Snowy 2.0 Main Works

Biodiversity Monitoring Program: Year 3 Annual Monitoring Report (2022/2023)

Prepared for Snowy Hydro Limited

March 2024

Snowy 2.0 Main Works

Biodiversity Monitoring Program: Year 3 Annual Monitoring Report (2022/2023)

Snowy Hydro Limited

E221227 RP1

March 2024

Version	Date	Prepared by	Reviewed by	Comments
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Approved by

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4 March 2024

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Executive Summary

Snowy Hydro Limited (Snowy Hydro) is the proponent of the Snowy 2.0 Project (Snowy 2.0), a large-scale pumped hydro-electric storage and generation project that will increase hydro-electric capacity within the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme). An Environmental Impact Statement (EIS) for the Main Works for Snowy 2.0 (Main Work EIS) was submitted to the Department of Planning, Industry and Environment (DPIE) in September 2019 (EMM 2019), with a Preferred Infrastructure Report and Response to Submissions submitted to DPIE in February 2020 (EMM 2020a). Approval was granted in May 2020.

The Main Works Biodiversity Monitoring Program (BMP) (EMM 2020b) forms Appendix B of the Main Works Biodiversity Management Plan (Snowy Hydro and FGJV 2020) and sets out a monitoring framework to ensure that impacts arising from the Main Works project are consistent with those outlined in the EIS. The BMP is required to be implemented as part of the Main Works project.

The objectives of this monitoring report are to:

- provide the biodiversity monitoring results for all monitoring programs for Year 3 that occurred between November 2022 and November 2023, comprising quarterly monitoring periods
- compare results across monitoring periods against threshold triggers for adaptive management prescribed in the BMP, identify any relevant additional trends related to Main Works impacts, and identify where adaptive management is required
- detail any changes or gaps to, or limitations of, the biodiversity monitoring methodology outlined in the BMP. This includes monitoring components, method of data collection (frequency and location), method of data analysis and reporting requirements
- provide recommendations for improvements and amendments to the BMP.

ES1.1 Monitoring effort

Fourteen field survey events were undertaken throughout 2022/2023 and were conducted over 200 days, including 2017 people hours. During the third year of monitoring a total of 183 impact and control sites were monitored across the Main Works project area and control areas and included the following:

- threatened flora monitoring
- small mammal presence/absence monitoring
- small mammal habitat characteristic monitoring
- Alpine Tree Frog occupancy monitoring
- Booroolong Frog occupancy monitoring
- Booroolong Frog habitat characteristics monitoring
- Alpine She-oak Skink occupancy monitoring
- feral animal occupancy monitoring
- feral animal abundance monitoring
- weed presence / absence monitoring

- Phytophthora presence/absence monitoring.

ES1.2 Adaptive management triggered in 2022/2023 monitoring period

Adaptive management actions have been triggered for the following monitoring components:

- small terrestrial mammal presence/absence monitoring: two impact sites (SM07 and SM18) remain triggered for adaptive management as the Eastern Pygmy Possum was not observed in Year 3. Additional sites where absence of the species was recorded in Year 3 were not triggered for adaptive management as they did not record presence in Year 1 (baseline surveys).

- small terrestrial mammal habitat characteristic monitoring: three impact sites (SM18, SM35 and SM36) have been triggered for adaptive management due observed degradation in vegetation structure and habitat characteristics and due to the absence of the target species

- feral animal presence/absence and abundance monitoring: adaptive management has been triggered at feral animal occupancy and abundance monitoring locations. Pest control in accordance with the Weed, Pest and Pathogen Management Plan (FGJV 2020) has been triggered due to the sighting of feral animals in proximity to known Smoky Mouse habitat

- Phytophthora presence/absence monitoring: adaptive management has been triggered by a positive result from PS03 for *Phytophthora cinnamomi.*

Although adaptive management was not triggered for the remaining monitoring activities, additional recommendations have been identified as part of the project. These are discussed in their respective sections of this report and summarised in Section 5.

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1 Introduction

1.1 Project overview

Snowy Hydro Limited (Snowy Hydro) is the proponent of the Snowy 2.0 Project (Snowy 2.0), a large-scale pumped hydro-electric storage and generation project that will increase hydro-electric capacity within the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme). This will be achieved by linking the existing Tantangara and Talbingo reservoirs within the Snowy Scheme through a series of underground tunnels and new underground hydro-electric power station.

The nearest large towns are Cooma and Tumut, approximately 70 kilometres (km) south-east and 50 km north-northwest of the Main Works project, respectively (Figure 1.1). Several small communities and townships are located nearby, including Talbingo, Tumbarumba, Batlow, Cabramurra and Adaminaby. Talbingo and Cabramurra were built for the original Snowy Scheme workers and their families, and Adaminaby was relocated to alongside the Snowy Mountains Highway from its original location (now known as Old Adaminaby) in 1957 due to the construction of Lake Eucumbene.

Snowy Hydro and its project partner Future Generation Joint Venture (FGJV) are currently undertaking construction work for Snowy 2.0 ('Main Works') (Figure 1.2). The Main Works project includes pre-construction activities such as pre-clearing works, pre-construction/site establishment, geotechnical investigation and survey, and implementing environmental mitigation measures. Construction activities include access road and bridge work, excavation and tunnelling, excavated rock management, intake and gate-shaft construction, progressive rehabilitation, fit out, testing and commissioning, and final rehabilitation.

1.2 Project approval

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

The Environmental Impact Statement (EIS) for the Main Works project (Main Works EIS) was submitted to Department of Planning, Industry and Environment (DPIE or the Department) in September 2019 and was publicly exhibited between 26 September 2019 and 6 November 2019 (EMM 2019). A total of 222 submissions were received during the public exhibition period. In February 2020, the Preferred Infrastructure Report and Response to Submissions Report (PIR) was issued to DPIE to outline the preferred project design and address the public and agency submissions (EMM 2020a). The Main Works PIR included Revised Environmental Management Measures (REMMs) within Appendix C, which were also to be implemented for the project.

Following consideration of the Main Works EIS and PIR, approval was granted by the Minister for Planning and Public Spaces on 20 May 2020, through issue of Infrastructure Approval SSI 9687. In addition to the State approval, a referral (EPBC 2018/8322) was prepared and lodged with the Commonwealth Department of Agriculture, Water and Environment (DAWE) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Commonwealth Minister's delegate determined on 5 December 2018 that Snowy 2.0 Main Works is a "controlled action" under the EPBC Act, and the Project was assessed by accredited assessment under Part 5, Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Approval was granted under the EPBC Act on 29 June 2020 (EPBC 2018/8322).

1.3 Main Works Overview

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

- an underground pumped hydro-electric power station complex
- water intake structures at Tantangara and Talbingo reservoirs
- power waterway tunnels, chambers, and shafts
- access tunnels
- new and upgraded roads to allow ongoing access and maintenance
- power, water, and communication infrastructure, including:
    - a cable yard to facilitate connection between the NEM electricity transmission network and Snowy 2.0
    - permanent auxiliary power connection
    - permanent communication cables
    - permanent water supply to the underground power station
- post-construction revegetation and rehabilitation.

1.4 Aim, purpose and objectives

The Main Works EIS (EMM 2019) and PIR (EMM 2020a), prepared to assess impacts on the environment, included an assessment of biodiversity impacts. The EIS identified that the main biodiversity issues for the project were the impacts to several threatened flora and fauna species and their habitat, including the Kiandra Leek Orchid (*Prasophyllum retroflexum*), Clover Glycine (*Glycine latrobeana*), Smoky Mouse (*Pseudomys fumeus*), Eastern Pygmy Possum (*Cercartetus nanus*), Broad-toothed Rat (*Mastacomys fuscus*), Alpine She-oak Skink (*Cyclodomorphus praealtus*), Alpine Tree Frog (*Litoria verreauxii alpina*) and Booroolong Frog (*Litoria booroolongensis*), which were confirmed to be present within and adjacent to the Main Works project disturbance footprint. The EIS also identified potential indirect impacts to biodiversity, including the potential for introduction and/or exacerbation of weeds and pathogens, feral herbivores, and feral predators.

To address these issues, the Main Works Biodiversity Management Plan was developed (Snowy Hydro & FGJV 2020). The Biodiversity Monitoring Program (BMP) (EMM 2020b) forms Appendix B of the Biodiversity Management Plan (Snowy Hydro & FGJV 2020) and sets out a monitoring framework to ensure that impacts arising from the Main Works project are consistent with those outlined in the EIS. The BMP was required to be implemented during pre-construction and construction stages of the Main Works project.

The aim of the BMP is to ensure that impacts arising from the Main Works project do not exceed those predicted to occur within the EIS. The key objectives of the BMP are to:

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

EMM Consulting Pty Ltd (EMM) was commissioned by Snowy Hydro to undertake Main Works monitoring in line with the BMP. The 2020/2021 (i.e. Year 1) monitoring was undertaken between October 2020 October 2021 and the 2021/2022 (i.e. Year 2) monitoring was undertaken between November 2021 and October 2022. The '*Biodiversity Monitoring Program: Year 1 Annual Monitoring Report (2020/2021)*' (EMM 2022a) presents the results of all monitoring activities during Year 1. The '*Biodiversity Monitoring Program: Year 2 Annual Monitoring Report (2021/2022),*' (EMM 2023c) presents the results of all monitoring activities conducted during Year 2.

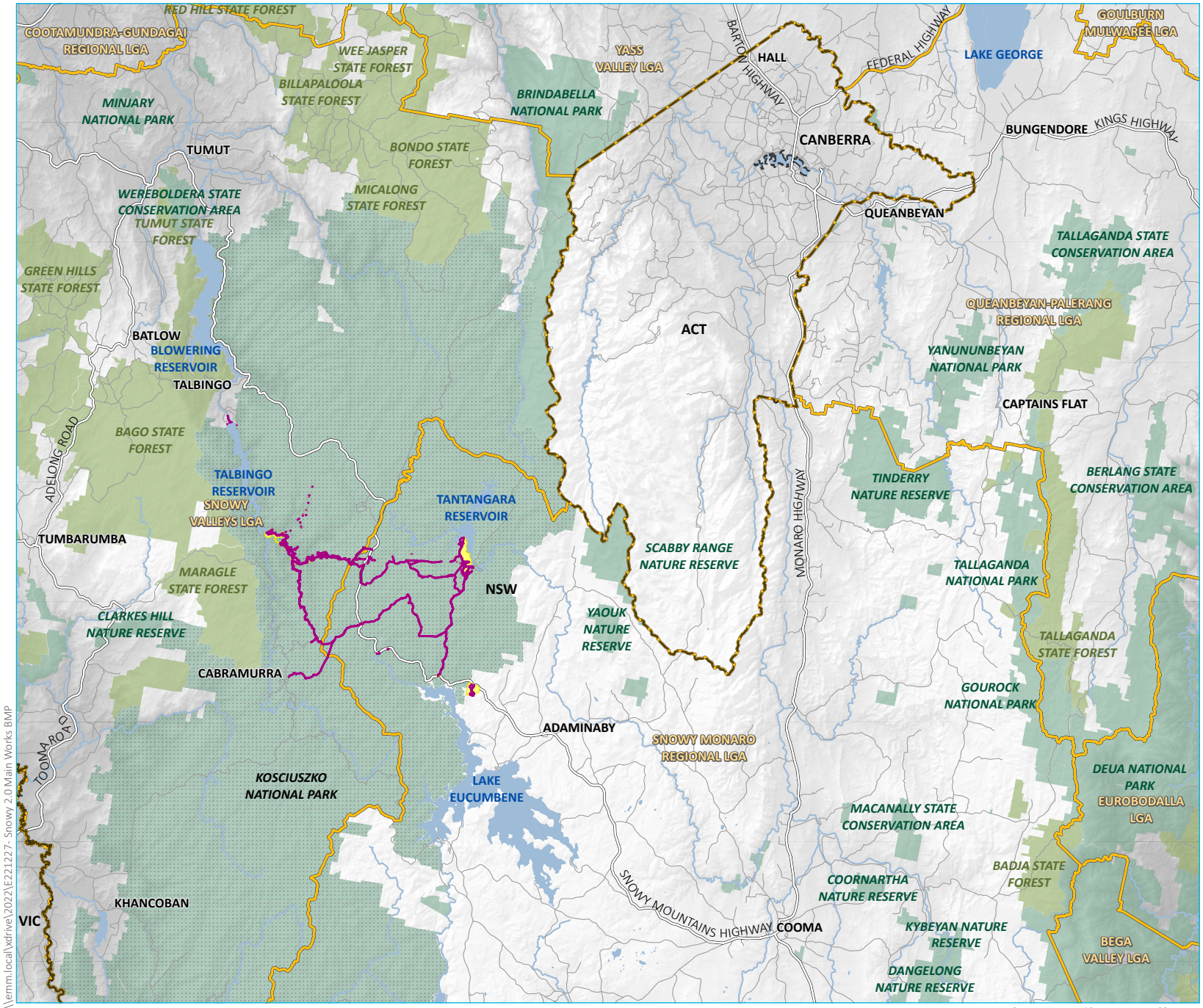
The purpose of this report is to present the results of all monitoring activities during Year 3 (2022/2023) and to compare data results to Year 1 and Year 2 to provide analysis on the efficacy of the implemented environmental management measures at mitigating the indirect biodiversity impacts of construction.

The objectives of the report are as follows:

- Detail any changes, gaps, or limitations to the biodiversity monitoring methodology outlined in the BMP. This includes monitoring components, method of data collection (frequency and location), method of data analysis, and reporting requirements.
- Provide the biodiversity monitoring results for all monitoring events between November 2022 and November 2023, comprising quarterly monitoring periods (EMM 2022b; EMM 2022c; EMM 2023a; EMM 2023b).
- Compare results across monitoring periods against threshold triggers for adaptive management presented in the BMP, identifying any relevant additional trends related to Main Works impacts, and identify where adaptive management is required.
- Provide recommendations for improvements and amendments to the BMP.

The remainder of this annual report presents the methods, results, and a discussion of the data analysis for all monitoring components completed in Year 3. Recommendations are provided at the end of the report.

A detailed summary of all monitoring results and recommendations are provided in Appendix A.



KEY

- Approved disturbance
- Approved construction envelope

Existing environment

- Major road
- Minor road
- Major watercourse
- Waterbody
- Kosciuszko National Park
- NPWS reserve
- State forest
- Local government area
- State boundary

Location of the Snowy 2.0 Main Works project in New South Wales

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 1.1

snowy 2.0

EMM creating opportunities

Source: EMM (2024); DFSI (2017); GA (2011); ASGC (2006)

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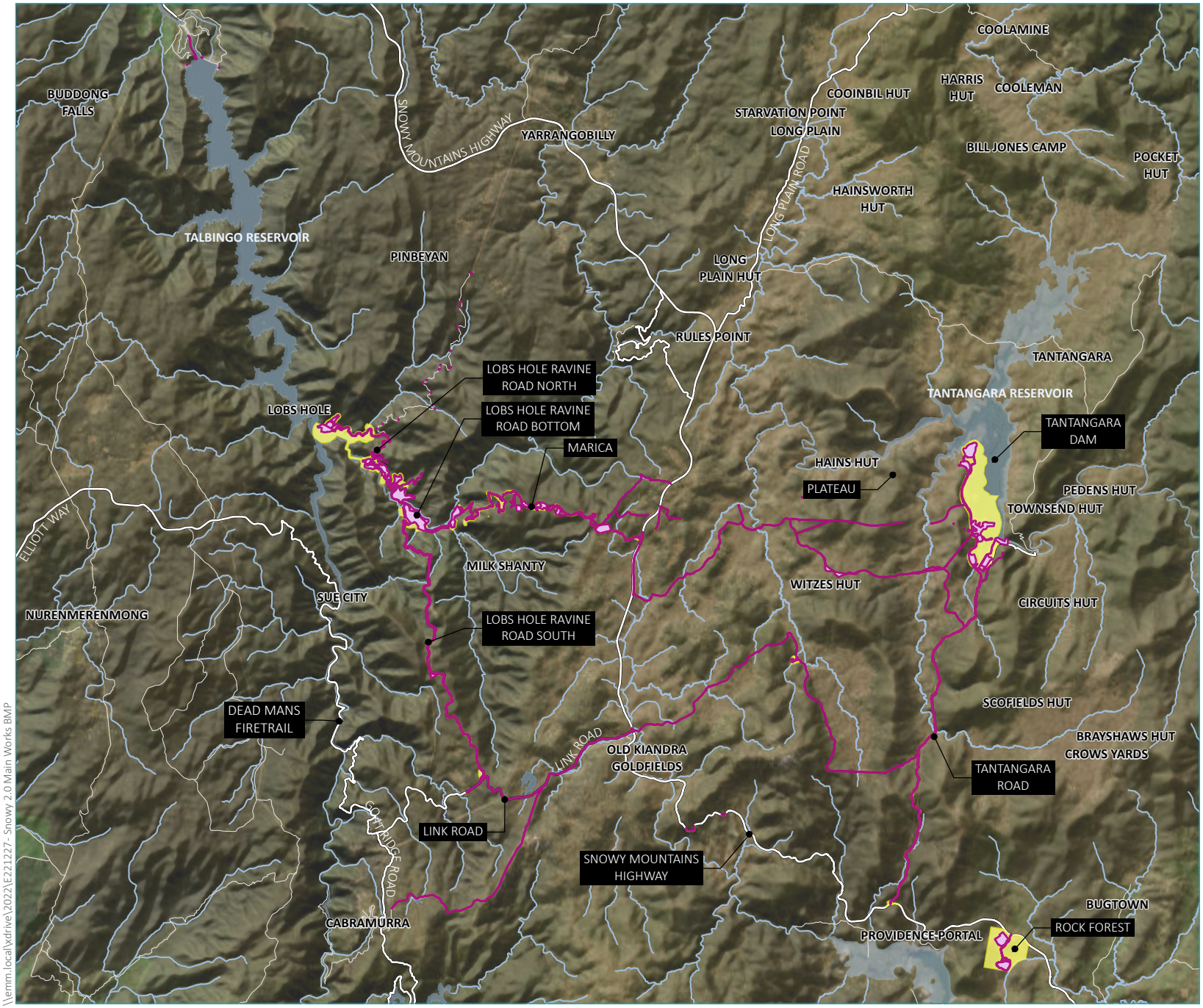

KEY

- Approved disturbance
- Approved construction envelope

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

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Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 5 10 km

GDA 1994 MGA Zone 55

N

Location of Snowy 2.0 Main Works infrastructure

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 1.2

snowy 2.0

EMM creating opportunities

2 Methods

The monitoring schedule and methods implemented during the 2022/2023 monitoring periods are largely consistent with those outlined in the BMP (EMM 2020b).

A summary of the Year 3 BMP monitoring periods referred to throughout this report are provided in Table 2.1.

Table 2.1 Summary of Main Works BMP monitoring periods in Year 3

Monitoring period during construction	BMP Monitoring dates	Notes
Q1	1 November 2022 to 28 February 2023	Monitoring surveys extended to 11 March 2023
Q2	1 March 2023 to 31 May 2023	Monitoring surveys extended to 8 June 2023
Q3	1 June 2023 to 31 August 2023	
Q4	1 September 2023 to 30 October 2023	Monitoring period extended to 30 November 2023

2.1 Survey design

The components monitored in 2022/2023 are:

- threatened flora monitoring
- small mammal presence/absence monitoring
- small mammal habitat characteristic monitoring
- Alpine Tree Frog occupancy monitoring
- Booroolong Frog occupancy monitoring
- Booroolong Frog habitat characteristics monitoring
- Alpine She-oak Skink occupancy monitoring
- feral animal occupancy monitoring
- feral animal abundance monitoring
- weed presence / absence monitoring
- Phytophthora presence/absence monitoring.

Key infrastructure areas where impact and control monitoring sites were established are shown in Figure 1.2 and include:

- Lobs Hole Ravine Road North (LHRR North)
- Lobs Hole Ravine Road South (LHRR South)
- Lobs Hole Ravine Road Bottom (LHRR Bottom)
- Tantangara Dam
- Tantangara Road
- Plateau
- Marica
- Rock Forest.

Additional control monitoring sites were also established at:

- Dead Mans
- Link Road
- Snowy Mountains Highway.

Fourteen field surveys events were undertaken throughout 2022/2023 and were conducted over 200 days, including 2017 people hours. During the third year of monitoring a total of 183 impact and control sites were monitored across the Main Works project area and control areas (Figure 2.1 to Figure 2.6, Appendix B).

An extensive amount of time has been implemented on data quality assurance (QA), collation and analysis to ensure the BMP is adequately assessing the potential impacts of the project.

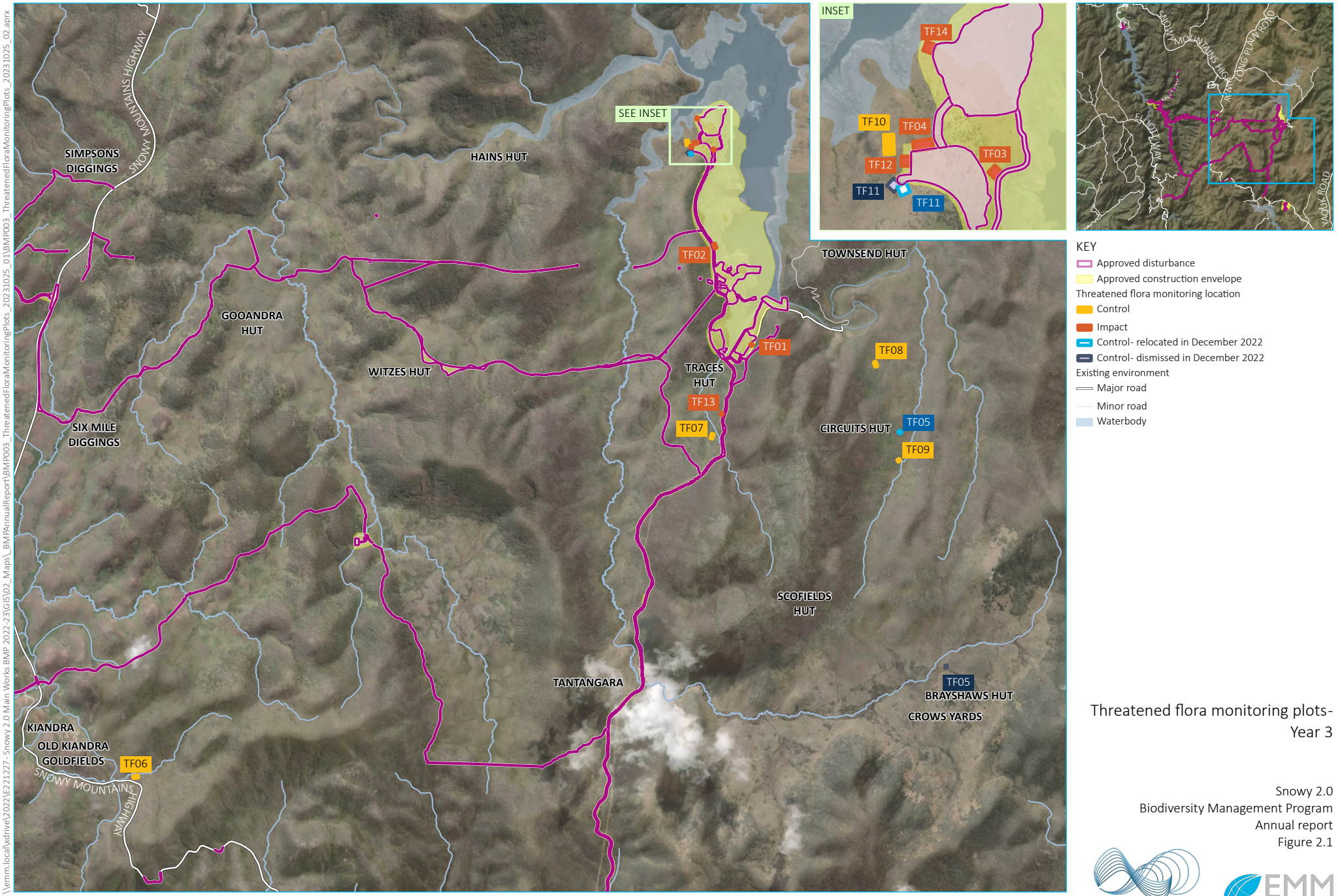
The total number of sites monitored, and timing and frequency of monitoring during the 2022/2023 monitoring period is generally consistent with the prescriptions in the BMP.

2.2 Limitations

Monitoring during Year 3 was influenced by several factors including:

- increasing construction activity limiting safe access to established monitoring sites
- unsafe river conditions impacting frog occupancy monitoring and
- adjustments in frog habitat characteristics monitoring.

Limitations encountered during monitoring are more thoroughly presented in Appendix C.



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Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

Threatened flora monitoring plots- Year 3

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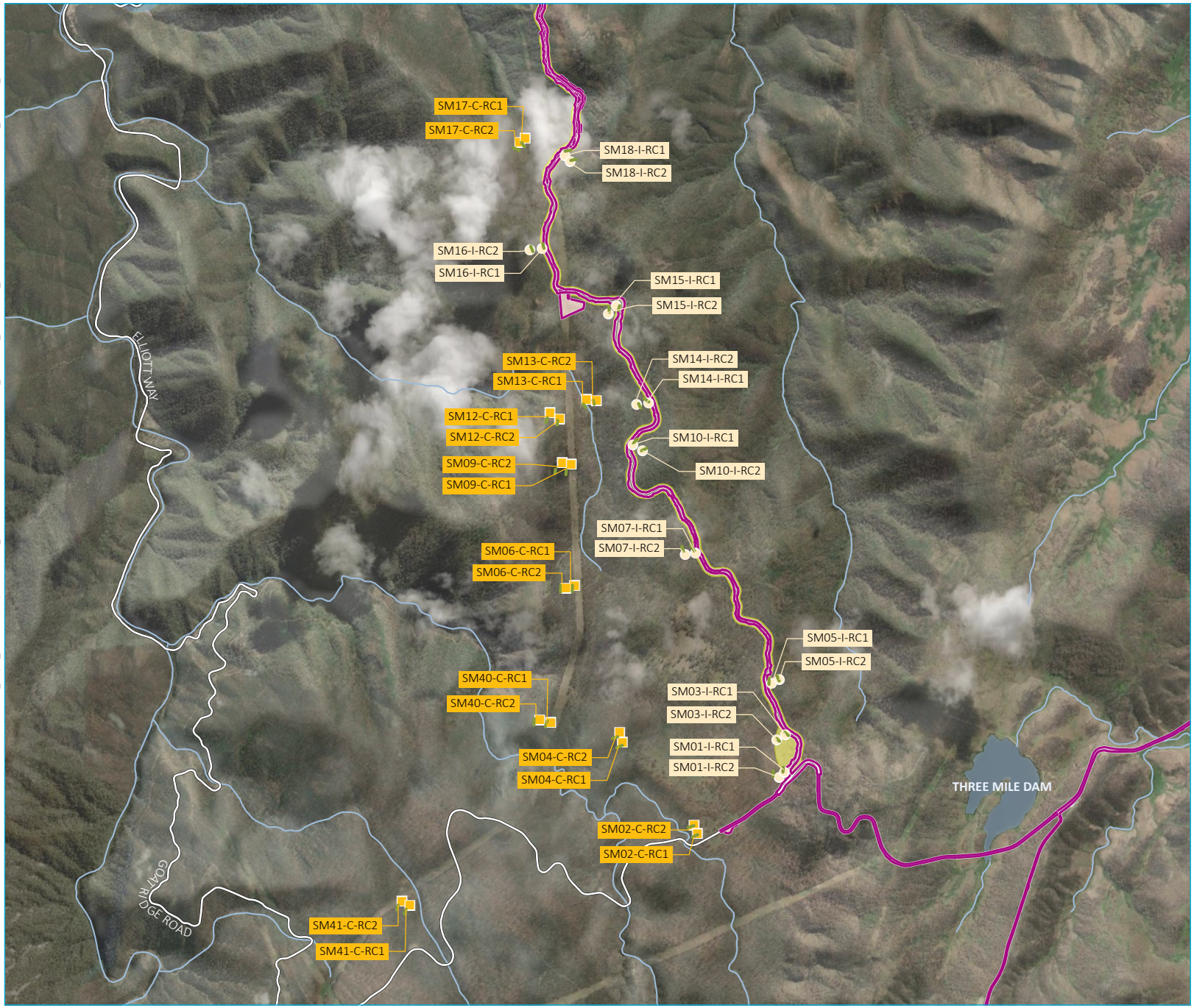
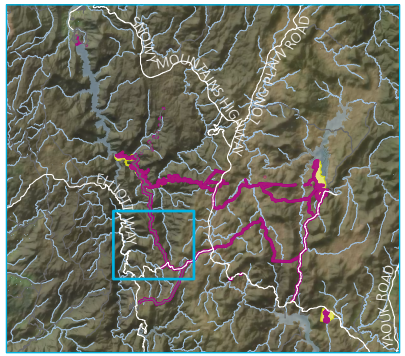
Figure 2.1





KEY

- Approved disturbance
- Approved construction envelope
- Small mammal habitat transect

Small mammal RCMS

- Control
- Impact

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

Small mammal occupancy and habitat characteristic monitoring sites – Year 3

Snowy 2.0
Biodiversity Management Program
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Figure 2.2a

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

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GDA 1994 MGA Zone 55

snowy 2.0

EMM creating opportunities

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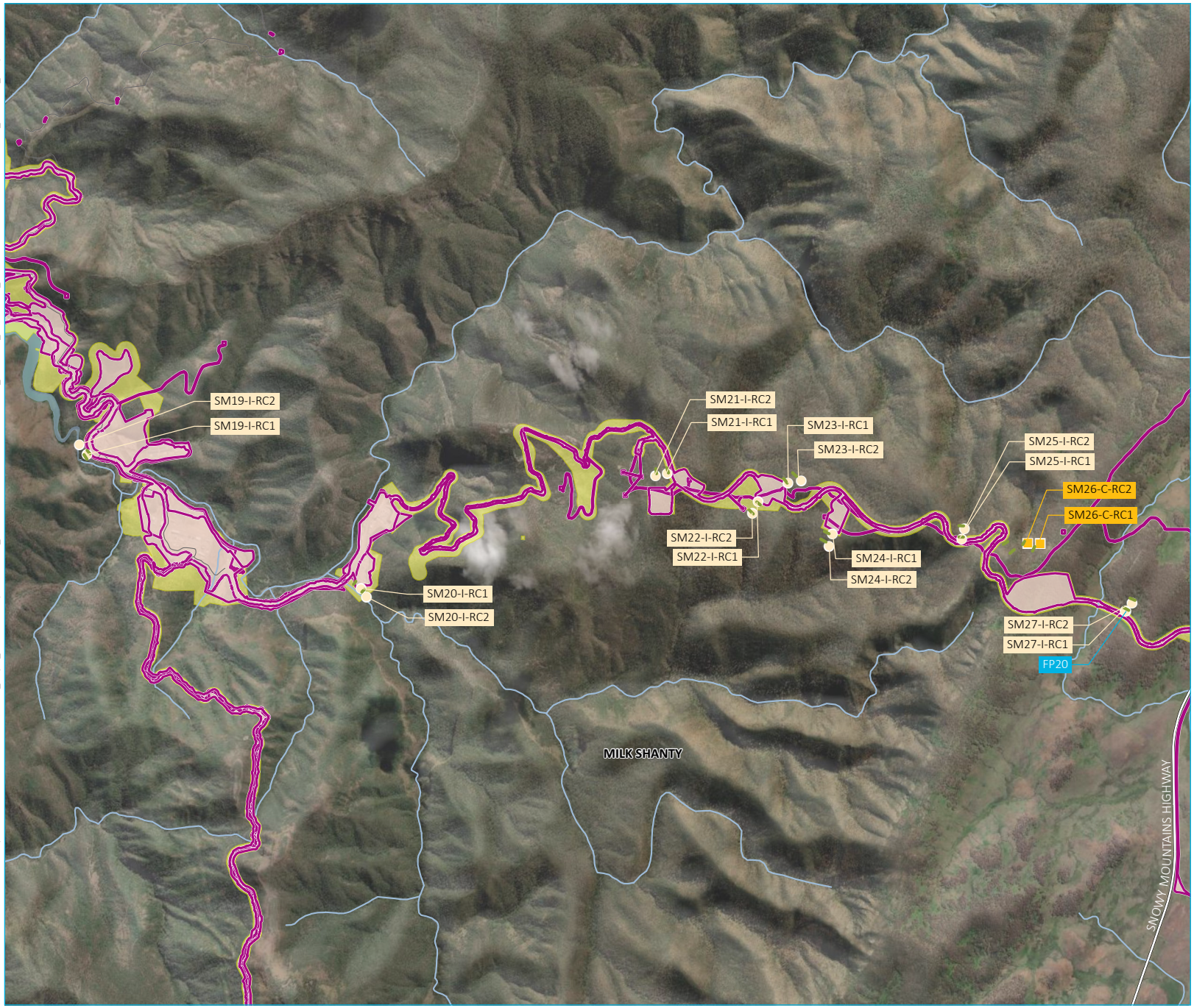

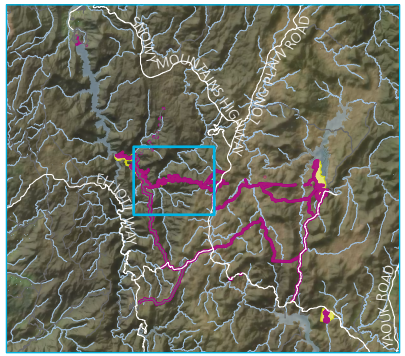

KEY

- Approved disturbance
- Approved construction envelope
- Small mammal habitat transect

BTR fecal pellet

- Impact

Small mammal RCMS

- Control
- Impact

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

Small mammal occupancy and habitat characteristic monitoring sites – Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 2.2b

