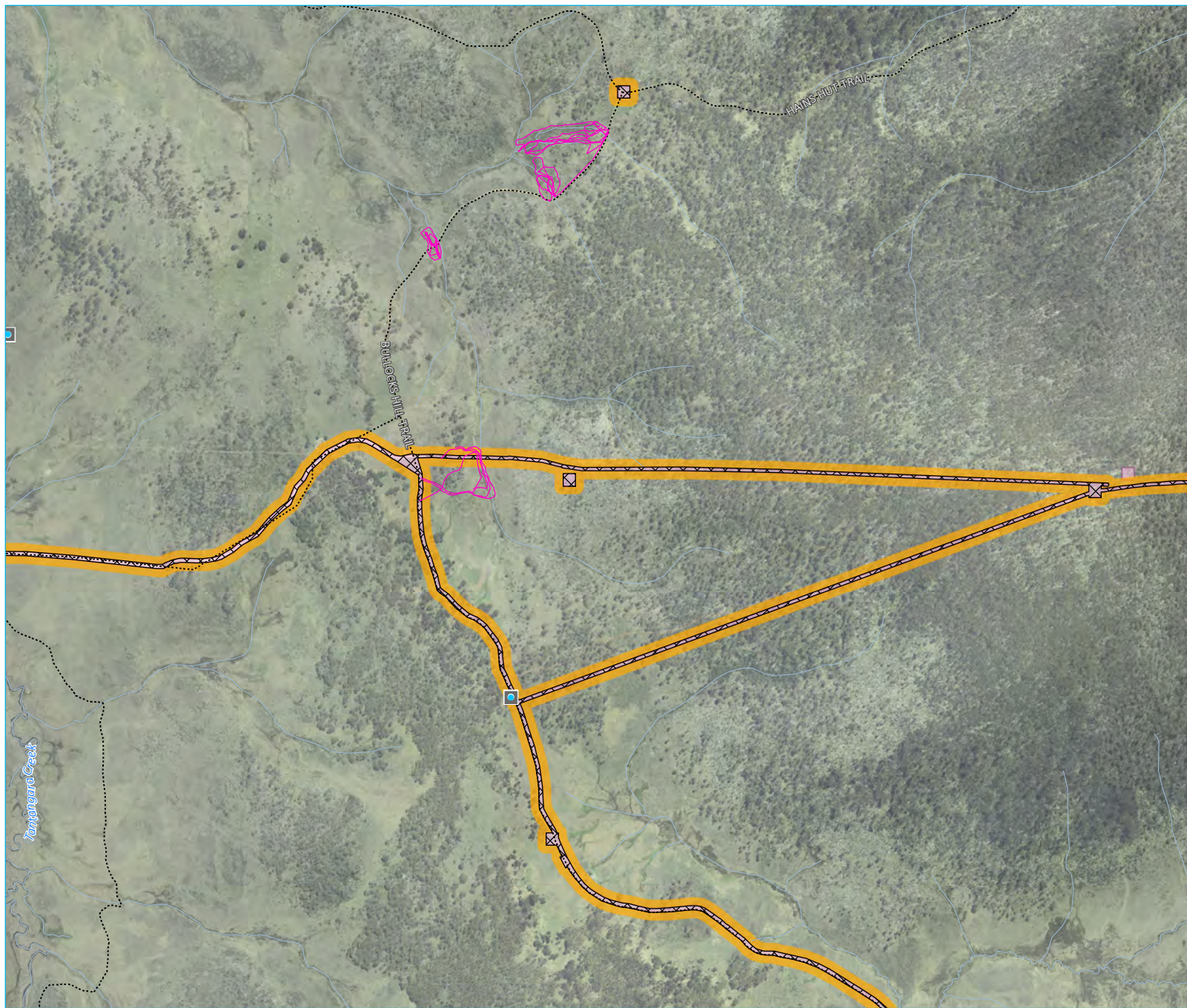
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.12



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

0 250 500
m
GDA 1994 MGA Zone 55

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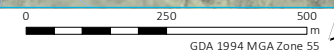
- KEY
- Watercourse / drainage line
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Tile grid
 - Tile transect
 - North Corroboree Frog survey

Fauna survey locations

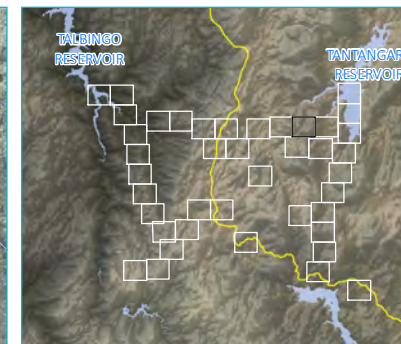
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.13



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



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- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal

Fauna survey locations

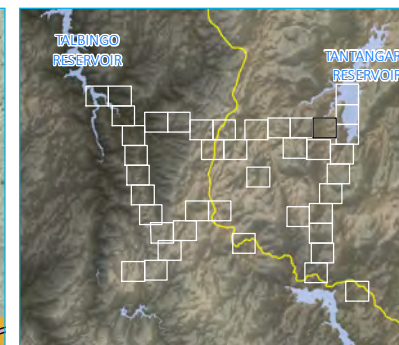
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.14



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

0 250 500
m
GDA 1994 MGA Zone 55

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- KEY
- Watercourse / drainage line
 - ☒ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Alpine Tree Frog survey
 - North Corroboree Frog survey

Fauna survey locations

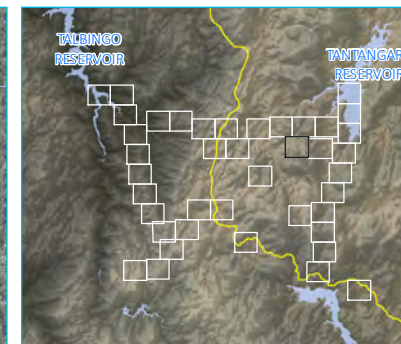
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.15

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

0 250 500
m
GDA 1994 MGA Zone 55



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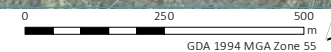
KEY

- Watercourse / drainage line
- Vehicular track
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope
- Tile grid
- Tile transect
- Alpine Tree Frog survey

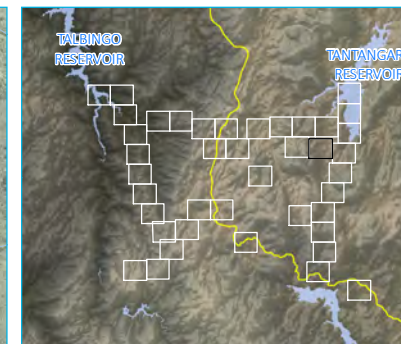
Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.16

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



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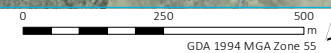
KEY

- Watercourse / drainage line
- Vehicular track
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope
- Tile grid
- Tile transect
- Anabat acoustic detection
- Alpine Tree Frog survey

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.17

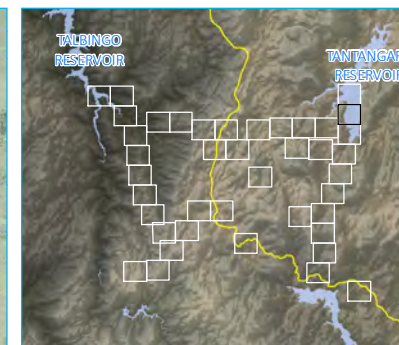
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



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



- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ▨ Disturbance area
 - ▭ Indirect disturbance area
 - ▭ Construction envelope
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Tile grid
 - Tile transect
 - Fauna survey transect
 - Bird survey
 - Alpine Tree Frog survey
 - Spotlighting

Fauna survey locations

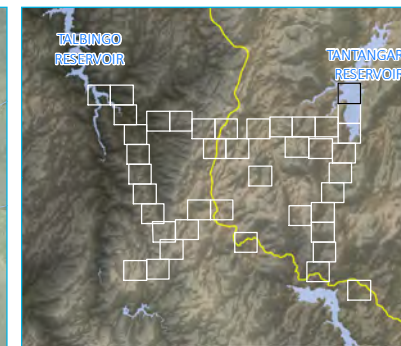
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.18



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



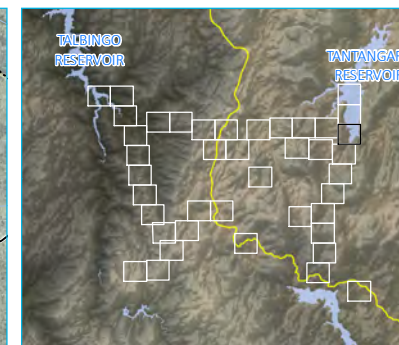
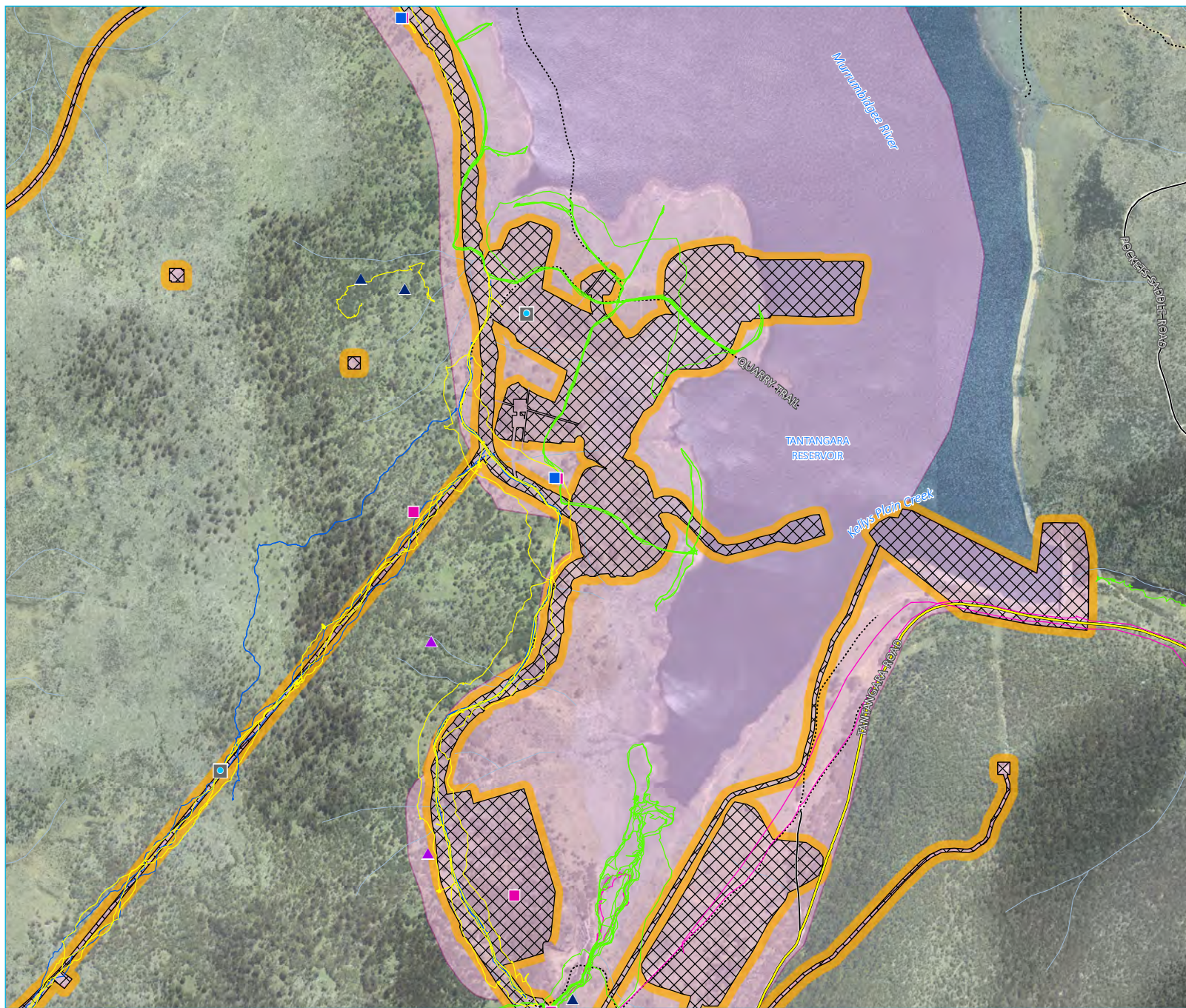
- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Tile grid
 - Alpine Tree Frog survey
 - North Corroboree Frog survey

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.19



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- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - ▨ Disturbance area
 - ▭ Indirect disturbance area
 - ▭ Construction envelope
 - ▲ Remote camera - small mammal
 - ▲ Remote camera - large mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Tile grid
 - Tile transect
 - Fauna survey transect
 - Bird survey
 - Alpine Tree Frog survey
 - North Corroboree Frog survey
 - Spotlighting

Fauna survey locations

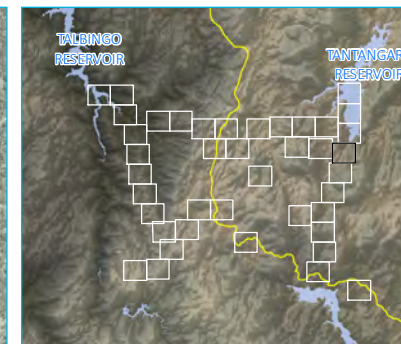
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.20



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

0 250 500
m
GDA 1994 MGA Zone 55

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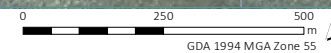
- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Tile grid
 - Tile transect
 - Fauna survey transect
 - Bird survey
 - Alpine Tree Frog survey
 - North Corroboree Frog survey
 - Spotlighting

Fauna survey locations

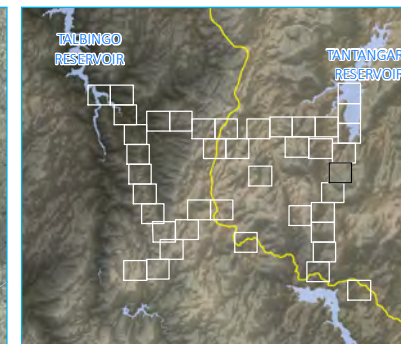
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.21



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



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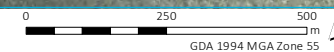


- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Tile grid
 - Tile transect
 - Fauna survey transect
 - Bird survey
 - Spotlighting

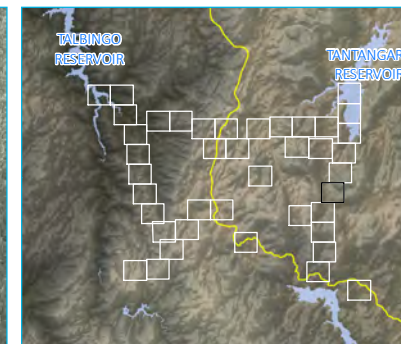
Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.22

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



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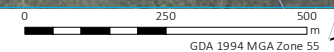


- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Tile grid
 - Tile transect
 - Fauna survey transect
 - Bird survey
 - Spotlighting

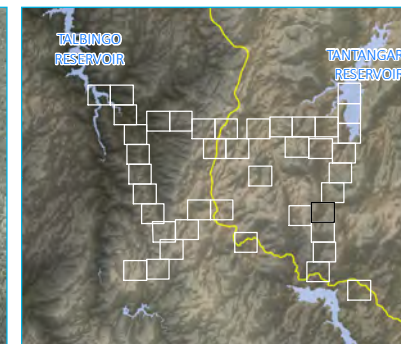
Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.23

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



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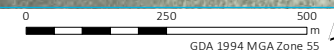


- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - Small mammal terrestrial trapping
 - Tile grid
 - Tile transect
 - Anabat acoustic detection
 - Fauna survey transect
 - Bird survey
 - Alpine Tree Frog survey
 - North Corroboree Frog survey
 - Spotlighting