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

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GDA 1994 MGA Zone 55

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snowy 2.0

EMM creating opportunities

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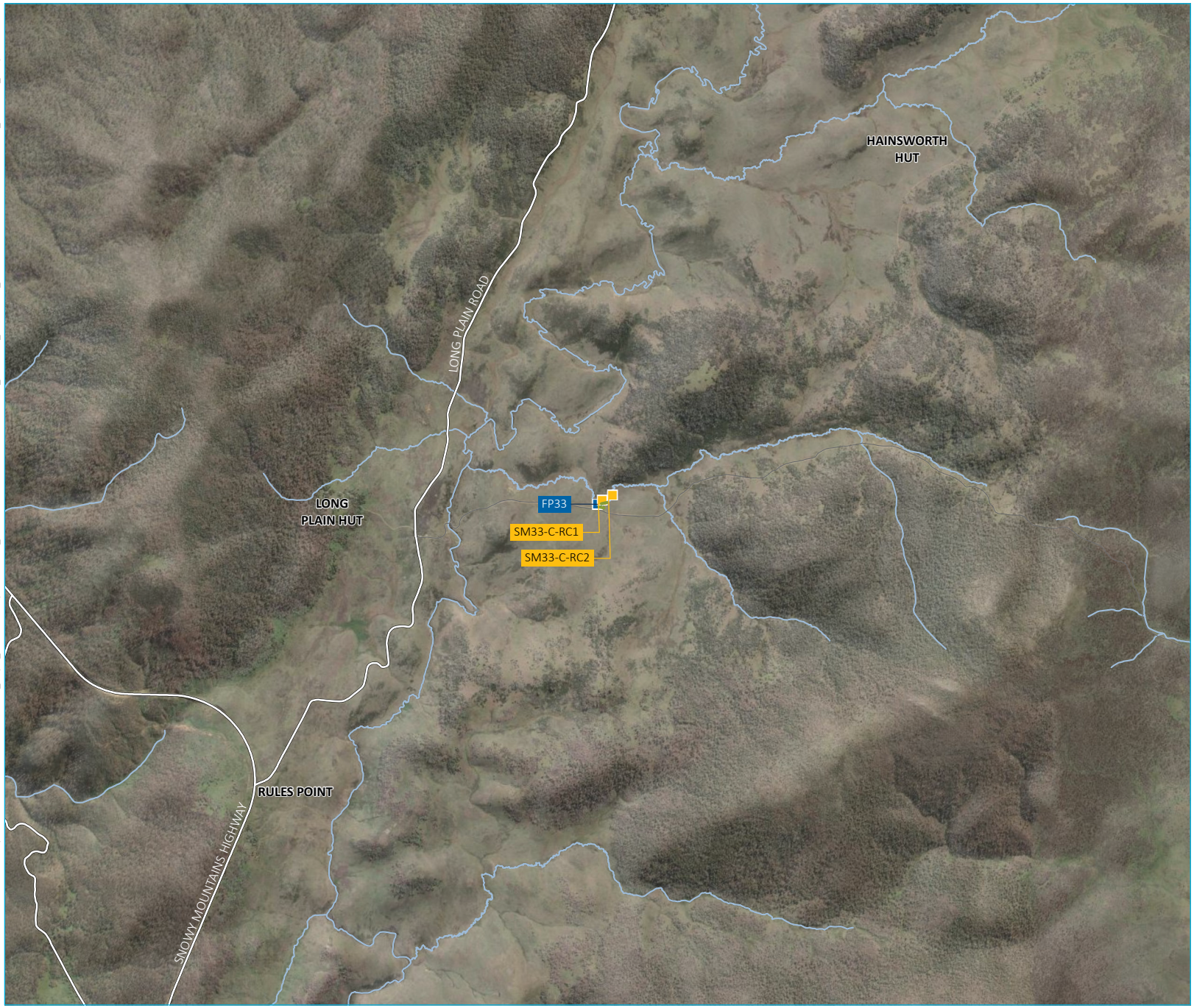

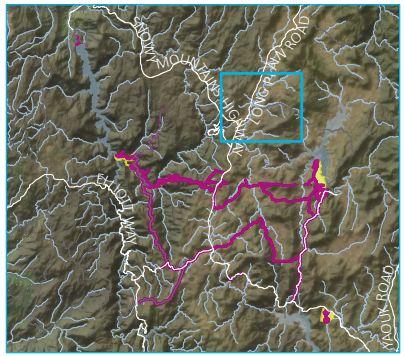

KEY

- Approved disturbance
- Approved construction envelope
- Small mammal habitat transect

BTR fecal pellet

- Control

Small mammal RCMS

- Control

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

Small mammal occupancy and habitat characteristic monitoring sites – Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 2.2c

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

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snowy 2.0

EMM creating opportunities

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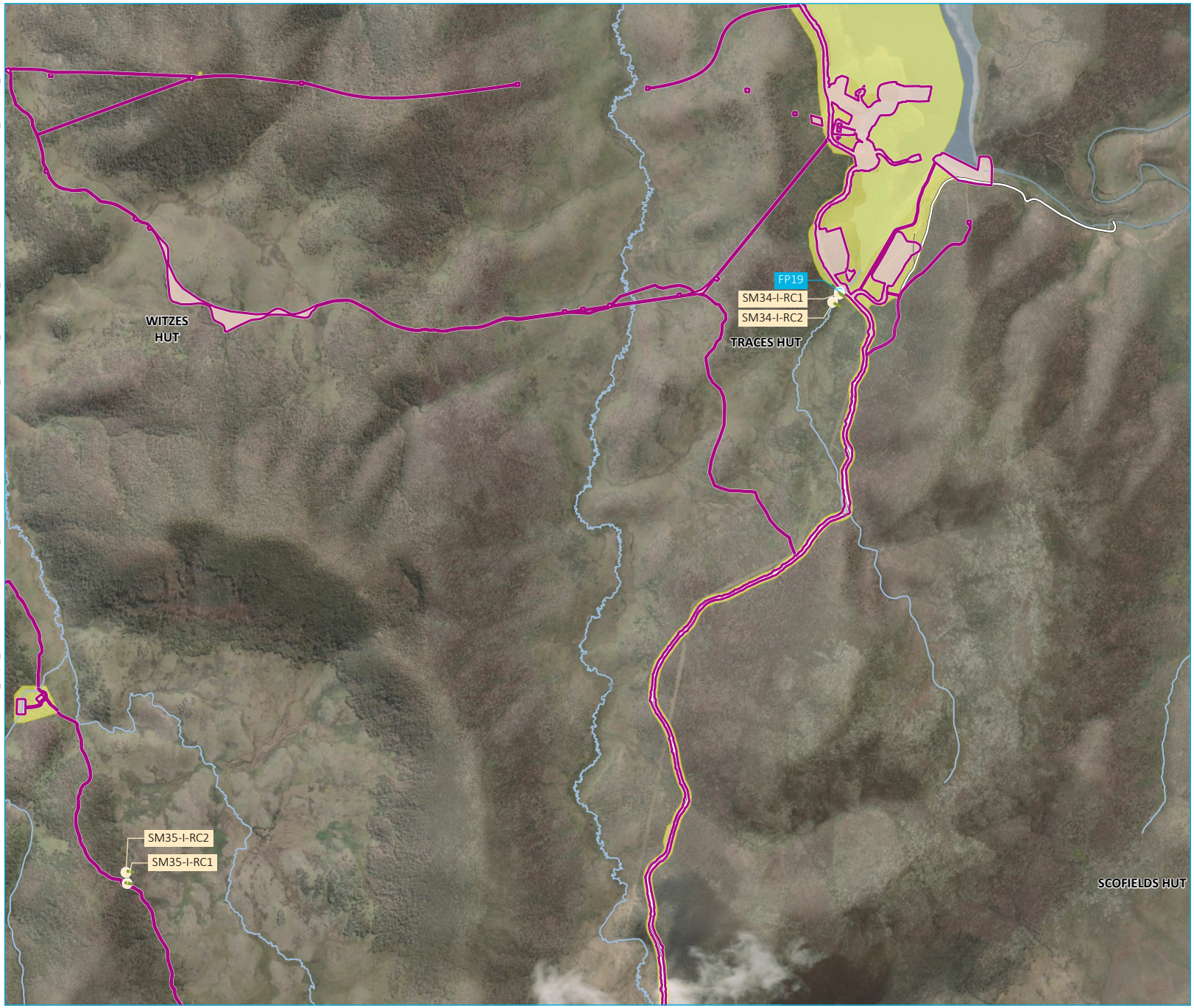

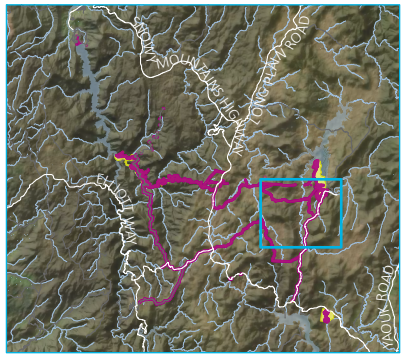

KEY

- Approved disturbance
- Approved construction envelope
- Small mammal habitat transect

BTR fecal pellet

- Impact

Small mammal RCMS

- Impact

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

Small mammal occupancy and habitat characteristic monitoring sites – Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 2.2d

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

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GDA 1994 MGA Zone 55

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snowy 2.0

EMM creating opportunities

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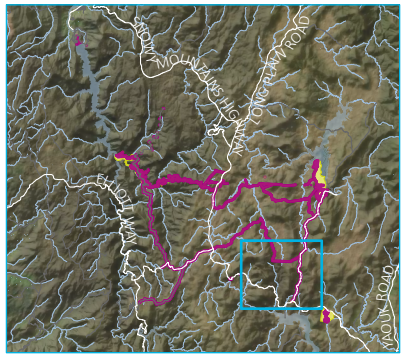

KEY

- Approved disturbance
- Approved construction envelope
- Small mammal habitat transect

BTR fecal pellet

- Control
- Impact

Small mammal RCMS

- Control
- Impact
- Dismissed in June 2023
- Established in June 2023

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

Small mammal occupancy and habitat characteristic monitoring sites – Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 2.2e

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

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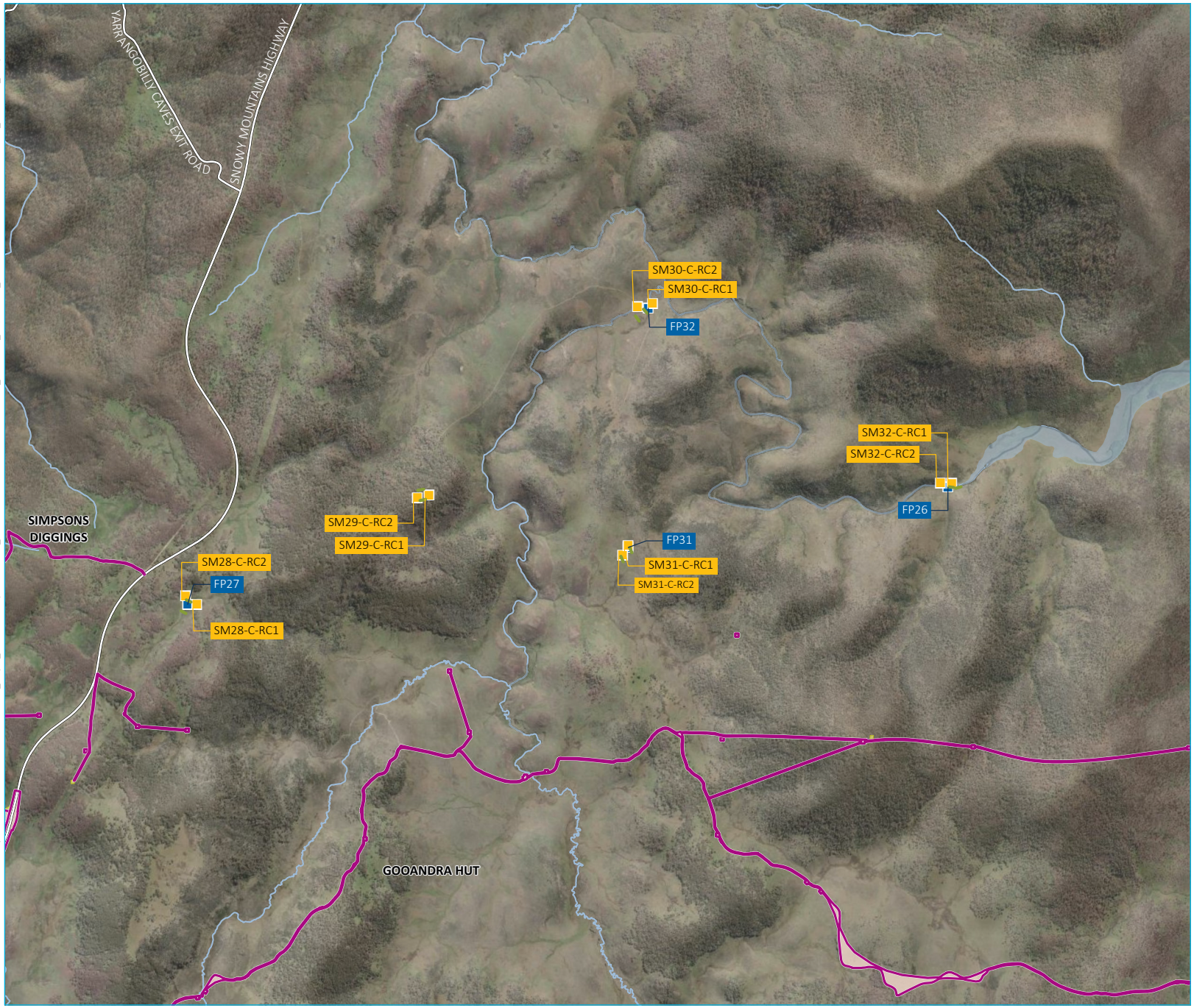

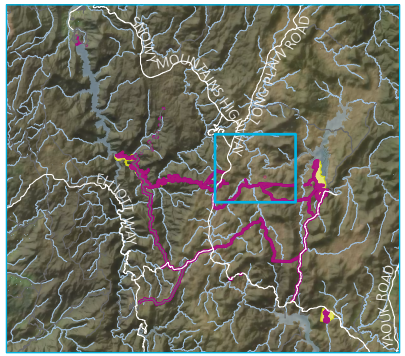

KEY

- Approved disturbance
- Approved construction envelope
- Small mammal habitat transect

BTR fecal pellet

- Control

Small mammal RCMS

- Control

Existing environment

- Major road
- Named watercourse
- Waterbody

Small mammal occupancy and habitat characteristic monitoring sites – Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 2.2f

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

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GDA 1994 MGA Zone 55

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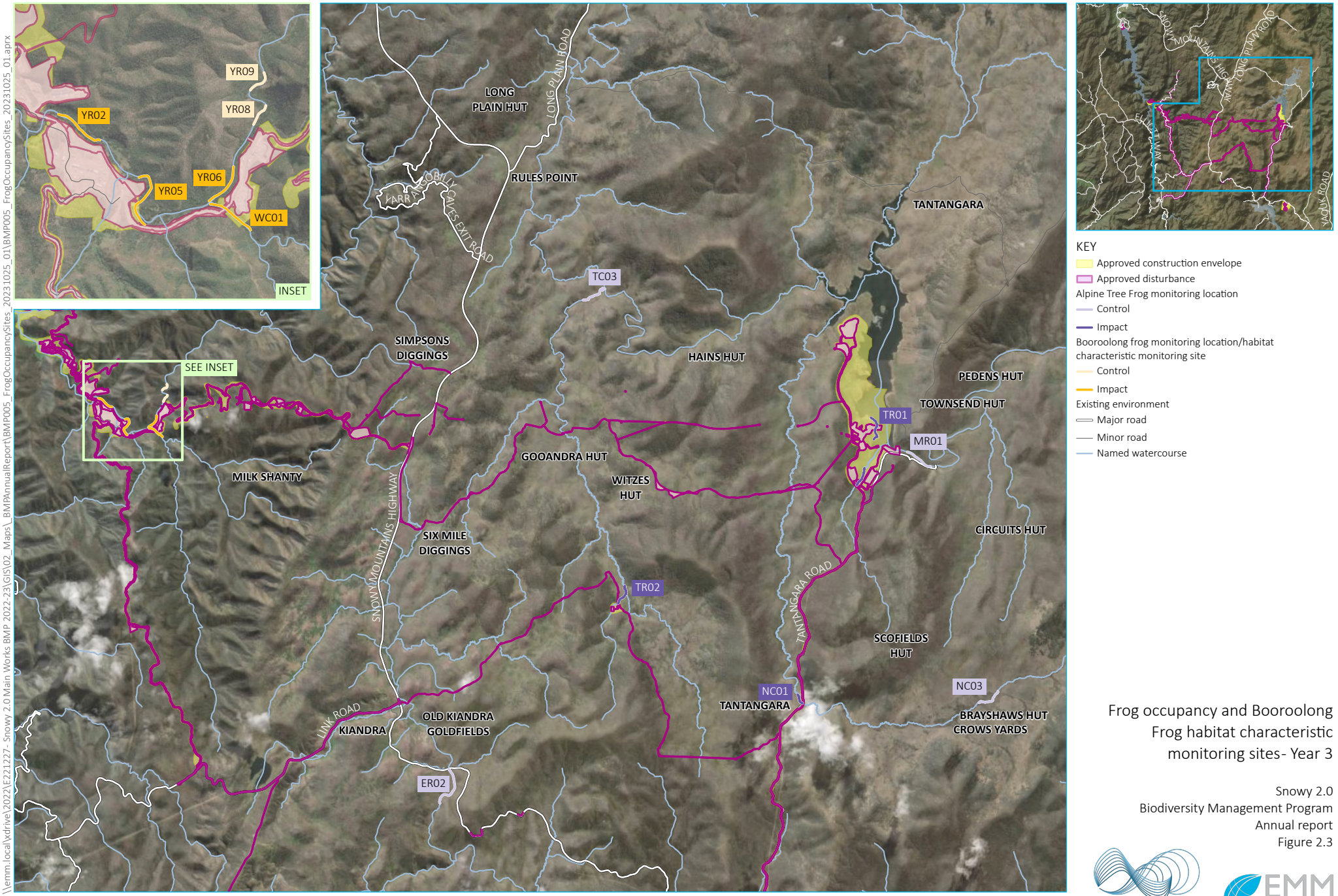

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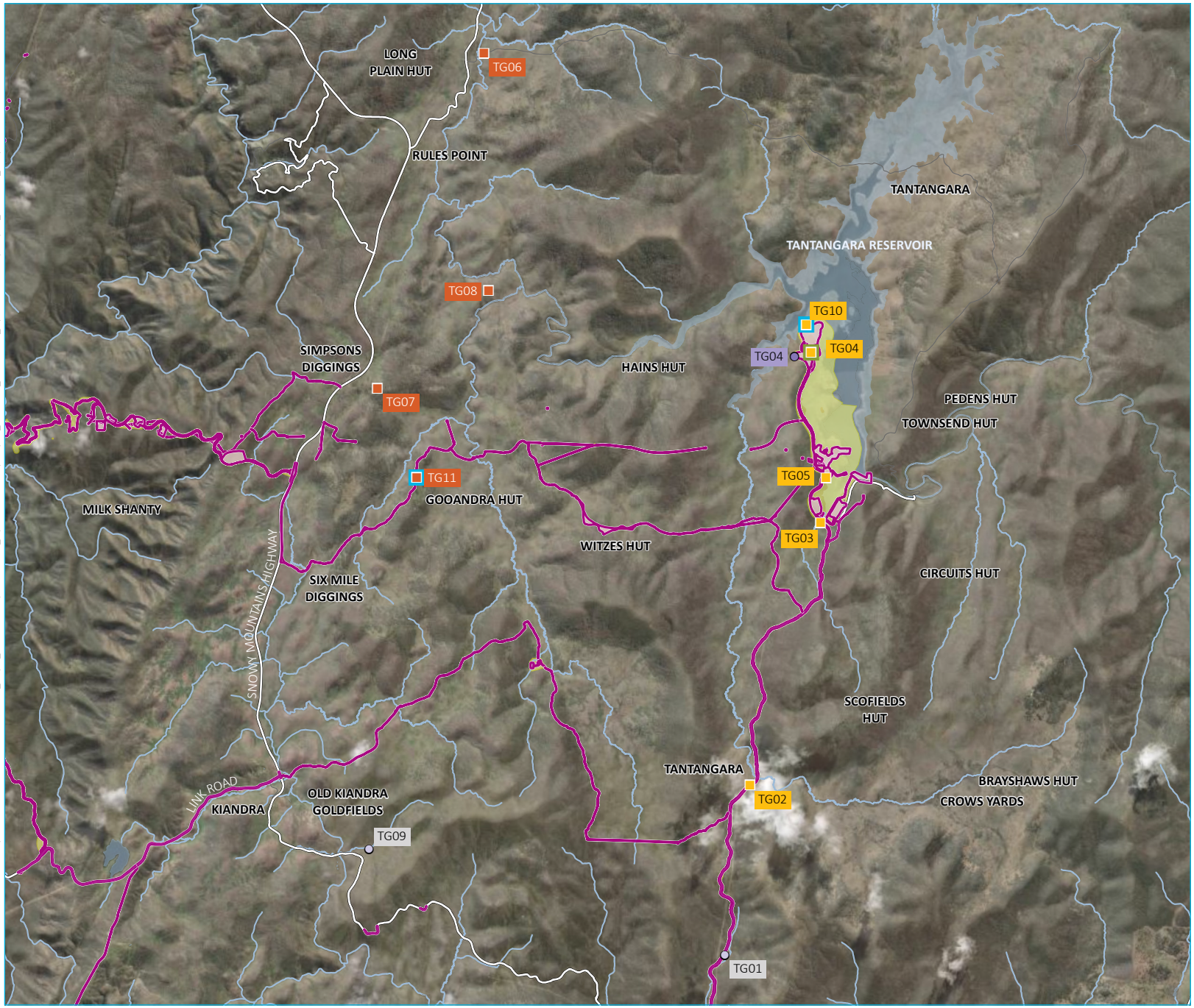
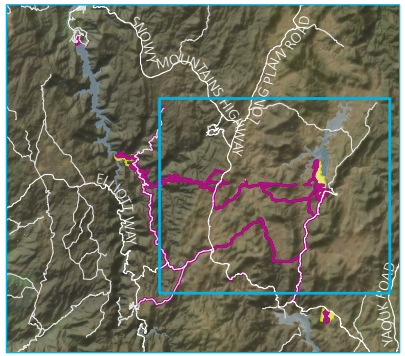
Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

Frog occupancy and Booroolong Frog habitat characteristic monitoring sites- Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 2.3





KEY

- Approved disturbance
- Approved construction envelope

Alpine She-oak Skink monitoring location

- Control
- Impact
- Decommissioned in March 2022
- Decommissioned in January 2023
- Established in March 2022
- Established in January 2023

Existing environment

- Major road
- Minor road
- Waterbody

\\emm.localvxdrive\2022\E221227- Snowy 2.0 Main Works BMP 2022-23\GIS\02_Maps_BMPAnnualReport\BMP006_AlpineSheoakOccupancyYr3_20240125_01\BMP006_AlpineSheoakOccupancyYr3_20240125_01.aprx

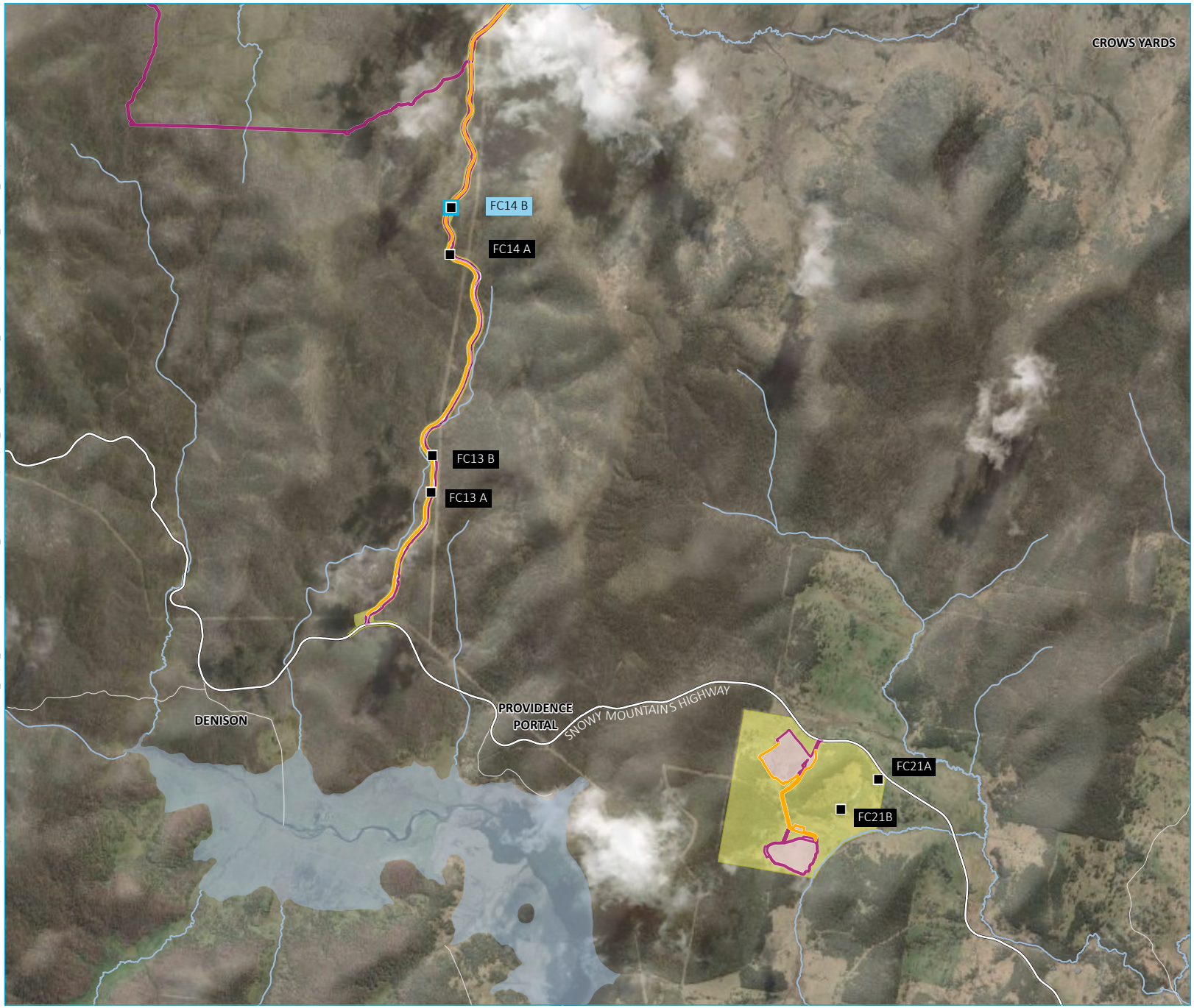
Source: EMM (2024); Snowy Hydro (2023); SMEC (2021); Robert Bird (2021); DFSI (2017); ESRI (2024)

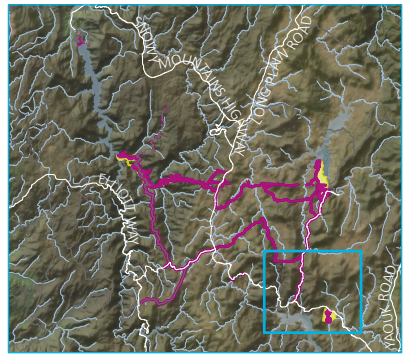
Alpine She-oak Skink occupancy monitoring sites – Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 2.4

snowy 2.0

EMM creating opportunities





KEY

- Approved disturbance
- Approved construction envelope
- Spotlighting transcect
- Feral animal camera
- Established in 2023

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

Feral animal occupancy and abundance monitoring sites – Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 2.5a

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km
GDA 1994 MGA Zone 55

N

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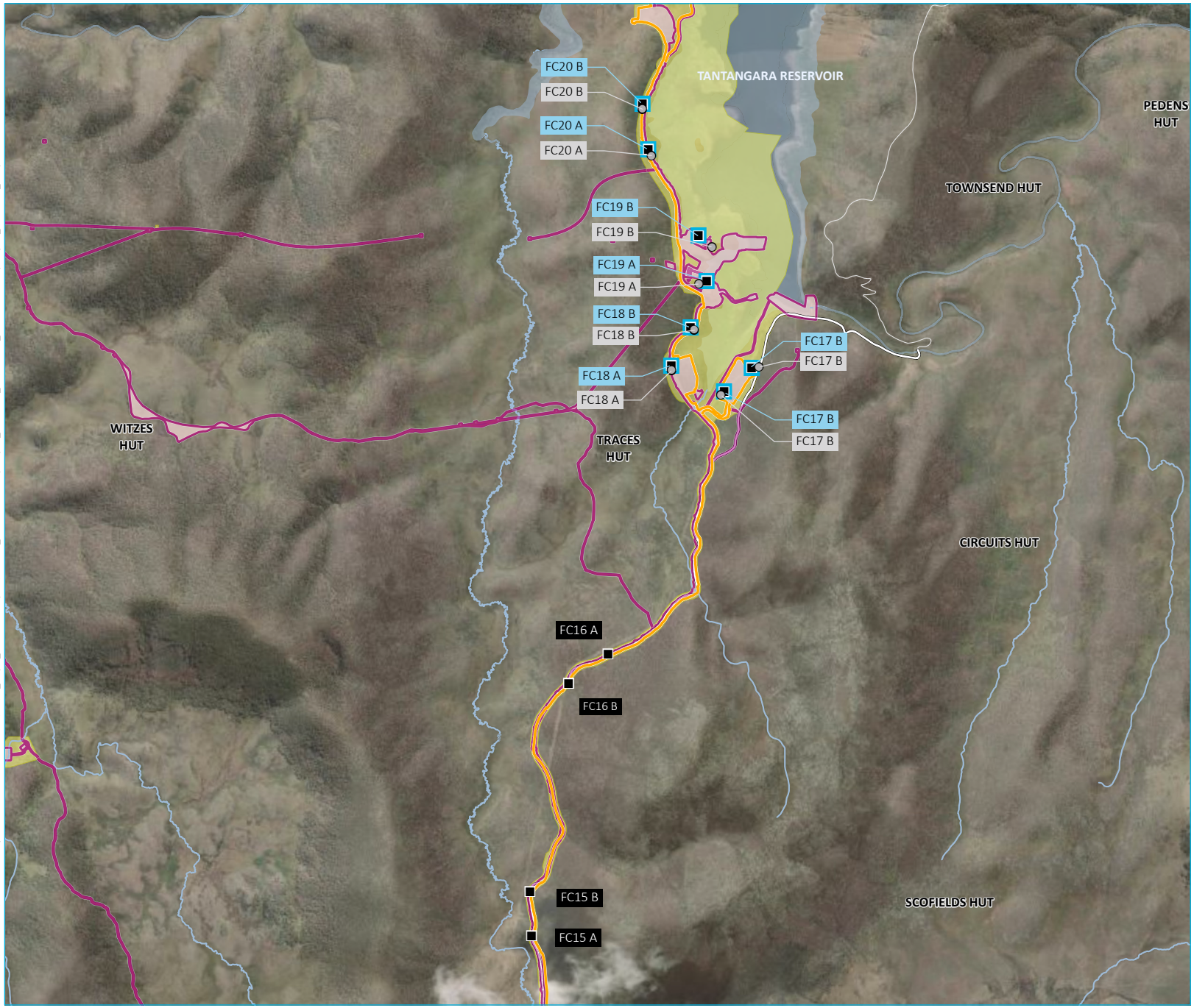

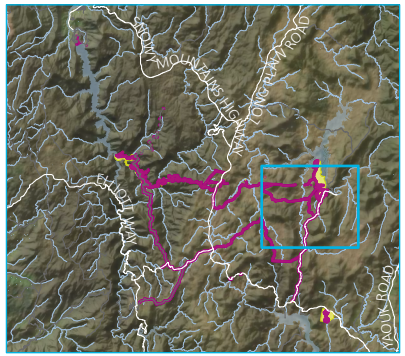

KEY

- Approved disturbance
- Approved construction envelope
- Spotlighting transect
- Feral animal camera
- Decommissioned in 2023
- Established in 2023

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

N

Feral animal occupancy and abundance monitoring sites – Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 2.5b

snowy 2.0

EMM creating opportunities

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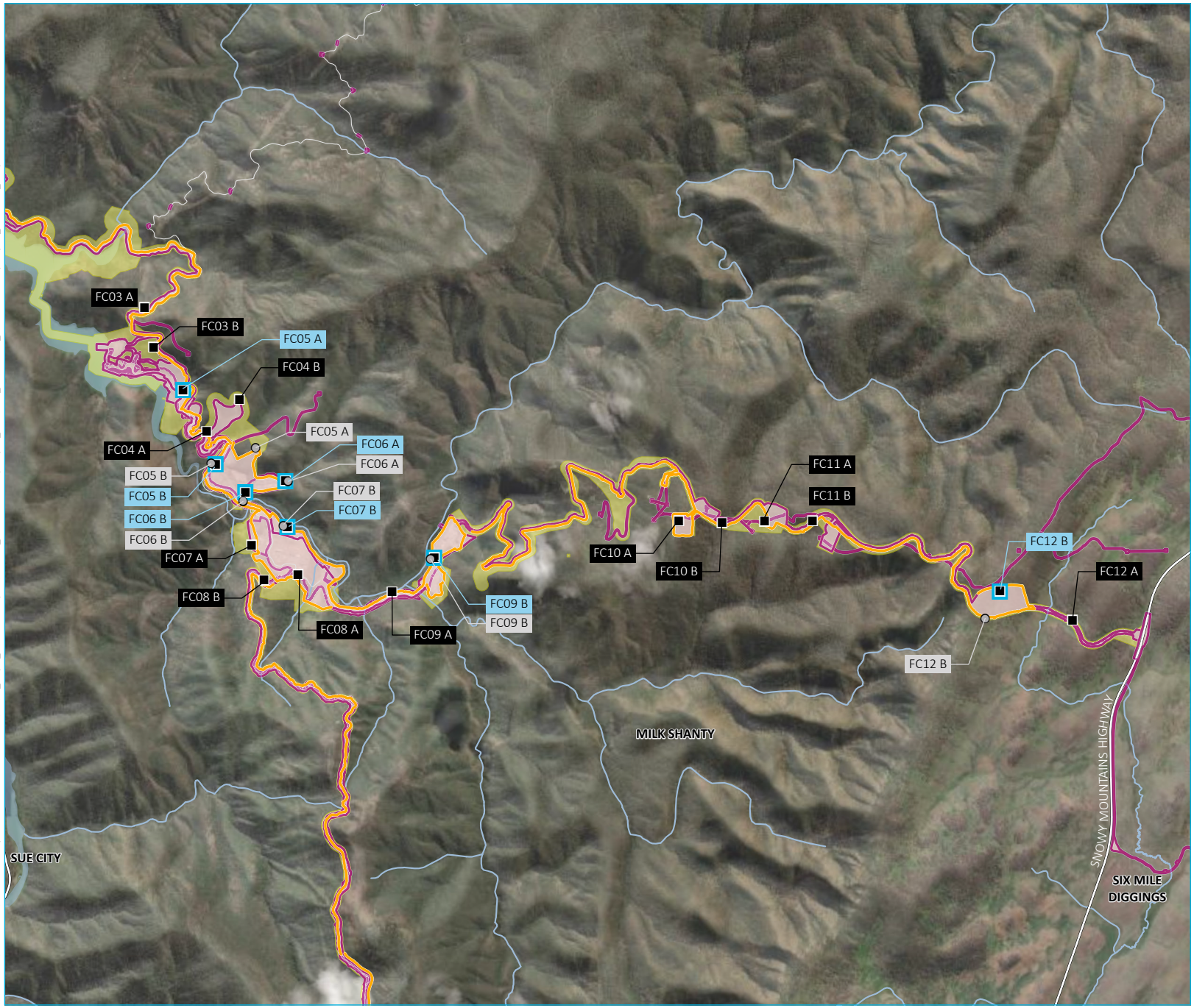

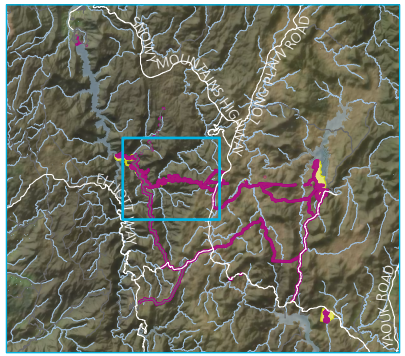

KEY

- Approved disturbance
- Approved construction envelope
- Spotlighting transect
- Feral animal camera
- Decommissioned in 2023
- Established in 2023

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

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Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

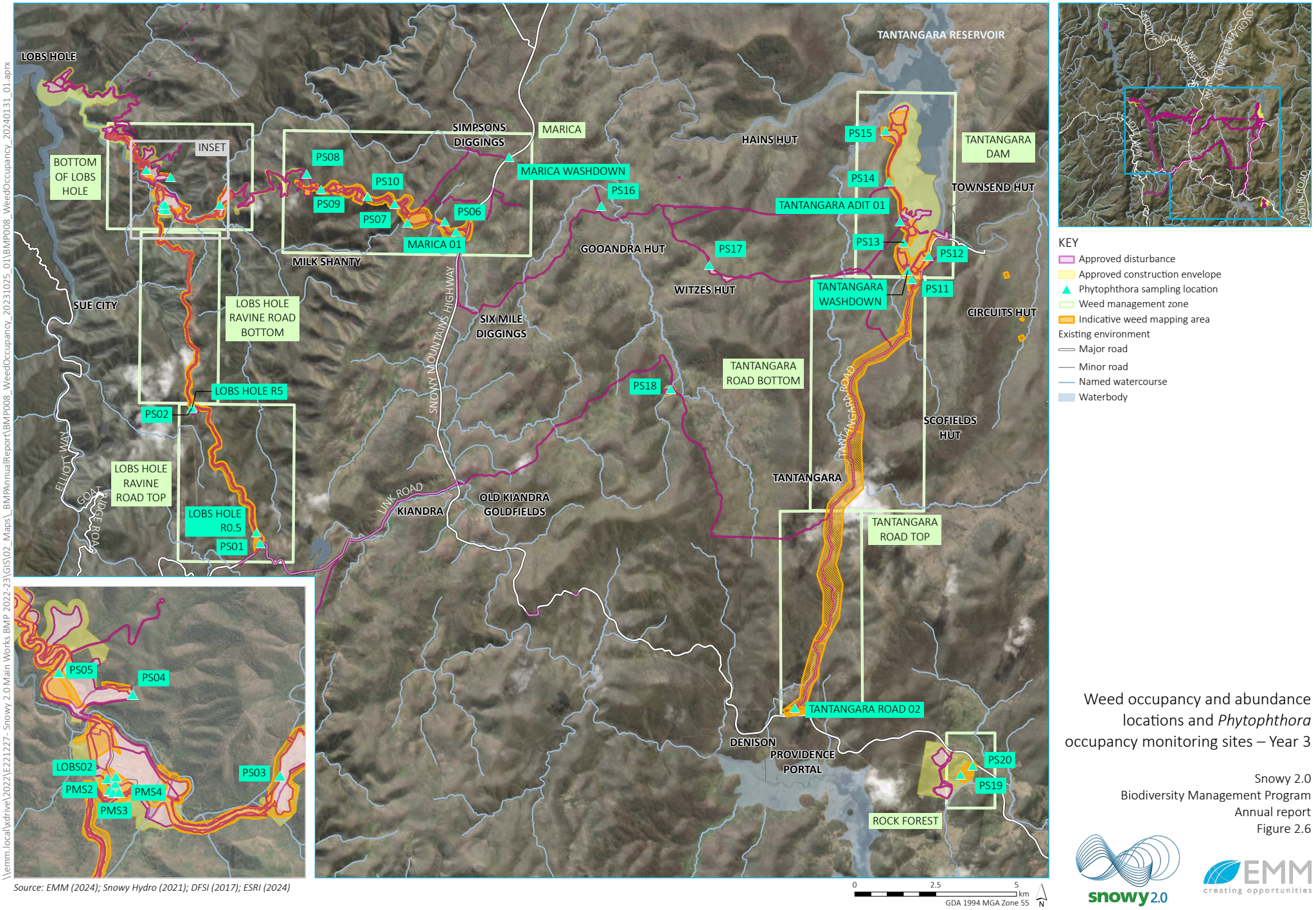
N

Feral animal occupancy and abundance monitoring sites – Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 2.5c

snowy 2.0

EMM creating opportunities



KEY

Approved disturbance
Approved construction envelope
Phytophthora sampling location
Weed management zone
Indicative weed mapping area

Existing environment

Major road
Minor road
Named watercourse
Waterbody

Weed occupancy and abundance locations and *Phytophthora* occupancy monitoring sites – Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 2.6

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

\\emm.local\xdrive\2022\E221227- Snowy 2.0 Main Works BMP 2022-23\GIS\02_Maps_BMPAnnualReport\BMP008_WeedOccupancy_20231025_01\BMP008_WeedOccupancy_20240131_01.aprx

3 Results

3.1 Threatened flora monitoring

The objective of the threatened flora monitoring is to determine the health of threatened flora populations of Clover Glycine (*Glycine latrobeana*) and Kiandra Leek Orchid (*Prasophyllum retroflexum*) located adjacent to the disturbance area, to document any changes as a result of the Main Works, and to implement additional controls if necessary.