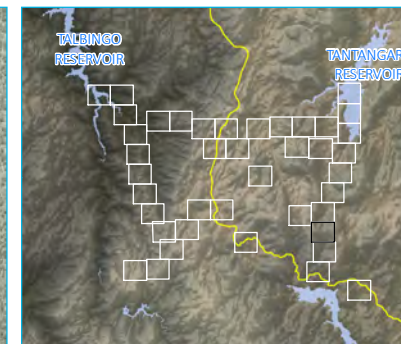
Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.24

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



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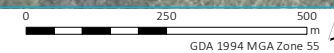
- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - Fauna survey transect
 - Bird survey
 - Spotlighting

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.25



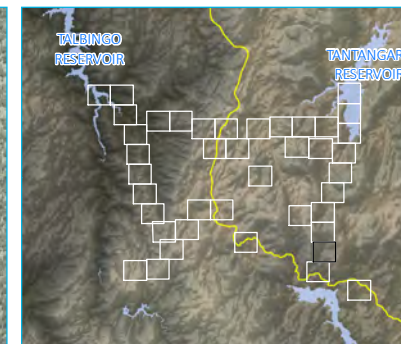
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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



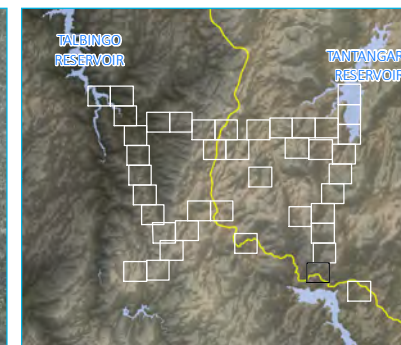
- KEY**
- Watercourse / drainage line
 - Main road
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Tile grid
 - Tile transect
 - Fauna survey transect
 - Bird survey
 - Spotlighting

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.26



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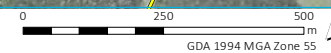
- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - ⊗ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Fauna survey transect
 - Bird survey
 - Spotlighting

Fauna survey locations

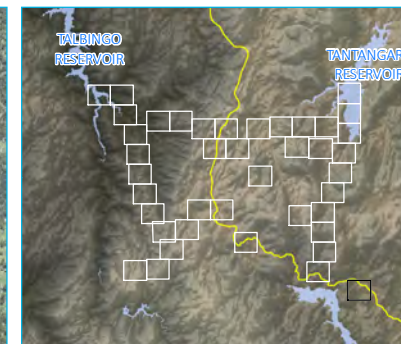
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.27



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



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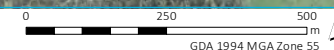
- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ▣ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Tile grid
 - Tile transect
 - Fauna survey transect
 - Bird survey
 - Alpine Tree Frog survey
 - Spotlighting

Fauna survey locations

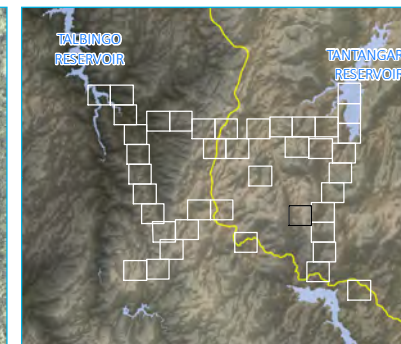
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.28



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



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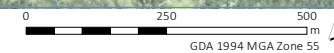
- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Small mammal terrestrial trapping
 - Fauna survey transect
 - Bird survey

Fauna survey locations

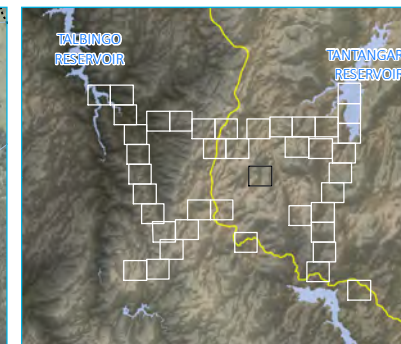
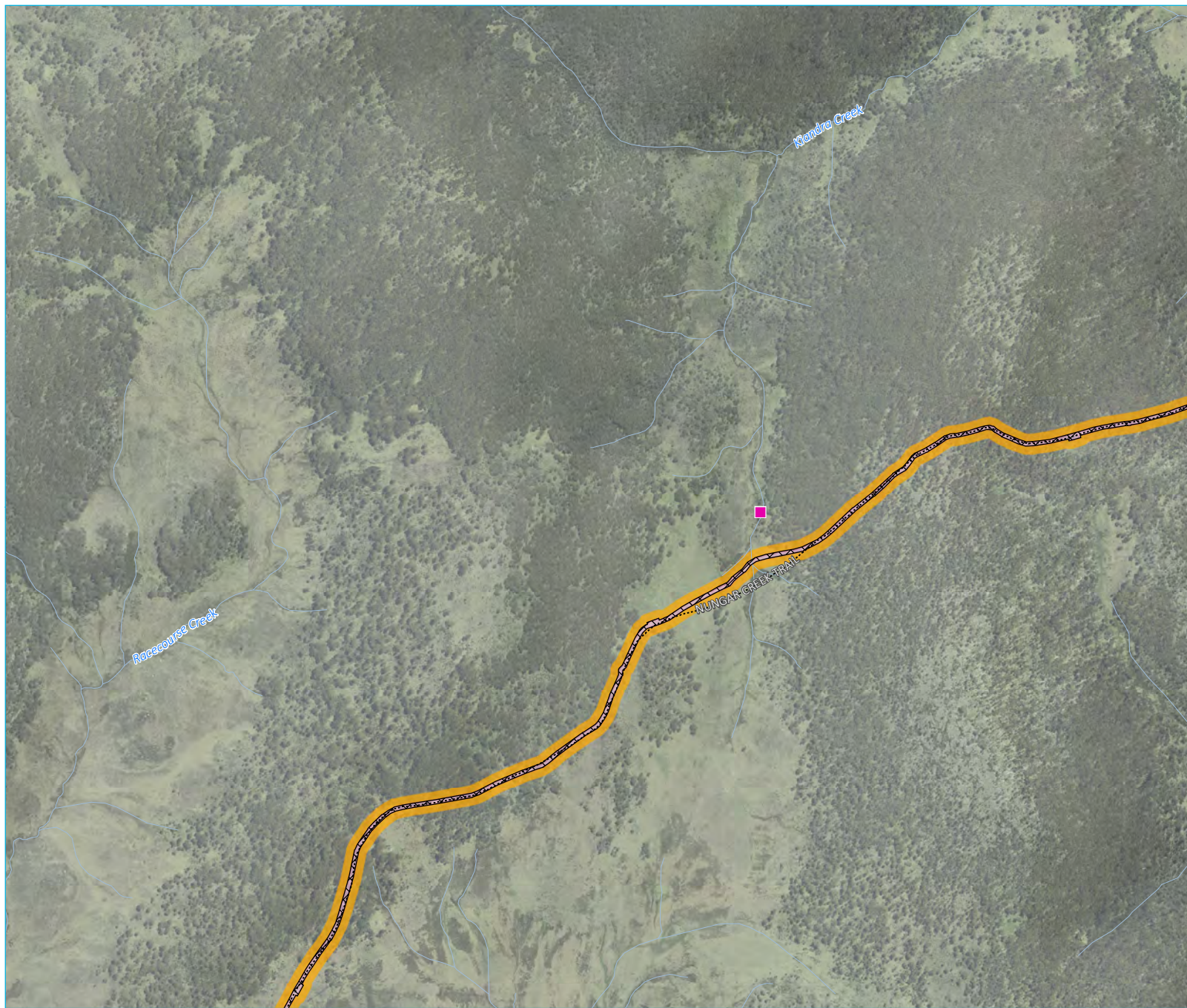
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.29



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



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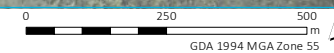


- KEY
- Watercourse / drainage line
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Small mammal terrestrial trapping

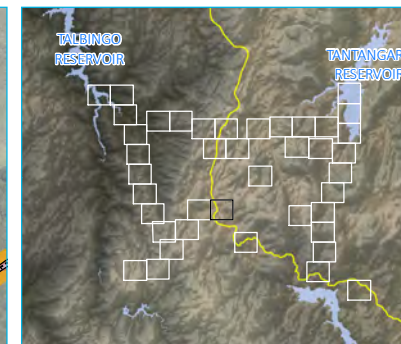
Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.30

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



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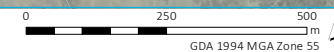
KEY

- Watercourse / drainage line
- Main road
- Local road
- Vehicular track
- ⊠ Disturbance area
- Indirect disturbance area
- Construction envelope
- Tile grid
- Tile transect
- Alpine Tree Frog survey

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.31

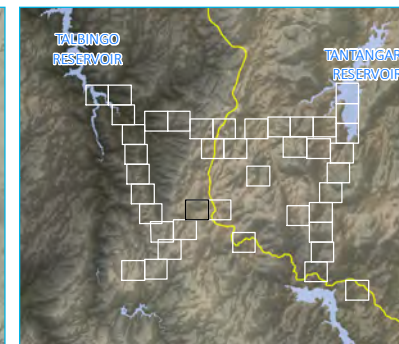
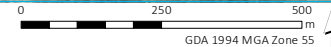
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



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



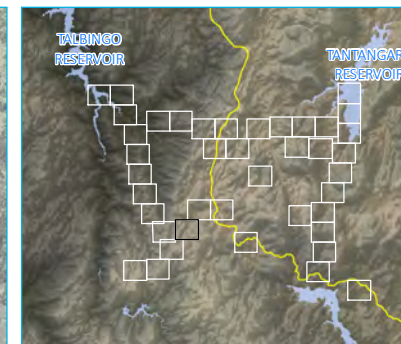
- KEY**
- Watercourse / drainage line
 - Main road
 - ▨ Disturbance area
 - ▨ Indirect disturbance area
 - ▨ Construction envelope
 - Tile grid
 - Tile transect
 - Alpine Tree Frog survey

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.32



\\emmswr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RTS\BDAR\BDAR005_FaunaSurvey\locations_20200203_DDP_02.mxd 20/02/2020



- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Small mammal terrestrial trapping
 - Tile grid
 - Tile transect
 - Anabat acoustic detection
 - Alpine Tree Frog survey

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.33



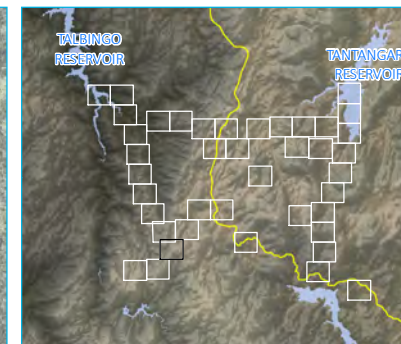
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

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GDA 1994 MGA Zone 55

\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MW\RHS\BDAR\BDAR005_FaunaSurvey\locations_20200203_DDP_02.mxd 20/02/2020



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



- KEY**
- Watercourse / drainage line
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Small mammal terrestrial trapping

Fauna survey locations

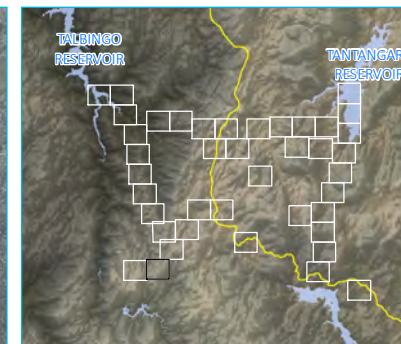
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.34



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RHS\BDAR\BDAR005_FaunaSurvey\locations_20200203_DDP_02.mxd 20/02/2020



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



- KEY**
- Watercourse / drainage line
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Small mammal terrestrial trapping
 - Tile grid
 - Tile transect

Fauna survey locations

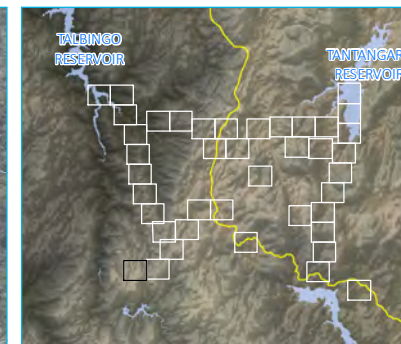
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.35



\\lemmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RIS\BDAR\BDAR005_FaunaSurvey\locations_20200203_DDP_02.mxd 20/02/2020



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



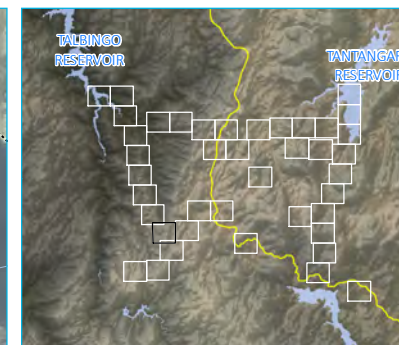
- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Small mammal terrestrial trapping
 - Tile grid
 - Tile transect

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.36



\\lemmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR005_FaunaSurvey\locations_20200203_DDP_02.mxd 20/03/2020



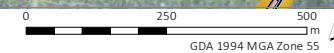
- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Koala spot assessment technique (SAT)
 - Owl surveys
 - Smoky Mouse camera
- Fauna survey transect**
- Bird survey
 - Spotlighting

Fauna survey locations

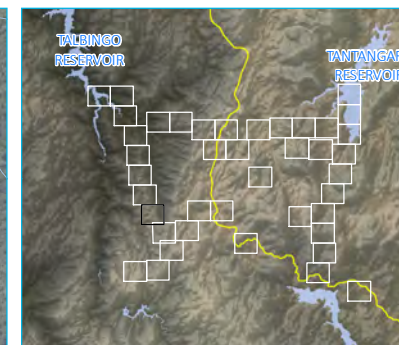
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.37



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



\\lemmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR005_FaunaSurvey\locations_20200203_DDP_02.mxd 20/02/2020



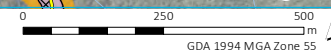
- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Koala spot assessment technique (SAT)
 - Koala songmeter
 - Tile grid
 - Tile transect
 - Owl surveys
 - Smoky Mouse camera
 - Fauna survey transect
 - Bird survey
 - Spotlighting

Fauna survey locations

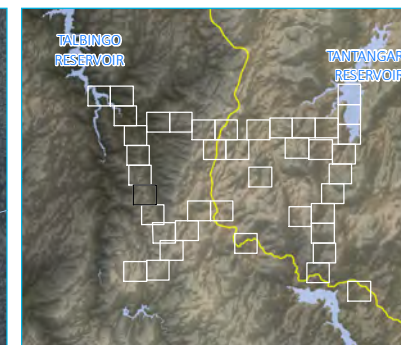
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.38



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



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RTS\BDAR\BDAR005_FaunaSurvey\locations_20200203_DDP_02.mxd 20/02/2020



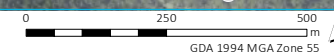
- KEY**
- Watercourse / drainage line
 - Local road
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Koala spot assessment technique (SAT)
 - Koala songmeter
 - Owl surveys
 - Smoky Mouse camera
 - Fauna survey transect
 - Bird survey
 - Spotlighting