3.1.1 Year 3

Clover Glycine and Kiandra Leek Orchid were surveyed across 12 sites, including six impact sites and six control sites (Figure 3.1). Two impact sites (TF01 and TF02) were not surveyed during December 2022 and January 2023 monitoring events as these sites were cleared as part of the Main Works prior to Year 3. These sites were not relocated in Year 3 as Kiandra Leek Orchid and Glover Glycine were unable to be located within the area adjacent to the footprint after targeted searches of the species based on previous records.

Clover Glycine was recorded at six sites during Year 3, including two impact sites (TF03 and TF14) and four control sites (TF07, TF08, TF09 and TF10), representing 50% of threatened flora monitoring sites. A total of 38 individuals of Clover Glycine were recorded within impact sites and 100 individuals were recorded within control sites. No individuals of Clover Glycine were recorded at four impact sites (TF04, TF11, TF12 and TF13), and two control sites (TF05 and TF06).

The Kiandra Leek Orchid was recorded at four sites during Year 3, including one impact site (TF13) and three control sites (TF06, TF07 and TF09), representing 33% of threatened flora monitoring sites. A total of 22 individuals of Kiandra Leek Orchid were recorded within one impact site while 52 individuals were recorded within the three control sites. No individuals of Kiandra Leek Orchid were recorded at five impact sites (TF03, TF04, TF11, TF12 and TF14), and three control sites (TF05, TF08, and TF10).

Threatened flora presence/absence at each monitoring site in Year 3 is summarised in Table 3.1 and presented in Plate 3.1 and Plate 3.2. Monitoring events and further details of each record are presented in Appendix D, including photographs from photo points established at each monitoring site.

Table 3.1 Number of threatened flora individuals recorded

Site	Clover Glycine		Kiandra Leek Orchid	
	December 2022	January 2023	December 2022	January 2023
Impact				
TF01	NA	NA	NA	NA
TF02	NA	NA	NA	NA
TF03	11	3	0	0
TF04	0	0	0	0
TF11	0	0	0	0
TF12	0	0	0	0
TF13	0	0	22	0
TF14	2	22	0	0

Table 3.1 Number of threatened flora individuals recorded

Site	Clover Glycine		Kiandra Leek Orchid	
	December 2022	January 2023	December 2022	January 2023
Total (impact)	**13**	**25**	**22**	**0**
Control				
TF05	0	0	0	0
TF06	0	0	9	1
TF07	0	7	2	0
TF08	12	20	0	0
TF09	6	54	40	0
TF10	0	1	0	0
Total (control)	**18**	**82**	**51**	**1**
TOTAL	***31***	***107***	***73***	***1***

Notes: NA – survey not conducted due to clearing as a result of construction works.

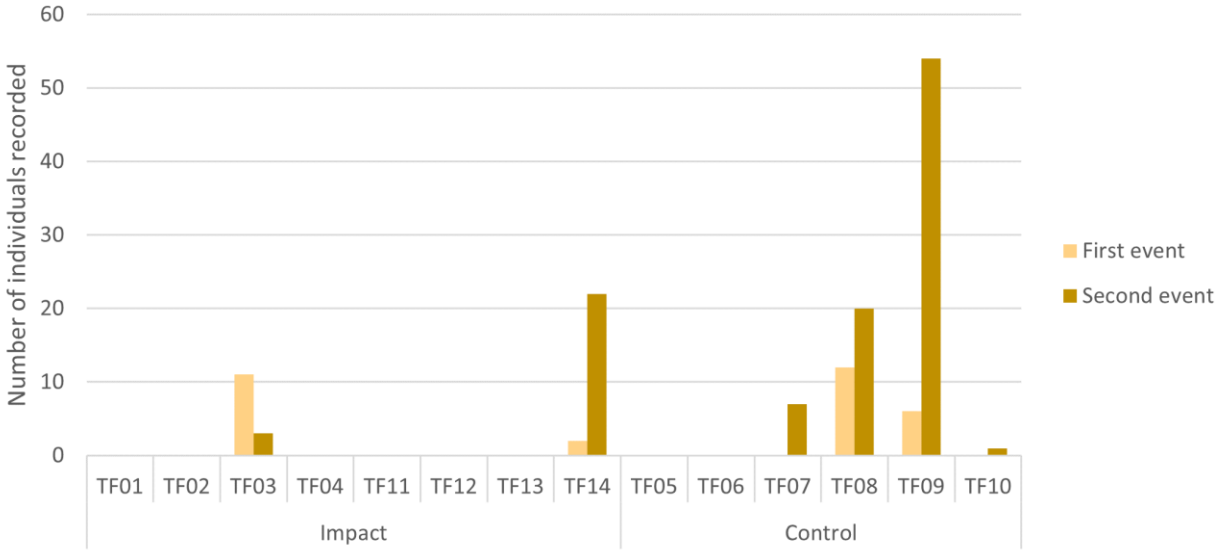


Plate 3.1 **Clover Glycine records during Year 3**

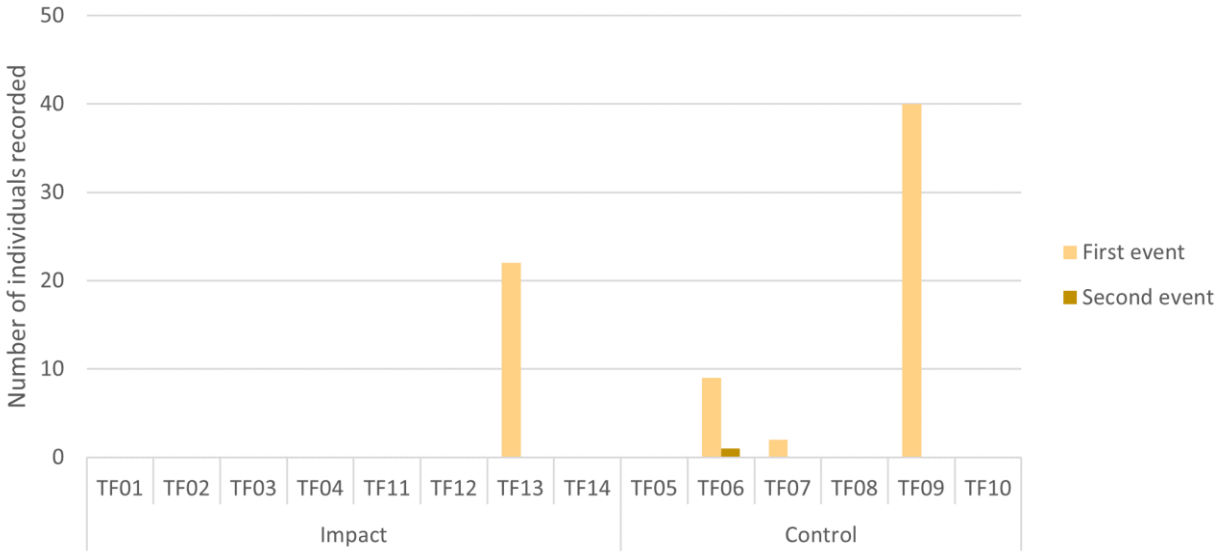


Plate 3.2 **Kiandra Leek Orchid records during Year 3**

3.1.2 Comparative analysis- Year 2 and Year 3

Between Year 2 and Year 3, an overall decline in Clover Glycine numbers was observed at two impact sites (TF04 and TF12) and two control sites (TF07 and TF10) (Plate 3.3). An increase in Clover Glycine numbers was observed at two impact sites (TF03 and TF14) and three control sites (TF06, TF08 and TF09). Two impact sites (TF11 and TF13) and one control site (TF05) recorded no individuals of Clover Glycine in Year 2 or Year 3.

The percentage decline in the number of Clover Glycine recorded at one impact site (TG04) was observed over two consecutive monitoring periods but did not fall outside of the standard deviation observed at control sites.

Between Year 2 and Year 3, an overall decline in Kiandra Leek Orchid numbers was observed at one impact site (TF04) and two control sites (TF06 and TF07). An increase in Kiandra Leek Orchid numbers was observed at one impact site (TF13) and one control site (TF09). The remaining plots (impact site TF03, TF11, TF12 and TF14, and control sites TF05, TF08 and TF10) recorded no individuals of Kiandra Leek Orchid in Year 2 or Year 3.

No percentage decline in the number of Kiandra Leek Orchid was observed over two consecutive monitoring periods or outside of the standard deviation observed at control sites.

One impact site (TF11) and one control site (TF05) have never recorded individuals of Clover Glycine or Kiandra Leek Orchid.

A comparison of Year 3, Year 2 and Year 1 (baseline) is presented in Plate 3.3 for Clover Glycine, and Plate 3.4 for Kiandra Leek Orchid.

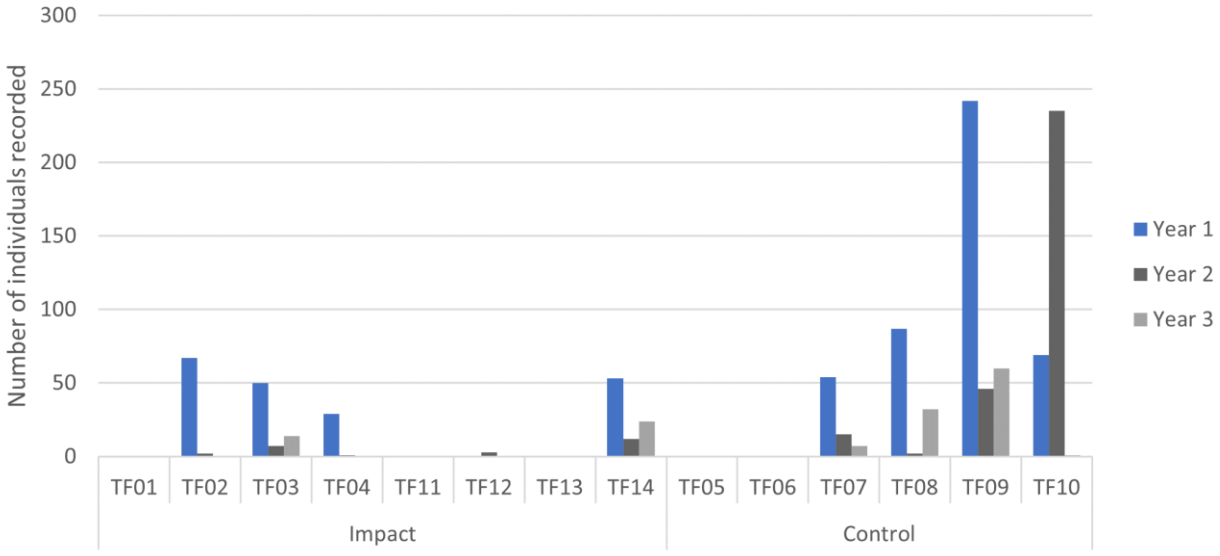


Plate 3.3 **Clover Glycine records during Year 3 compared to Year 2 and baseline (Year 1)**

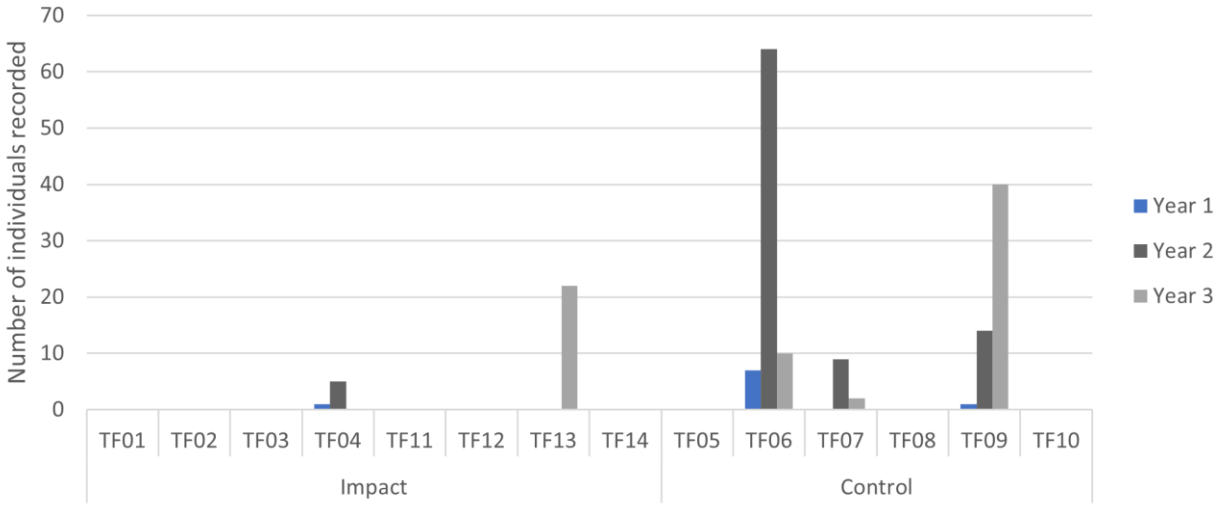
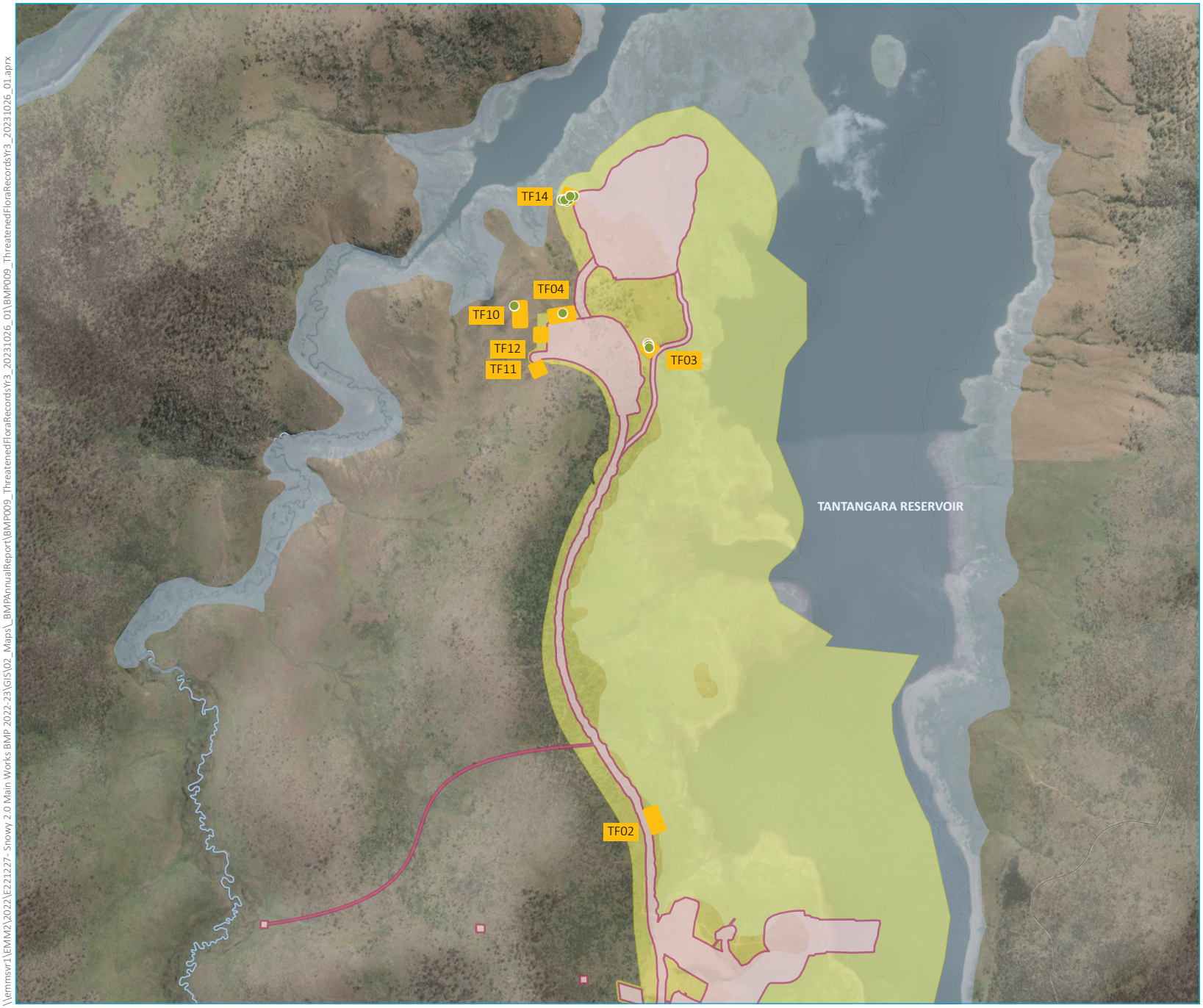
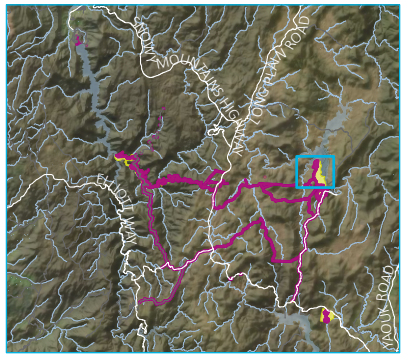


Plate 3.4 **Kiandra Leek Orchid records during Year 3 compared to Year 2 and baseline (Year 1)**





KEY

- Approved disturbance
- Approved construction envelope
- Threatened flora monitoring location
- Clover Glycine
- Kiandra Leek Orchid

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse
- Waterbody

\\emmsvr1\EMM2\2022\E221227- Snowy 2.0 Main Works BMP 2022-23\GIS\02_Maps_BMPAnnualReport\BMP009_ThreatenedFloraRecordsYr3_20231026_01\BMP009_ThreatenedFloraRecordsYr3_20231026_01.aprx

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 1 2 km

GDA 1994 MGA Zone 55

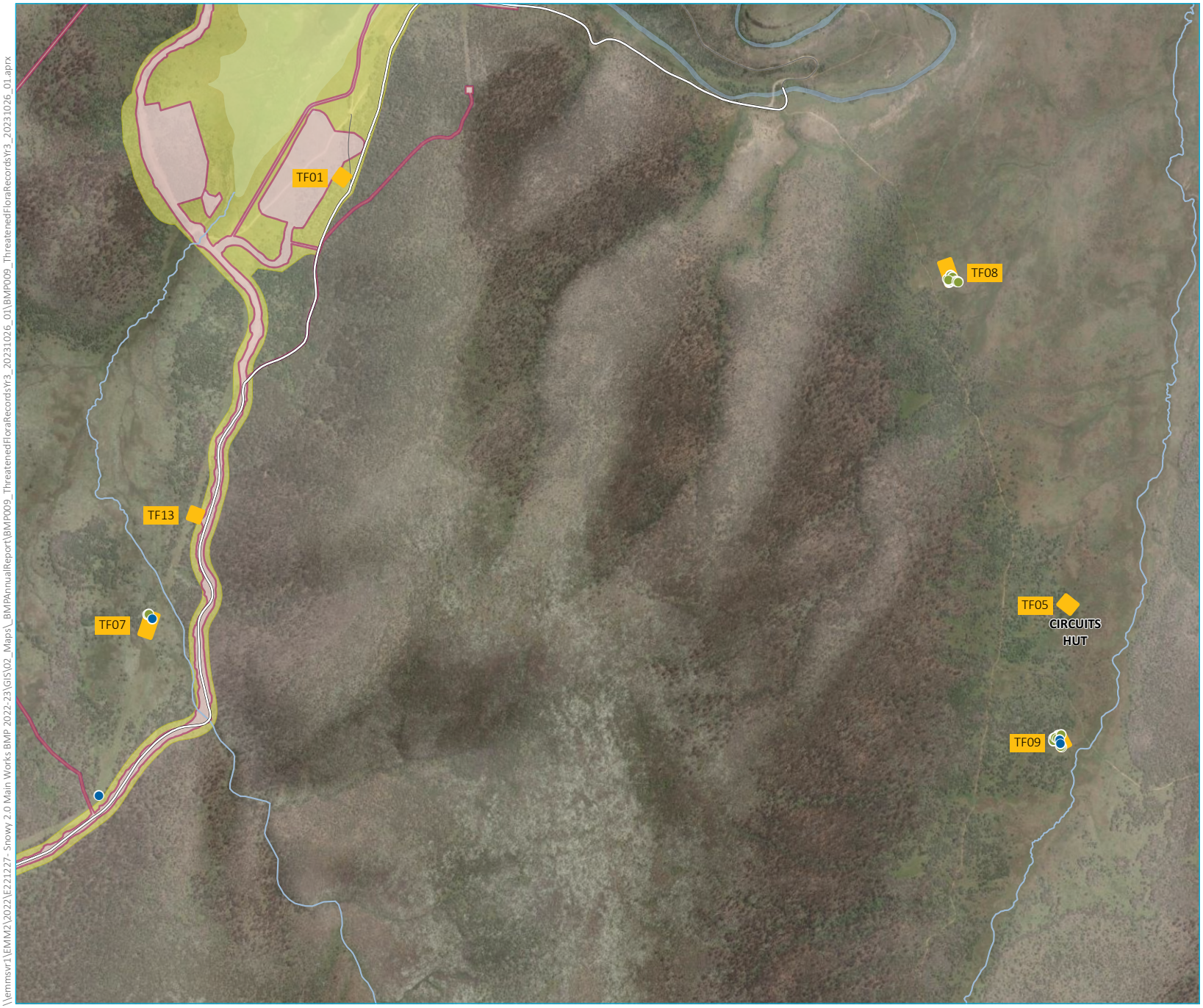
N

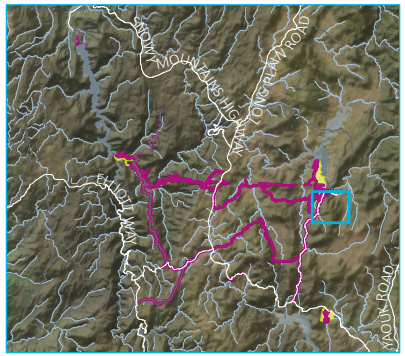
Threatened flora records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.1a

snowy 2.0

EMM creating opportunities





KEY

- Approved disturbance
- Approved construction envelope
- Threatened flora monitoring location
- Clover Glycine
- Kiandra Leek Orchid

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse
- Waterbody

\\emmsvr1\EMM2\2022\E221227- Snowy 2.0 Main Works BMP 2022-23\GIS\02_Maps_BMPAnnualReport\BMP009_ThreatenedFloraRecords\Yr3_20231026_01\BMP009_ThreatenedFloraRecordsYr3_20231026_01.aprx

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 1 2 km

GDA 1994 MGA Zone 55

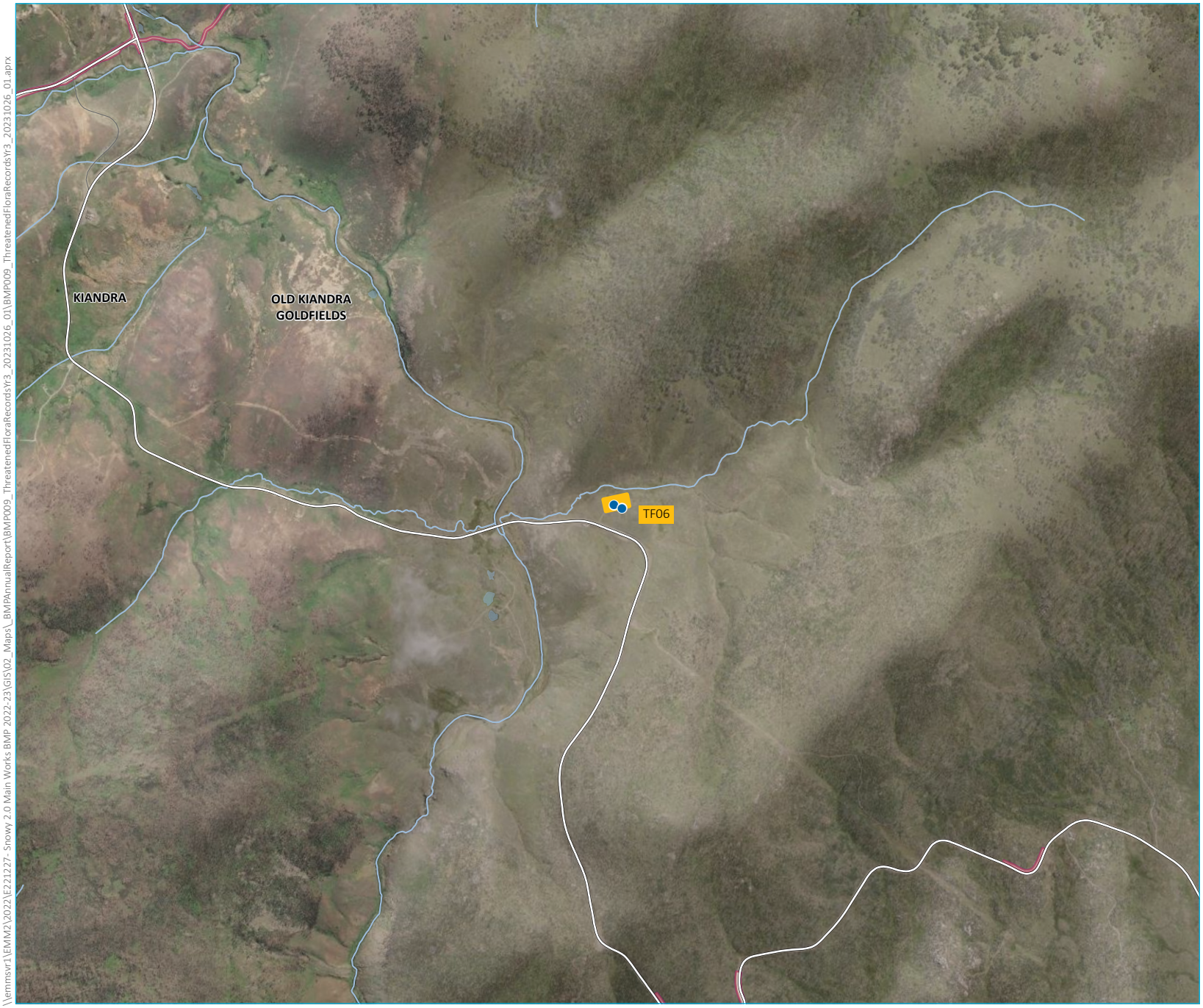
N

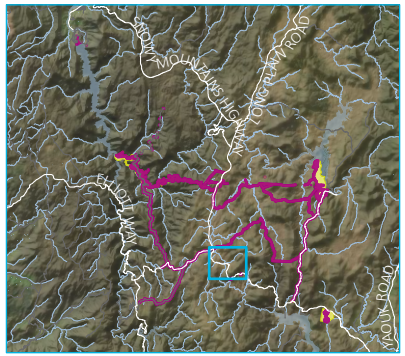
Threatened flora records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.1b

snowy 2.0

EMM creating opportunities





KEY

- Approved disturbance
- Approved construction envelope
- Threatened flora monitoring location
- Clover Glycine
- Kiandra Leek Orchid

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse
- Waterbody

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 1 2 km

GDA 1994 MGA Zone 55

N

Threatened flora records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.1c

snowy 2.0

EMM creating opportunities

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3.2 Small terrestrial mammal monitoring

3.2.1 Occupancy (presence/absence) monitoring

The objective of the small terrestrial mammal occupancy monitoring is to determine presence/absence of the Smoky Mouse, Eastern Pygmy-possum, and Broad-toothed Rat at sites within proximity to the project and document any changes as a result of the Main Works.

During Year 3, 39 remote camera monitoring sites (two cameras per site) were surveyed during each of four monitoring events. Each site comprises paired cameras, one placed at approximately 20 m and a second placed at approximately 120 m from the road verge. The 39 monitoring sites include 22 impact monitoring sites and 17 control sites, with a total of 78 cameras deployed to record target species.

i Smoky Mouse

a Year 3

No Smoky Mouse (*Pseudomys fumeus*) were recorded at any impact or control site during Year 3 (Table 3.2).

Ten impact sites (SM05-I, SM10-I, SM14-I, SM18-I, SM19-I, SM21-I, SM22-I, SM23-I, SM24-I and SM35-I) had previously recorded the presence of Smoky Mouse prior to the species absence in Year 3 (either in Year 1 or Year 2). All these sites, which previously recorded Smoky Mouse presence, did not record the species for greater than one year. Three control sites, which previously recorded Smoky Mouse presence, also recorded the absence of the species for greater than one year (SM09-C, SM12-C and SM17-C).

Smoky Mouse presence/absence at each monitoring site is summarised in Table 3.2. As no presence of the target species was recorded in Year 3, no Year 3 graph is presented for the Smoky Mouse. Further detailed information including monitoring dates and presence/absence at each camera is provided in Appendix E.1.

Table 3.2 Smoky Mouse remote camera presence/absence (Year 3)

Site	Previously recorded in Year 1	Previously recorded in Year 2	Year 3			
			Q1 (Summer)	Q2 (Autumn)	Q3 (Winter)	Q4 (Spring)
Impact						
SM01-I	No	No				
SM03-I	No	No				
SM05-I	Yes (Q4 (Spring))	No				
SM07-I	No	No				
SM10-I	No	Yes (Q1 (Summer))				
SM14-I	No	Yes (Q2 (Autumn))				
SM15-I	No	No				
SM16-I	No	No				
SM18-I	No	Yes (Q3 (Winter))				
SM19-I	No	No*				

Table 3.2 Smoky Mouse remote camera presence/absence (Year 3)

Site	Previously recorded in Year 1	Previously recorded in Year 2	Year 3			
			Q1 (Summer)	Q2 (Autumn)	Q3 (Winter)	Q4 (Spring)
SM20-I	No	No				
SM21-I	No	Yes (Q2 (Autumn))				
SM22-I	Yes (Q4 (Spring))	Yes (Q1 (Summer))				
SM23-I	Yes (Q4 (Spring))	Yes (Q2 (Autumn))				
SM24-I	Yes (Q3 (Winter))	No				
SM25-I	No	No				
SM26-I	No	No				
SM27-I	No	No				
SM34-I	No	No				
SM35-I	Yes (Q3 (Winter))	No				
SM36-I	No	No				
SM37-I	No	No				
Total sites where detected	**5**	**7**	**0**	**0**	**0**	**0**
Total sites where detected (% of total impact sites)	**23%**	**32%**	**0%**	**0%**	**0%**	**0%**
Control						
SM02-C	No	No				
SM04-C	No	No				
SM06-C	No	No				
SM09-C	Yes (Q4 (Spring))	Yes (Q2 (Autumn))				
SM12-C	No	Yes (Q2 (Autumn))				
SM13-C	No	No				
SM17-C	Yes (Q4 (Spring))	Yes (Q3 (Winter))				
SM28-C	No	No				
SM29-C	No	No				
SM30-C	No	No				

Table 3.2 Smoky Mouse remote camera presence/absence (Year 3)

Site	Previously recorded in Year 1	Previously recorded in Year 2	Year 3			
			Q1 (Summer)	Q2 (Autumn)	Q3 (Winter)	Q4 (Spring)
SM31-C	No	No				
SM32-C	No	No				
SM33-C	No	No				
SM38-C	No	No				
SM39-C	No	No				
SM40-C	No	No				
SM41-C	No	No				
Total sites where detected	**2**	**3**	**0**	**0**	**0**	**0**
Total sites where detected (% of total control sites)	**12%**	**18%**	**0%**	**0%**	**0%**	**0%**
TOTAL (impact and control)	***7 (18%)***	***10 (26%)***	***0 (0%)***	***0 (0%)***	***0 (0%)***	***0 (0%)***

Notes: Cells highlighted in grey represent sites with unsuitable habitat for the Smoky Mouse. Blank cells represent absence of species. NA indicates sites not surveyed during that monitoring period. *The record for SM19-I in Year 2 was updated following a second review, which confirmed that the species had been initially misidentified.

b Comparative analysis- Year 1, Year 2 and Year 3

An overall increase in the number of monitoring sites that reported Smoky Mouse presence was observed between Year 1 (seven) and Year 2 (10), representing a 42% increase. However, in Year 3, none of the monitoring sites documented the species' presence.

The data indicates that overall, there has been a decrease in the number of sites where Smoky Mouse was detected from Year 1 to Year 3, with a substantial decline in Year 3.

A comparison of Year 2 and Year 3 presence compared to Year 1 baseline is presented in Plate 3.5.

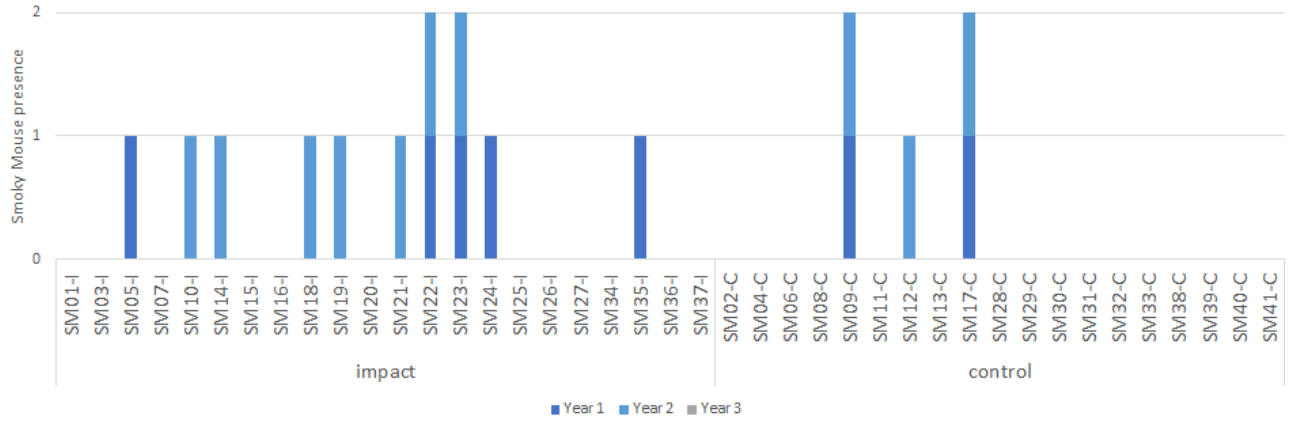
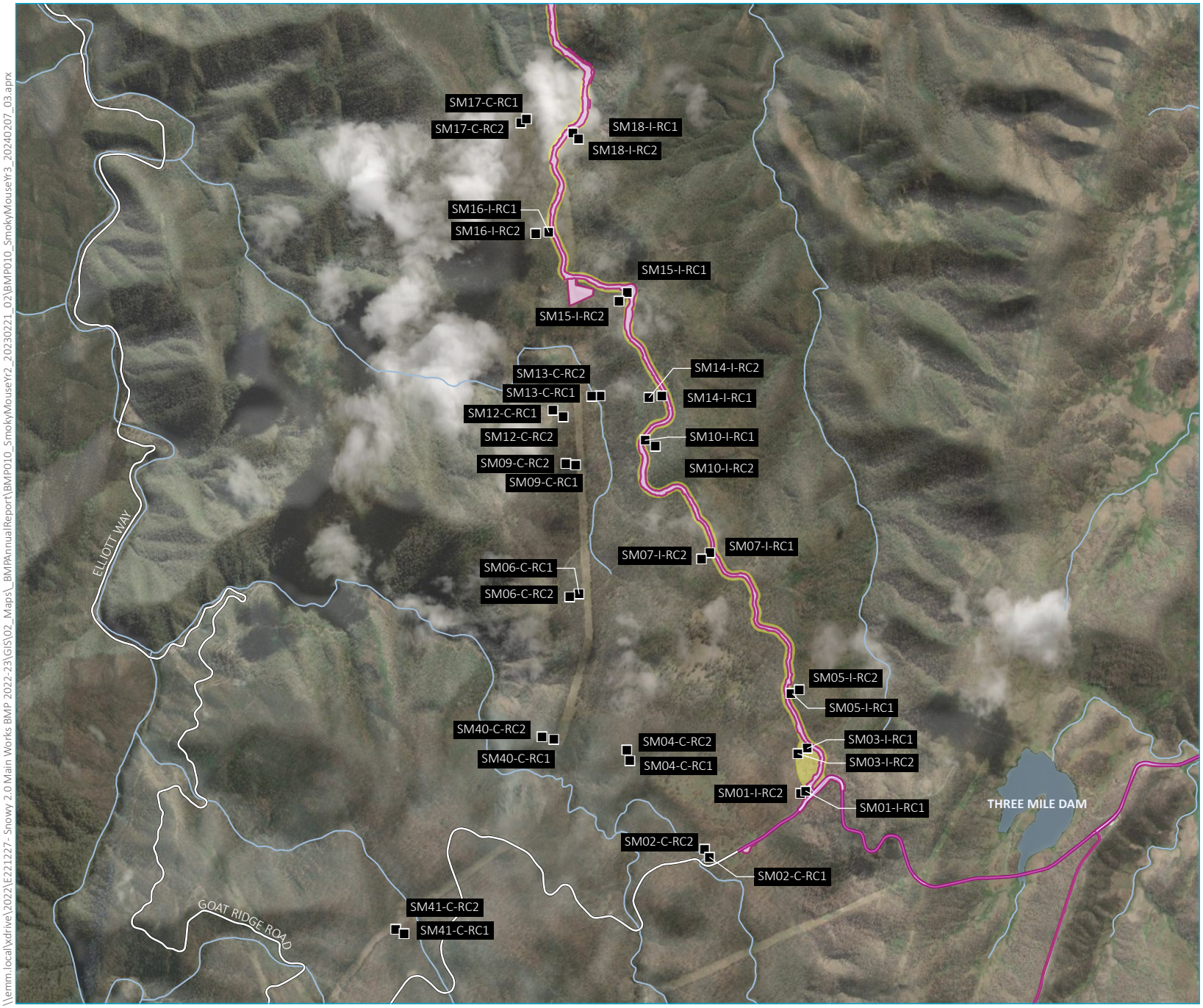
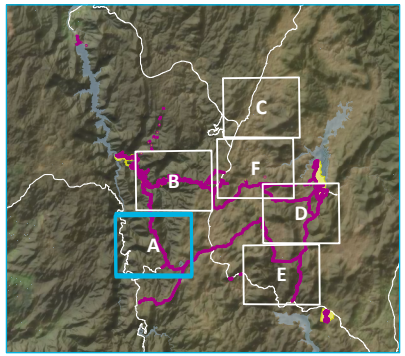


Plate 3.5 Year 2 and Year 3 Smoky Mouse presence compared to baseline (Year 1)





KEY

Approved disturbance

Approved construction envelope

Camera records- Smoky Mouse

Absense

Existing environment

Major road

Minor road

Named watercourse

Waterbody

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

N

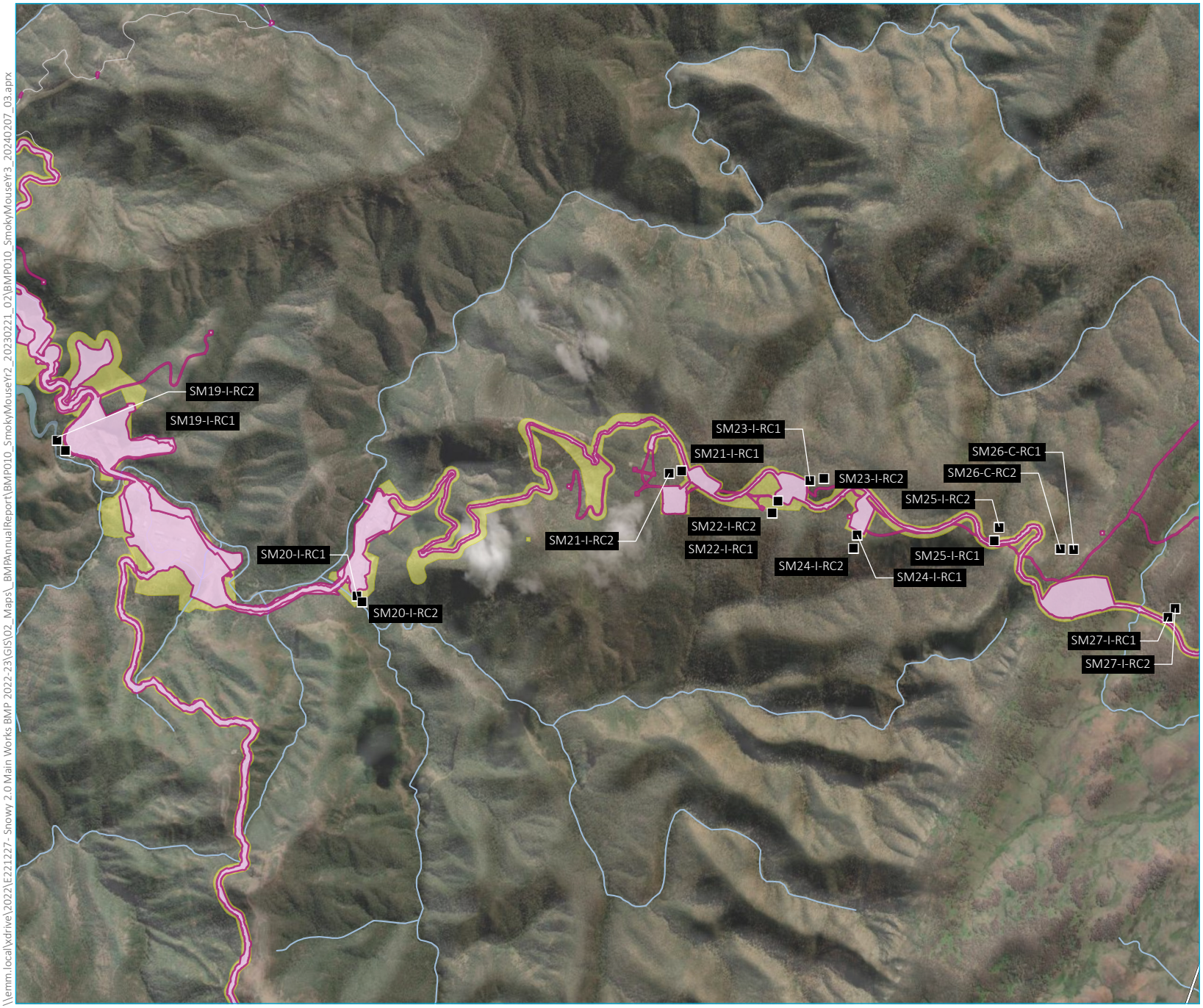
\\emm.localvxdrive\2022\E221227- Snowy 2.0 Main Works BMP 2022-23\GIS\02_Maps_BMPAnnualReport\BMP010_SmokyMouseYr2_20230221_02\BMP010_SmokyMouseYr3_20240207_03.aprx

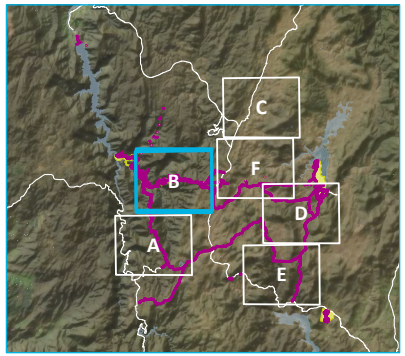
Smoky Mouse presence/absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.2

snowy 2.0

EMM creating opportunities





KEY

Approved disturbance

Approved construction envelope

Camera records- Smoky Mouse

Absense

Existing environment

Major road

Minor road

Named watercourse

Waterbody

\\emm.local\xdrive\2022\E221227- Snowy 2.0 Main Works BMP 2022-23\GIS\02_Maps_BMPAnnualReport\BMP010_SmokyMouseYr2_20230221_02\BMP010_SmokyMouseYr3_20240207_03.aprx

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

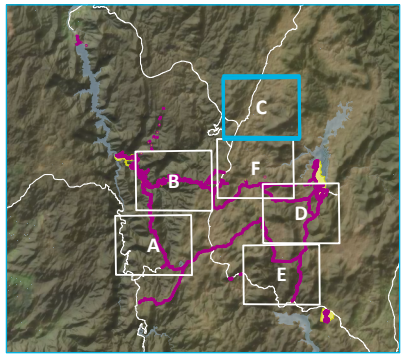
N

Smoky Mouse presence/absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.2

snowy 2.0

EMM creating opportunities



KEY

Approved disturbance

Approved construction envelope

Camera records- Smoky Mouse

Absense

Existing environment

Major road

Minor road

Named watercourse

Waterbody

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Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

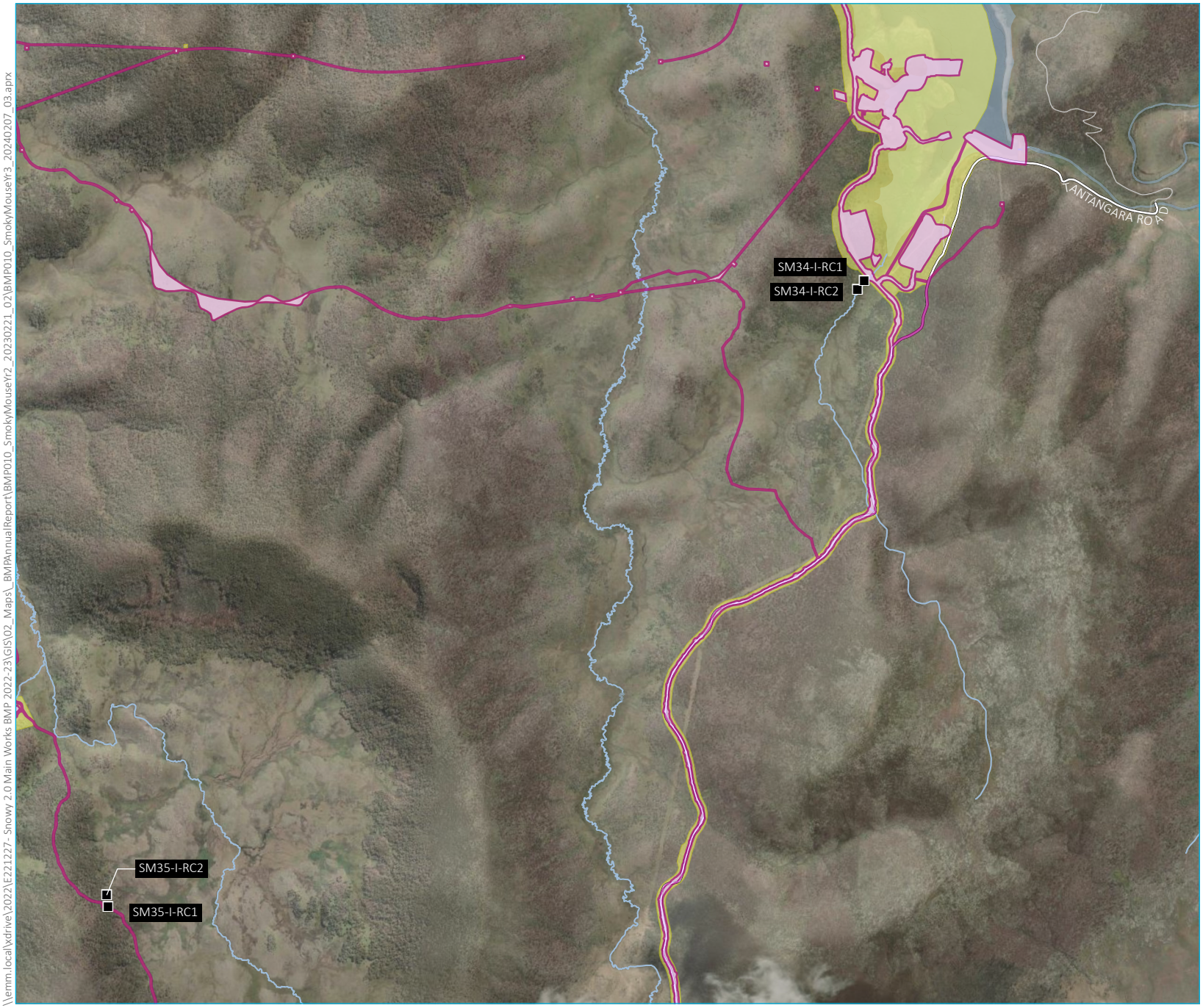
N

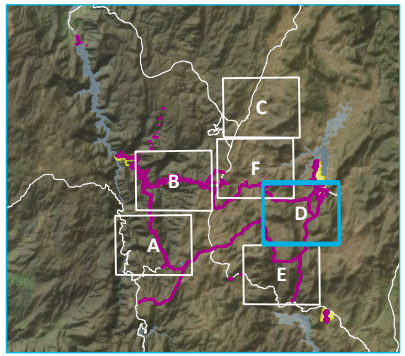
Smoky Mouse presence/absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.2

snowy 2.0

EMM creating opportunities





KEY

- Approved disturbance
- Approved construction envelope

Camera records- Smoky Mouse

- Absense

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

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Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

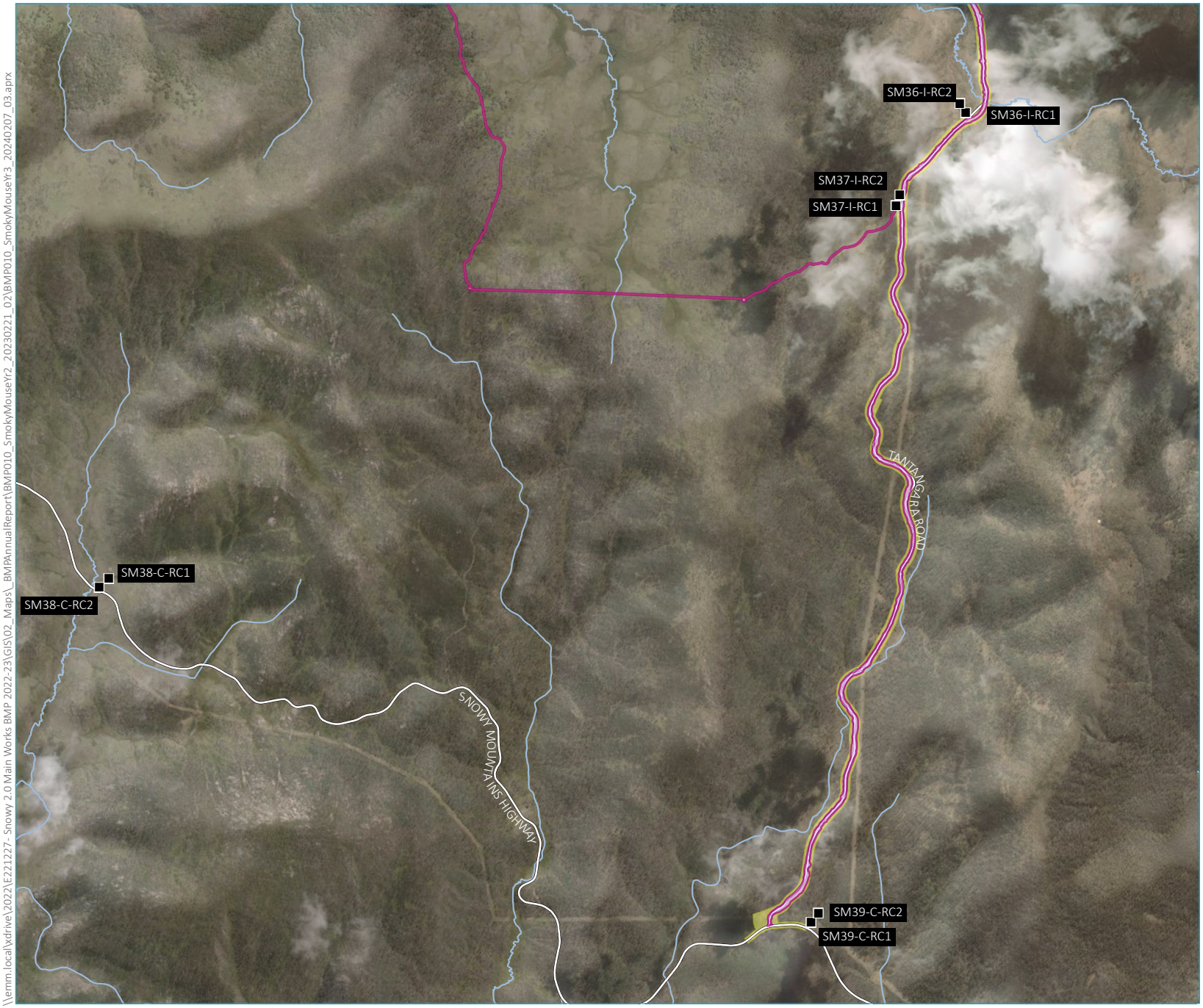
N

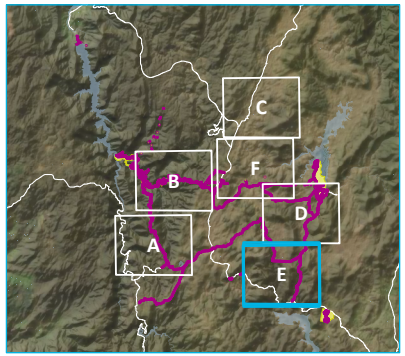
Smoky Mouse presence/absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.2

snowy 2.0

EMM creating opportunities





KEY

Approved disturbance

Approved construction envelope

Camera records- Smoky Mouse

Absense

Existing environment

Major road

Named watercourse

Waterbody

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Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

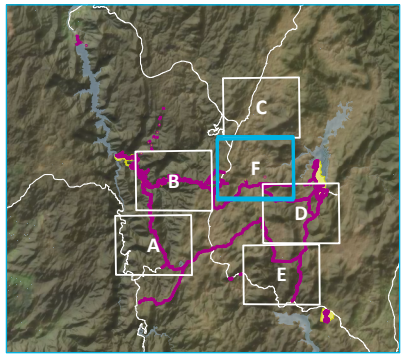
N

Smoky Mouse presence/absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.2

snowy 2.0

EMM creating opportunities



KEY

Approved disturbance

Approved construction envelope

Camera records- Smoky Mouse

Absense

Existing environment

Major road

Named watercourse

Waterbody

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Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

N

Smoky Mouse presence/absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.2

snowy 2.0

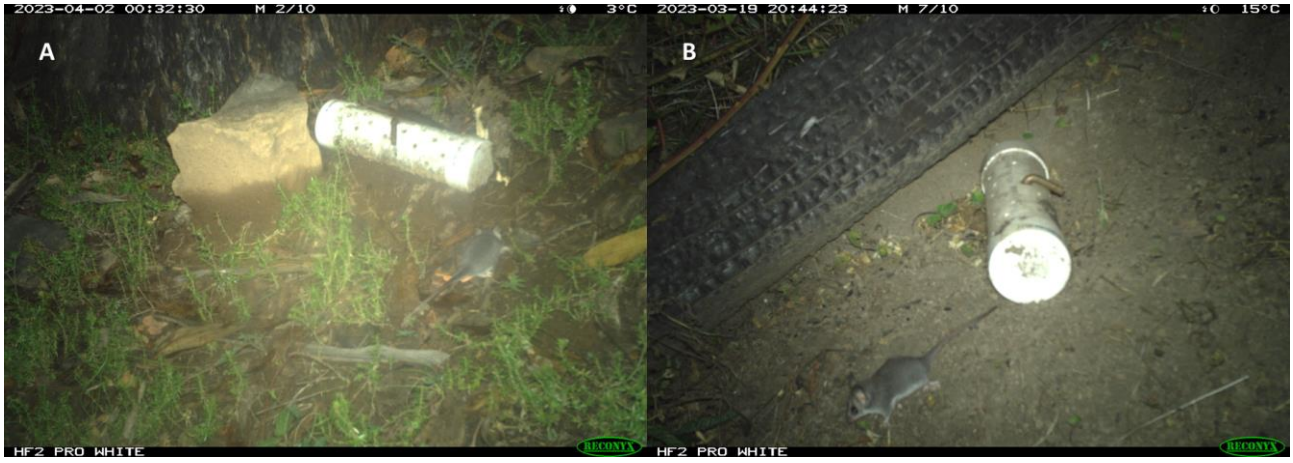
EMM creating opportunities

ii Eastern Pygmy-possum

a Year 3

The Eastern Pygmy-possum (*Cercartetus nanus*) (Photograph 3.1) was recorded at 20 sites during Year 3, including 12 impact sites (SM3-I, SM5-I, SM10-I, SM14-I, SM15-I, SM16-I, SM20-I, SM21-I, SM22-I, SM23-I, SM24-I, SM25-I) and 8 control sites (SM04-C, SM06-C, SM09-C, SM12-C, SM13-C, SM17-C, SM40-C and SM41-C) (Figure 3.3). The records at the 12 impact sites represent presence at 55% of all impact monitoring sites and 67% of impact sites supporting suitable habitat for the Eastern Pygmy-possum.

Throughout the year, Q2 was the season which observed the species at the most sites. During Q1, the Eastern Pygmy-possum was recorded at seven impact sites (SM15-I, SM16-I, SM21-I, SM22-I, SM23-I, SM24-I and SM25-I) and two control sites (SM06-C and SM17-C), representing 23% of all sites surveyed. During Q2, the Eastern Pygmy-possum was recorded at eight impact sites (SM05-I, SM14-I, SM15-I, SM16-I, SM21-I, SM23-I, SM24-I and SM25-I) and five control sites (SM06-C, SM09-C, SM13-C, SM40-C and SM41-C), representing 33% of all sites surveyed. During Q3, the Eastern Pygmy-possum was recorded at no impact sites or control sites. During Q4, the Eastern Pygmy-possum was recorded at seven impact sites (SM03-I, SM10-I, SM20-I, SM21-I, SM22-I, SM24-I and SM25-I) and six control sites (SM04-C, SM06-C, SM09-C, SM12-C, SM13-C and SM40-C), representing 33% of all sites surveyed.



Photograph 3.1 Eastern Pygmy-possum recorded from site SM06-C-RC1 (A) and SM13-C-RC1 (B) in Year 3

Eastern Pygmy-possum presence/absence at each monitoring site is summarised in Table 3.3 and presented in Plate 3.6. Further detailed information including monitoring dates and presence/absence at each camera is provided in Appendix E.1.

Table 3.3 Eastern Pygmy-possum remote camera records (Year 3)

Site	Previously recorded in Year 1	Previously recorded in Year 2	Q1 (Summer)	Q2 (Autumn)	Q3 (Winter)	Q4 (Spring)
Impact						
SM01-I	No	Yes (Q1 (Summer))				
SM03-I	Yes (Q2 (Autumn))	Yes (Q1 (Summer))				Present
SM05-I	Yes (Q3 (Winter))			Present		
SM07-I	Yes (Q2 (Autumn))					
SM10-I	Yes (Q1 (Summer))					Present
SM14-I	Yes (Q4 (Spring))	Yes (Q4 (Spring))		Present		
SM15-I	Yes (Q2 (Autumn))	Yes (Q2 (Autumn))	Present	Present		
SM16-I	Yes (Q2 (Autumn))	Yes (Q2 (Autumn))	Present	Present		
SM18-I	Yes (Q1 (Summer))					
SM19-I	No	Yes (Q2 (Autumn))				
SM20-I	Yes (Q2 (Autumn))					Present
SM21-I	Yes (Q4 (Spring))	Yes (Q1 (Summer))	Present	Present		Present
SM22-I	Yes (Q2 (Autumn))		Present			Present
SM23-I	Yes (Q4 (Spring))	Yes (Q2 (Autumn))	Present	Present		
SM24-I	Yes (Q2 (Autumn))	Yes (Q2 (Autumn))	Present	Present		Present
SM25-I	No	Yes (Q4 (Spring))	Present	Present		Present
SM26-I	No					
SM27-I	No					
SM34-I	No					
SM35-I	No	Yes (Q2 (Autumn))				
SM36-I	No					
SM37-I	No					

Table 3.3 Eastern Pygmy-possum remote camera records (Year 3)

Site	Previously recorded in Year 1	Previously recorded in Year 2	Q1 (Summer)	Q2 (Autumn)	Q3 (Winter)	Q4 (Spring)
Total sites where detected	**13**	**11**	**7**	**8**	**0**	**7**
Total sites where detected (% of total impact sites)	**59%**	**50%**	**32%**	**36%**	**0%**	**32%**
Control						
SM02-C	Yes (Q4 (Spring))					
SM04-C	Yes (Q2 (Autumn))					Present
SM06-C	Yes (Q2 (Autumn))	Yes (Q4 (Spring))	Present	Present		Present
SM09-C	Yes (Q4 (Spring))	Yes (Q2 (Autumn))		Present		Present
SM12-C	No	Yes (Q3 (Winter))				Present
SM13-C	No	Yes (Q2 (Autumn))		Present		Present
SM17-C	Yes (Q2 (Autumn))	Yes (Q2 (Autumn))	Present			
SM28-C	No					
SM29-C	No	Yes (Q2 (Autumn))				
SM30-C	No					
SM31-C	No					
SM32-C	No					
SM33-C	No					
SM38-C	No					
SM39-C	No					
SM40-C	Yes (Q4 (Spring))			Present		Present
SM41-C	No	Yes (Q2 (Autumn))		Present		
Total sites where detected	**6**	**7**	**2**	**5**	**0**	**6**
Total sites where detected (% of total control sites)	**35%**	**41%**	**12%**	**29%**	**0%**	**35%**

Table 3.3 Eastern Pygmy-possum remote camera records (Year 3)

Site	Previously recorded in Year 1	Previously recorded in Year 2	Q1 (Summer)	Q2 (Autumn)	Q3 (Winter)	Q4 (Spring)
TOTAL (impact and control)	***19 (49%)***	***8 (21%)***	***9 (23%)***	***13 (33%)***	***0 (0%)***	***13 (33%)***

Notes: Cells highlighted in grey represent sites with unsuitable habitat for the Eastern Pygmy-possum. Blank cells represent absence of species.

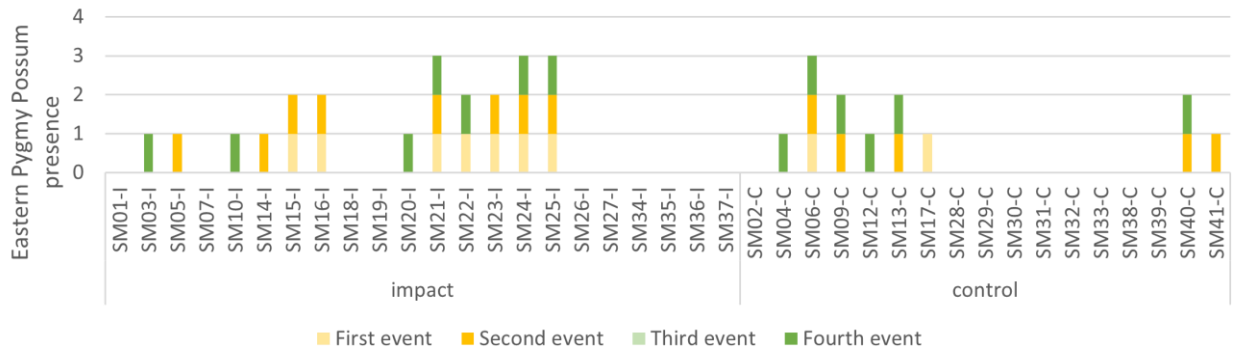


Plate 3.6 Eastern Pygmy-possum presence across monitoring periods (Year 3)

b Comparative analysis- Year 1, Year 2 and Year 3

A slight decline in the number of monitoring sites that reported Eastern Pygmy-possum presence was observed between Year 1 (19) and Year 2 (18), representing a 5% decline. In Year 3, 20 monitoring sites recorded presence of the species, determining a slight increase in respect to Year 1 (5%) and Year 2 (10%).

In Year 3, the Eastern Pygmy-possum was not recorded at ten impact sites (SM01-I, SM05-I, SM07-I, SM14-I, SM15-I, SM16-I, SM18-I, SM19-I, SM23-I and SM35-I) that previously recorded the species. Amongst these, five impact sites that previously recorded Eastern Pygmy-possum presence have recorded the absence for greater than one year (SM01-I, SM07-I, SM18-I, SM19-I and SM35-I). Two control sites also recorded the absence of the species for greater than one year (SM02-C and SM29-C).