Fauna survey locations

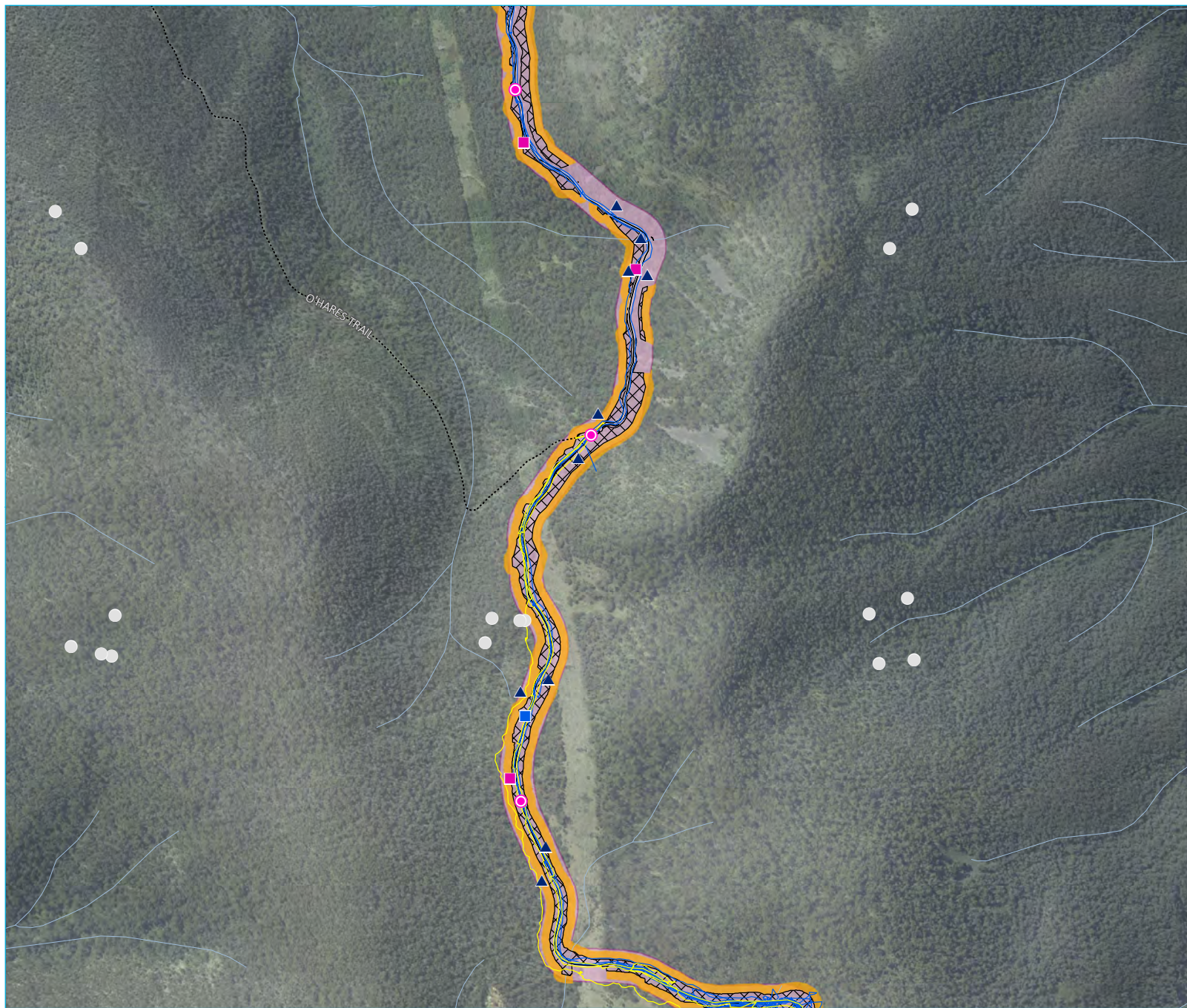
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.39



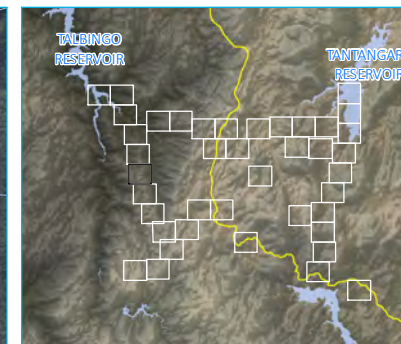
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\GIS\BDAR\BDAR005_FaunaSurvey\locations_20200203_DDP_02.mxd 20/02/2020



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



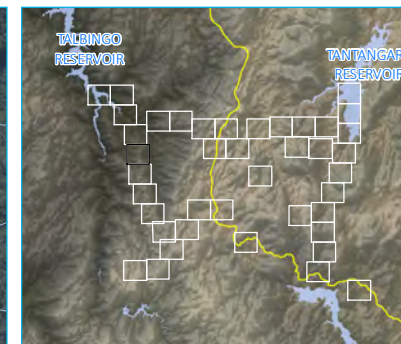
- KEY**
- Watercourse / drainage line
 - Local road
 - Vehicular track
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Owl surveys
 - Smoky Mouse camera
 - Fauna survey transect
 - Bird survey
 - Spotlighting

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.40



\\lemmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR005_FaunaSurvey\locations_20200203_DDP_02.mxd 20/07/2020

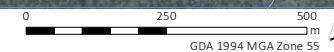


- KEY**
- Watercourse / drainage line
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal
 - Small mammal terrestrial trapping
 - Arboreal trapping
 - Koala songmeter
 - Owl surveys
 - Fauna survey transect
 - Bird survey
 - Spotlighting

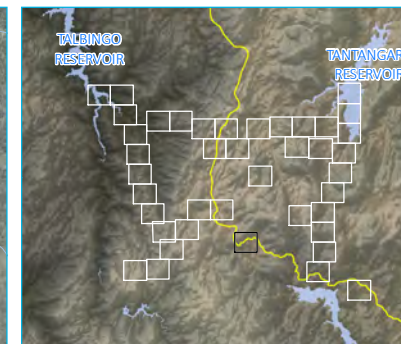
Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.41

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



\\lemmsr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RTS\BDAR\BDAR005_FaunaSurvey\locations_20200203_DDP_02.mxd 20/02/2020



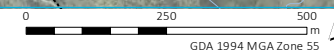
- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Small mammal terrestrial trapping
 - Alpine Tree Frog survey

Fauna survey locations

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.2.42

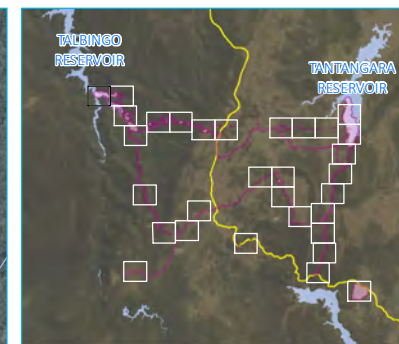
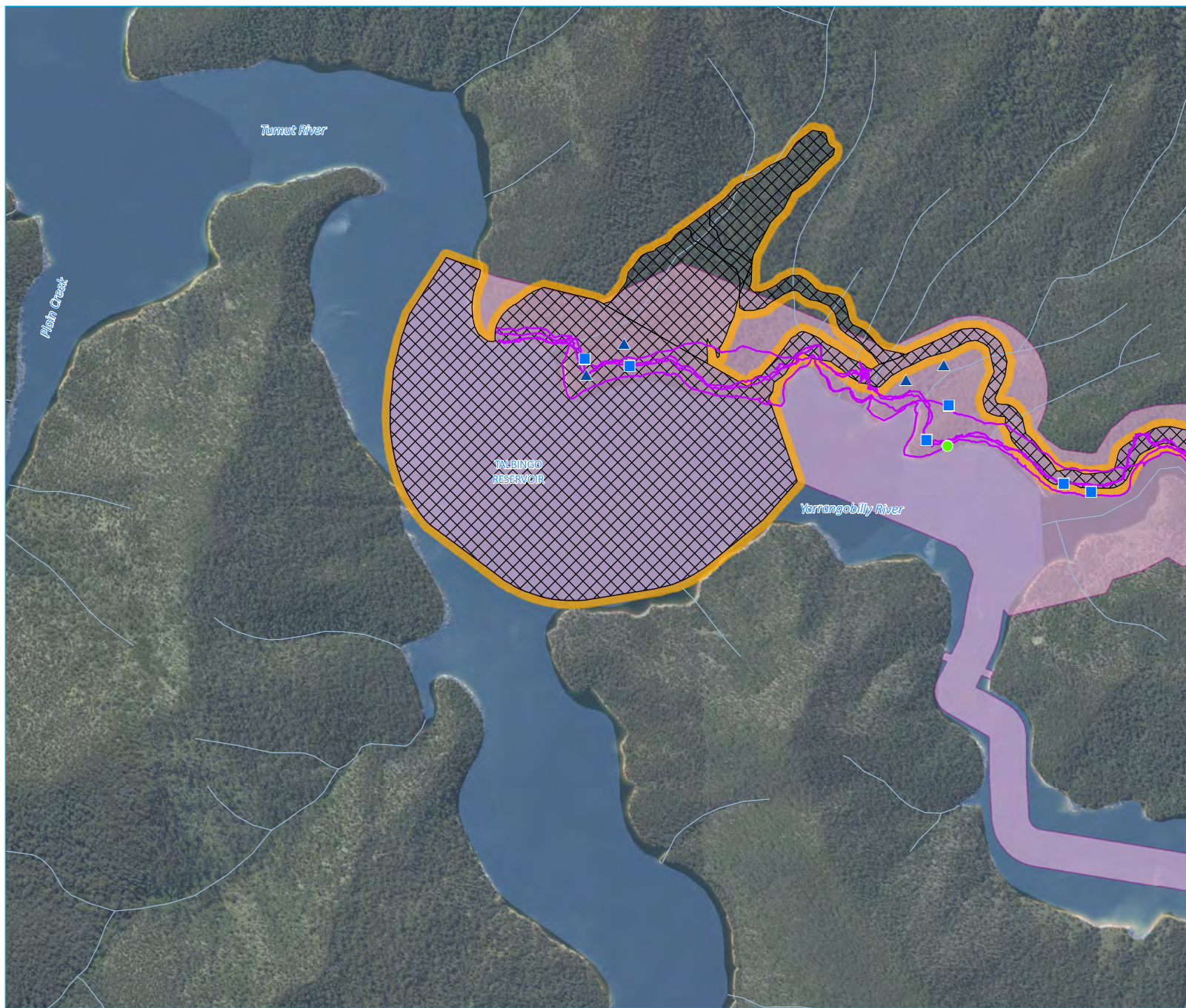


Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)





\\emmsvr1\EMM2\117188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RHS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020



- KEY
- Watercourse / drainage line
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Bird survey
 - ▲ Remote camera - small mammal
 - Arboreal camera
 - Anabat acoustic detection

Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.2



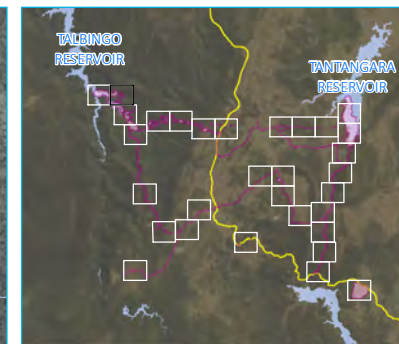
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

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GDA 1994 MGA Zone 55

\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020



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



KEY

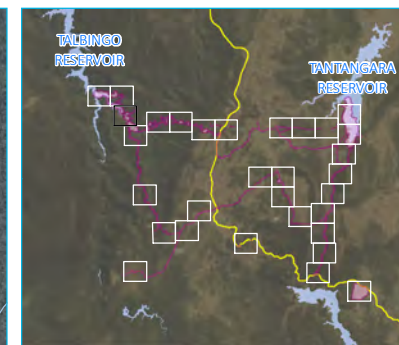
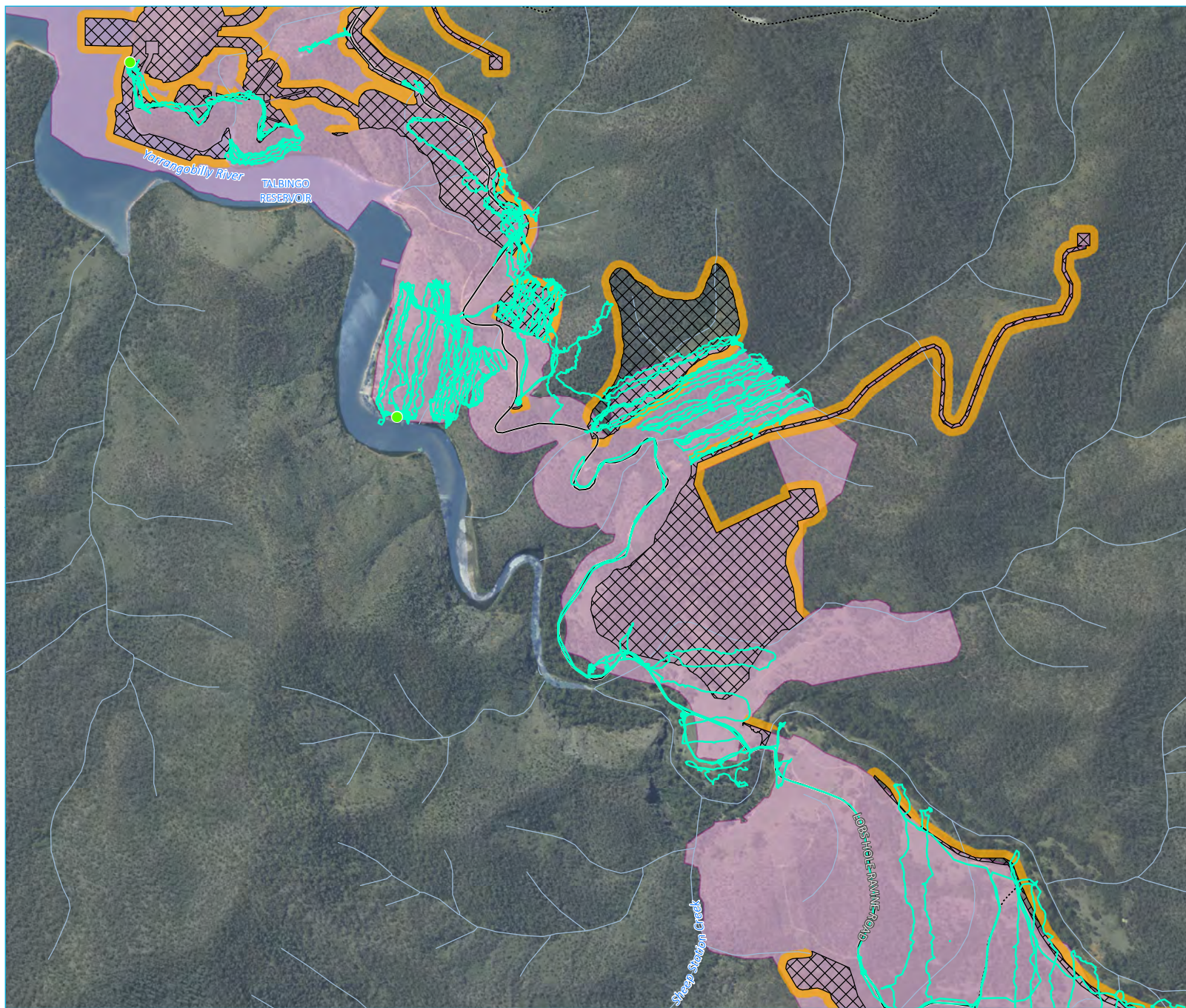
- Watercourse / drainage line
- Local road
- Vehicular track
- ▨ Disturbance area
- Indirect disturbance area
- Construction envelope
- Bird survey
- Flora survey transect
- ▲ Remote camera - small mammal
- Arboreal camera
- Anabat acoustic detection

Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.3



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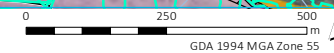
- KEY**
- Watercourse / drainage line
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect
 - Anabat acoustic detection