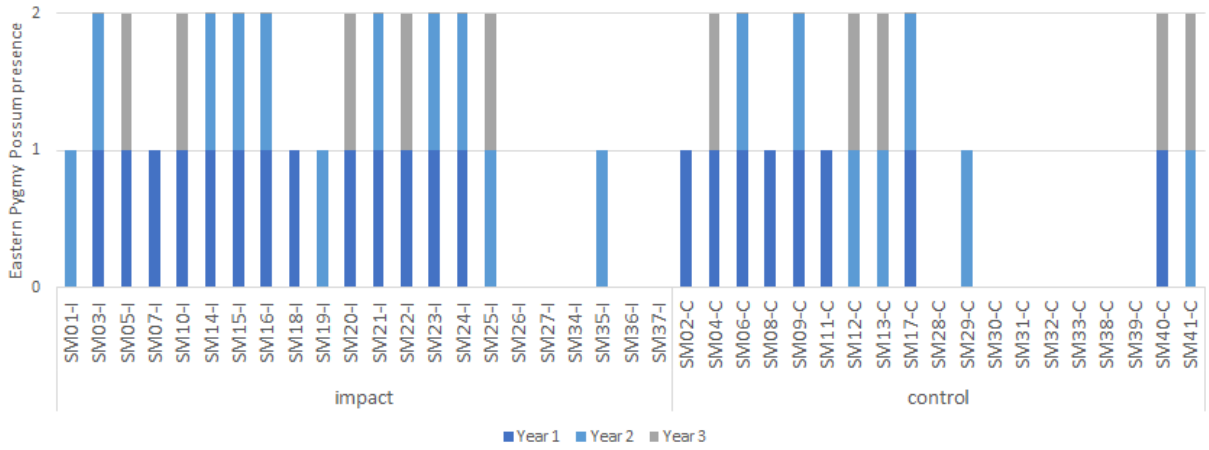
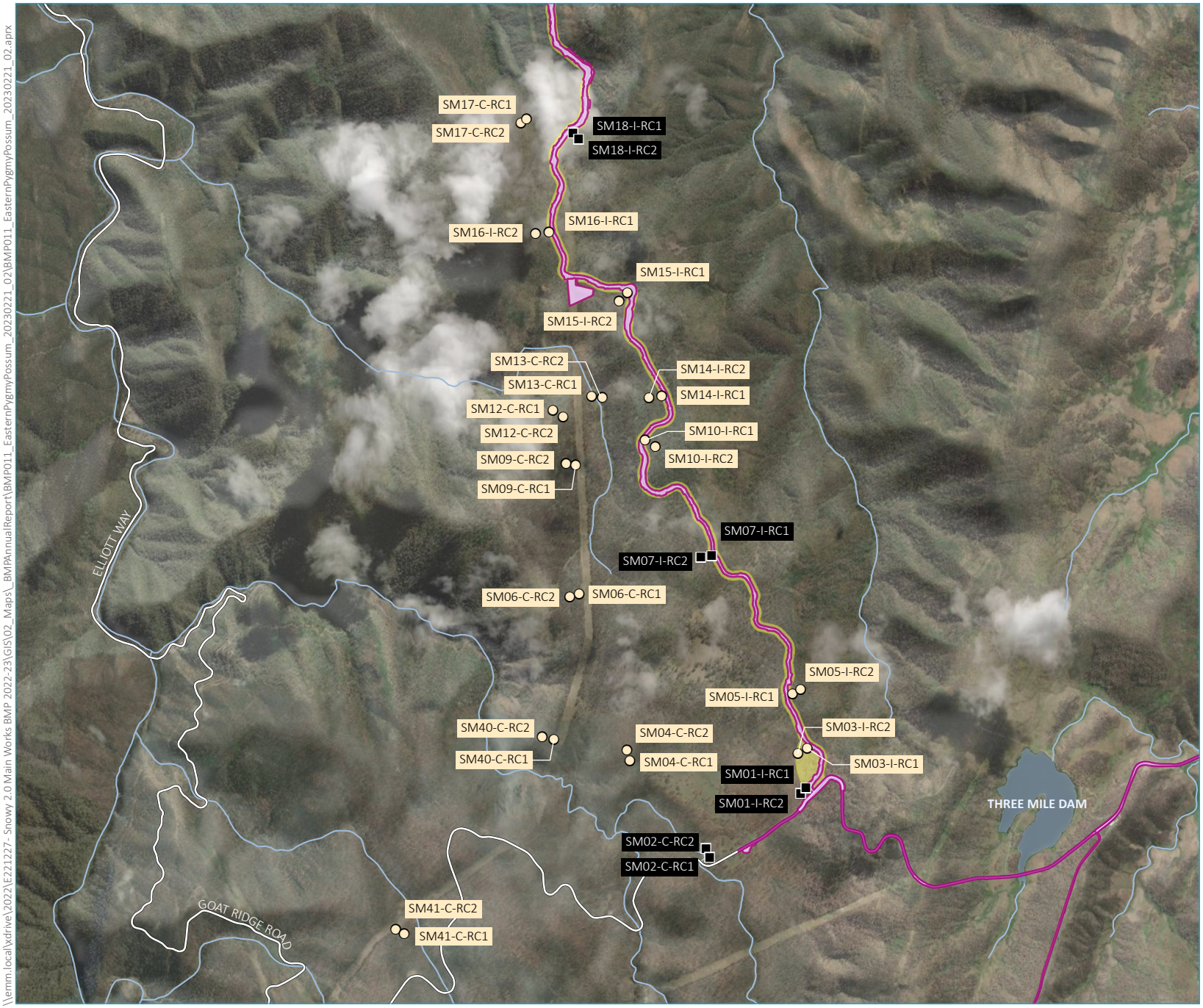
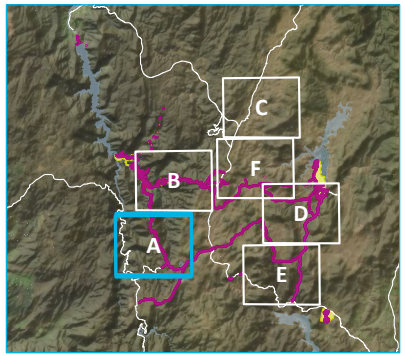


Plate 3.7 Year 2 and Year 3 Eastern Pygmy-possum presence compared to baseline (Year 1)





KEY

Approved disturbance

Approved construction envelope

Camera records- Eastern Pygmy Possum

Absence

Presence

Existing environment

Major road

Minor road

Named watercourse

Waterbody

Eastern Pygmy-possum presence/ absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.3

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

N

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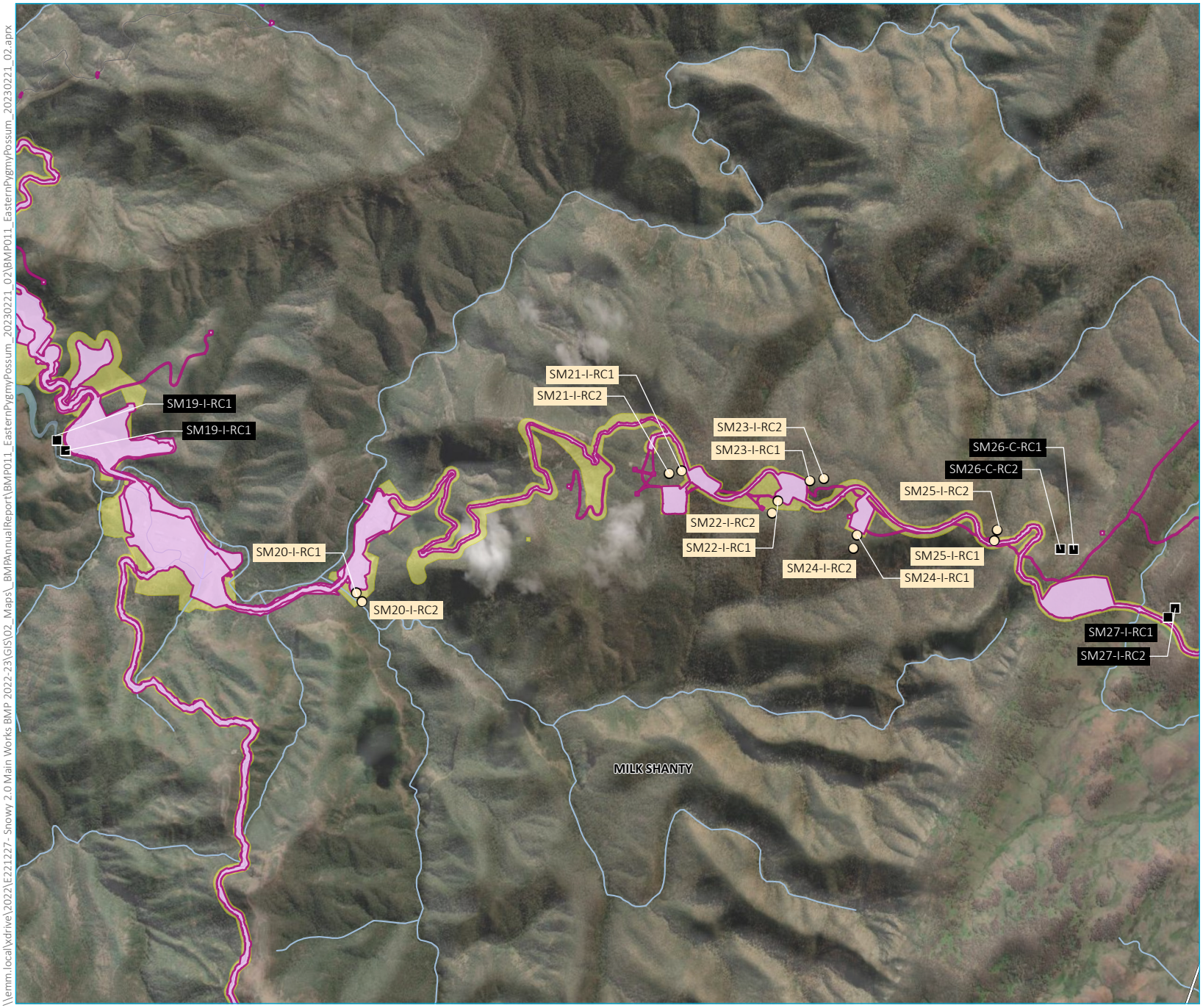

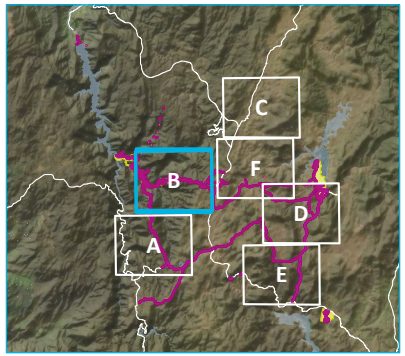

KEY

Approved disturbance

Approved construction envelope

Camera records- Eastern Pygmy Possum

Absence

Presence

Existing environment

Major road

Minor road

Named watercourse

Waterbody

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Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

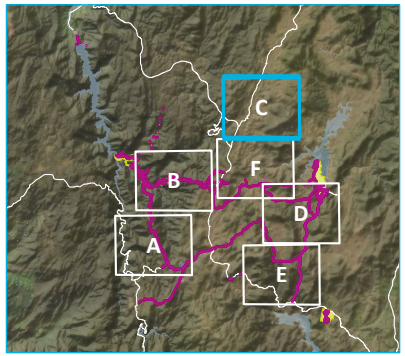
N

Eastern Pygmy-possum presence/ absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.3

snowy 2.0

EMM creating opportunities



KEY

Approved disturbance

Approved construction envelope

Camera records- Eastern Pygmy Possum

Absence

Existing environment

Major road

Minor road

Named watercourse

Waterbody

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Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

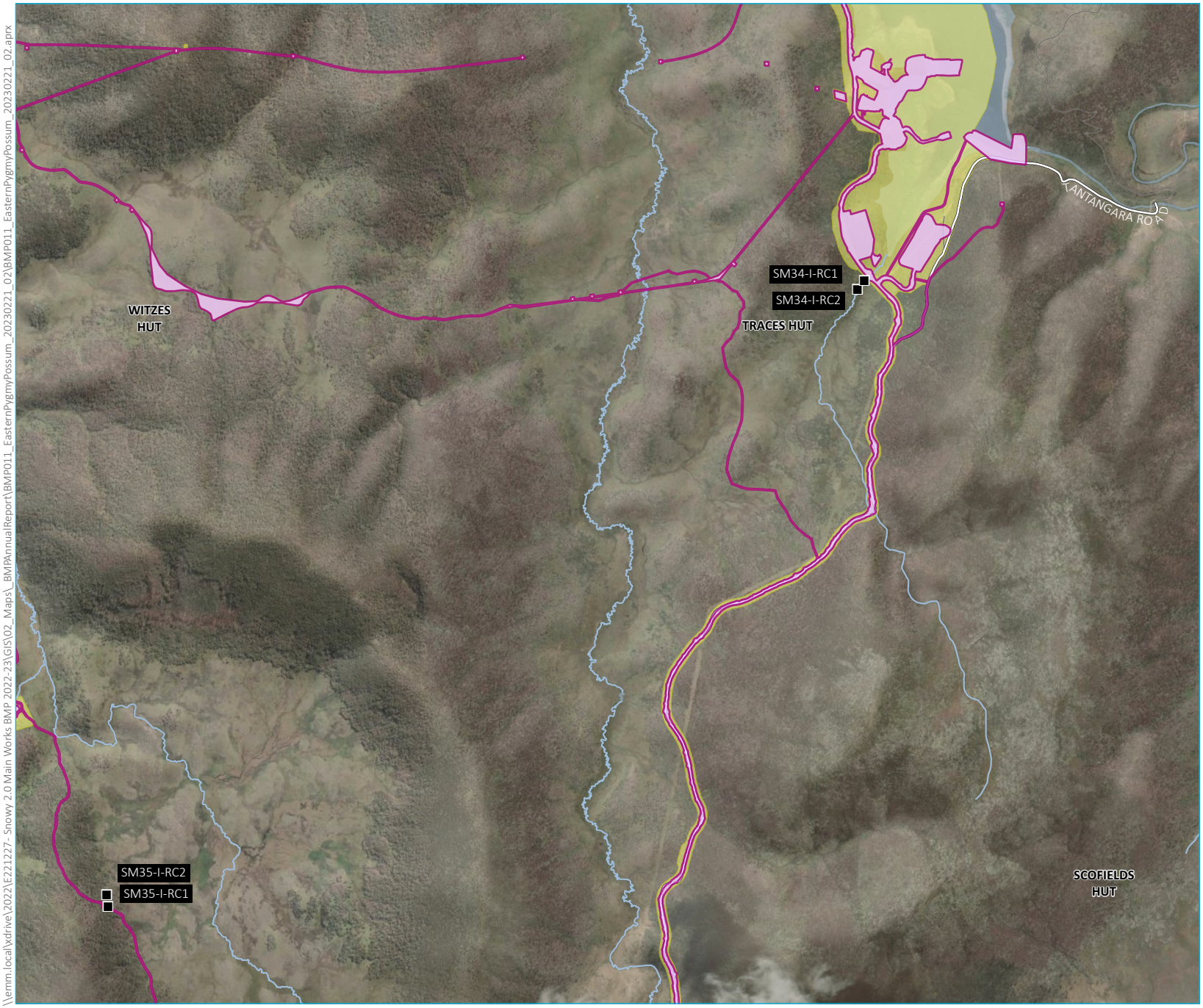
N

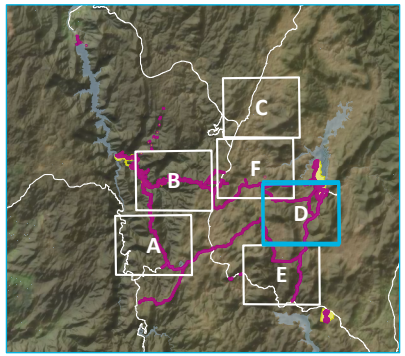
Eastern Pygmy-possum presence/ absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.3

snowy 2.0

EMM creating opportunities





KEY

Approved disturbance

Approved construction envelope

Camera records- Eastern Pygmy Possum

Absence

Existing environment

Major road

Minor road

Named watercourse

Waterbody

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Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

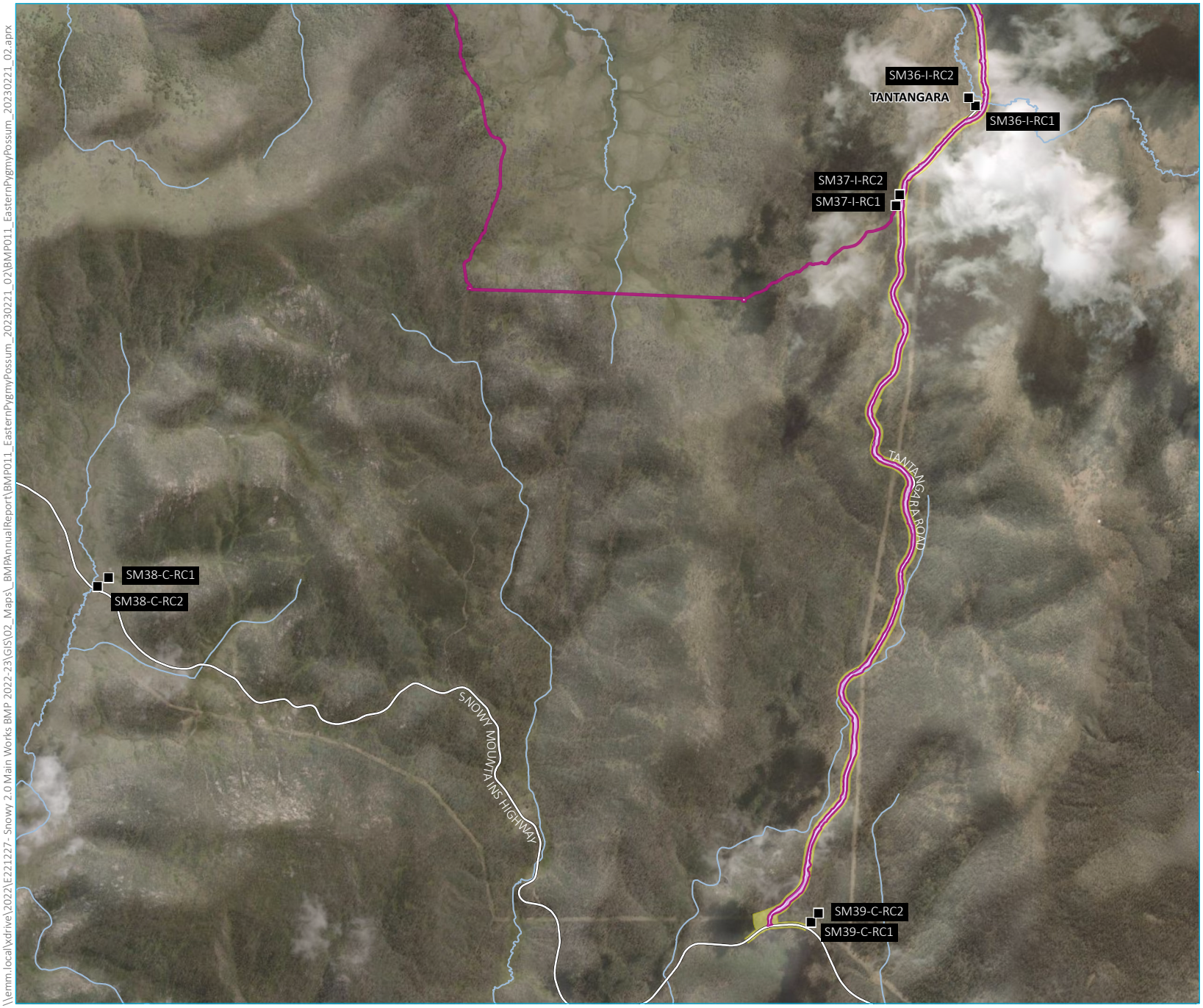
N

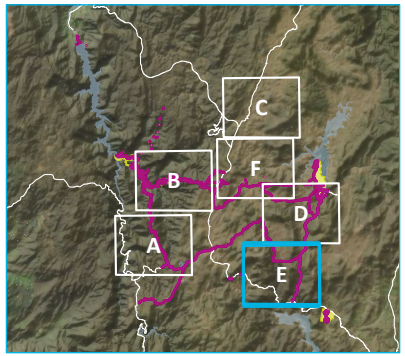
Eastern Pygmy-possum presence/ absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.3

snowy 2.0

EMM creating opportunities





KEY

Approved disturbance

Approved construction envelope

Camera records- Eastern Pygmy Possum

Absence

Existing environment

Major road

Minor road

Named watercourse

Waterbody

Eastern Pygmy-possum presence/ absence during Year 3

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

N

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.3

snowy 2.0

EMM creating opportunities

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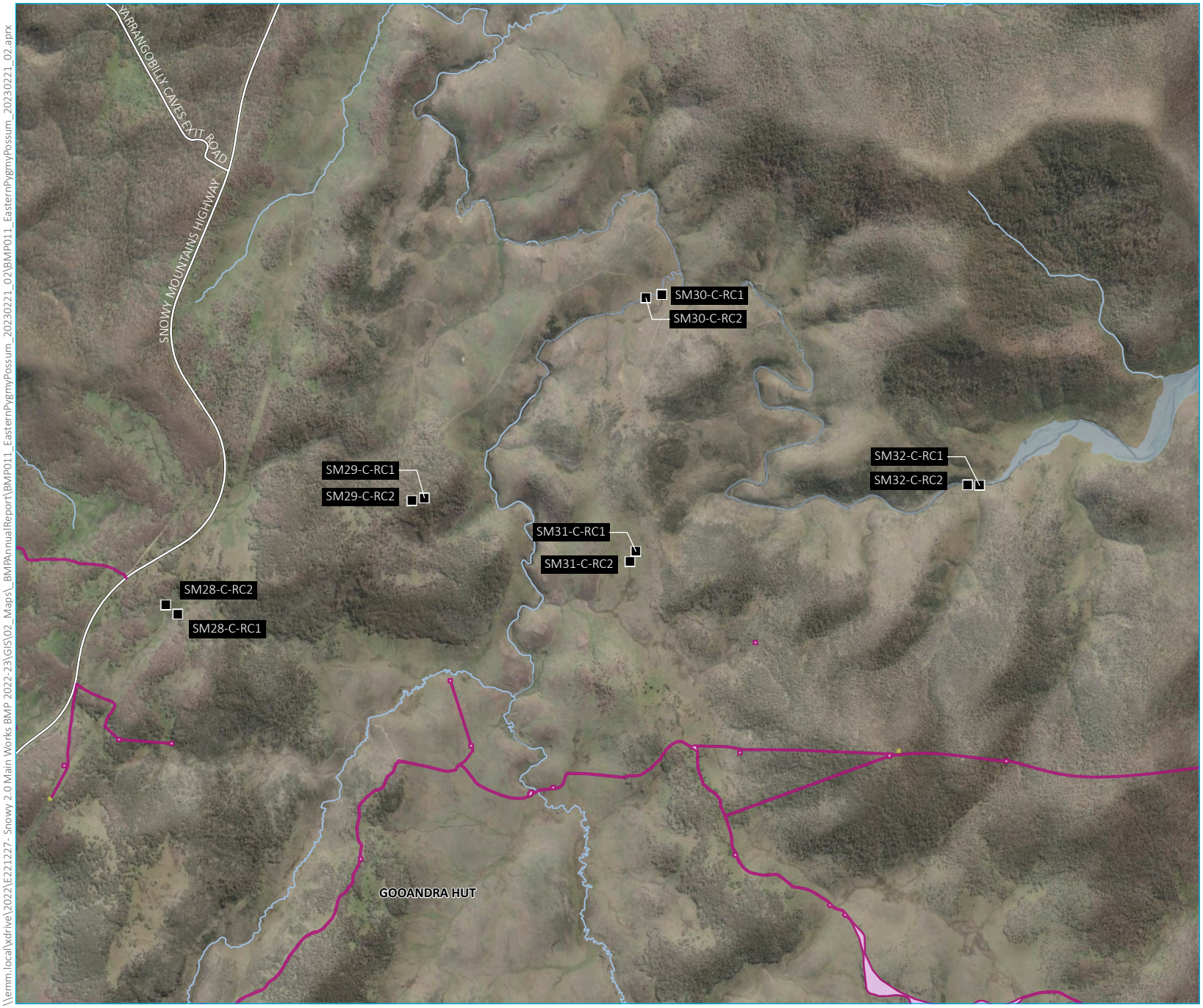

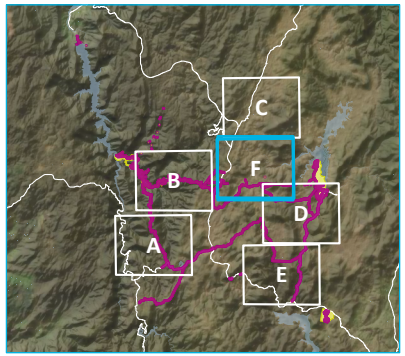

KEY

Approved disturbance

Approved construction envelope

Camera records- Eastern Pygmy Possum

Absence

Existing environment

Major road

Named watercourse

Waterbody

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Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

N

Eastern Pygmy-possum presence/ absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.3

snowy 2.0

EMM creating opportunities

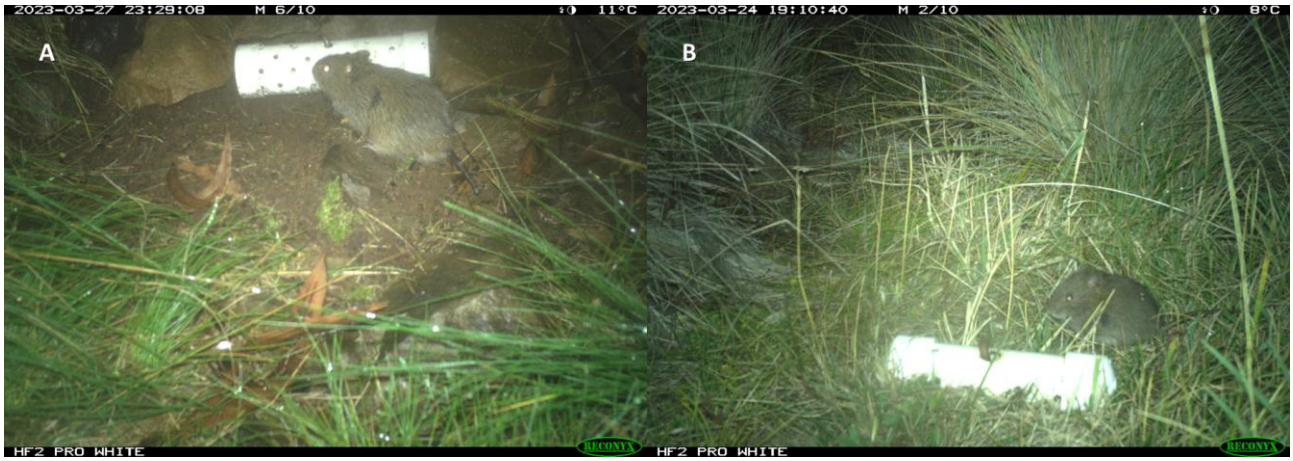
iii Broad-toothed Rat

a Camera traps

Year 3

The Broad-toothed Rat (*Mastacomys fuscus*) (Photograph 3.2) was recorded at ten sites during Year 3, including two impact sites (SM01-I and SM34-I) and eight control sites (SM02-C, SM04-C, SM28-C, SM30-C, SM31-C, SM32-C, SM33-C and SM39-C) (Figure 3.4). The records at the two impact sites represent presence at 2% of all impact monitoring sites and 50% of impact sites supporting suitable habitat for the Broad-toothed Rat.

During Q1, the Broad-toothed Rat was recorded at no impact sites and three control sites (SM30-C, SM32-C and SM39-C), representing 8% of all sites surveyed. During Q2, the Broad-toothed Rat was recorded at one impact site (SM34-I) and five control sites (SM02-C, SM30-C, SM32-C, SM33-C and SM39-C), representing again 15% of all sites surveyed. During Q3, the species was recorded at two impact sites (SM01-I and SM34-I) and eight control sites (SM02-C, SM04-C, SM28-C, SM30-C, SM31-C, SM32-C, SM33-C and SM39-C), representing 26% of all sites surveyed. During Q4, the Broad-toothed Rat was recorded at no impact sites and eight control sites (SM02-C, SM04-C, SM28-C, SM30-C, SM31-C, SM32-C, SM33-C and SM39-C), representing 21% of all sites surveyed.



Photograph 3.2 Broad-toothed Rat recorded in Year 3 from site SM02-C-RC2 (A) and SM32-C-RC2 (B)

Broad-toothed Rat presence/absence at each monitoring site is summarised in Table 3.4 and presence at sites is presented in Plate 3.8.

Further detailed information including monitoring dates and presence/absence at each camera is provided in Appendix E.1.

Table 3.4 Broad-toothed Rat remote camera records

Site	Previously recorded in Year 1	Previously recorded in Year 2	Q1 (Summer)	Q2 (Autumn)	Q3 (Winter)	Q4 (Spring)
Impact						
SM01-I	No	Yes (Q3 (Winter))			Present	
SM03-I	No					
SM05-I	No					
SM07-I	No	Yes (Q3 (Winter))				
SM10-I	No					
SM14-I	No					
SM15-I	No					
SM16-I	No					
SM18-I	No					
SM19-I	No					
SM20-I	No					
SM21-I	No					
SM22-I	No					
SM23-I	No					
SM24-I	No					
SM25-I	No					
SM26-I	No					
SM27-I	No					
SM34-I	No			Present	Present	
SM35-I	No					
SM36-I	No	Yes (Q2 (Autumn))				
SM37-I	No					
Total sites where detected	**0**	**3**	**0**	**1**	**2**	**0**
Total sites where detected (% of total impact sites)	**0%**	**14%**	**0%**	**5%**	**9%**	**0%**

Table 3.4 Broad-toothed Rat remote camera records

Site	Previously recorded in Year 1	Previously recorded in Year 2	Q1 (Summer)	Q2 (Autumn)	Q3 (Winter)	Q4 (Spring)
Control						
SM02-C	No			Present	Present	Present
SM04-C	No				Present	Present
SM06-C	No					
SM09-C	No					
SM12-C	No					
SM13-C	No					
SM17-C	No					
SM28-C	Yes (Q3 (Winter))				Present	Present
SM29-C	No					
SM30-C	Yes (Q4 (Spring))	Yes (Q4 (Spring))	Present	Present	Present	Present
SM31-C	No	Yes (Q4 (Spring))			Present	Present
SM32-C	Yes (Q4 (Spring))	Yes (Q3 (Winter))	Present	Present	Present	Present
SM33-C	Yes (Q2 (Autumn))	Yes (Q4 (Spring))		Present	Present	Present
SM38-C	Yes (Q2 (Autumn))	Yes (Q3 (Winter))				
SM39-C	Yes (Q4 (Spring))	Yes (Q4 (Spring))	Present	Present	Present	Present
SM40-C	No					
SM41-C	No					
Total sites where detected	**6**	**6**	**3**	**5**	**8**	**8**
Total sites where detected (% of total control sites)	**35%**	**35%**	**18%**	**29%**	**47%**	**47%**
TOTAL (impact and control)	***6 (15%)***	***9 (23%)***	***3 (8%)***	***6 (15%)***	***10 (26%)***	***8 (21%)***

Notes: Highlighted cells represent sites with unsuitable habitat for the Broad-toothed Rat. Blank cells represent absence of species.

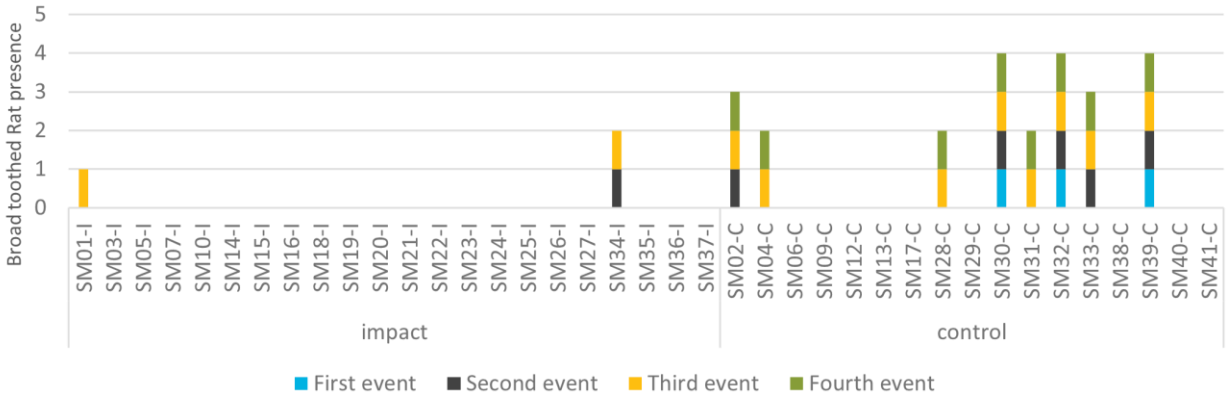


Plate 3.8 Year 2 and Year 3 Broad-toothed Rat presence compared to baseline (Year 1)

Comparative analysis- Year 1, Year 2 and Year 3

A increase in the number of monitoring sites that reported Broad-toothed Rat presence was observed between Year 1 (six) and Year 2 (nine), representing a 50% increase. In Year 3, 10 monitoring sites recorded presence of the species, determining an increase in respect to Year 1 (40%) and Year 2 (10%).

In Year 3, the Broad-toothed Rat was not recorded at four impact sites (SM01-I, SM07-I, SM34-I and SM36-I) that previously recorded the species. Amongst these, two impact sites that previously detected the presence of Broad-toothed Rat did not record the species for greater than one year (SM07-I and SM36-I). One control site, which previously recorded Broad-toothed Rat presence, also recorded the absence of the species for greater than one year (SM39-C).

A comparison of Year 2 and Year 3 presence compared to Year 1 baseline is presented in Plate 3.12.

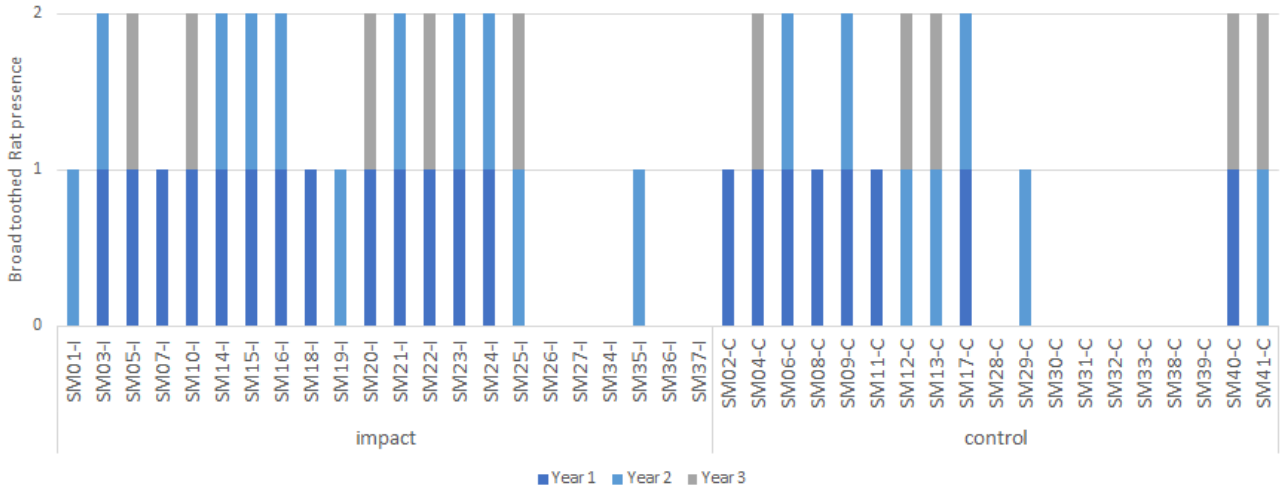


Plate 3.9 Year 2 and Year 3 Broad-toothed Rat presence compared to baseline (Year 1)

b Faecal Pellet Searches

Year 3

Broad-toothed Rat faecal pellet searches give an additional measure of occupancy (presence/absence) at monitoring sites where the species has been previously recorded.

During Year 3, Broad-toothed Rat (Photograph 3.2) faecal pellet searches were undertaken at all sites in all seasons (Figure 3.4). Broad-toothed Rat presence was recorded at all control sites and all impact sites. Across Year 3, control and impact sites comprised rare, uncommon, common, and abundant faecal pellets of all ages (fresh, intermediate, and old).

Broad-toothed Rat faecal pellet presence/absence at each monitoring site is summarised in Table 3.5 and presence at sites is presented in Plate 3.10. Further detailed information including monitoring dates is provided in Appendix E.

Table 3.5 Broad-toothed Rat faecal pellet presence, including abundance and age

Site	Monitoring event			
	First (Q1)	Second (Q2)	Third (Q3)	Fourth (Q4)
Impact				
FP17	Uncommon (old)	Uncommon (Fresh)	Abundant (Fresh)	Abundant (Fresh)
FP18	Rare (old)			
FP19	Rare (old)	Rare (Fresh)	Common (Intermediate)	Mixed (all types of abundance and ages)
FP20		Rare (Old)		
Control				
FP24	Uncommon (old)	Rare (Intermediate)	Abundant (Intermediate)	Abundant (Old)
FP30	Rare (intermediate)	Common (Intermediate)	Abundant (Intermediate)	Abundant (Fresh)
FP27				Rare (Intermediate)
FP30		Common (Fresh)	Abundant (Fresh)	Abundant (Old)
FP31	Rare (intermediate)	Uncommon (Intermediate)	Abundant (Intermediate)	Common (Intermediate)
FP32	Uncommon (old)	Abundant (Fresh)	Abundant (Fresh)	Abundant (Fresh)
FP33	Rare (old)	Abundant (Intermediate)	Uncommon (Intermediate)	Common (Old)

Notes: Faecal pellet abundance: Abundant >200 faecal pellets, common = 100-200 faecal pellets, uncommon = 50-100 faecal pellets, rare <50 faecal pellets and not present = no faecal pellets recorded; faecal pellet age: Old = completely dry, fresh = bright olive green, intermediate = between old and fresh; and blank cells represent absence of pellets at the monitoring site.

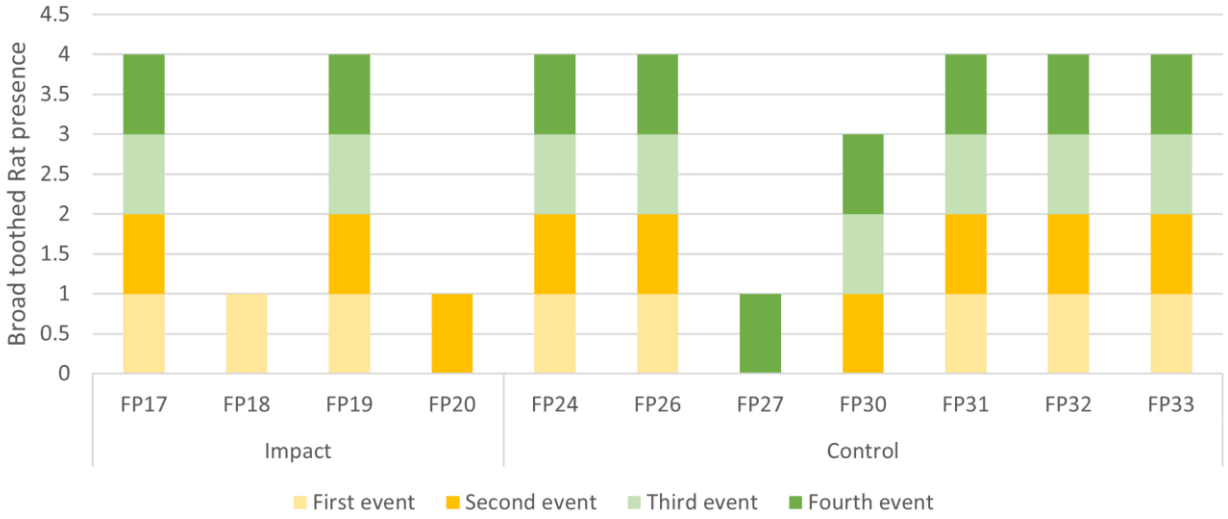


Plate 3.10 **Broad-toothed Rat faecal pellet presence across monitoring periods**

Comparative analysis- Year 1, Year 2 and Year 3

Between Year 1 and Year 2, an overall increase in the presence of Broad-toothed Rat faecal pellets was observed across all sites, with the exception of two impact sites (FP17 and FP20) and one control site (FP30). At these three sites, no change in Broad-toothed Rat faecal pellet presence was recorded. In Year 3, all sites recorded the presence of the target species across the same or higher numbers of monitoring events, except for impact site FP18, which was recorded only during one monitoring event in Year 3, two monitoring events in Year 2 and zero in Year 1. Impact site FP20 recorded the presence of the species for the first time in Year 3.

A comparison of Year 2 and Year 3 presence compared to Year 1 baseline is presented in Plate 3.11.

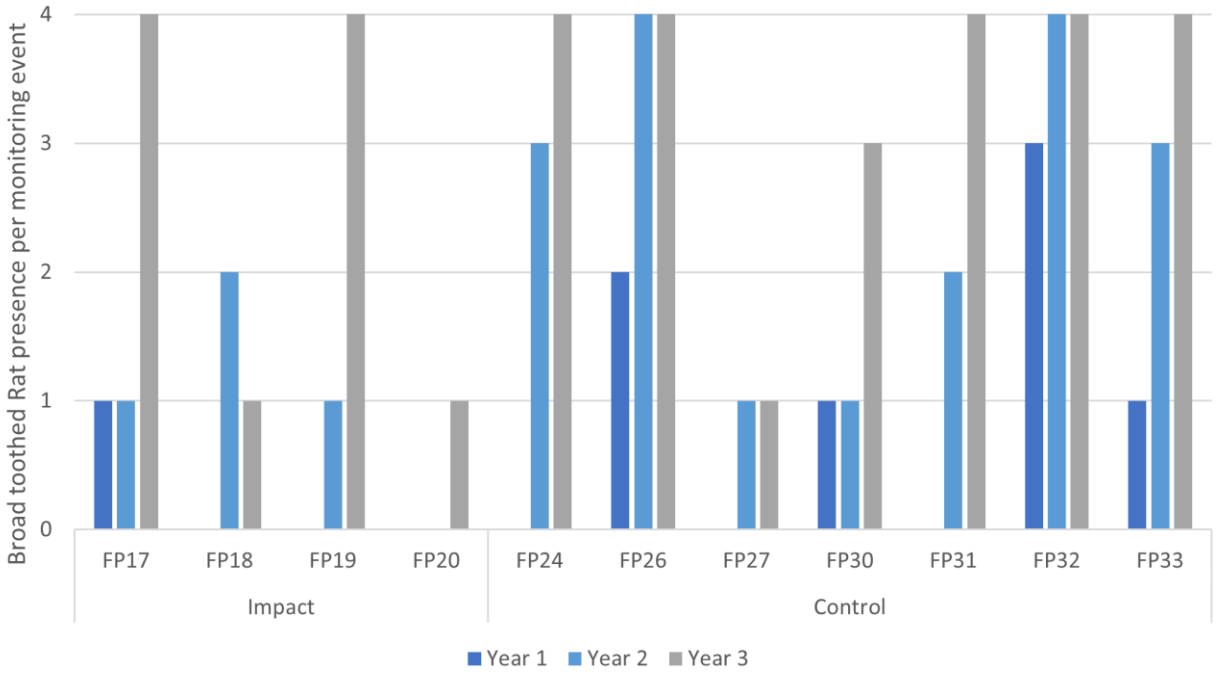


Plate 3.11 **Broad-toothed Rat faecal pellet presence during Year 2 and Year 3 compared to baseline (Year 1)**

In Year 2, the species' presence was recorded during the first monitoring event (Q1) for the first time. As per Year 1, also during Year 2 the greatest number of sites recording Broad-toothed Rat presence was documented in the third monitoring event. In Year 3, all the monitoring events presented similarly high numbers of sites recording the target species.

The presence recorded at the four monitoring events in Year 2 and Year 3 compared to Year 1 baseline is presented in Plate 3.12.

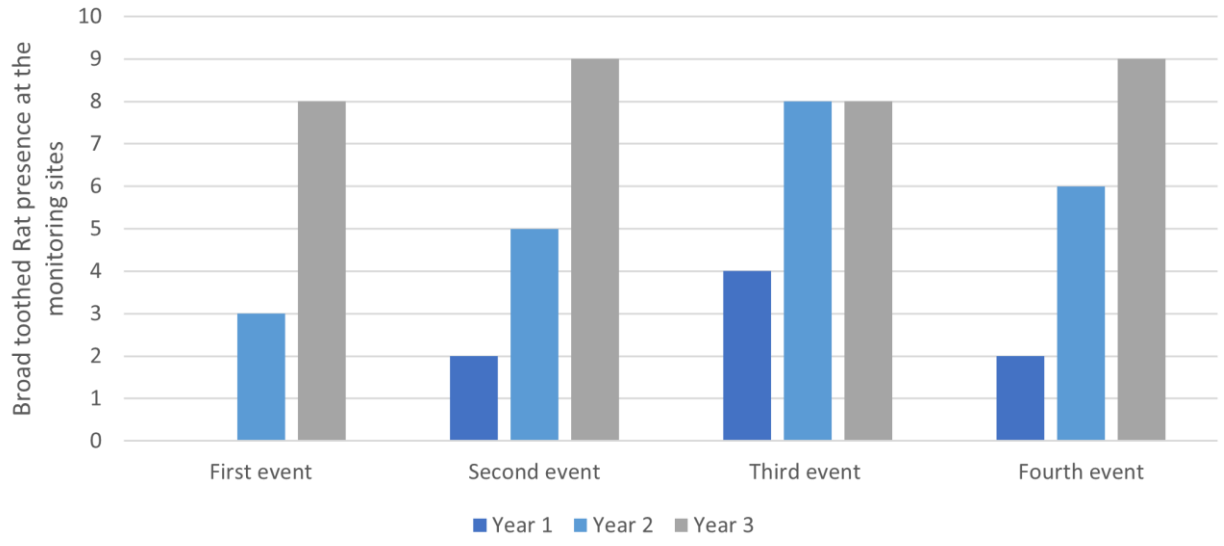
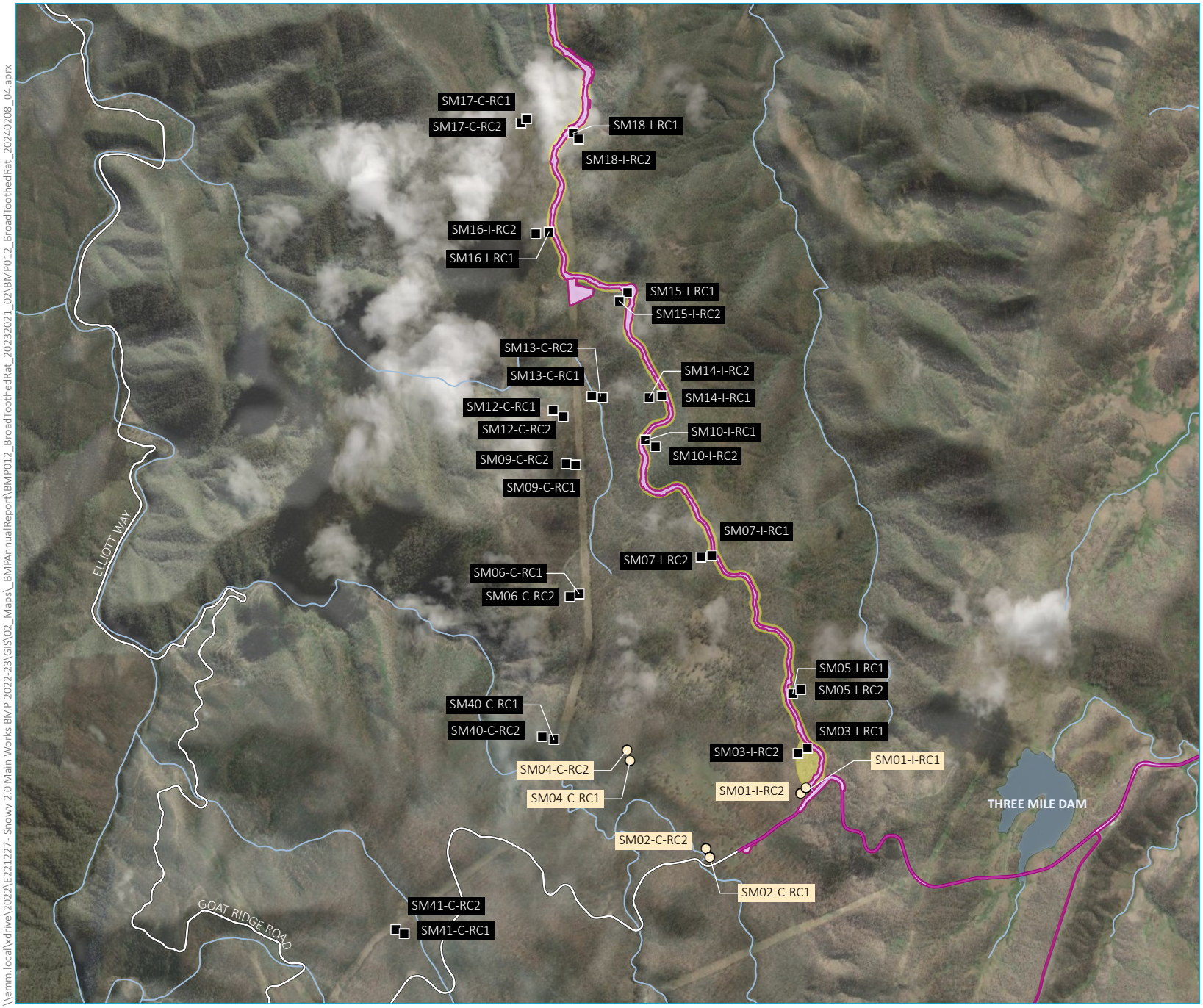
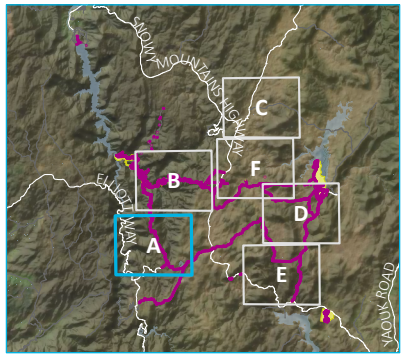


Plate 3.12 **Broad-toothed Rat faecal pellet presence recorded at the monitoring sites during the four monitoring events of Year 2 and Year 3 compared to baseline (Year 1)**





KEY

- Approved disturbance
- Approved construction envelope

Camera records- Broad-toothed Rat

- Absence
- Presence

Faecal records- Broad-toothed Rat

- Absence
- Presence

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

Broad-toothed Rat presence/ absence during Year 3

Snowy 2.0
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Figure 3.4

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km
GDA 1994 MGA Zone 55

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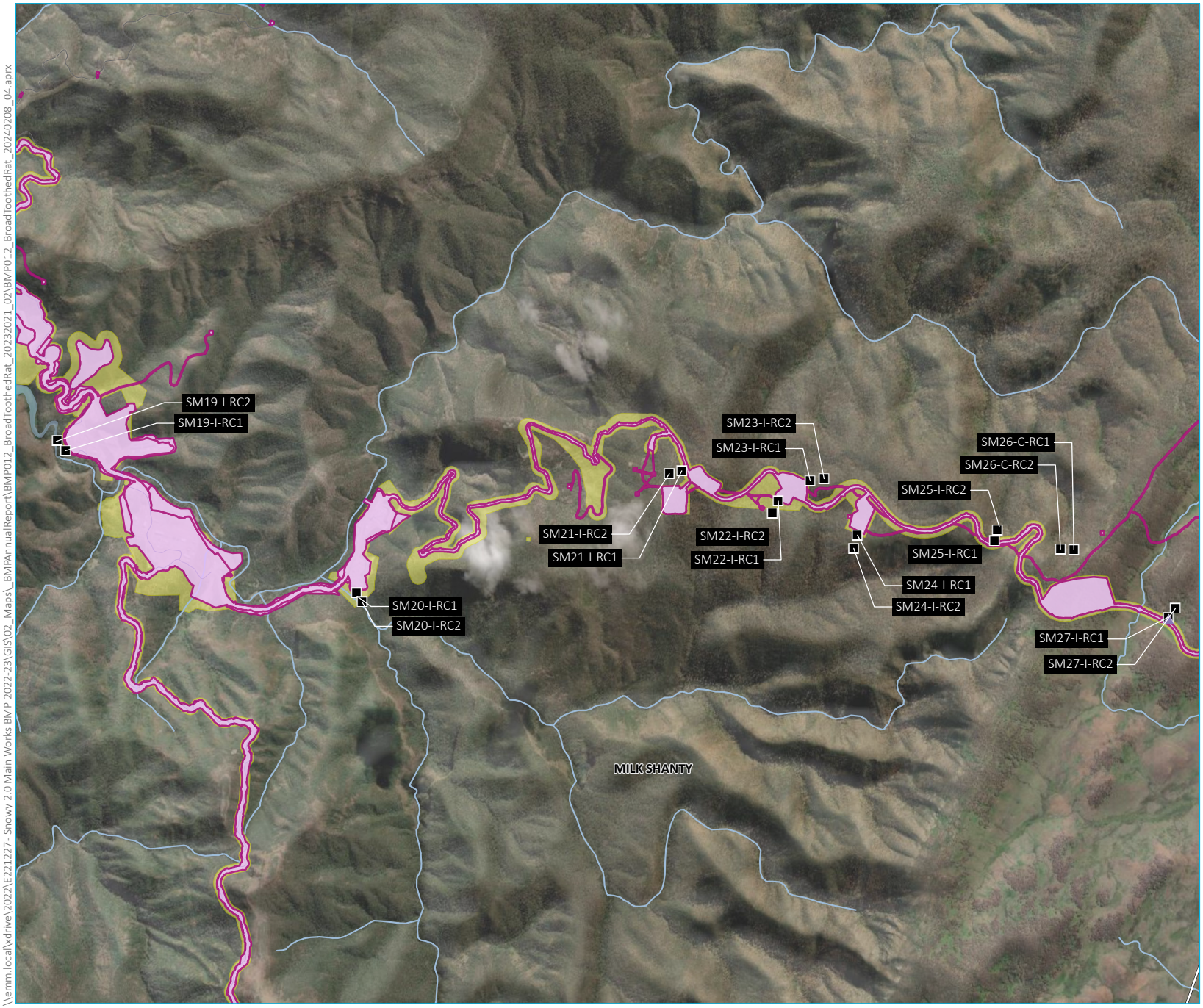

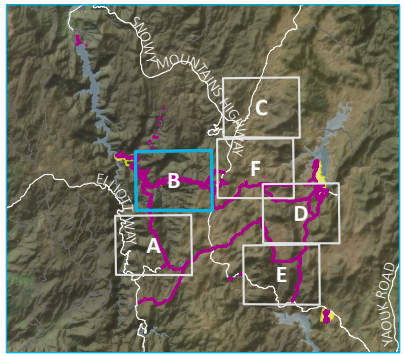

KEY

- Approved disturbance
- Approved construction envelope

Camera records- Broad-toothed Rat

- Absence
- Presence

Faecal records- Broad-toothed Rat

- Absence
- Presence

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

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Broad-toothed Rat presence/ absence during Year 3

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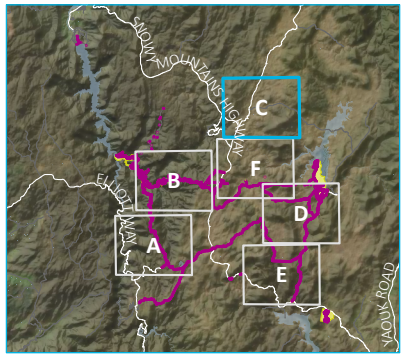
Annual report
Figure 3.4

snowy 2.0

EMM creating opportunities



KEY

- Approved disturbance
- Approved construction envelope

Camera records- Broad-toothed Rat

- Absence
- Presence

Faecal records- Broad-toothed Rat

- Absence
- Presence

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

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Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

0 1 2 km

GDA 1994 MGA Zone 55

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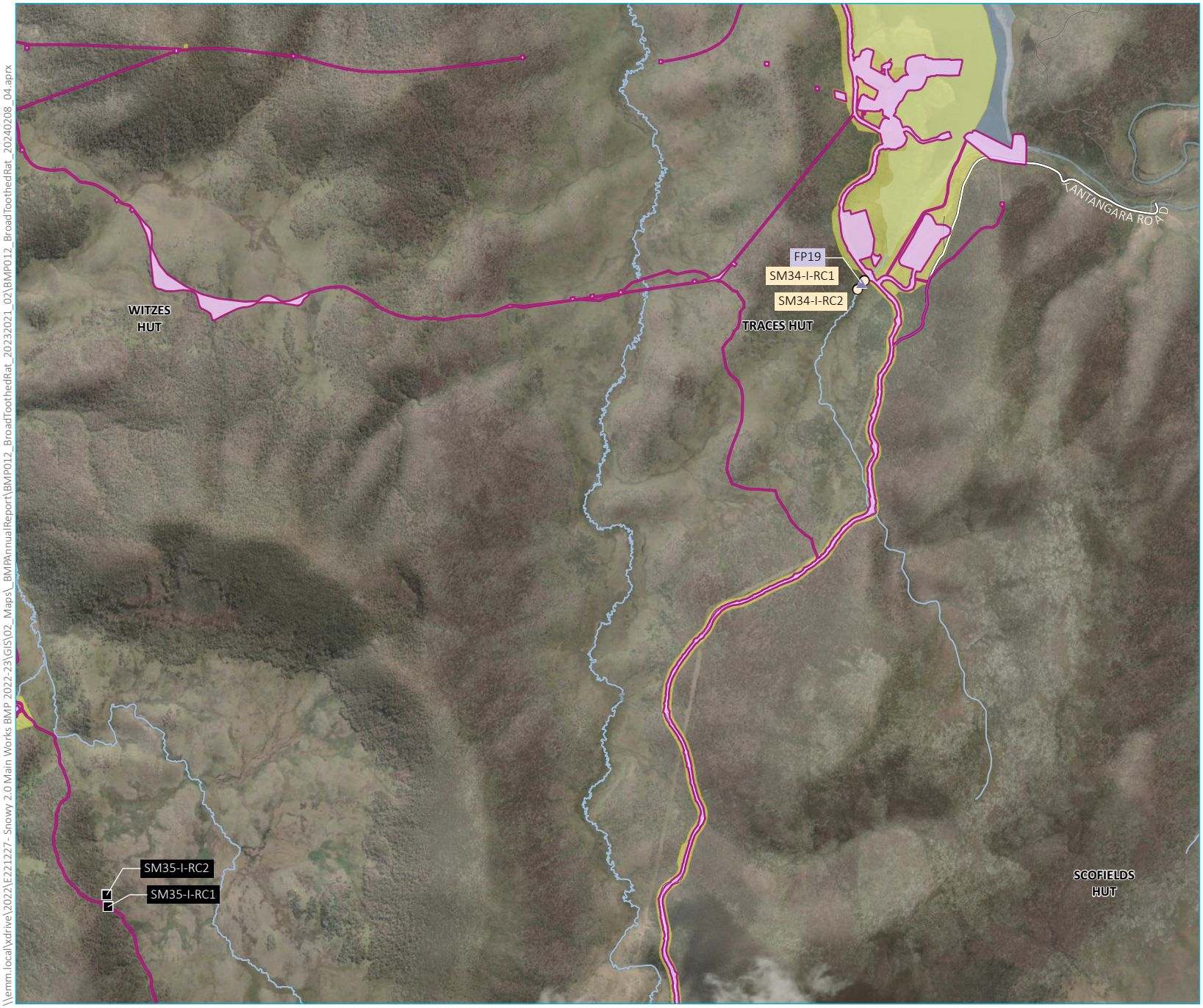
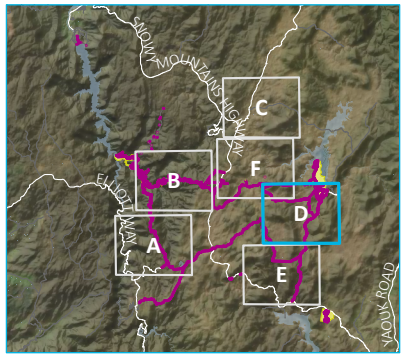
Broad-toothed Rat presence/ absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.4

snowy 2.0

EMM creating opportunities





KEY

- Approved disturbance
- Approved construction envelope

Camera records- Broad-toothed Rat

- Absence
- Presence

Faecal records- Broad-toothed Rat

- Absence
- Presence

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

0 1 2 km

GDA 1994 MGA Zone 55

N

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

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Broad-toothed Rat presence/ absence during Year 3

Snowy 2.0
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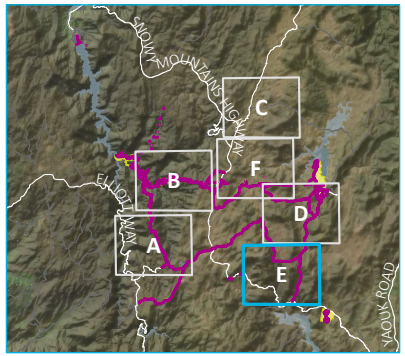
Annual report
Figure 3.4

snowy 2.0

EMM creating opportunities



KEY

- Approved disturbance
- Approved construction envelope

Camera records- Broad-toothed Rat

- Absence
- Presence

Faecal records- Broad-toothed Rat

- Absence
- Presence

Existing environment

- Major road
- Named watercourse
- Waterbody

Broad-toothed Rat presence/ absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.4

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

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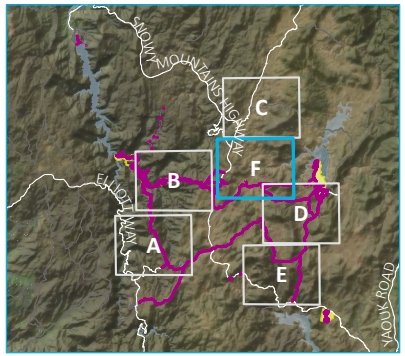

KEY

- Approved disturbance
- Approved construction envelope

Camera records- Broad-toothed Rat

- Absence
- Presence

Faecal records- Broad-toothed Rat

- Absence
- Presence

Existing environment

- Major road
- Named watercourse
- Waterbody

Broad-toothed Rat presence/ absence during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.4

Source: EMM (2024); Snowy Hydro (2021); DFSI (2017); ESRI (2024)

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GDA 1994 MGA Zone 55

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EMM creating opportunities

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3.2.2 Habitat characteristic monitoring

The objective of the small terrestrial mammal habitat characteristic monitoring is to determine the habitat characteristics of occupied Smoky Mouse, Eastern Pygmy-possum, and Broad-toothed Rat habitat within proximity to the Main Works project and document any changes to the habitat arising from the Main Works project.

According to the BMP, any native or exotic flora species, or other habitat structures (deep (>5 cm) leaf litter, logs or coarse woody debris), recorded at each monitoring site was scored to gain an estimate of habitat complexity below 1.5 m. Cover was split into three categories (native, exotic and habitat structure) and percentage recorded at three height intervals (<0.5 m, 1–1.5 m, 1–1.5 m).

i Year 3

During Year 3, 39 sites were surveyed (Figure 2.2).

During Year 3, native vegetation cover was similar at impact and control sites for all height classes, with a percentage difference range between 2% and 7%. Impact sites recorded a lower average cover of native species below 0.5 m (72%) compared to control sites (78%). Greater native vegetation structure occurred at 0.5–1 m; 18% at the impact sites and 16% at the control sites. Greater native cover occurred also at 1–1.5 m; 16% at impact sites and 9% at control sites.

During Year 3, exotic vegetation cover was similar at impact and control sites for all height classes, with a percentage difference range between 2% and 4%. Impact sites recorded a greater average cover of exotic species below 0.5 m (12%) compared to control sites (8%). Specifically, three control sites (SM29, SM31 and SM32) and five impact sites (SM19, SM20, SM27, SM34 and SM35) recorded the exotic species cover ≥20%. The same average exotic vegetation cover (1%) was observed at 0.5–1 m at the impact and the control sites. A greater average of exotic cover occurred also at 1–1.5 m; 2% at impact sites and 0% at control sites.

During Year 3, habitat structure cover was similar at impact and control sites for all height classes, with a percentage difference range between 1% and 7%. The average habitat structure cover was greater at impact sites at the <0.5 m height class, with impact sites averaging 15% and control sites averaging 8%. The height classes 0.5–1 m and 1–1.5 m for habitat structure were similar with a small 1% difference between control (0-1%) and impact sites (1-2%).

Data is presented in Table 3.6 and presented in Plate 3.13. Data is provided for each site in Appendix E.2.

Table 3.6 Minimum, maximum and average cover scores by height class for native vegetation, exotic vegetation and habitat structure at control and impact sites

Component		<0.5 m		0.5–1 m		1–1.5 m	
		Control	Impact	Control	Impact	Control	Impact
Native	Minimum	24%	42%	0%	0%	0%	0%
	Maximum	98%	95%	69%	45%	43%	53%
	Average	78%	72%	16%	18%	9%	16%
Exotic	Minimum	0%	0%	0%	0%	0%	0%
	Maximum	44%	63%	5%	7%	0%	28%
	Average	8%	12%	1%	1%	0%	2%

Table 3.6 Minimum, maximum and average cover scores by height class for native vegetation, exotic vegetation and habitat structure at control and impact sites

Component		<0.5 m		0.5–1 m		1–1.5 m	
		Control	Impact	Control	Impact	Control	Impact
Habitat structure	Minimum	0%	0%	0%	0%	0%	0%
	Maximum	33%	45%	2%	8%	1%	3%
	Average	8%	15%	1%	2%	0%	1%

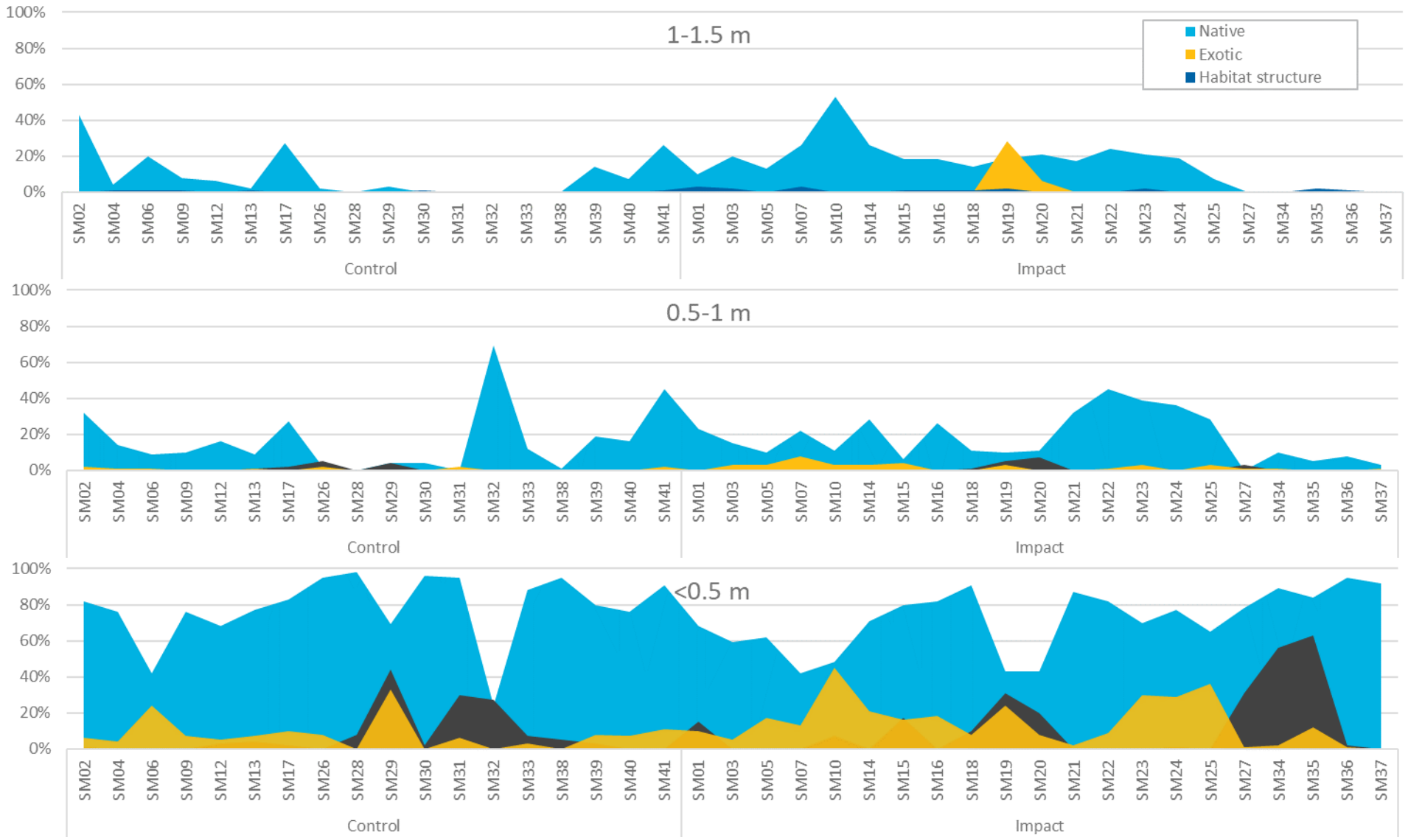


Plate 3.13 **Average percentage cover (native, exotic, and habitat structure) below 1.5 m recorded during Year 3**

ii Comparative analysis- Year 1, Year 2 and Year 3

The average cover scores recorded across the three monitoring years is presented in Table 3.7.

Average cover scores for native vegetation at both impact and control sites increased or remained the same across all three height intervals between Year 1 and Year 2. In Year 3, the native species cover either increased or remained the same as in previous years, or slightly decreased, but never by more than 2% compared to the percentage recorded in Year 1.

Average cover scores for exotic vegetation at both impact and control sites decreased or remained the same in comparison to Year 1 and Year 2 across the >0.5 m and 0.5-1 m intervals. During Year 3, the greatest average exotic cover (2%) was recorded at impact sites but not control sites at the 1-1.5 m height interval.

Average cover scores for habitat structure at both impact and control sites increased or remained the same across all three height intervals between Year 1 and Year 2. This trend was maintained in Year 3, except for the average habitat structure cover below 0.5 m, which was the lowest ever recorded at both control and impact sites.

A comparison of Year 3, Year 2 and Year 1 (baseline) is presented in Plate 3.14 for the average native vegetation, exotic vegetation and habitat structure cover.

Table 3.7 Average cover scores by height class for native vegetation, exotic vegetation and habitat structure at control and impact sites across the three monitoring years

Monitoring year	Component	<0.5 m		0.5–1 m		1–1.5 m	
		Control	Impact	Control	Impact	Control	Control
Native	Year 1	74%	74%	15%	17%	2%	3%
	Year 2	74%	90%	14%	19%	2%	9%
	Year 3	78%	72%	16%	18%	9%	16%
Exotic	Year 1	18%	14%	1%	2%	0%	0%
	Year 2	19%	19%	2%	1%	0%	0%
	Year 3	8%	12%	1%	1%	0%	2%
Habitat structure	Year 1	18%	18%	0%	1%	0%	0%
	Year 2	20%	25%	0%	1%	0%	0%
	Year 3	8%	15%	1%	2%	0%	1%

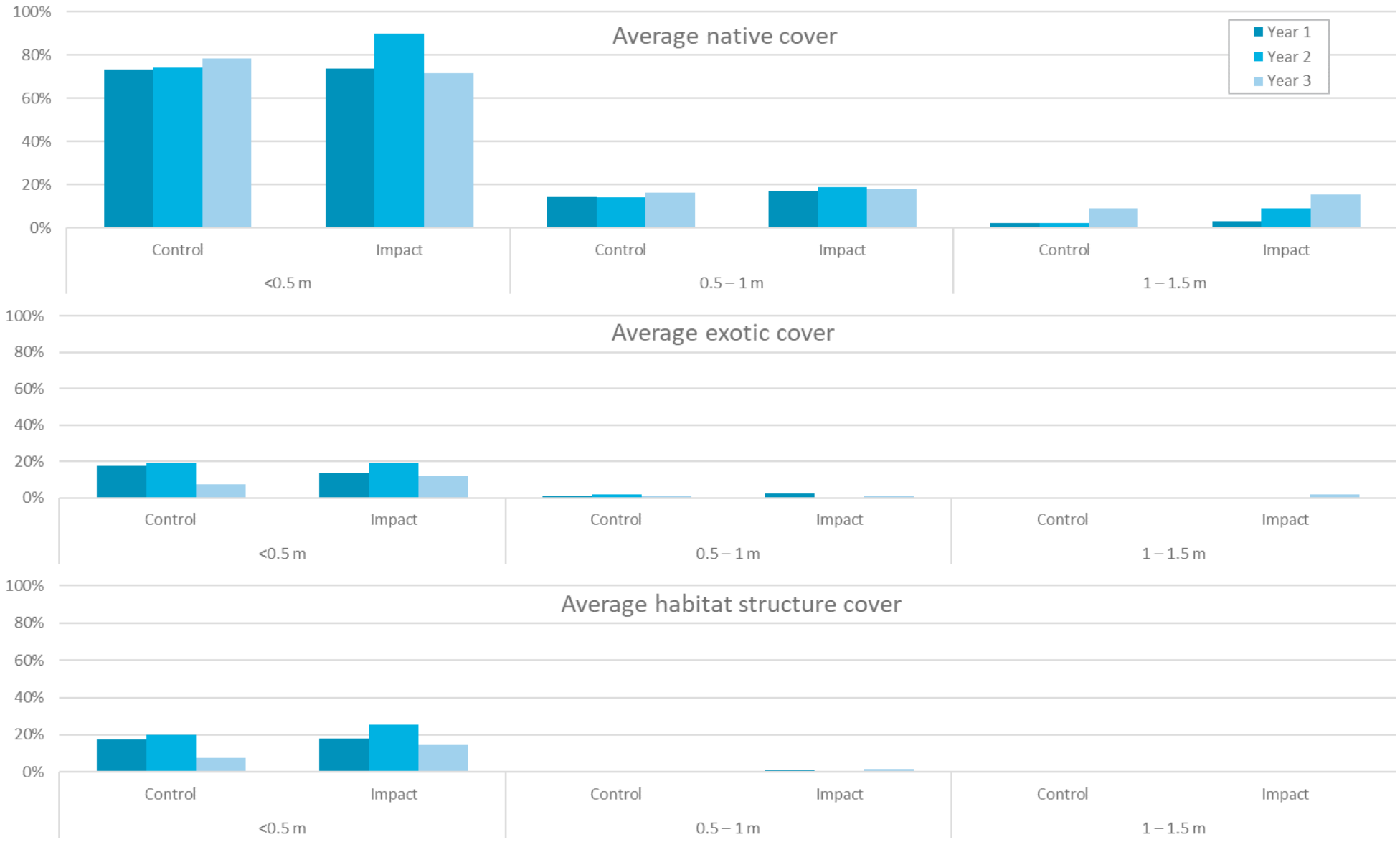


Plate 3.14 **Average vegetation cover (from the top: native, exotic and habitat structure cover) by height class across the three monitoring years**

3.3 Frog monitoring

3.3.1 Occupancy (presence/absence) monitoring

The objective of the frog occupancy monitoring is to determine occupancy distribution of the threatened frog target species, Alpine Tree Frog (*Litoria verreauxii alpina*) and Booroolong Frog (*Litoria booroolongensis*) and document any changes arising from the Main Works.

i Alpine Tree Frog occupancy

a Year 3

The Alpine Tree Frog (Photograph 3.3) was recorded at all eight sites across the two monitoring events conducted during Year 3 (Figure 3.5). Due to weather constraints (river was flooded), the first monitoring event was conducted between 16 January and 20 January 2023 and the second monitoring event was conducted between 23 January and 27 January 2023.