Additional surveys completed

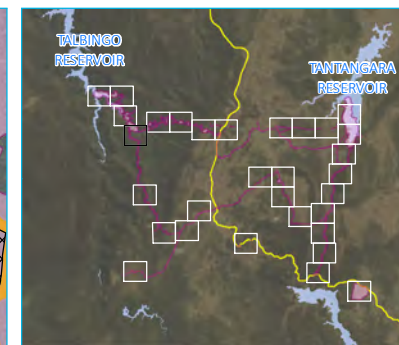
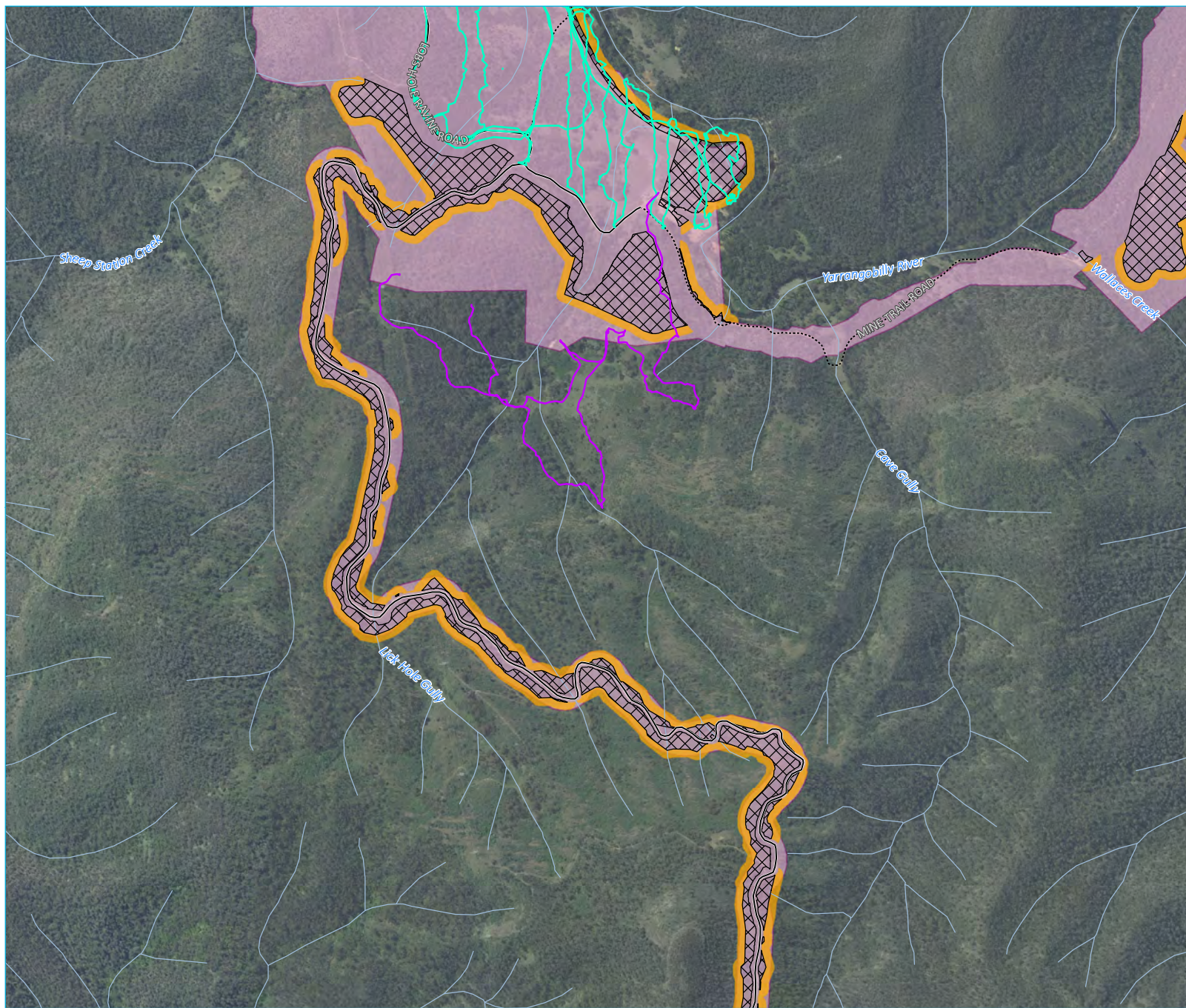
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.4



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



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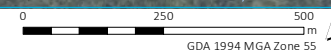
- KEY**
- Watercourse / drainage line
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Yellow line Indirect disturbance area
 - Pink area Construction envelope
 - Purple line Bird survey
 - Cyan line Flora survey transect

Additional surveys completed

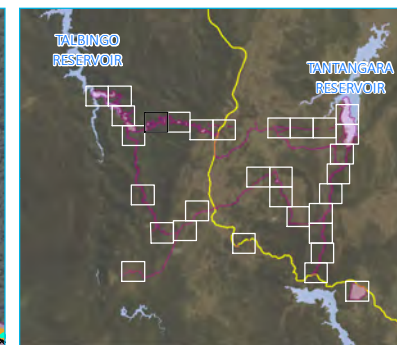
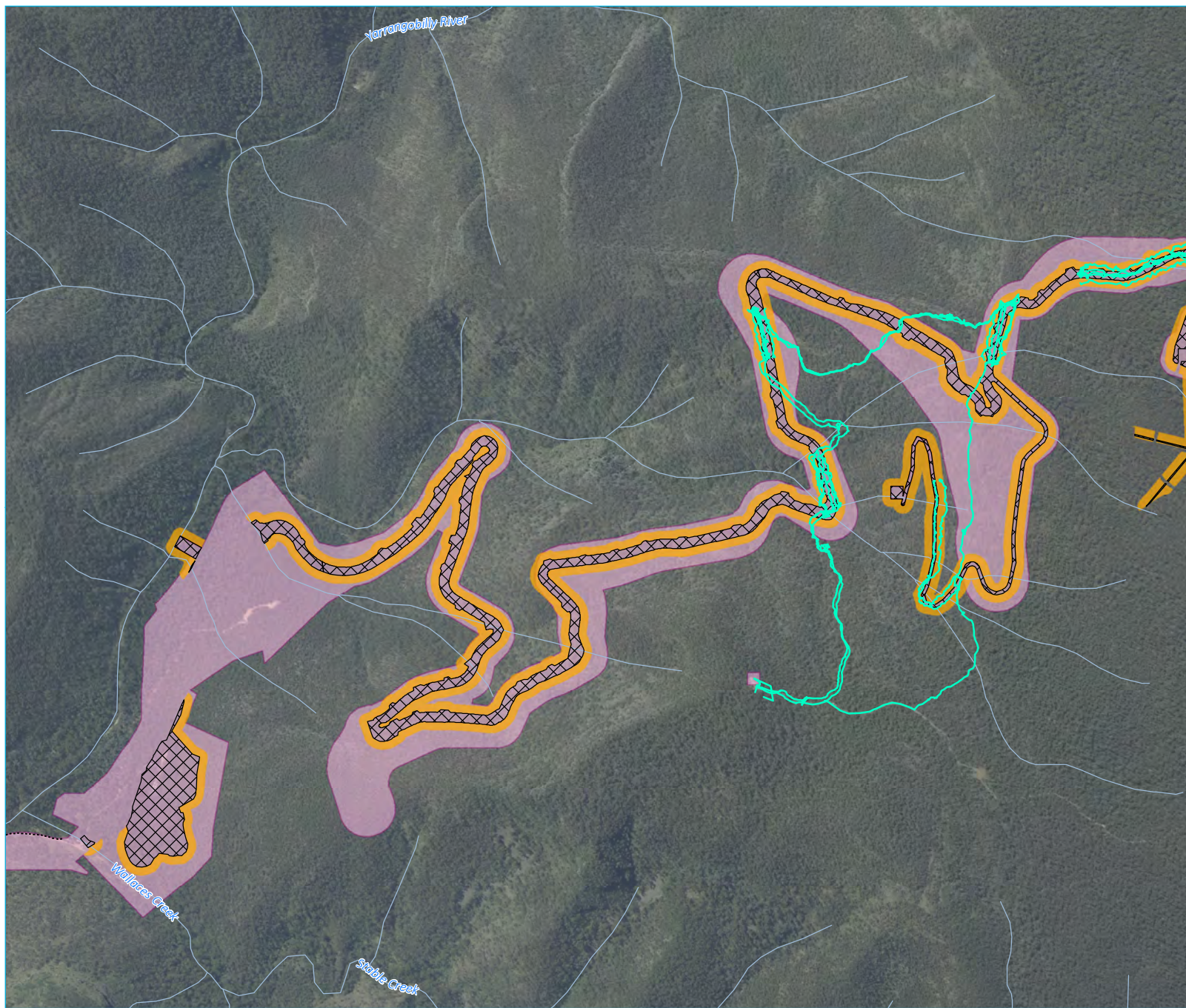
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.5



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



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- KEY
- Watercourse / drainage line
 - Vehicular track
 - ▣ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect

Additional surveys completed

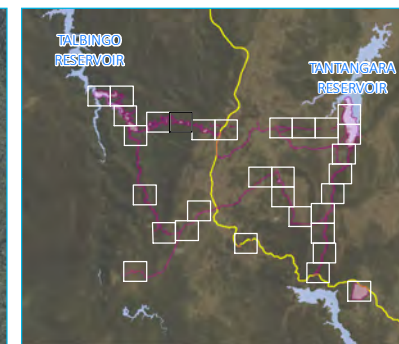
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.6

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

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GDA 1994 MGA Zone 55



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- KEY
- Watercourse / drainage line
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect

Additional surveys completed

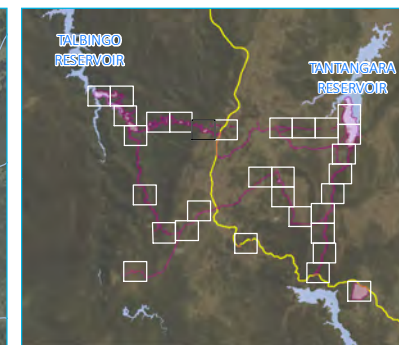
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.7



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

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GDA 1994 MGA Zone 55

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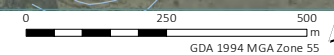
- KEY
- Watercourse / drainage line
 - Vehicular track
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal

Additional surveys completed

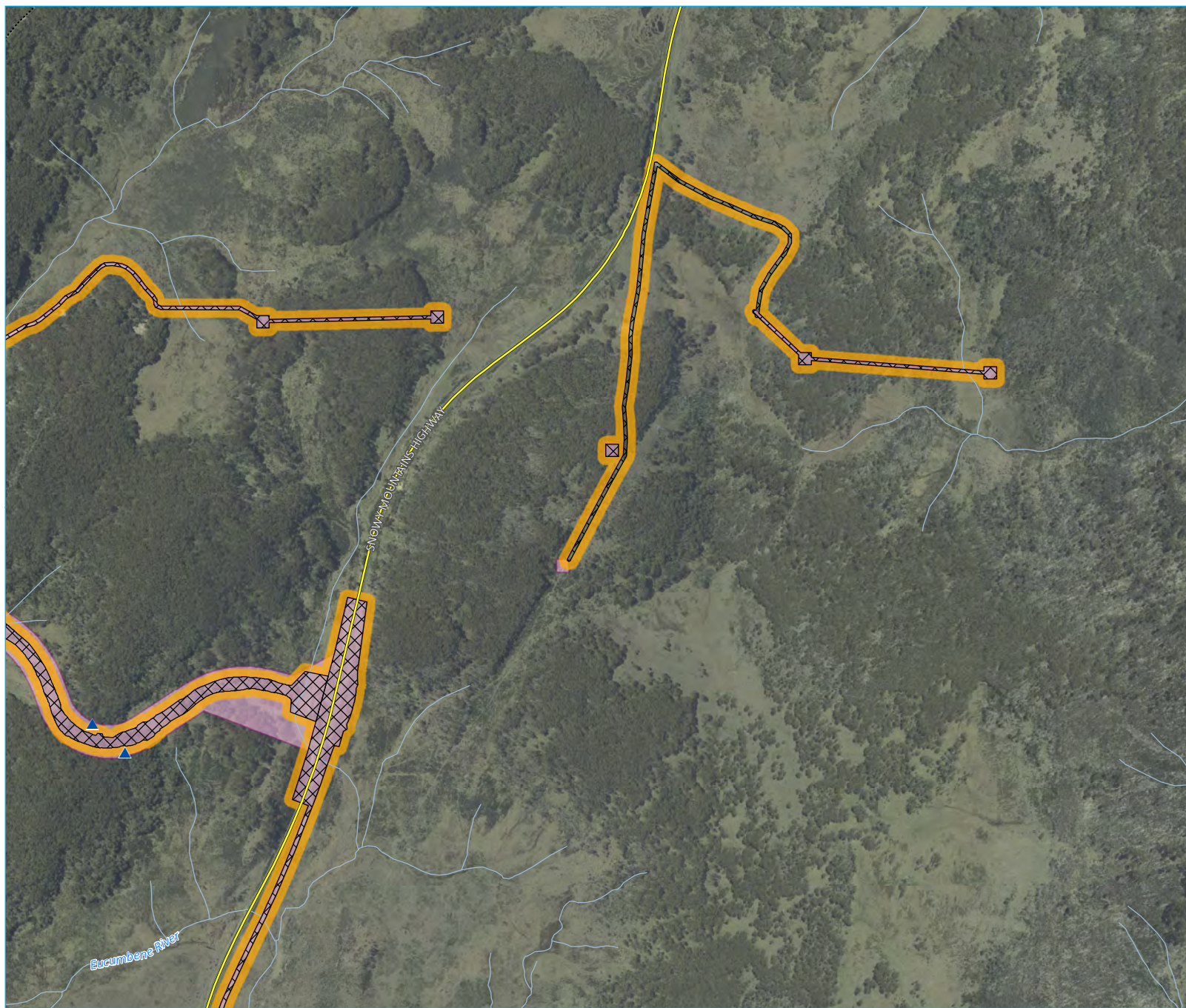
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.8



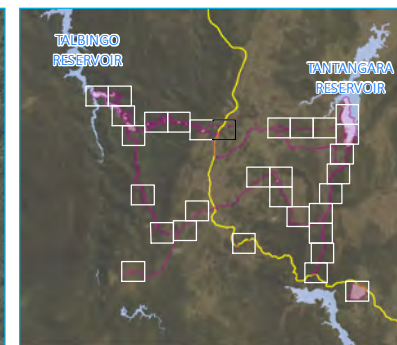
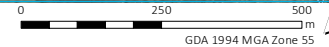
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