Over the two monitoring events conducted in Year 3, 21 Alpine Tree Frogs were recorded across three impact sites (TR01, TC02 and NC01). At the control sites, 125 Alpine Tree Frogs were recorded across all four sites. No Alpine Tree Frogs were recorded at one impact site (KPC01). The control sites had the highest number of sightings, with TC03 recording the highest (47 records) number of individuals.

Alpine Tree Frog presence/absence at each monitoring site is summarised in Table 3.8 and presented in Plate 3.15. Further detailed information including monitoring dates is provided in Appendix F.

Photograph 3.3 Alpine Tree Frog recorded during January 2021 monitoring surveys

Table 3.8 Number of Alpine Tree Frog individuals recorded

Site	Monitoring event	
	First (January 2023)	Second (January 2023)
Impact		
TR01	0	12
TC02	7	0
NC01	0	2
KPC01	0	0
Control		
TC03	21	26
ER02	40	0
MR01	14	10
NC03	5	9

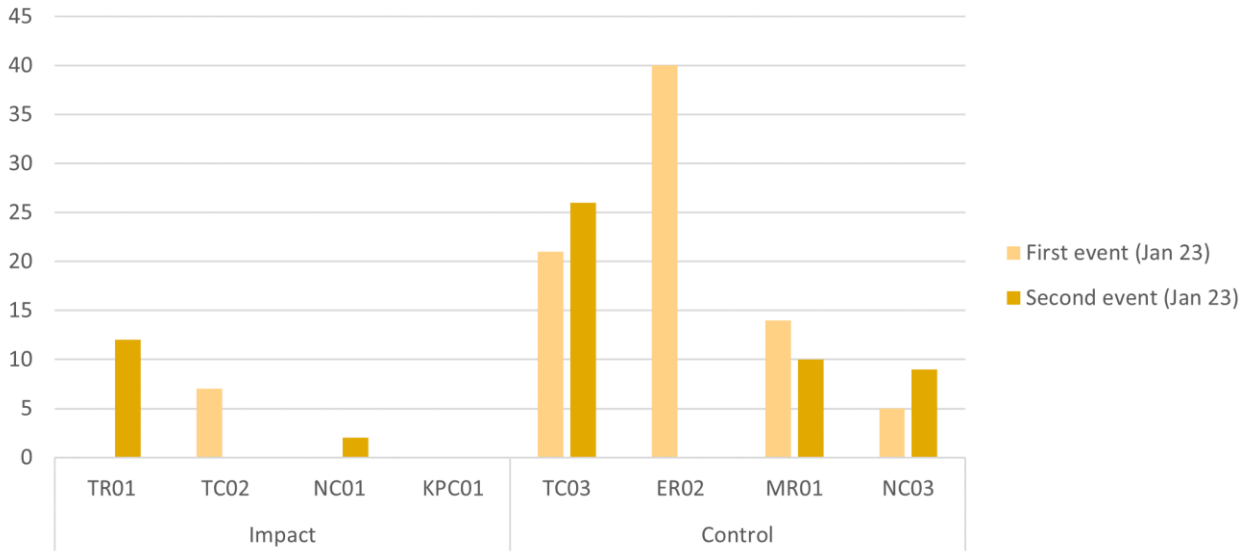


Plate 3.15 Alpine Tree Frog records during Year 3

b Comparative analysis- Year 1, Year 2 and Year 3

The total number of Alpine Tree frog records was 160 individuals in Year 1, 165 individuals in Year 2, and 146 individuals in Year 3. At impact sites, a similar trend was observed. The total number of Alpine Tree Frogs recorded at impact sites was 16 in Year 1, 27 in Year 2 and 21 in Year 3. At control sites, a decline was also observed. The number of Alpine Tree Frogs recorded at control sites was 144 in Year 1, 138 in Year 2 and 125 in Year 3.

In comparison to Year 1, there was a 31% increase of records at impact sites and a 13% decline at control sites surveyed in Year 3. In comparison to Year 2, there was a 22% decline of records at impact sites and a 9% decline at control sites surveyed in Year 3. Specifically, two impact sites (NC01 and KPC01) recorded a decline in the number of Alpine Tree Frogs in comparison to Year 1 (-71% for NC01; and -100% for KPC01) and Year 2 (-82% for NC01; and -100% for KPC01). Only one control site (MR01) recorded a decline in the number of Alpine Tree Frogs both during Year 1 (-33%) and Year 2 (-48%).

During Year 1, the number of individuals recorded in the second monitoring event was 48% lower than in the first monitoring event. During Year 2, the number of individuals recorded in the second monitoring event was 368% greater than in the first monitoring event. During Year 3, the number of individuals recorded in the second monitoring event was 32% lower than in the first monitoring event.

Plate 3.16 shows the comparison between the number of Alpine Tree Frogs recorded during Year 1, Year 2 and Year 3. Plate 3.17 shows the comparison between monitoring events conducted across the three monitoring years.

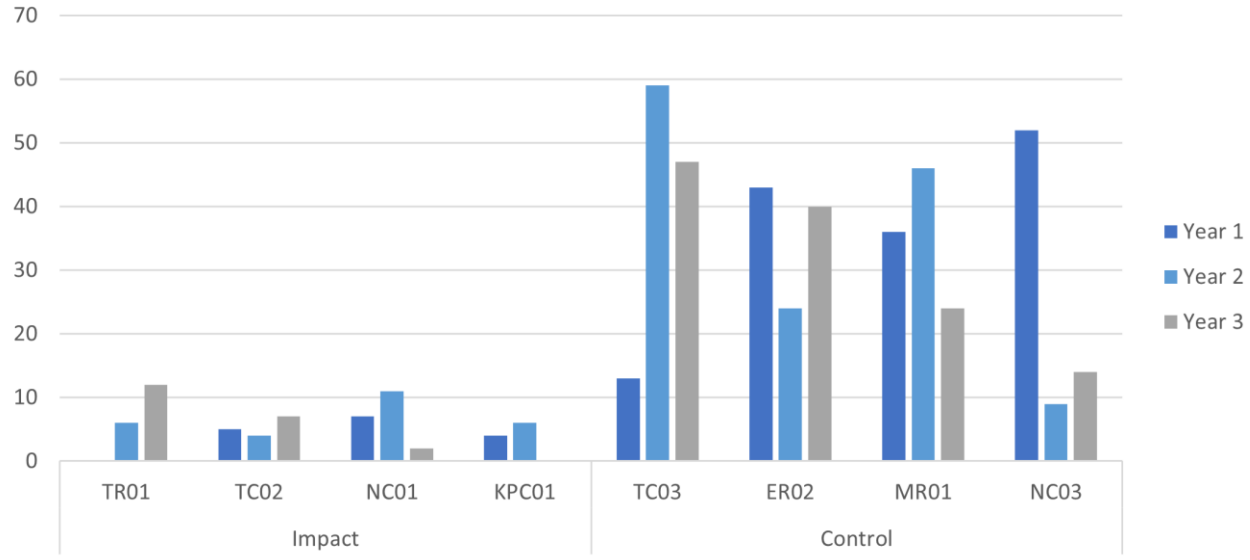


Plate 3.16 Alpine Tree Frog records during Year 1, Year 2 and Year 3

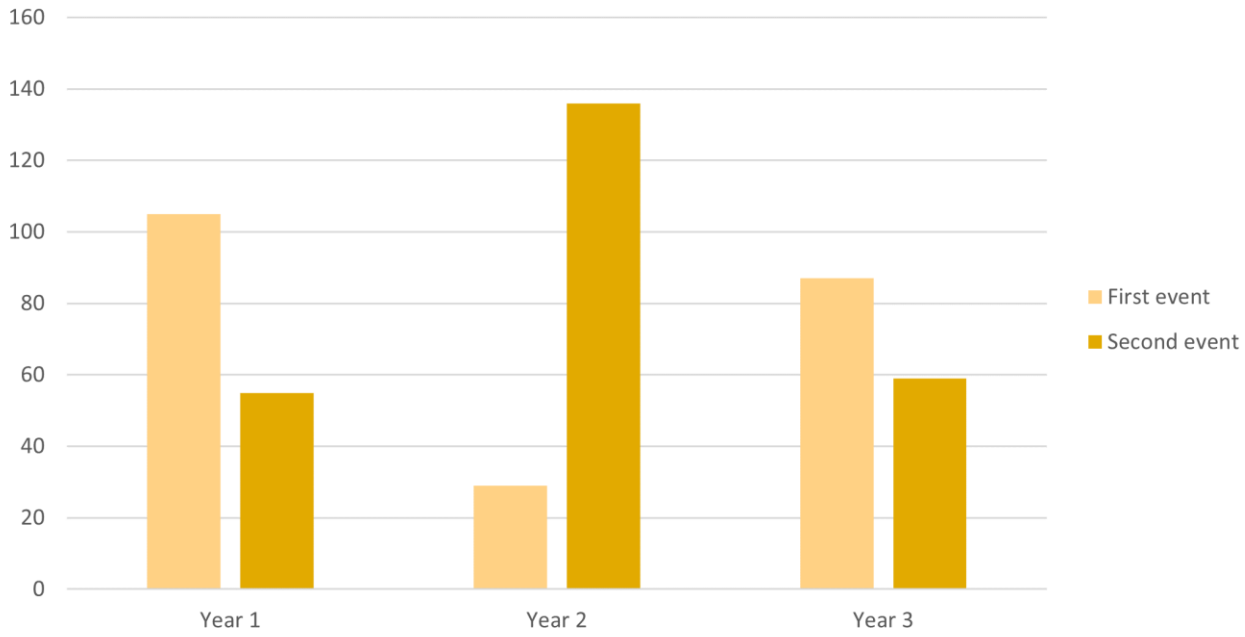
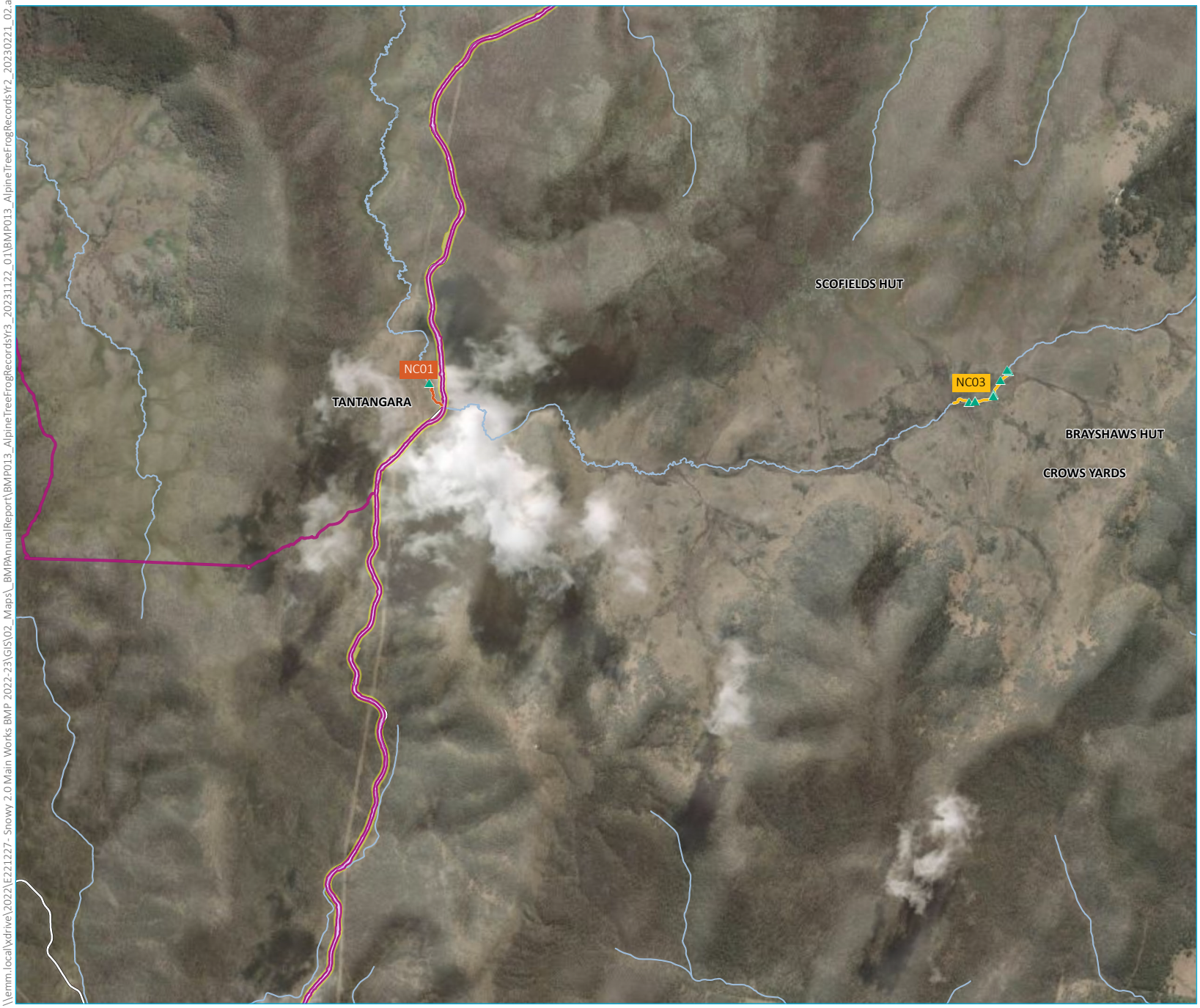
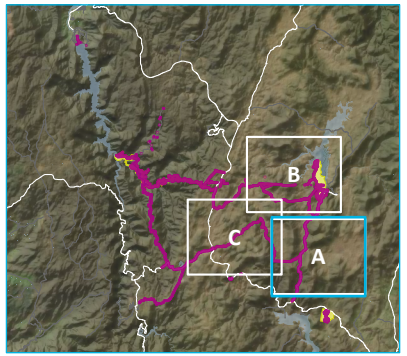


Plate 3.17 **Alpine Tree Frog records during first and second event of Year 1, Year 2 and Year 3**





KEY

- Approved disturbance
- Approved construction envelope
- Alpine Tree Frog records

Alpine Tree Frog monitoring location

- Control
- Impact

Existing environment

- Major road
- Named watercourse
- Waterbody

Alpine Tree Frog records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.5a

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 0.5 1 km
GDA 1994 MGA Zone 55

N

snowy 2.0

EMM creating opportunities

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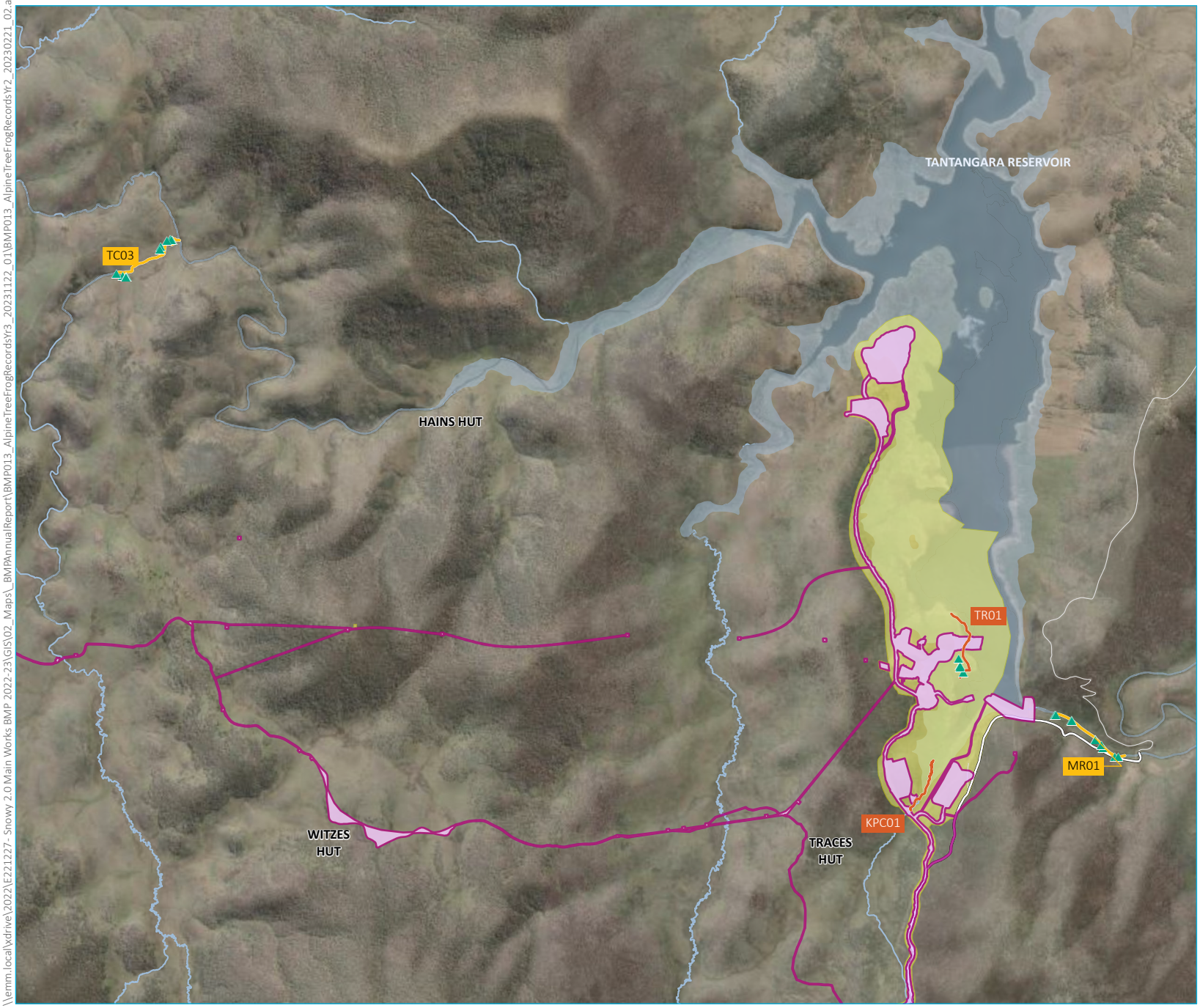

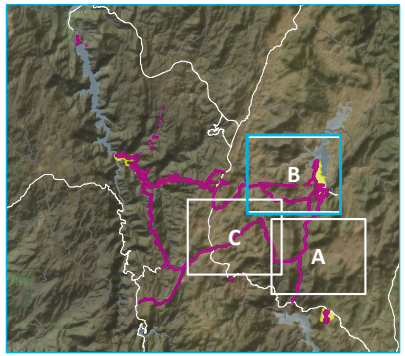

KEY

- Approved disturbance
- Approved construction envelope
- Alpine Tree Frog records

Alpine Tree Frog monitoring location

- Control
- Impact

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

0 0.5 1 km
GDA 1994 MGA Zone 55

N

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

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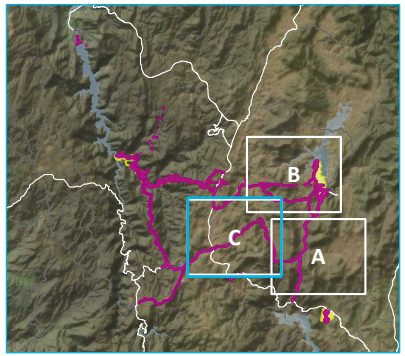
Alpine Tree Frog records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.5b

snowy 2.0

EMM
creating opportunities



KEY

- Approved disturbance
- Approved construction envelope
- Alpine Tree Frog records

Alpine Tree Frog monitoring location

- Control
- Impact

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

0 0.5 1 km
GDA 1994 MGA Zone 55

N

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

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Alpine Tree Frog records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.5c

snowy 2.0

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ii Booroolong Frog occupancy

a Year 3

During Year 3, the Booroolong Frog (Photograph 3.4) was surveyed at five out the six monitoring sites (Figure 3.6). Due to weather constraints, the first monitoring event was conducted between 6 December and 7 December 2022 and the second monitoring event was conducted between 20 December and 21 December 2022. All transects were surveyed except for one control site (YR09), which was not surveyed due to unsafe conditions on site.

Overall, 14 Booroolong Frogs were recorded across three impact sites (YR02, YR05 and YR06) and five individuals at the one control site (YR08). No Booroolong Frogs were recorded at one impact site (WC01). The impact sites had the highest number of sightings, with YR05 and YR06 recording the highest (four records) number of individuals.

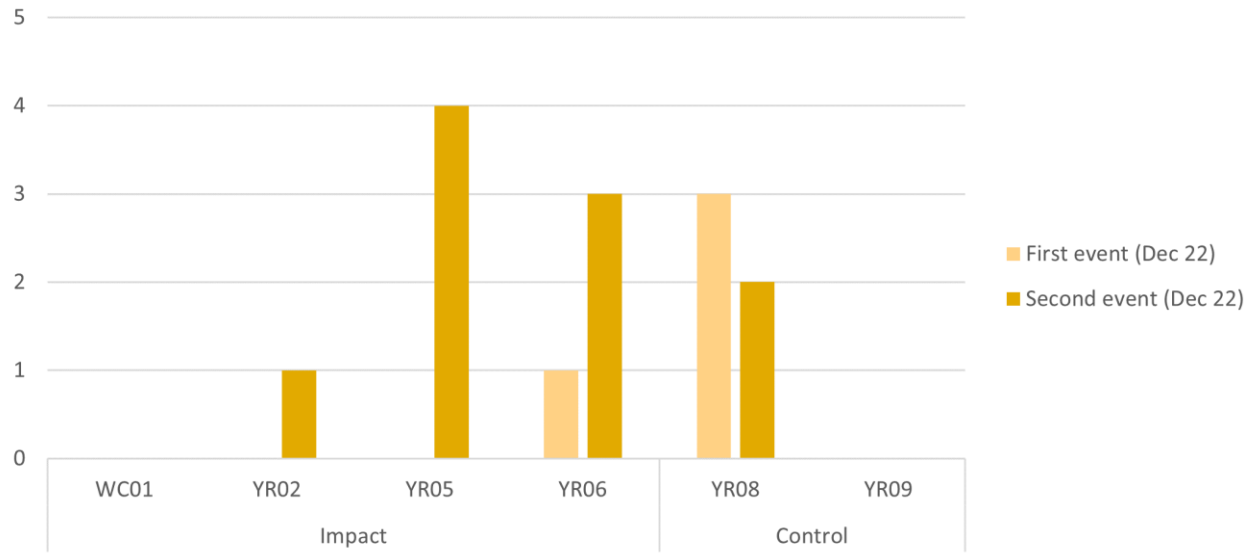
Booroolong Frog presence/absence at each monitoring site is summarised in Table 3.9 and presented in Plate 3.18. Further detailed information including monitoring dates is provided in Appendix F.

Photograph 3.4 Booroolong Frog Recorded at control site YR06 during monitoring period

Table 3.9 Number of Booroolong Frog individuals recorded

Site	Monitoring event	
	First (December 2022)	Second (December 2022)
Impact		
WC01	0	0
YR02	0	1
YR05	0	4
YR06	1	3
Control		
YR08	3	2
YR09	NA	NA

Notes: NA – survey not conducted due to unsafe conditions on site



Notes: No survey was conducted at YR09 due to unsafe conditions

Plate 3.18 Booroolong Frog records during Year 3

b Comparative analysis- Year 1, Year 2 and Year 3

The total number of Booroolong Frog records was 25 individuals in Year 1, eight individuals in Year 2, and 14 individuals in Year 3. At impact sites, the number of Booroolong Frogs recorded was 20 in Year 1, four in Year 2 and nine in Year 3. At control sites, the number of Alpine Tree Frogs recorded was five in Year 1, four in Year 2 and five in Year 3, despite only one out of the two control sites being surveyed in Year 3.

In comparison to Year 1, there was a 55% decline of records at impact sites and a 0% decline at control sites surveyed in Year 3. In comparison to Year 2, there was a 125% increase of records at impact sites and a 25% increase at control sites surveyed in Year 3. In Year 3, three impact sites (WC01, YR02 and YR05) recorded a decline in the number of Booroolong Frogs in comparison to Year 1; all impact sites surveyed either recorded a slight increase in the number of records or remained consistent compared to Year 2. The only control site surveyed in Year 3 did not record any decline in comparison to Year 1 or Year 2.

During Year 1, the number of individuals recorded in the second monitoring event was 157% higher than in the first monitoring event. During Year 2, only one monitoring event was conducted. During Year 3, the number of individuals recorded in the second monitoring event was 150% higher than in the first monitoring event.

Plate 3.19 shows the comparison between the number of Booroolong Frogs recorded during Year 1, Year 2 and Year 3. Plate 3.20 shows the comparison between monitoring events conducted across the three monitoring years.

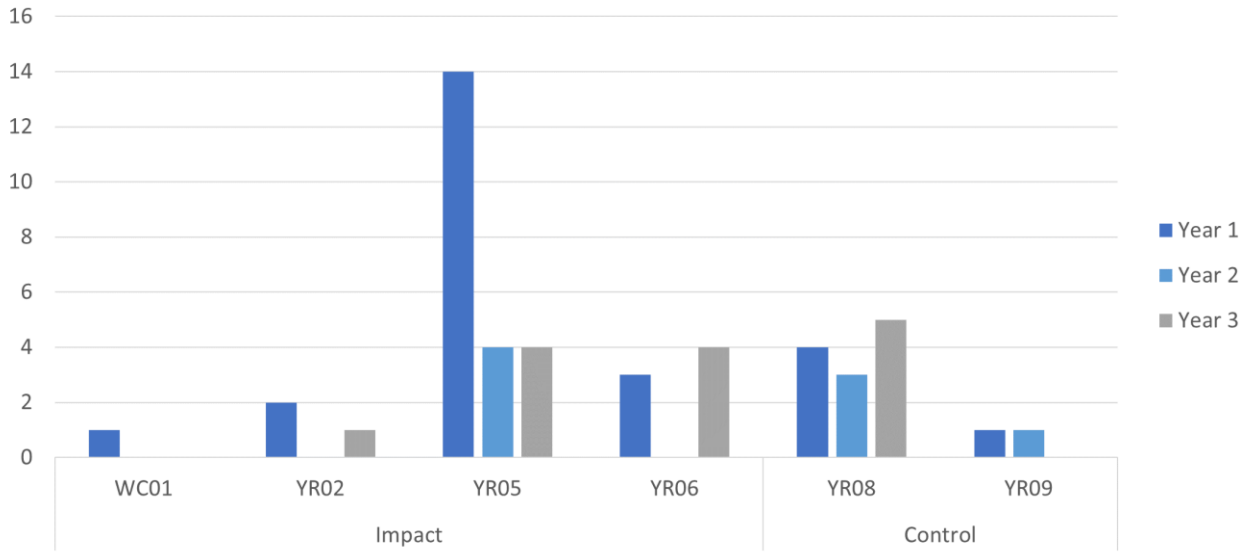
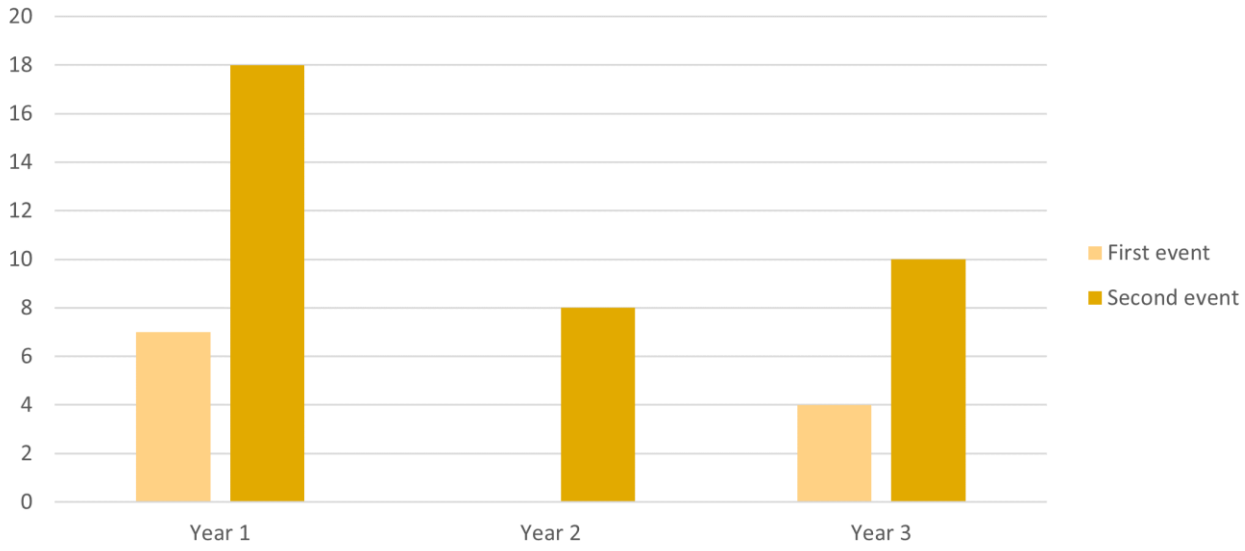
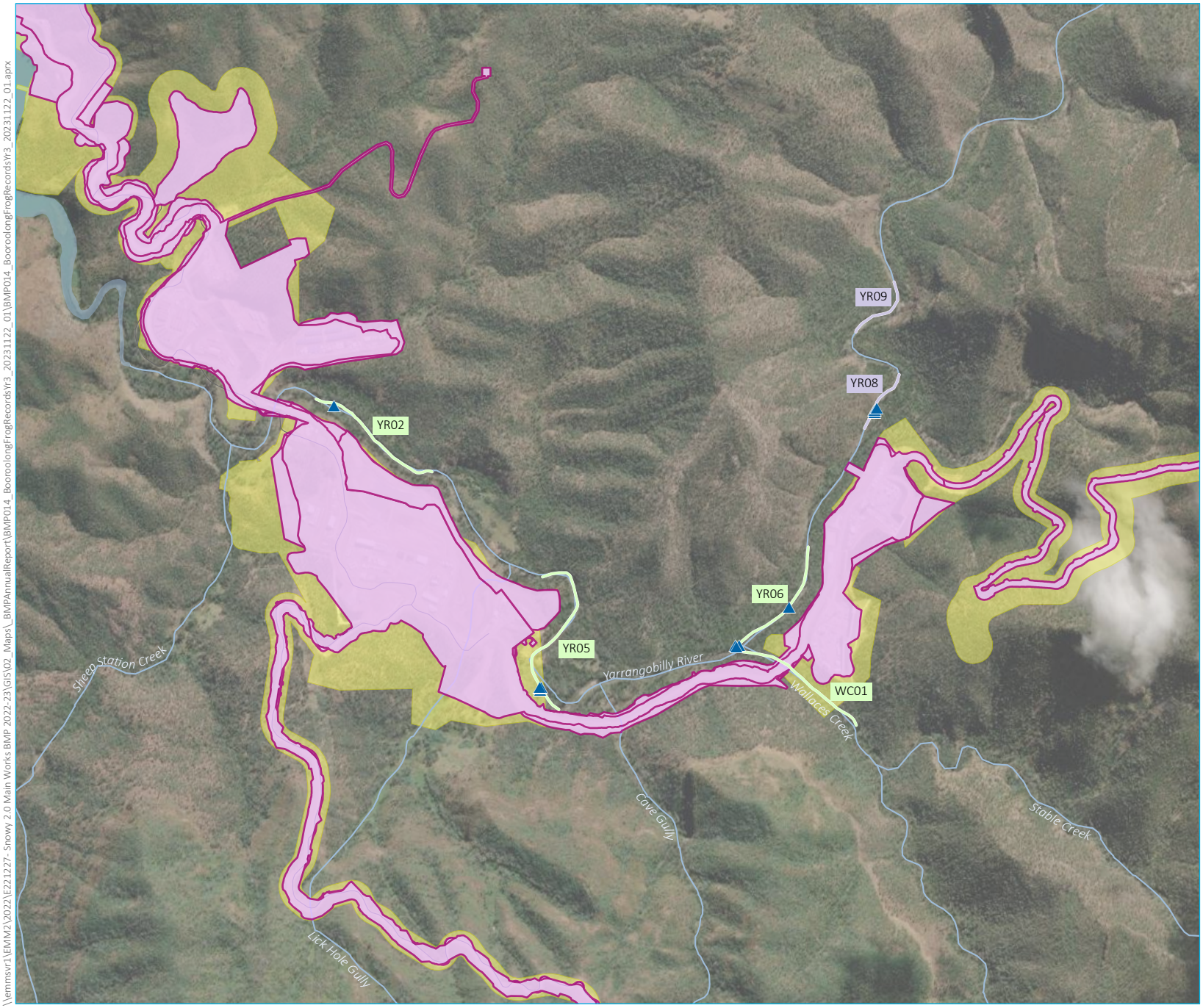


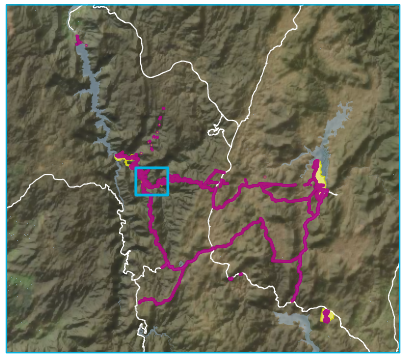
Plate 3.19 Booroolong Frog records during Year 1, Year 2 and Year 3



Notes: No survey was conducted for the first monitoring event in Year 2

Plate 3.20 Booroolong Frog records during first and second event of Year 1, Year 2 and Year 3





KEY

- Approved disturbance
- Approved construction envelope
- Booroolong frog record

Booroolong frog monitoring location

- Control
- Impact

Existing environment

- Minor road
- Named watercourse
- Waterbody

0 0.5 1 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM2\2022\E221227- Snowy 2.0 Main Works BMP 2022-23\GIS\02_Maps_BMPAnnualReport\BMP014_BooroolongFrogRecordsYr3_20231122_01\BMP014_BooroolongFrogRecordsYr3_20231122_01.aprx

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

Booroolong Frog records during Year 3

Snowy 2.0
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Annual report
Figure 3.6

snowy 2.0

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3.3.2 Booroolong Frog habitat characteristic monitoring

The objective of the Booroolong Frog habitat characteristic monitoring is to monitor rocky breeding habitat and depth of pools within sections of the Yarrangobilly River and Wallaces Creek that occur within and adjacent to the project area and document any changes arising from the project. Specific objectives are:

- to compare shifts in distribution and abundance of rocky breeding habitat between impact (Yarrangobilly River and Wallaces Creek in the project area) and reference sections of the Yarrangobilly River (upstream of the project area).

i Year 3

Year 3 data was collected in December 2022. The habitat characteristics monitoring survey was conducted at all impact and control transects. Pool cover was not recorded for two impact sites (YR02 and YR06) and all control sites (YR08 and YR09).