\\lemmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020



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



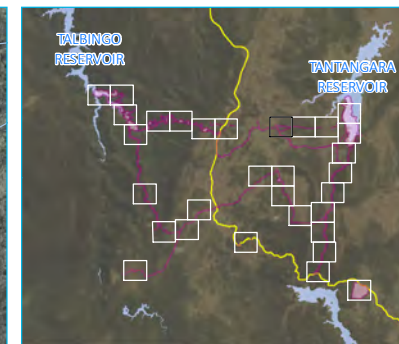
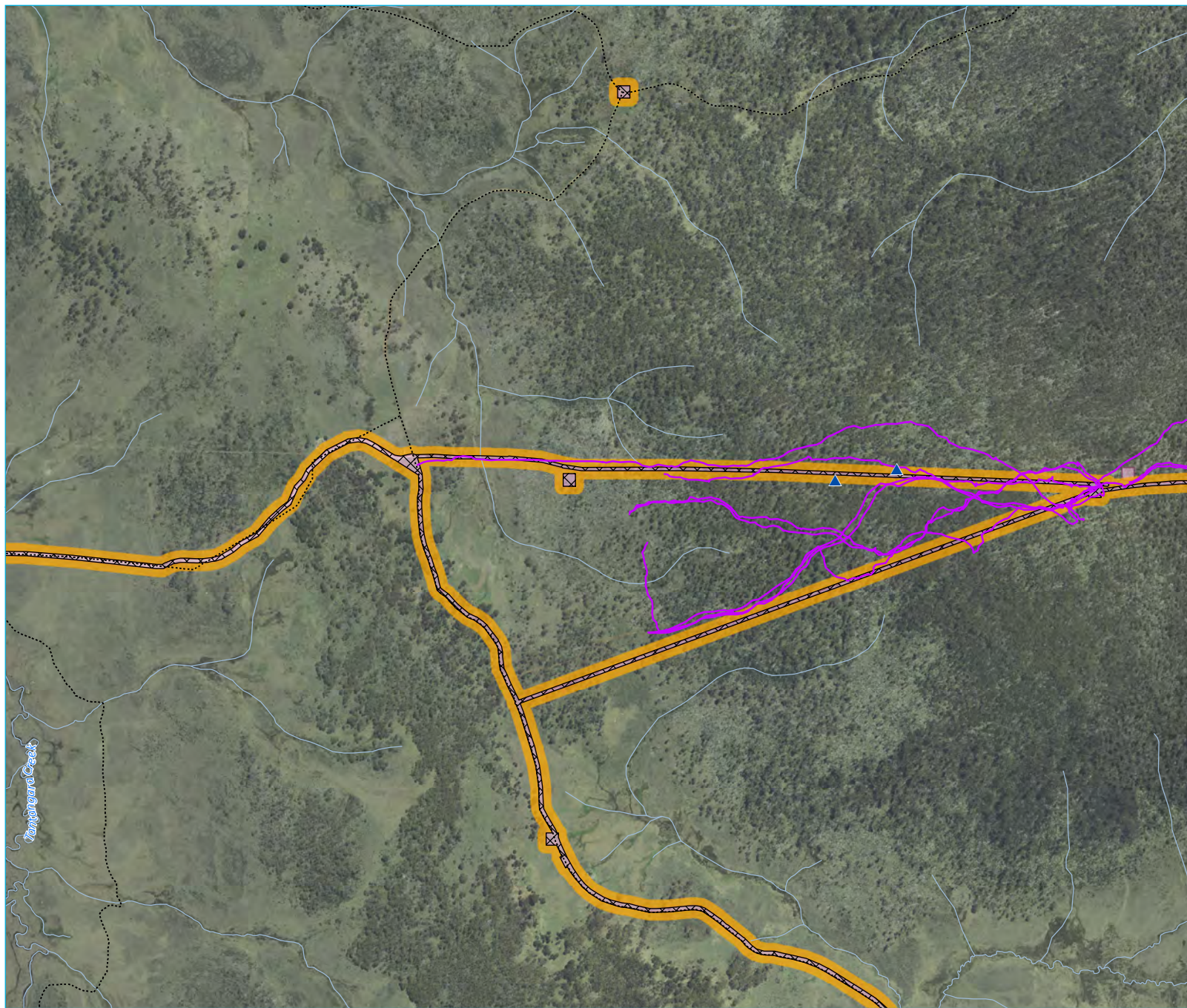
- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - ▲ Remote camera - small mammal

Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.9



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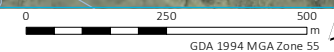


- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Bird survey
 - ▲ Remote camera - small mammal

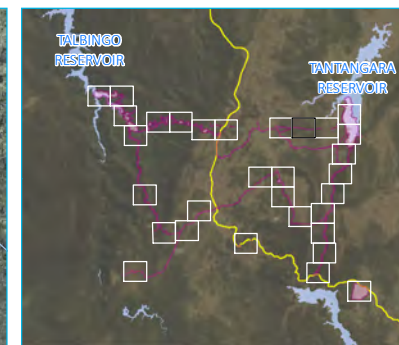
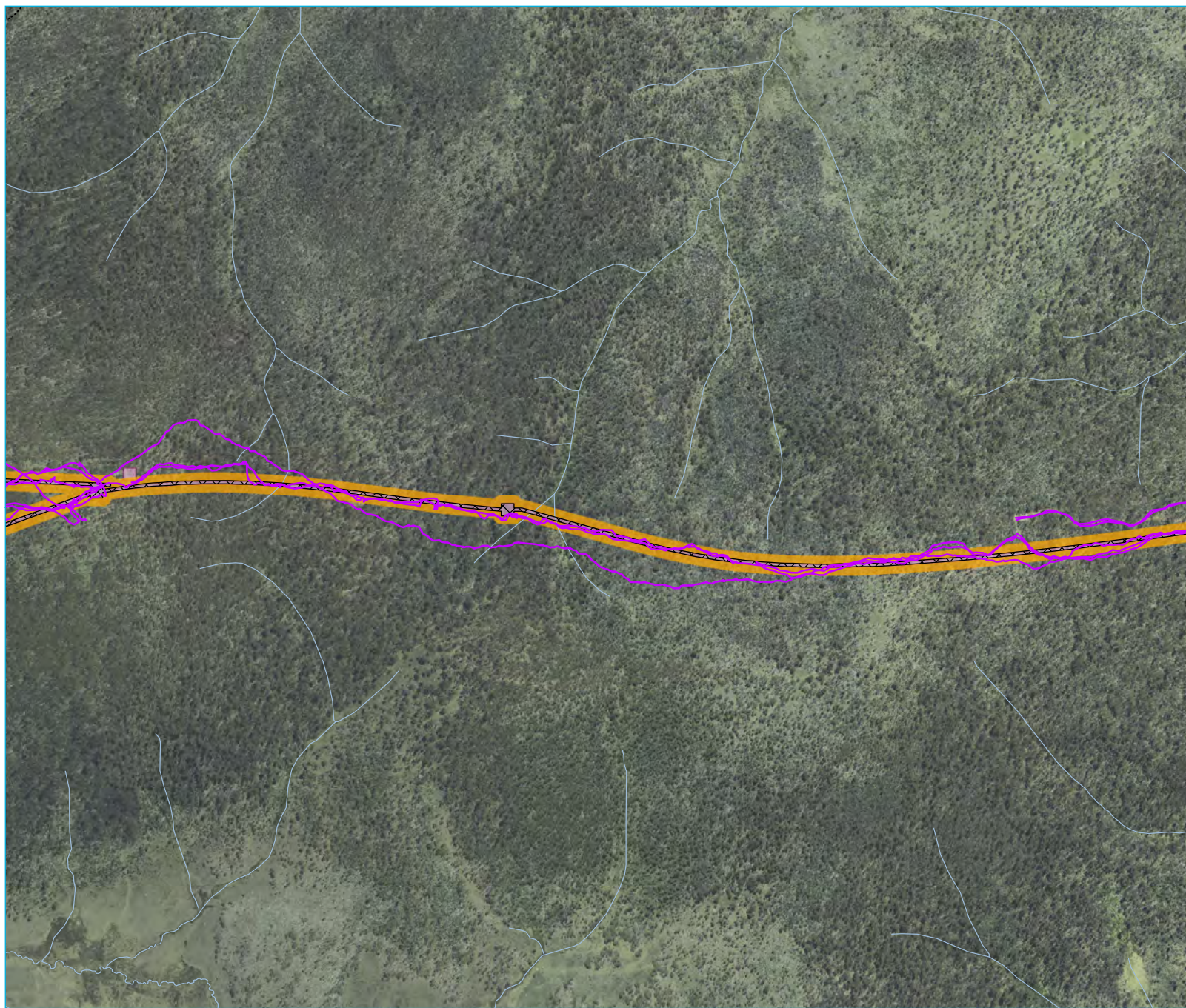
Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.10

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



\\lemmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020

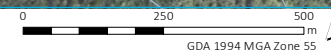


- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ⊠ Disturbance area
 - Yellow Indirect disturbance area
 - Pink Construction envelope
 - Purple Bird survey

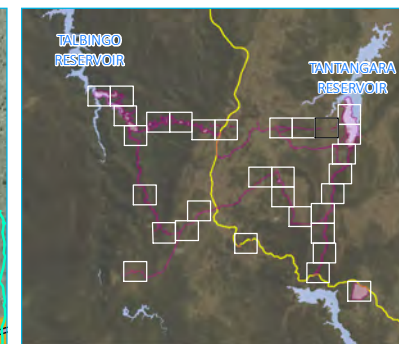
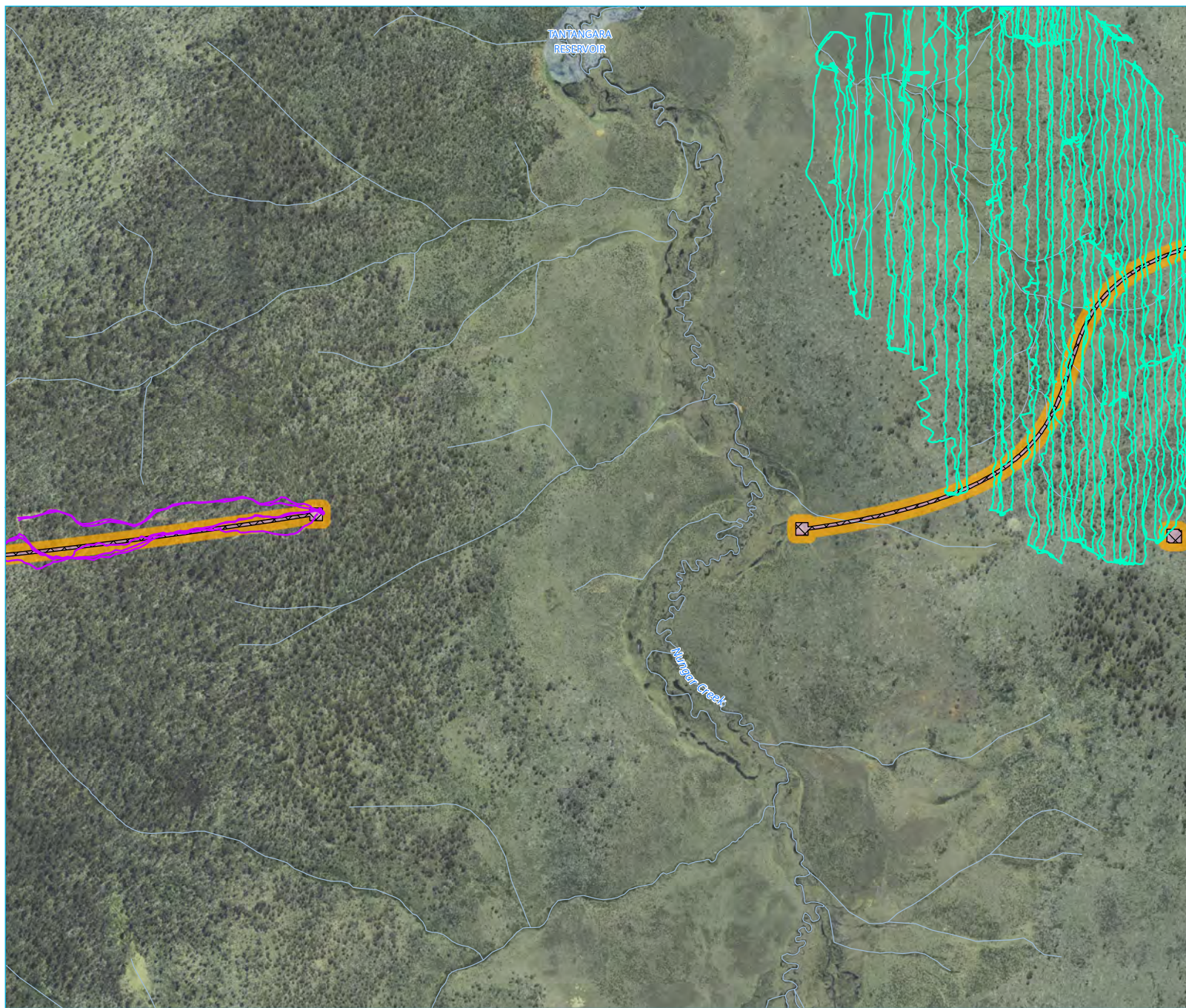
Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.11

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



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020



- KEY
- Watercourse / drainage line
 - ▣ Disturbance area
 - ▨ Indirect disturbance area
 - ▭ Construction envelope
 - ▭ Bird survey
 - ▭ Flora survey transect

Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.12

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

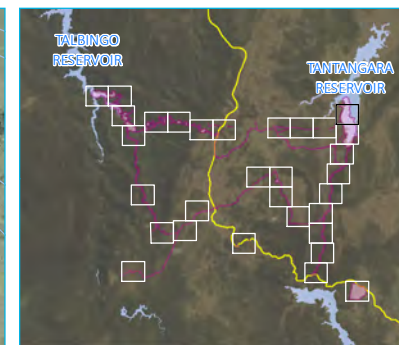
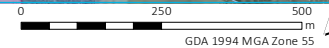
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GDA 1994 MGA Zone 55



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020



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



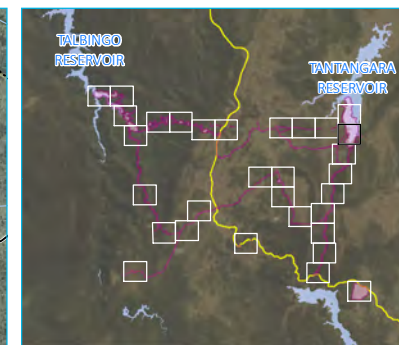
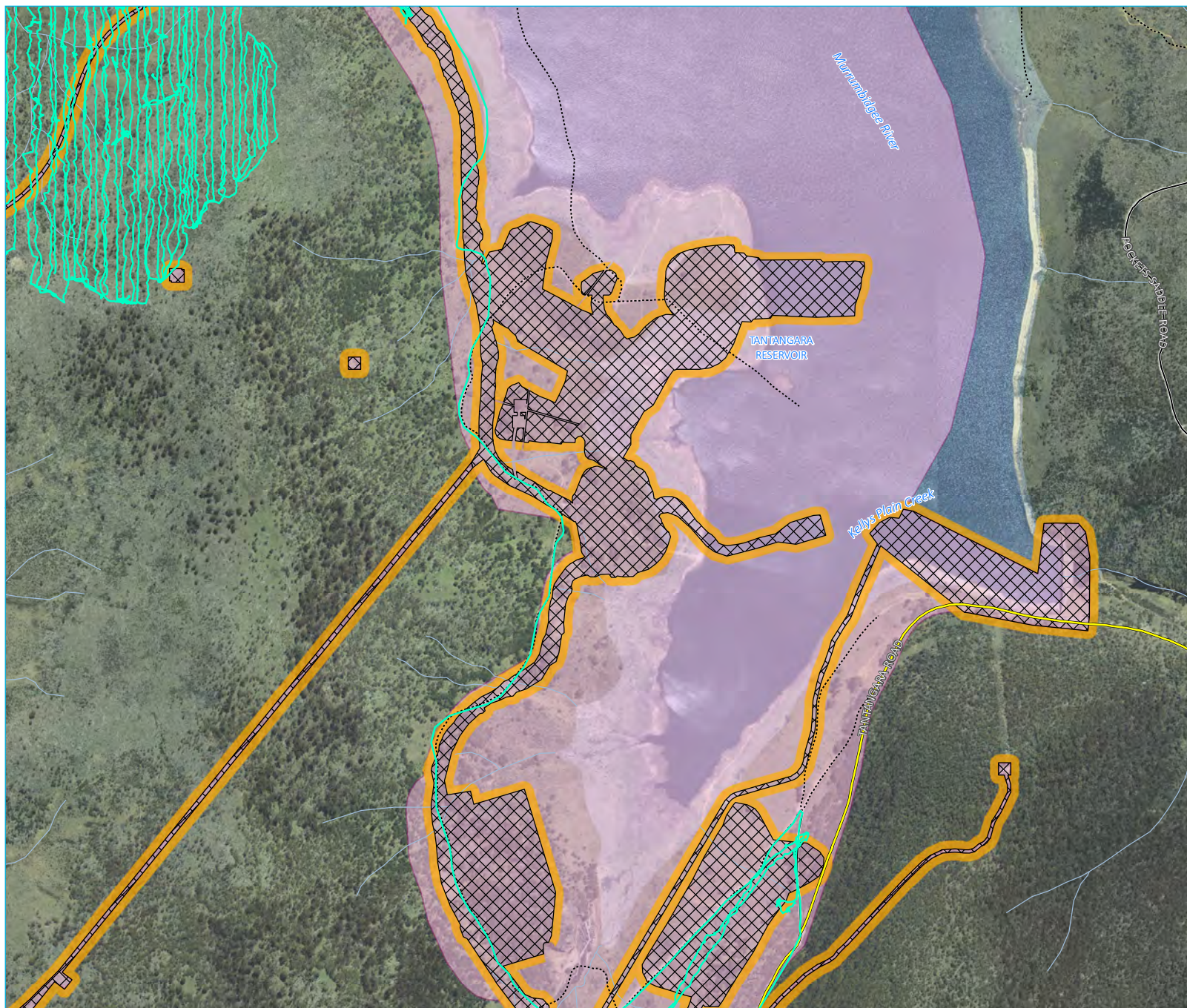
- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect

Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.13



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RHS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020

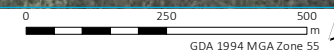


- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect

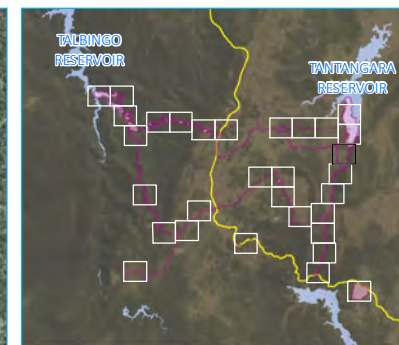
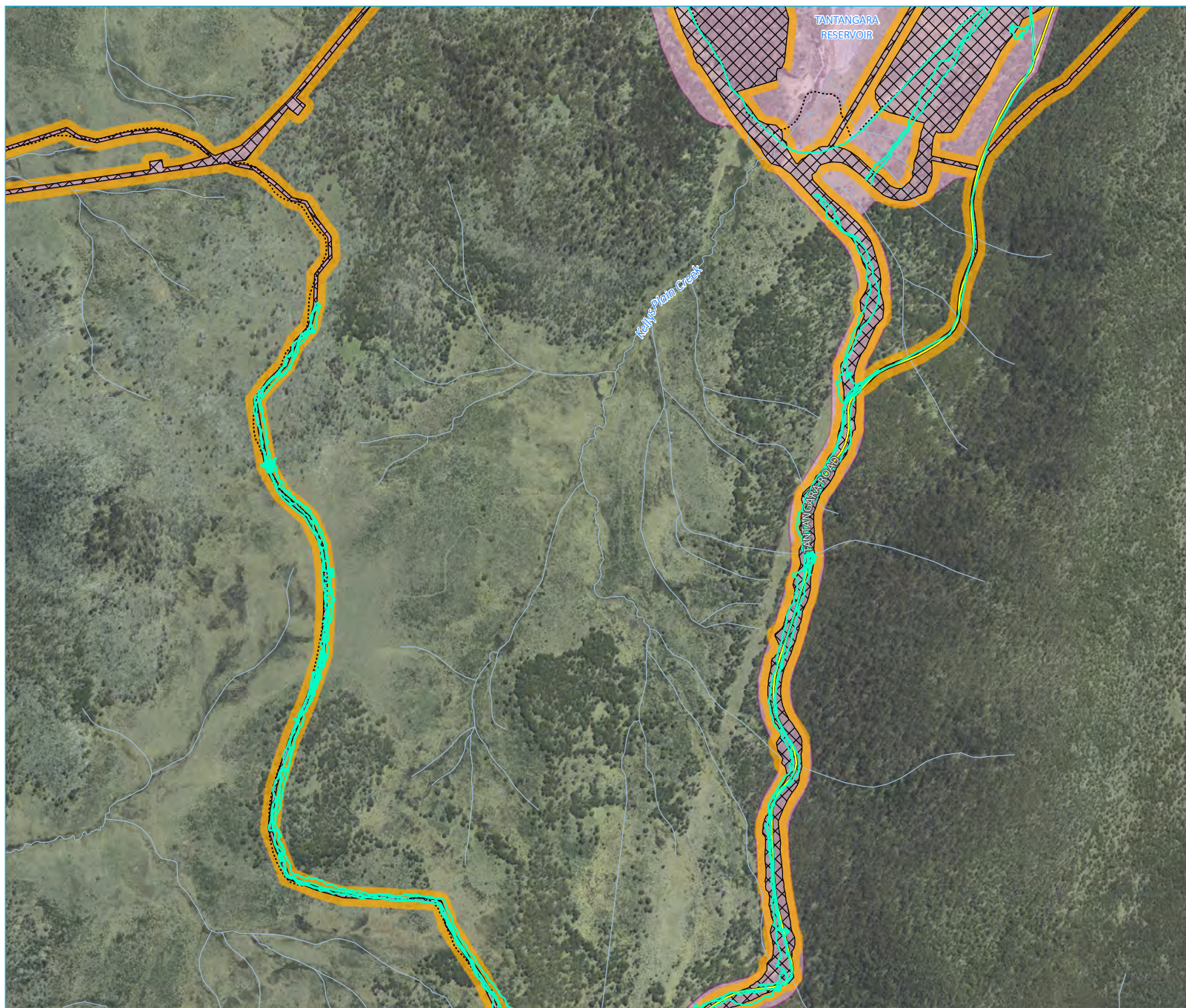
Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.14

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



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- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect

Additional surveys completed

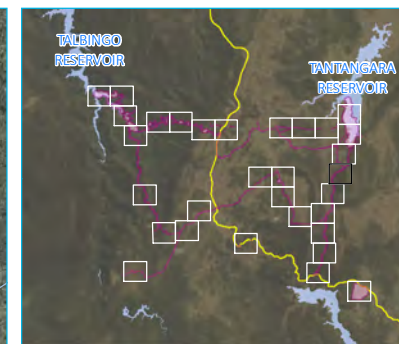
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.15



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

0 250 500
m
GDA 1994 MGA Zone 55

\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020



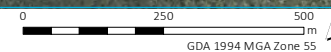
KEY

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

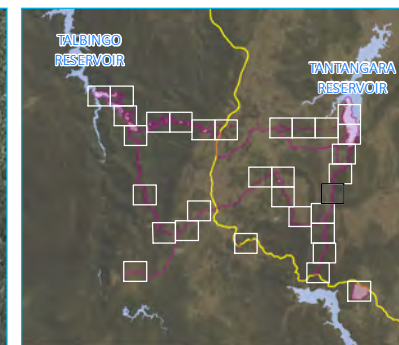
Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.16

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



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RHS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020

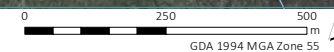


- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect

Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.17

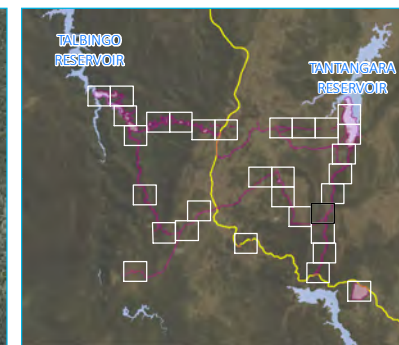
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\BDA\BDA006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020



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



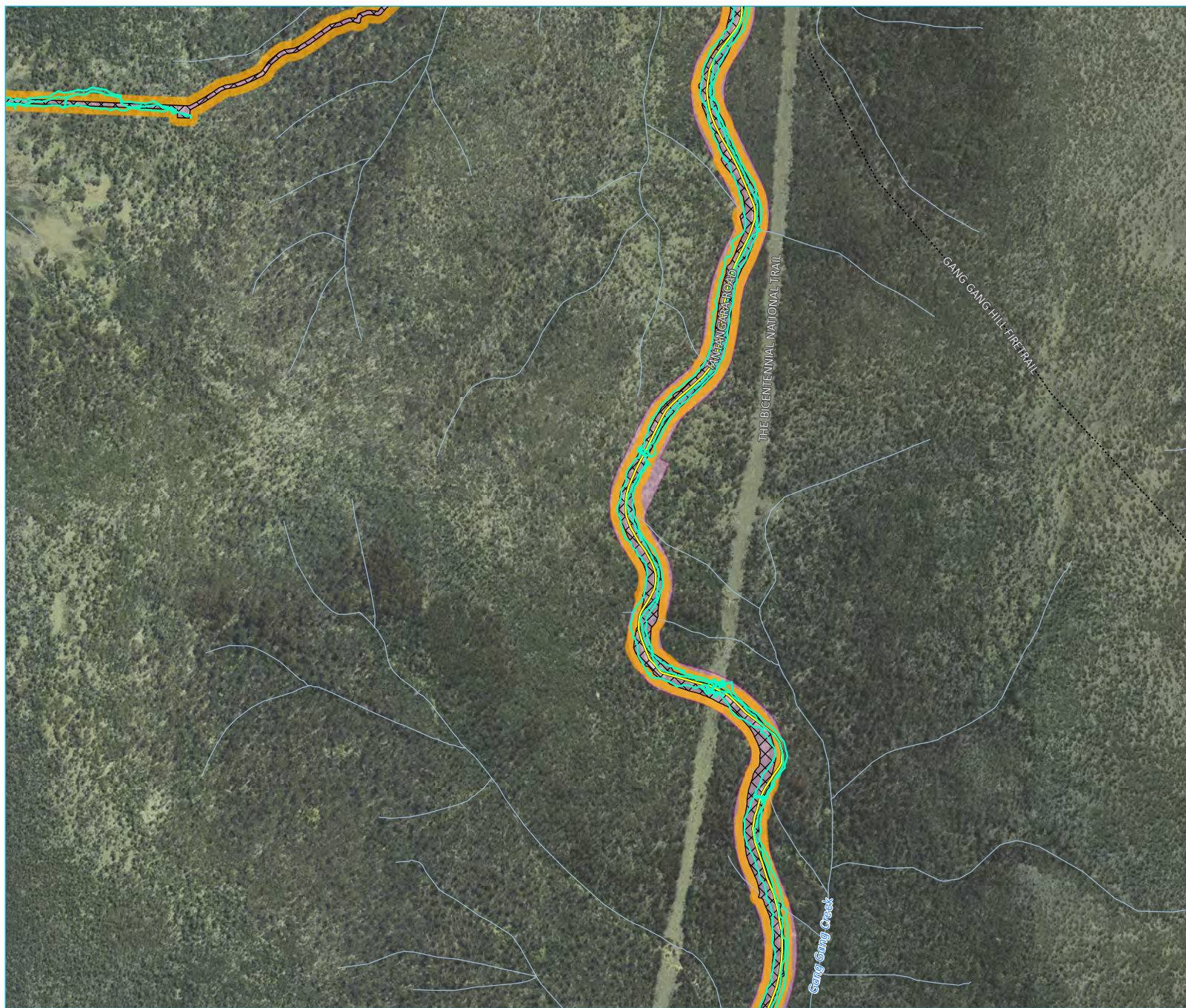
- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect

Additional surveys completed

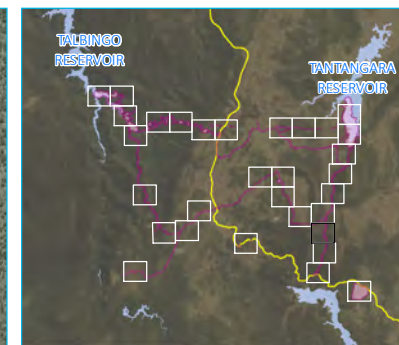
Snowy 2.0
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Figure 5.3.18



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RHS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020



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



KEY

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

Additional surveys completed

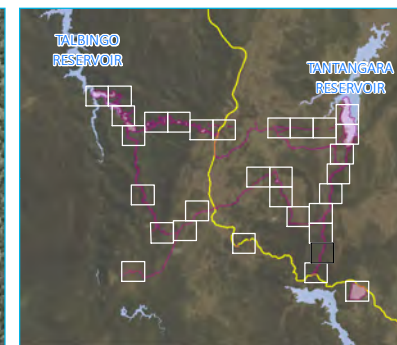
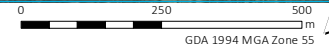
Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.3.19



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RIS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020



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



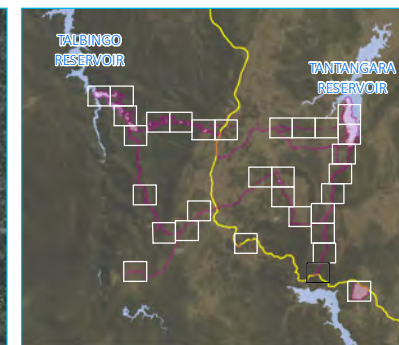
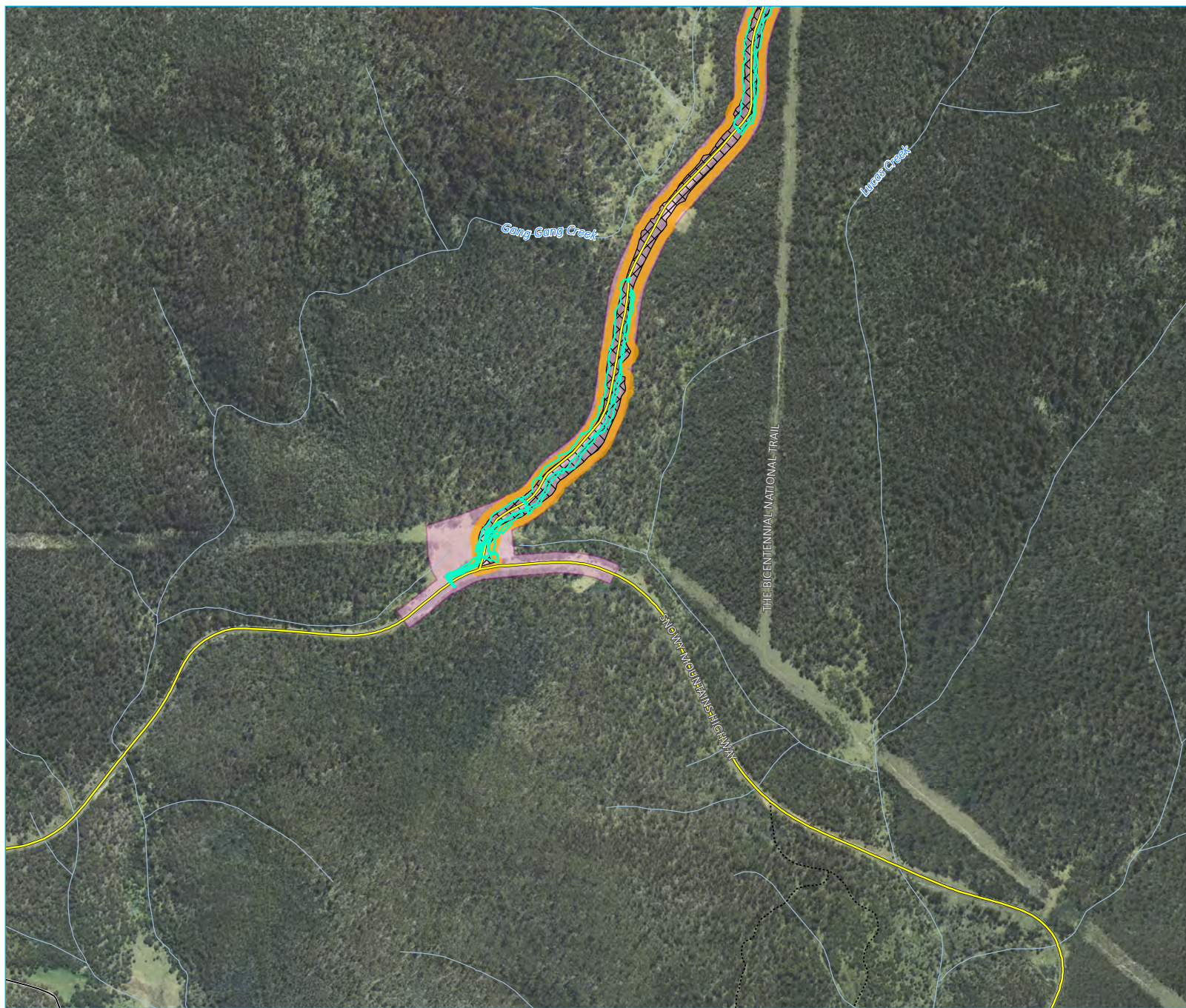
- KEY
- Watercourse / drainage line
 - Main road
 - Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect

Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.3.20



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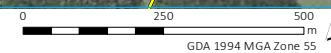
- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect

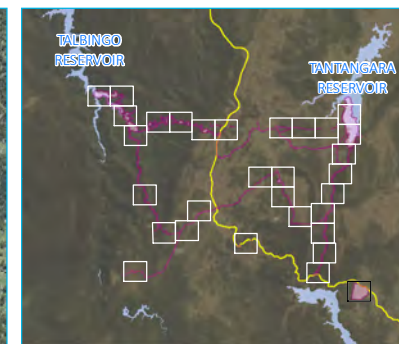
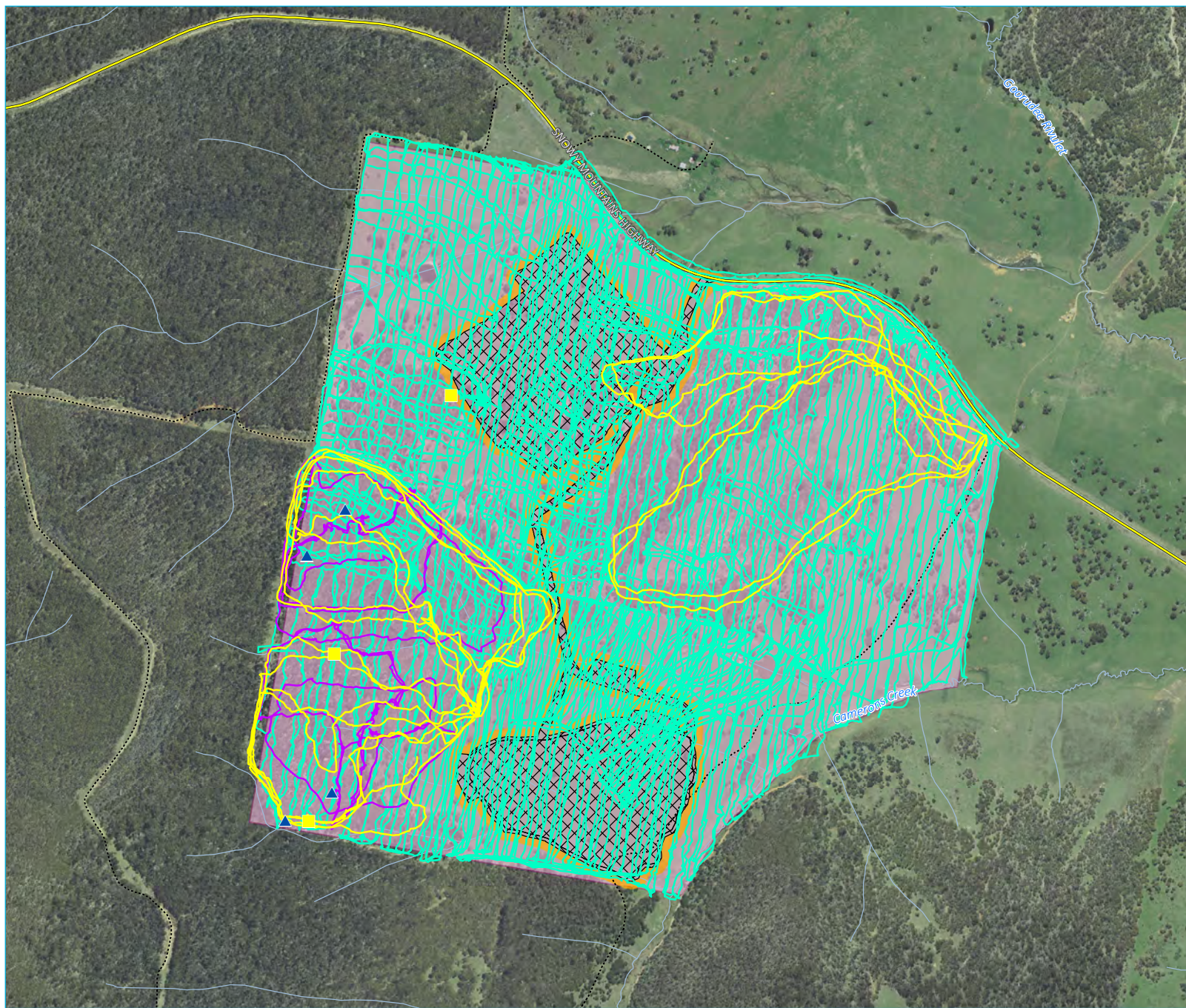
Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.21



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





- KEY**
- Watercourse / drainage line
 - Main road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Arobreal trapping
 - Construction envelope
 - Bird survey
 - Spotlighting
 - Flora survey transect
 - ▲ Remote camera - small mammal

Additional surveys completed

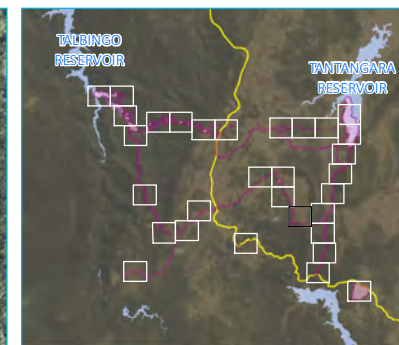
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.22

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

0 250 500
m
GDA 1994 MGA Zone 55



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- KEY
- Watercourse / drainage line
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Bird survey
 - Flora survey transect
 - ▲ Remote camera - small mammal
 - ▲ Remote camera - large mammal

Additional surveys completed

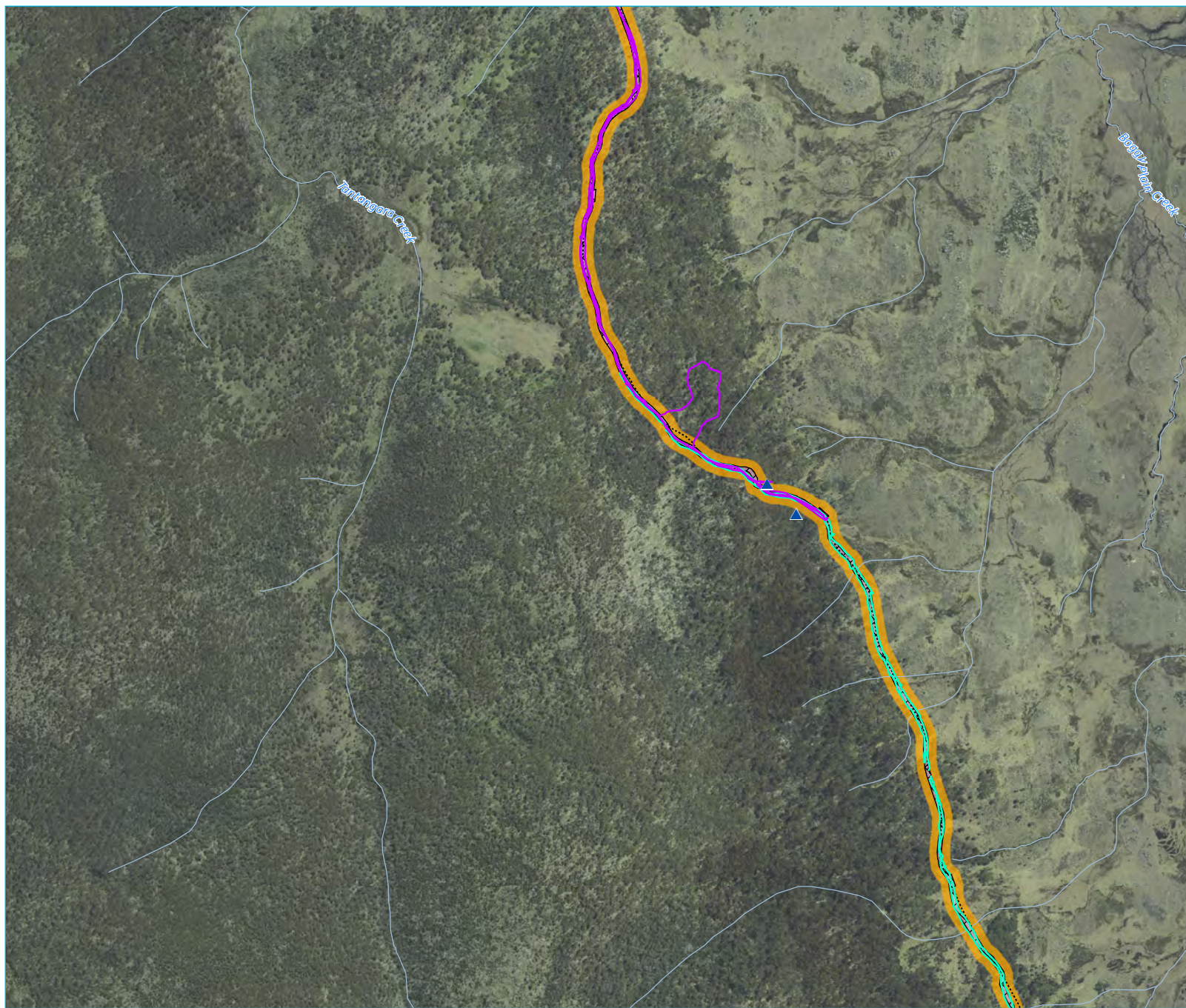
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.23



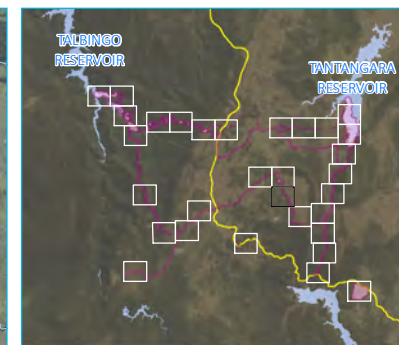
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500
m
GDA 1994 MGA Zone 55

\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MM\RIS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020



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



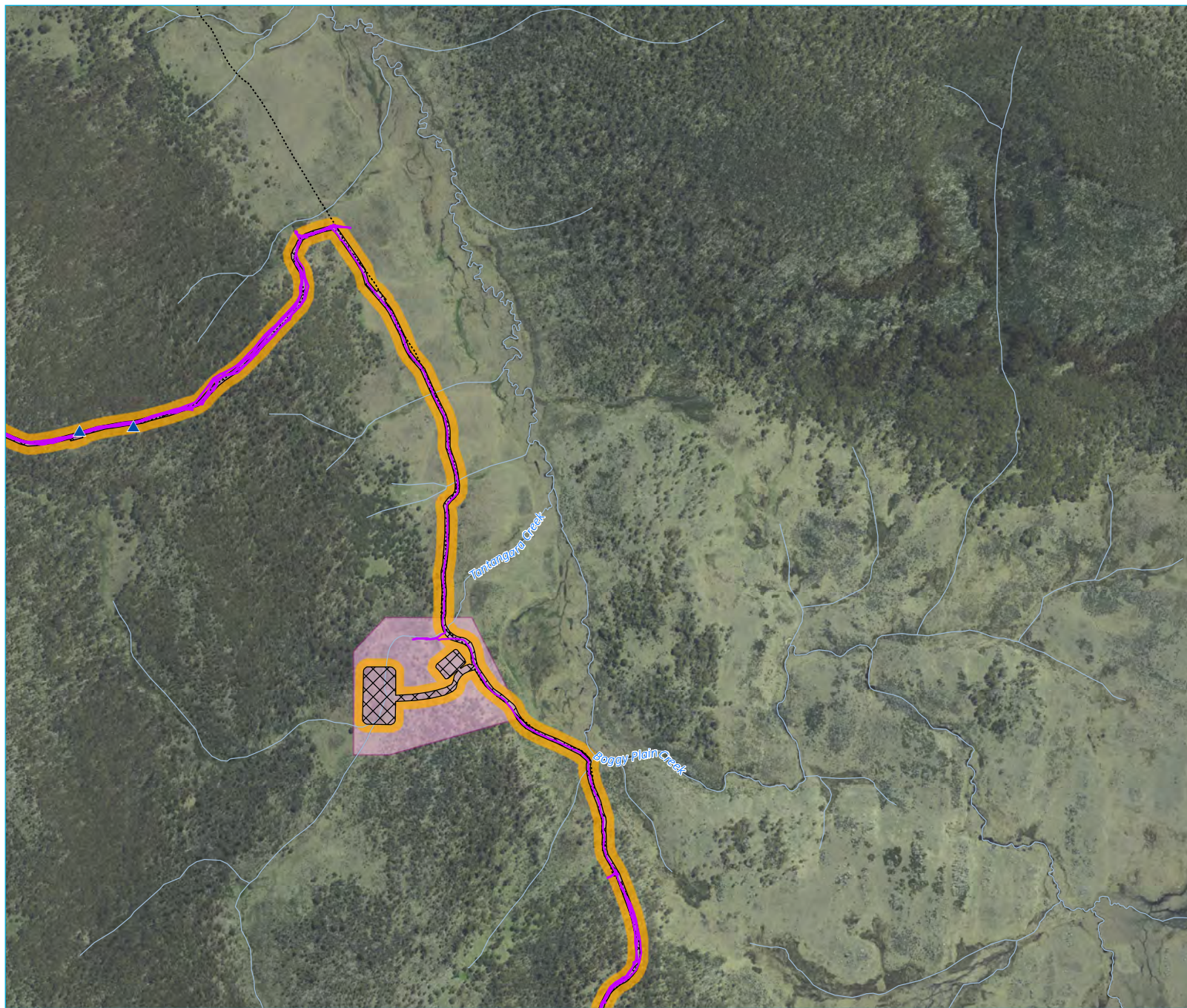
- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ⊠ Disturbance area
 - Yellow Indirect disturbance area
 - Pink Construction envelope
 - Purple Bird survey
 - Green Flora survey transect
 - ▲ Remote camera - small mammal

Additional surveys completed

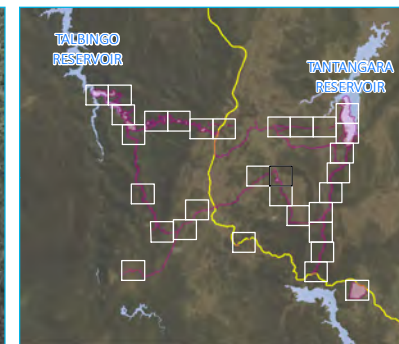
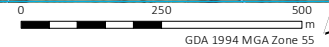
Snowy 2.0
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Figure 5.3.24



\\emmsvr1\EMM2\17188 - Snowy Hydro 2.0\GIS\02_Maps\EIS_MW\RS\BDAR\BDAR006_AdditionalSurveys_20200204_DDP_02.mxd 21/02/2020



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



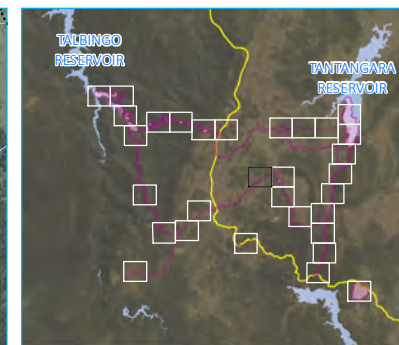
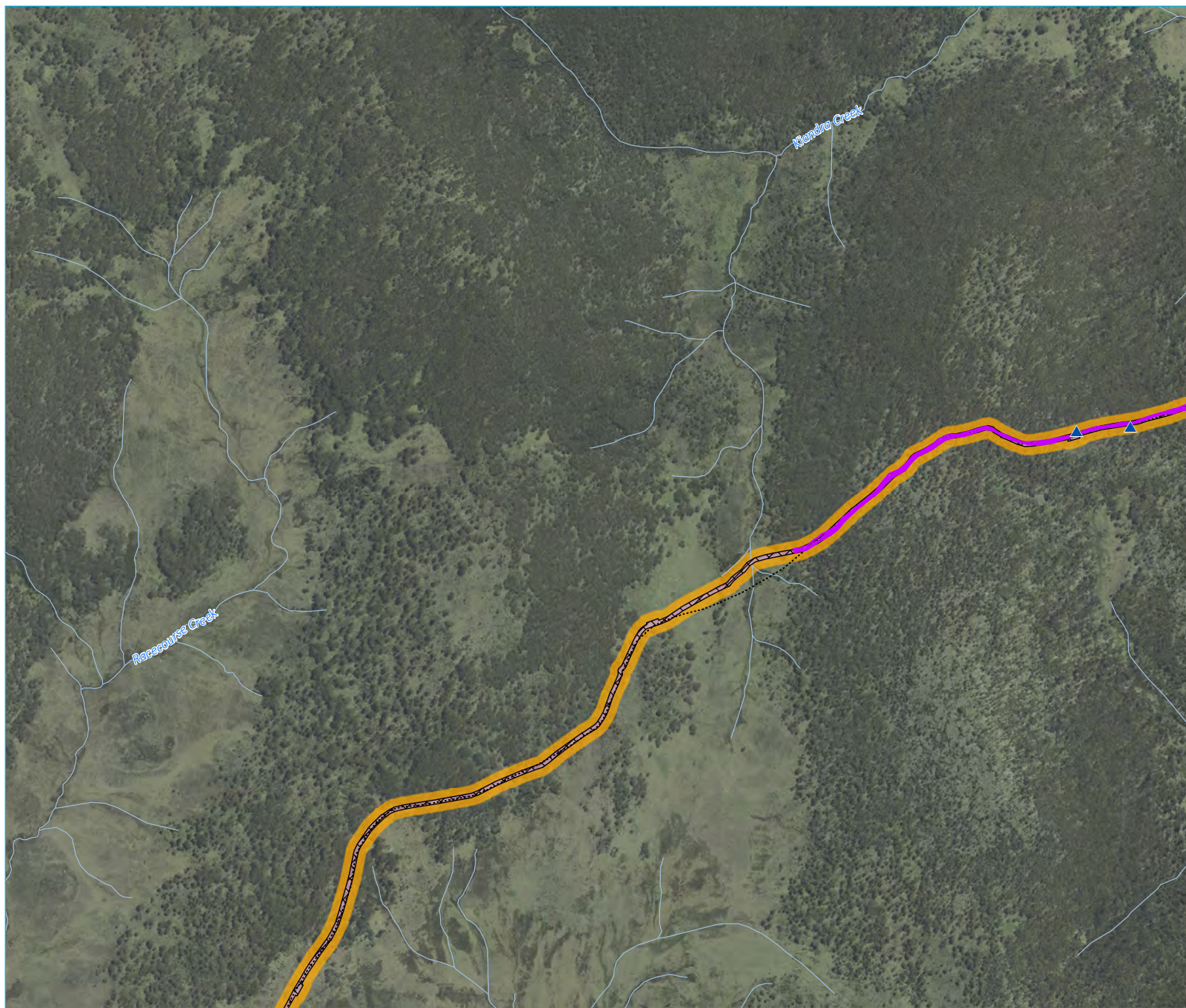
- KEY**
- Watercourse / drainage line
 - Vehicular track
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Bird survey
 - ▲ Remote camera - small mammal

Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.3.25



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- KEY
- Watercourse / drainage line
 - Vehicular track
 - ⊠ Disturbance area
 - Yellow Indirect disturbance area
 - Pink Construction envelope
 - Purple Bird survey
 - ▲ Remote camera - small mammal

Additional surveys completed

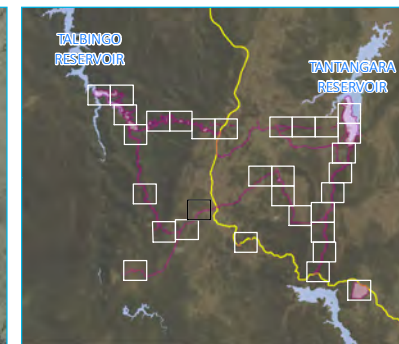
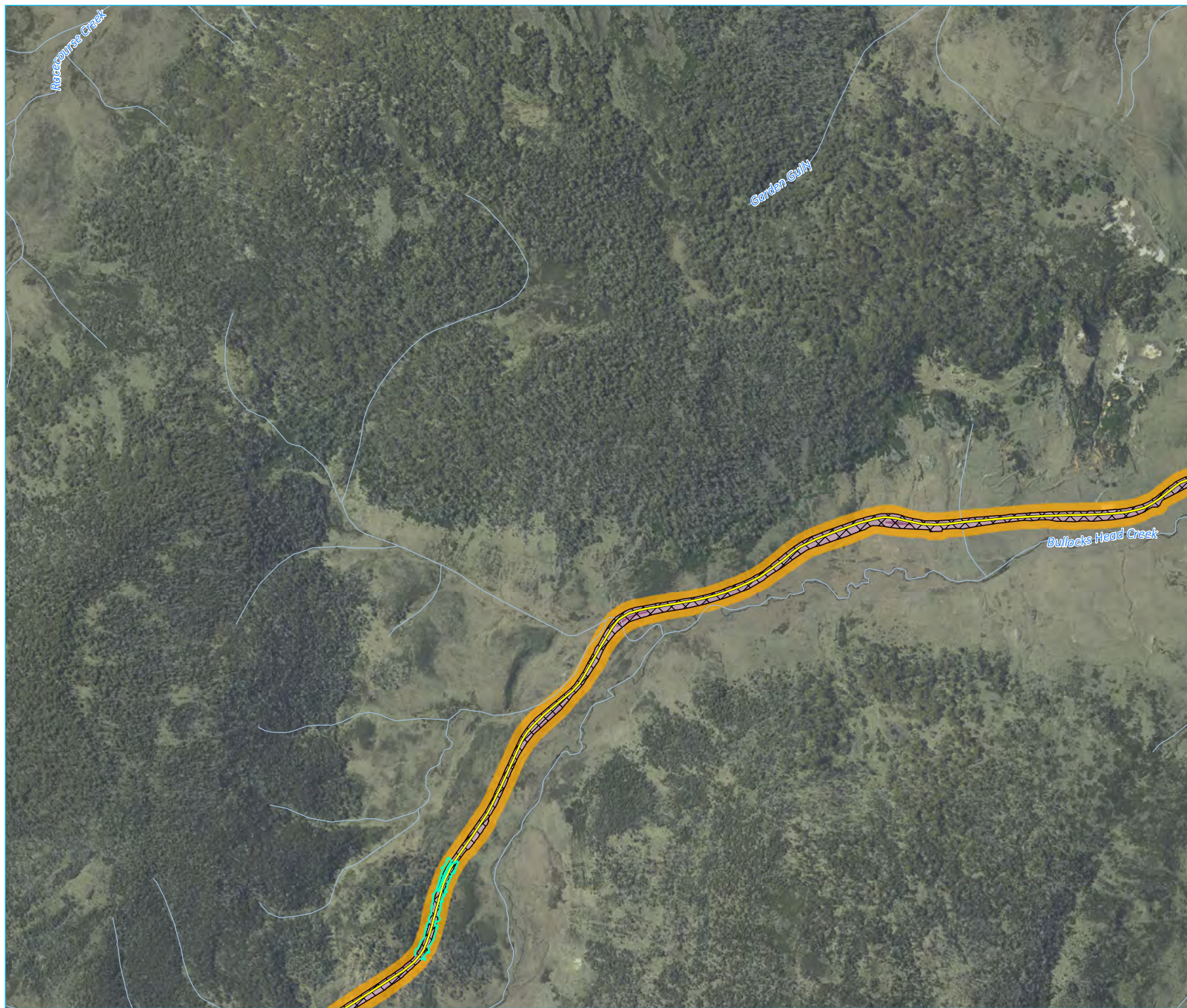
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.26

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

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m
GDA 1994 MGA Zone 55



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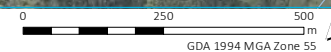


- KEY**
- Watercourse / drainage line
 - Main road
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect

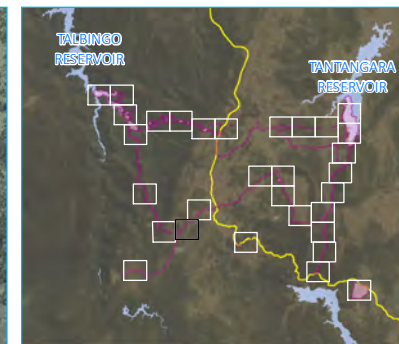
Additional surveys completed

Snowy 2.0
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Main Works
Figure 5.3.27

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



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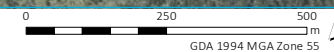


- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Aerobial trapping
 - Construction envelope
 - Bird survey
 - Flora survey transect
 - ▲ Remote camera - small mammal

Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.3.28

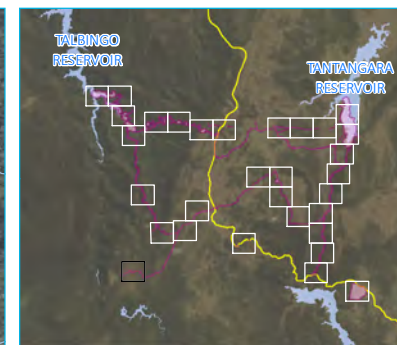
Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



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



KEY

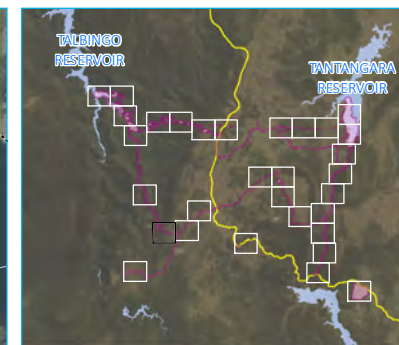
- Watercourse / drainage line
- Main road
- Local road
- Vehicular track
- Disturbance area
- Indirect disturbance area
- Construction envelope
- Flora survey transect

Additional surveys completed

Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.3.29



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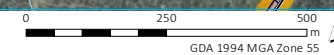
- KEY**
- Watercourse / drainage line
 - Main road
 - Local road
 - Vehicular track
 - ⊠ Disturbance area
 - Indirect disturbance area
 - Arobreal trapping
 - Construction envelope
 - Bird survey
 - Spotlighting
 - Flora survey transect
 - ▲ Remote camera - small mammal
 - ▲ Remote camera - large mammal

Additional surveys completed

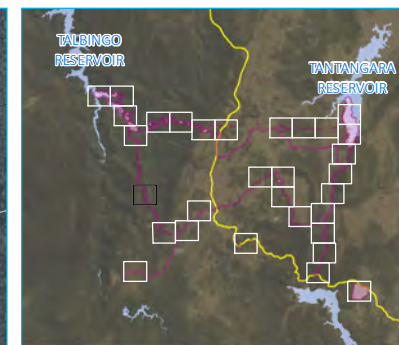
Snowy 2.0
Biodiversity Development Assessment Report
Main Works
Figure 5.3.30



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



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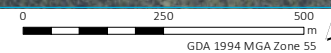
- KEY**
- Watercourse / drainage line
 - Local road
 - ▨ Disturbance area
 - Indirect disturbance area
 - Construction envelope
 - Flora survey transect

Additional surveys completed

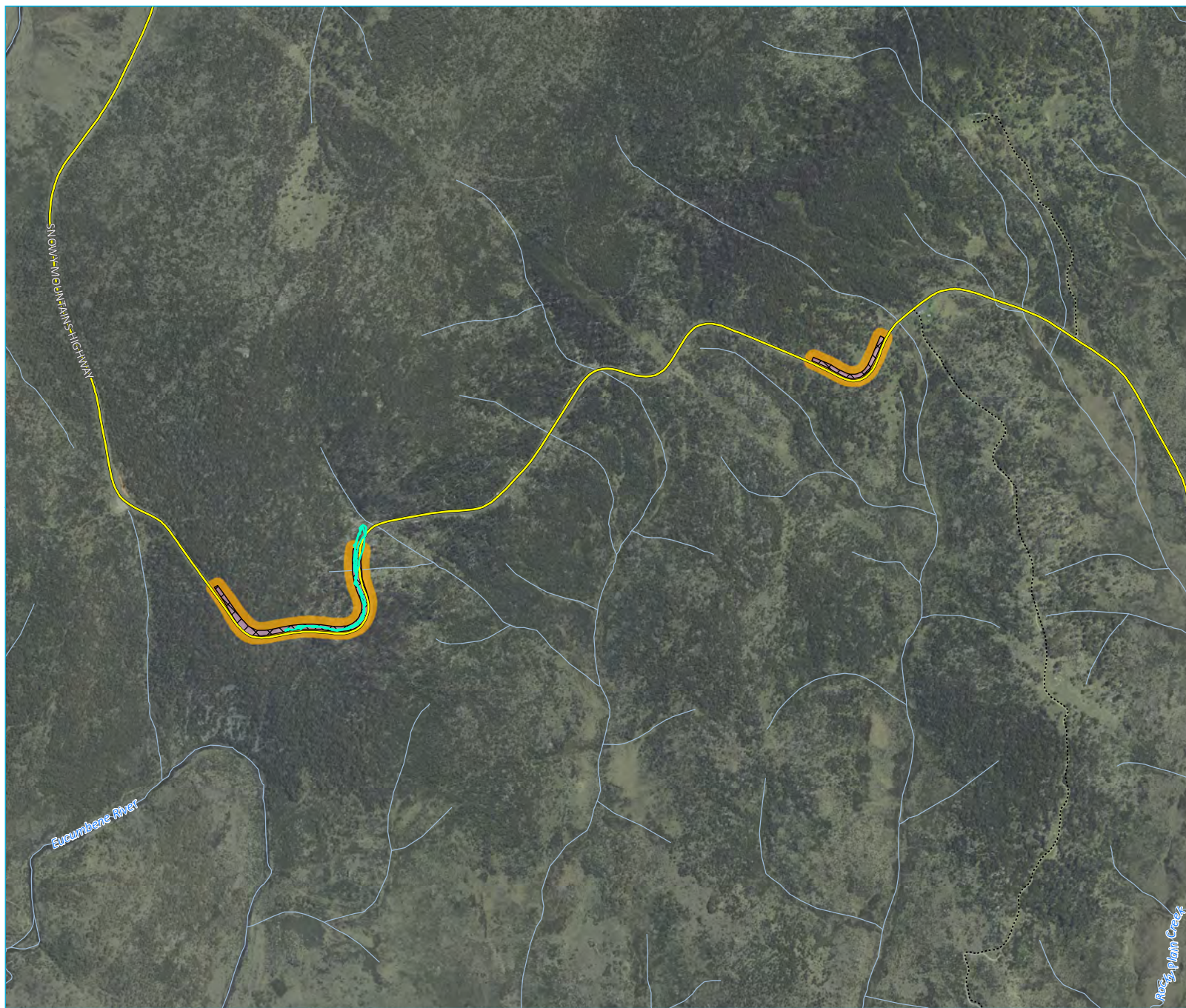
Snowy 2.0
Biodiversity Development Assessment Report
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Figure 5.3.31



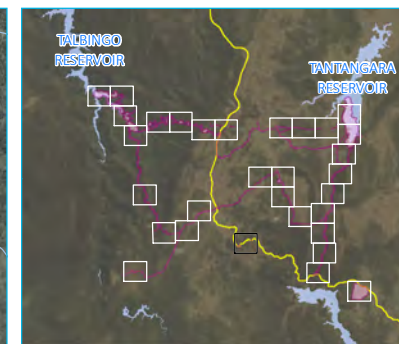
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Source: EMM (2020); Snowy Hydro (2019); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)



KEY

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

Additional surveys completed

Snowy 2.0
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Main Works
Figure 5.3.32