Overall, the average area of most habitat features within impact sites was included within the standard deviation observed at control sites. However, the average extent of the cobble bank, riparian vegetation and run fell outside the standard deviation observed at control sites. The average extent of these three features was between 53% and 55% greater at the impact sites when compared to the control sites. The average extent of the rocky bank within impact sites was included within the standard deviation observed at the control sites.

Stream features mapped during Year 3 included bed rock bank, cobble bank, mud bank, pool, riffle, riparian vegetation, rocky bank and run (Figure 3.7 to Figure 3.12). Composition of stream features at each transect in Year 3 is summarised in Table 3.10 and presented in Plate 3.21.

Table 3.10 Stream feature area (ha) for Year 3

	Transect	Stream feature area (ha)								
		Bed rock bank	Cobble bank	Mud bank	Pool	Riffle	Riparian vegetation	Rocky bank	Run	Other
Impact	WC01	0.00	0.01	0.00	0.00	0.01	3.44	0.02	0.23	0.70
	YR02	0.02	0.05	0.01		0.07	3.47	0.04	0.67	0.34
	YR05	0.10	0.16	0.01	0.00	0.11	3.93	0.01	0.91	0.96
	YR06	0.01	0.01	0.01		0.06	3.39	0.05	0.50	0.00
Control	YR08	0.05	0.02	0.01		0.05	1.75	0.03	0.23	0.01
	YR09	0.02	0.04	0.00		0.03	1.47	0.05	0.30	0.48

Note – Blank cells represent data not recorded.

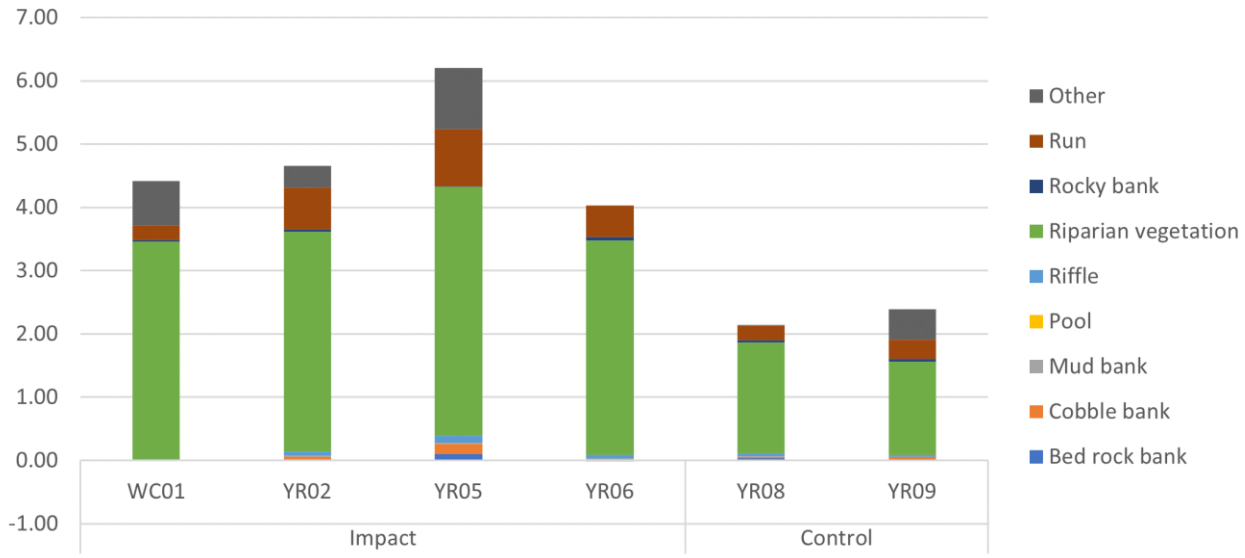


Plate 3.21 Composition of stream features during Year 3 habitat characteristic monitoring

ii Comparative analysis- Year 1, Year 2 and Year 3

In Year 2, the mapped area was greater than that of Year 1, making it difficult to draw a comparison between the two monitoring years. In Year 3, all three mapping extents were overlaid, and the extent covered by the three surveys was used to identify a new boundary for each transect and therefore improve consistency across years. The imagery for Year 1, Year 2 and Year 3 were clipped to the new boundary and calculations for the area of each stream feature was re-run.

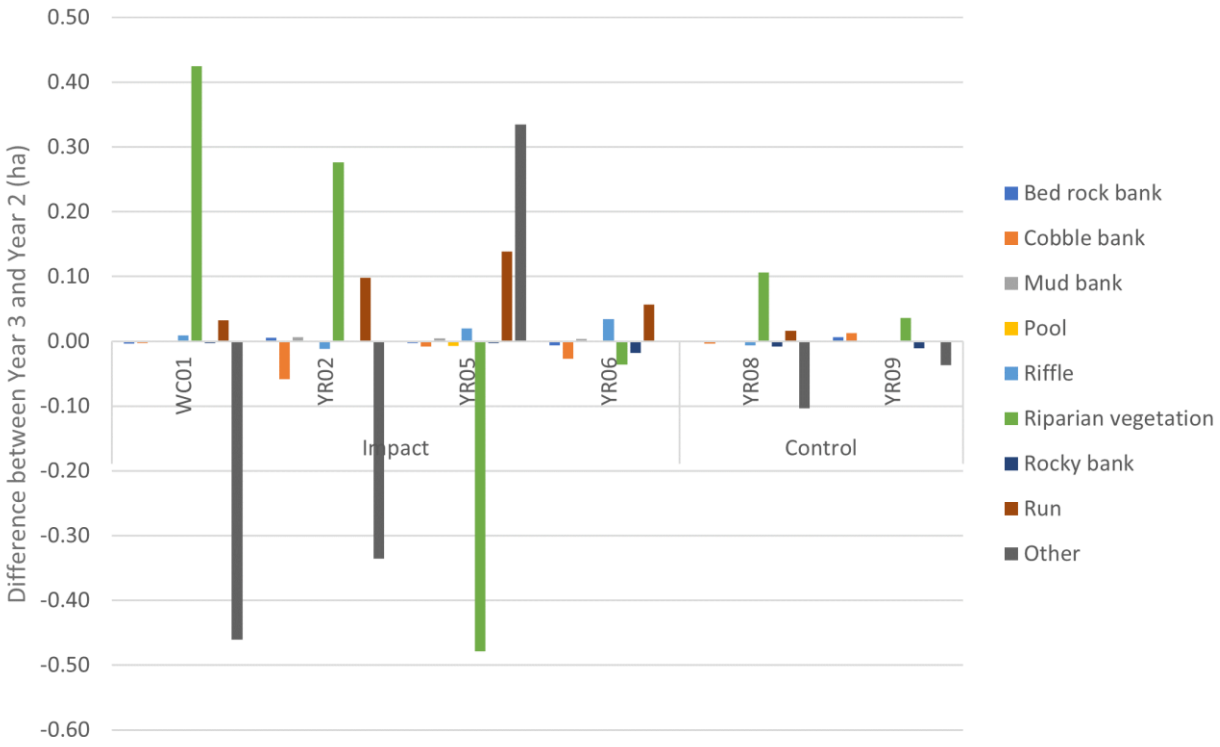
In the comparative analysis between Year 2 and Year 3, the majority of stream feature areas were similar, except for the riparian vegetation extent, which increased between 6 and 12% at three impact sites (WC01, YR02 and YR08) and decreased by 12% at one impact site (YR05) in Year 3. Such changes appear to have occurred at the expense of the stream feature class designated as "other", which comprised various elements such as other vegetation, access tracks, and cleared land.

The differences in stream feature area for each transect between Year 2 and Year 3 are presented in Table 3.11 and shown in Plate 3.22.

Table 3.11 Difference in stream feature area (ha) for each transect between Year 2 and Year 3

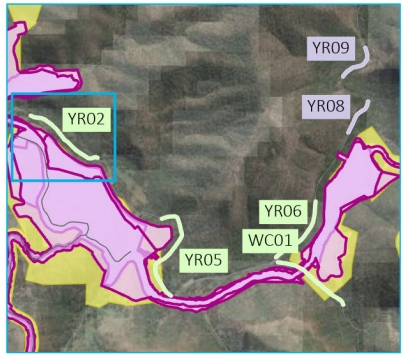
	Transect	Stream feature area (ha)								
		Bed rock bank	Cobble bank	Mud bank	Pool	Riffle	Riparian vegetation	Rocky bank	Run	Other
Impact	WC01	0.00	0.00	0.00		0.01	0.42	0.00	0.03	-0.46
	YR02	0.01	-0.06	0.01		-0.01	0.28		0.10	-0.34
	YR05	0.00	-0.01	0.00	-0.01	0.02	-0.48	0.00	0.14	0.33
	YR06	-0.01	-0.03	0.00		0.03	-0.04	-0.02	0.06	0.00
Control	YR08	0.00	0.00	0.00		-0.01	0.11	-0.01	0.02	-0.10
	YR09	0.01	0.01			0.00	0.04	-0.01	0.00	-0.04

Note – Blank cells represent data that could not be compared given that it had not been recorded either in Year 2 or Year 3.



Notes: YR02, YR06, YR08 and YR09 pool cover were not recorded in Year 3; WC01 pool cover and YR02 rocky bank cover were not recorded in Year 2; YR08 rocky bank was not recorded in Year 1 and YR09 monitoring transect was not surveyed in Year 1.

Plate 3.22 Difference in composition of stream feature (ha) for each transect between Year 3 and Year 2



KEY

- Approved disturbance
- Approved construction envelope

Booroolong frog monitoring location

- Control
- Impact

Stream feature classification

- Bedrock bank
- Cobble bank
- Riparian vegetation
- Pool
- Riffle
- Run
- Mud bank
- Rocky bank

Existing environment

- Minor road
- Named watercourse

Source: EMM (2023); Snowy Hydro (2024); DFSI (2017)

0 50 100 m

GDA 1994 MGA Zone 55

N

Stream feature classification during Year 3 – YR02

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Figure 3.7

snowy 2.0

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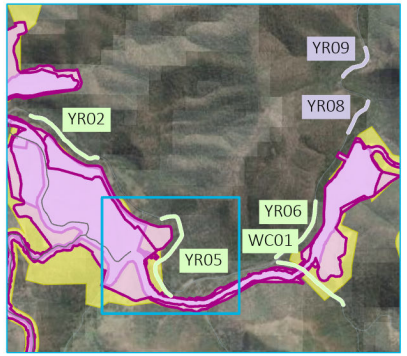

KEY

- Approved disturbance
- Approved construction envelope

Booroolong frog monitoring location

- Control
- Impact

Stream feature classification

- Bedrock bank
- Cobble bank
- Riparian vegetation
- Pool
- Riffle
- Run
- Mud bank
- Rocky bank

Existing environment

- Minor road
- Named watercourse

Source: EMM (2023); Snowy Hydro (2024); DFSI (2017)

0 50 100 m

GDA 1994 MGA Zone 55

N

Stream feature classification during Year 3 – YR05

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.8

snowy 2.0

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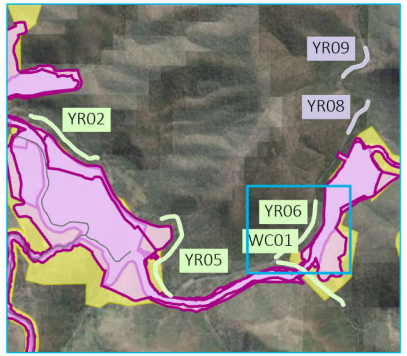

KEY

- Approved disturbance
- Approved construction envelope

Booroolong frog monitoring location

- Control
- Impact

Stream feature classification

- Bedrock bank
- Cobble bank
- Riparian vegetation
- Pool
- Riffle
- Run
- Mud bank
- Rocky bank
- Named watercourse

Source: EMM (2023); Snowy Hydro (2024); DFSI (2017)

0 50 100 m

GDA 1994 MGA Zone 55

N

Stream feature classification during Year 3 – YR06

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.9

snowy 2.0

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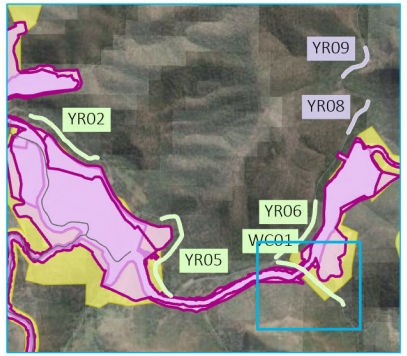

KEY

- Approved disturbance
- Approved construction envelope

Booroolong frog monitoring location

- Control
- Impact

Stream feature classification

- Bedrock bank
- Cobble bank
- Riparian vegetation
- Pool
- Riffle
- Run
- Mud bank
- Rocky bank
- Named watercourse

Source: EMM (2023); Snowy Hydro (2024); DFSI (2017)

0 50 100 m

GDA 1994 MGA Zone 55

N

Stream feature classification during Year 3 – WC01

Snowy 2.0
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Annual report
Figure 3.10

snowy 2.0

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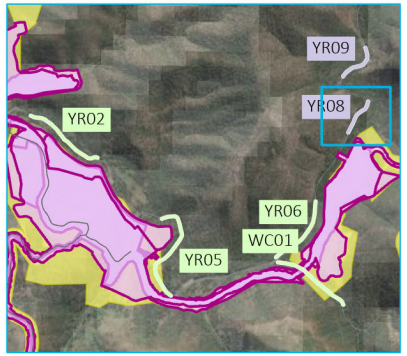

KEY

- Approved disturbance
- Approved construction envelope

Booroolong frog monitoring location

- Control
- Impact

Stream feature classification

- Bedrock bank
- Cobble bank
- Riparian vegetation
- Pool
- Riffle
- Run
- Mud bank
- Rocky bank
- Named watercourse

Source: EMM (2023); Snowy Hydro (2024); DFSI (2017)

0 50 100 m

GDA 1994 MGA Zone 55

N

Stream feature classification during Year 3 – YR08

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.11

snowy 2.0

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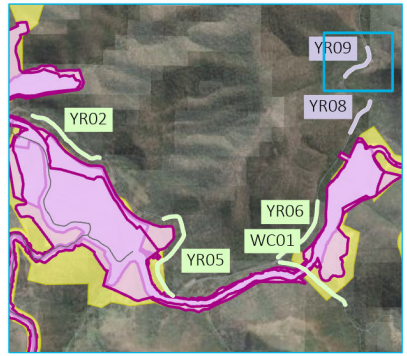


KEY

- Approved disturbance
- Approved construction envelope

Booroolong frog monitoring location

- Control
- Impact

Stream feature classification

- Bedrock bank
- Cobble bank
- Riparian vegetation
- Pool
- Riffle
- Run
- Mud bank
- Rocky bank
- Named watercourse

0 50 100 m

GDA 1994 MGA Zone 55

N

Source: EMM (2023); Snowy Hydro (2024); DFSI (2017)

Stream feature classification during Year 3 – YR09

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.12

snowy 2.0

EMM creating opportunities

3.4 Alpine She-oak Skink monitoring

The objective of the Alpine She-oak Skink (Photograph 3.5) monitoring is to determine the occupancy (presence/absence) of the species at potential habitat sites within proximity to the project and document any changes attributable to the Main Works.

3.4.1 Year 3

During Year 3, nine active monitoring sites were surveyed across the six monitoring events (in November, December, January, February, March and October). Impact site TG04 was relocated in January 2023 (Figure 3.13). Presence of Alpine She-oak Skink was not recorded at this site during baseline surveys or for the duration of the BMP (null data). The potential for monitoring outcomes at this site was limited, due to only being able to record an increase in records. This is not the original intent of the BMP. For this reason, TG04 was relocated. TG01 and TF09 were not surveyed in Year 3 as they were discontinued and replaced with TG10 and TG11 in Year 2 due to nil results (March 2022).

The Alpine She-oak Skink was recorded at six of the nine active monitoring sites during Year 3. These include two impact sites (TG02 and TG05) and all control sites (TG06, TG07, TG08 and TG11), representing 66% of Alpine She-oak Skink sites. Impact site TG10 was not surveyed in November 2022 due to safety concerns on site, and control site TG06 was not surveyed in October 2023 due to access issues.

Six monitoring events were recorded during Year 3. The fifth (March) and first (November) monitoring events recorded the greatest number of individuals (seven and six individuals each). All monitoring events recorded at least three individuals of the target species.

A total of four sightings were recorded within impact sites and 24 within the control sites. The species was not recorded from three impact sites (TG03, TG04 (relocated in January 2023) and TG10 (established in March 2022)), while all control sites recorded the presence of the species. Amongst impact sites, the greatest number of individuals reported across all monitoring events was three (at TG05), while the maximum number of individuals recorded amongst control sites was 18 (at TG11).

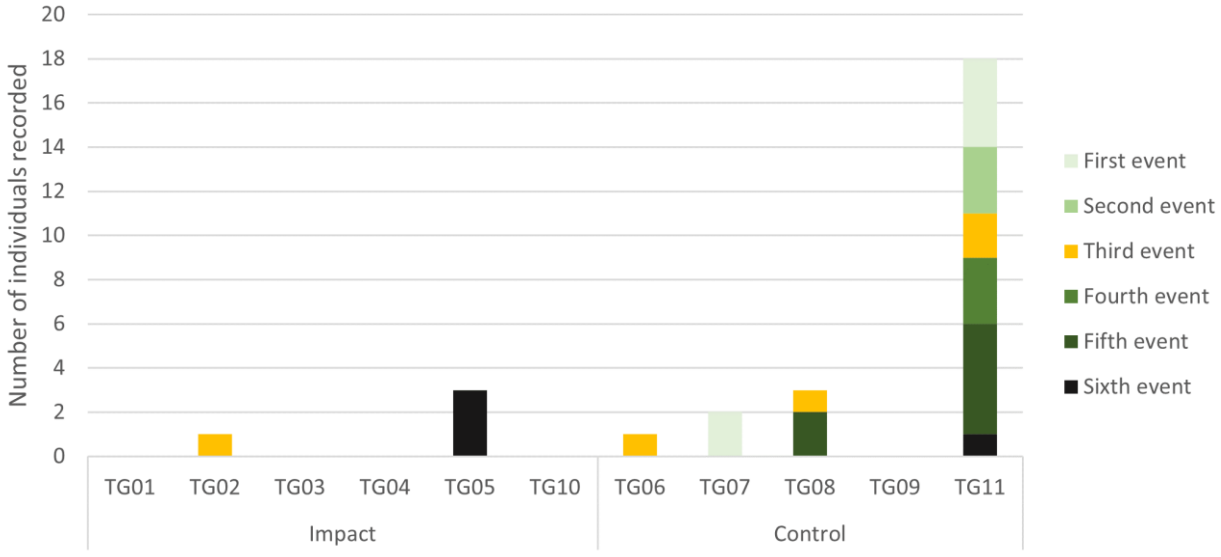
Alpine She-oak Skink presence/absence at each monitoring site is summarised in Table 3.12 and presented in Plate 3.23. Further detailed information including monitoring dates is provided in Appendix G.

Photograph 3.5 Alpine She-oak Skink recorded during the Q4 monitoring period

Table 3.12 Alpine She-oak Skinks recorded at each monitoring site during the 2022/23 monitoring period

	Monitoring events					
	Q4		Q1		Q2	Q4
Site	November 2022	December 2022	January 2023	February 2023	March 2023	October 2023
Impact						
TG01	NA	NA	NA	NA	NA	NA
TG02	0	0	1	0	0	0
TG03	0	0	0	0	0	0
TG04	0	0	0	0	0	0
TG05	0	0	0	0	0	3
TG10	NA*	0	0	0	0	0
Control						
TG06	0	0	1	0	0	NA**
TG07	2	0	0	0	0	0
TG08	0	0	1	0	2	0
TG09	NA	NA	NA	NA	NA	NA
TG11	4	3	2	3	5	1

Notes: NA – TG01 and TG09 were discontinued in Year 2 (March 2022), and TG10 and TG11 were established as a replacement. NA* – site was not surveyed due to safety concerns on site. NA** – site was not surveyed due to access issues.



Notes: TG01 and TG09 were discontinued in Year 2 (March 2022), and TG10 and TG11 were established as a replacement.

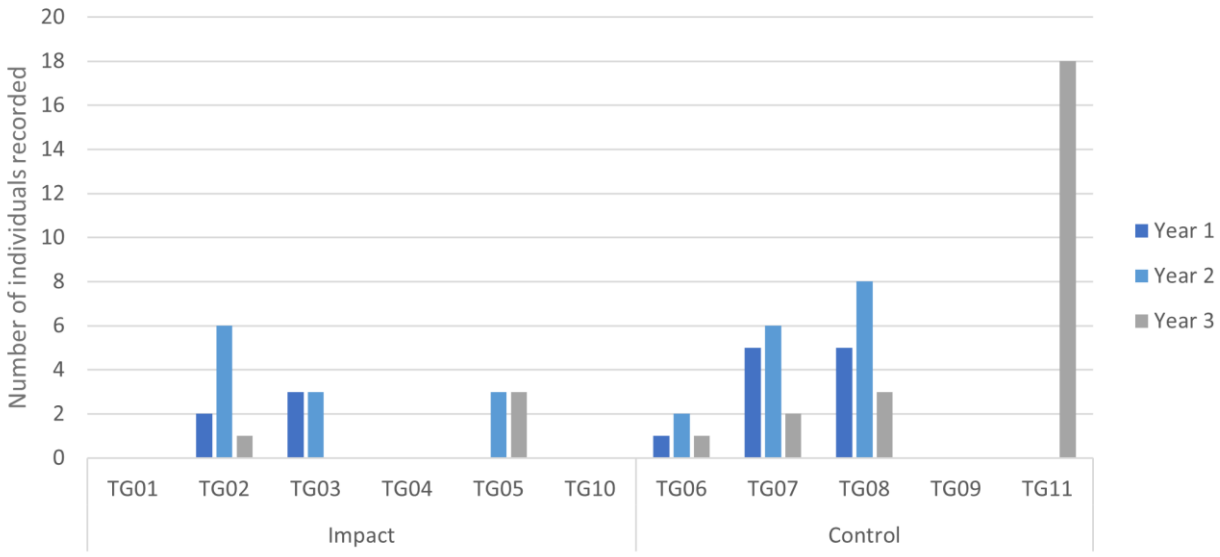
Plate 3.23 Total number of Alpine She-Oak Skink records per site and monitoring period

3.4.2 Comparative analysis- Year 1, Year 2 and Year 3

The total number of Alpine She-oak Skinks recorded was 16 in Year 1 and 28 in both Year 2 and Year 3. Among the impact sites surveyed in Year 1, five individuals were detected within two impact sites (TG02 and TG03). During Year 2, the number of skinks recorded increased to 12, within three impact sites (TG02, TG03 and TG05). Lastly, during Year 3, the number of skinks recorded was four, within two impact sites (TG02 and TG05). The number of individuals recorded at control sites increased over the years, starting from five in Year 1, 12 in Year 2 and 24 in Year 3.

All sites where the species was recorded during baseline surveys (Year 1) recorded Alpine She-oak presence in Year 2 and Year 3 as well, except for TG03 where the species was last recorded in March 2022. Alpine She-oak Skink was not detected at TG04 and TG10, these sites were only recently moved or established to better reflect Alpine She-oak Skink on site.

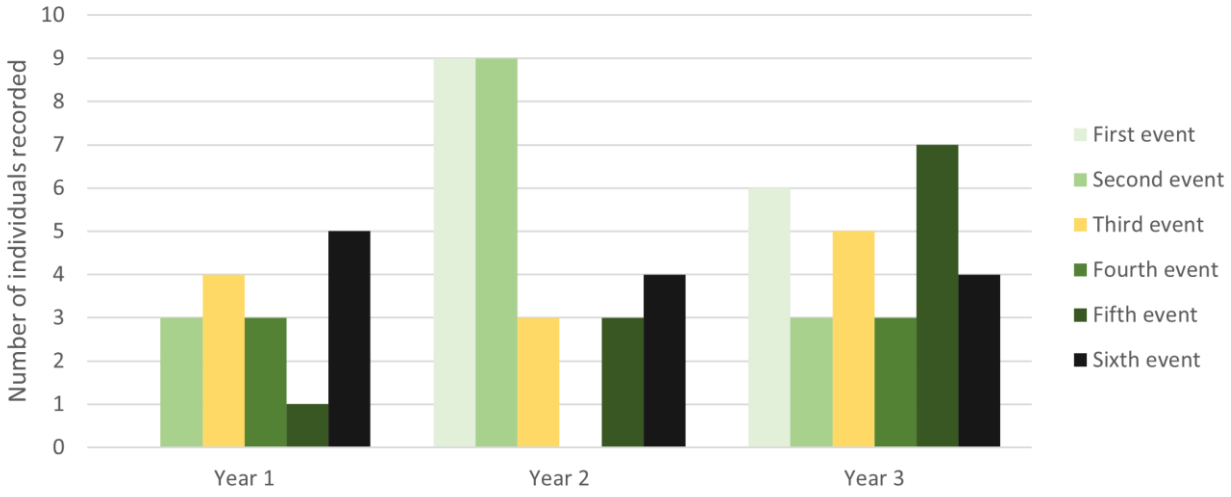
A comparison of Year 3 and Year 2 presence compared to Year 1 baseline is presented in Plate 3.24.



Notes: TG01 and TG09 were discontinued in Year 2 (March 2022), and TG10 and TG11 were established as a replacement.

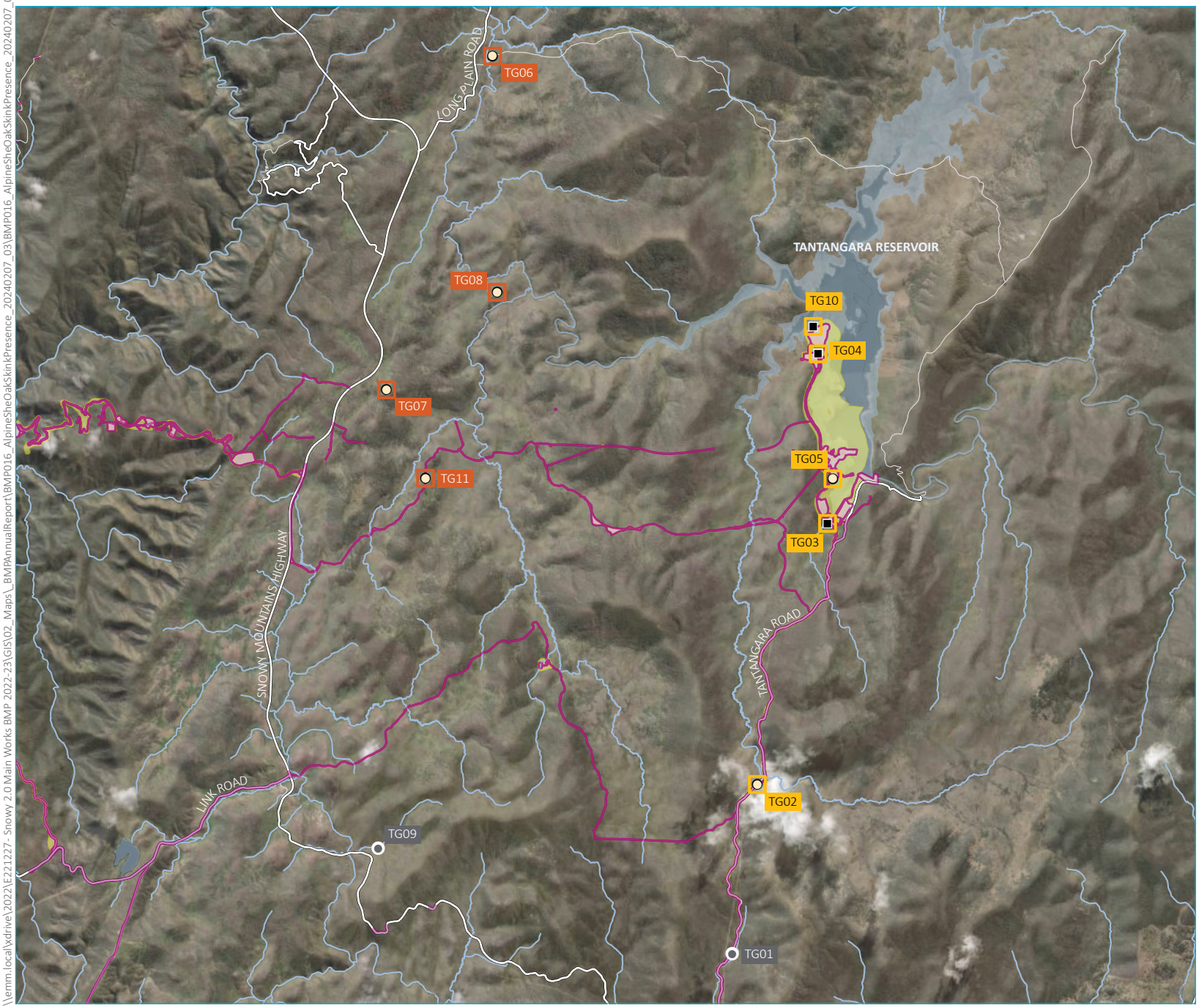
Plate 3.24 Alpine She-Oak Skink records during Year 3 and Year 2 compared to baseline (Year 1)

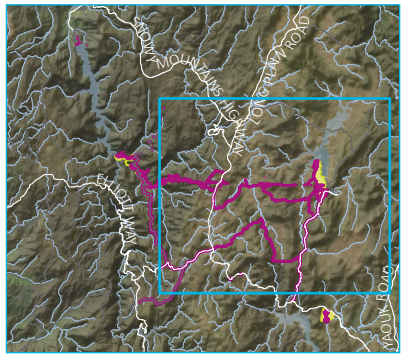
Plate 3.25 shows the comparison between Year 3, Year 2 monitoring events compared to Year 1 baseline. No apparent temporal trend was identified comparing the results of different monitoring events across Year 1, Year 2 and Year 3.



Notes: During Year 1, no first monitoring event was undertaken.

Plate 3.25 Alpine She-Oak Skink records during the six monitoring events of Year 1, Year 2 and Year 3





KEY

Approved disturbance

Approved construction envelope

Alpine She-oak Skink monitoring location

Control

Impact

Decommissioned in March 2023

Presence

Absence

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

Waterbody

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Alpine She-oak Skink presence/ absence during Year 3

Snowy 2.0
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Annual report
Figure 3.13

snowy 2.0

EMM creating opportunities

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3.5 Feral animal monitoring

3.5.1 Occupancy (presence/absence) monitoring

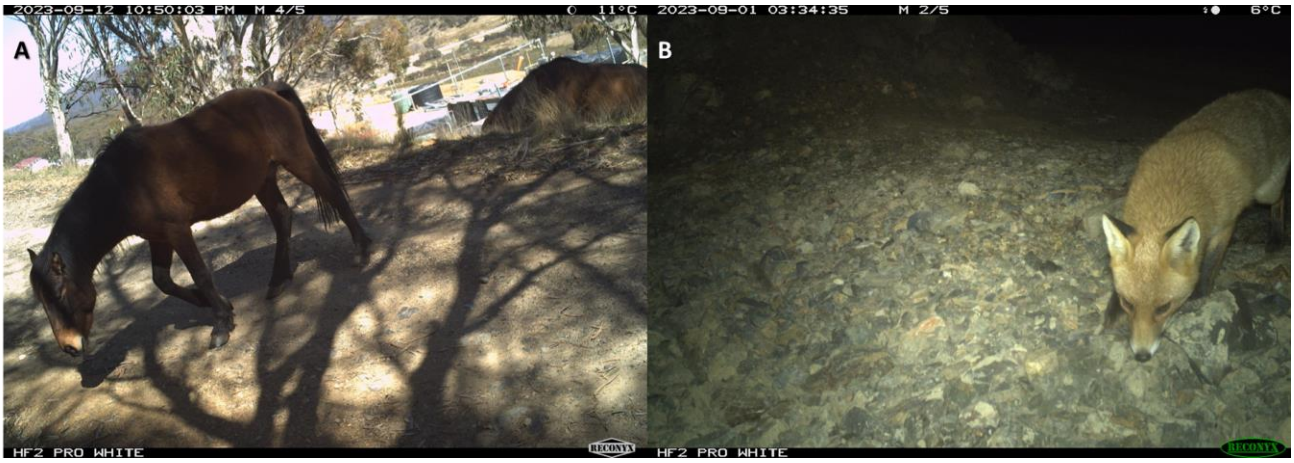
The objective of the feral animal occupancy monitoring is to determine presence/absence of feral animals within proximity to the project for control.

i Year 3

During Year 3, 19 sites were surveyed during each of the four monitoring events (see Section 3.2). Each site is comprised of two replicates, where 19 monitoring sites results in 38 cameras having potential to record feral species.

Overall, ten species of feral animals were recorded across 51 monitoring sites, representing 88% of all monitoring sites (Figure 3.14 to Figure 3.20). Out of the 58 monitoring sites, 60% recorded Red Fox (*Vulpes vulpes*), 43% recorded European Rabbit (*Oryctolagus cuniculus*), and 41% of the sites reported Feral Cat (*Felis catus*) presence (Plate 3.26) (Photograph 3.6). Other feral animals recorded included Feral Horse (*Equus caballus*) (24%), Sambar Deer (*Cervus unicolor*) (24%), Wild Dog (*Canis lupus*) (22%), Red Deer (*Cervus elaphus*) (12%), European Hare (*Lepus europaeus*) (9%), Fallow Deer (*Dama dama*) (2%) and Feral Pig (*Sus scrofa*) (2%) (Plate 3.26). No Rusa Deer (*Cervus timorensis*) were recorded by remote cameras in Year 3.

Feral animal presence/absence at each monitoring site is summarised in Table 3.13. Percentage of feral animals at remote camera sites during Year 3 is presented in Plate 3.26. Further detailed information including monitoring dates and presence/absence at each camera is provided in Appendix H.



Photograph 3.6 Feral Horse (A) and Red Fox (B) recorded on site in Year 3

Table 3.13 Feral animal remote camera presence/absence

Site name	Feral Cat				European Hare				European Rabbit				Feral Horse				Red Fox				Deer*				Wild Dog				Feral Pig			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
FC03		1	1							1	1	1								1		1		1								
FC04																						1	1									
FC05												1					1				1											
FC06																																
FC07									1		1						1				1	1	1					1				
FC08																																
FC09																																
FC10																		1				1										
FC11	1	1																														
FC12								1				1				1																
FC13				1																						1						
FC14					1					1								1								1						
FC15	1			1					1				1	1		1	1			1				1		1		1				
FC16		1							1				1	1		1	1					1				1						
FC17	1	1							1	1		1	1	1		1		1								1						
FC18									1					1										1								
FC19		1							1	1	1							1				1										
FC20			1							1	1			1				1						1								
FC21										1												1										

Notes: *The deer category includes Red, Sambar, Fallow Deer, as grouped within the BMP.

Cells highlighted in grey represent sites with unsuitable habitat for the Smoky Mouse. Blank cells represent absence of species.

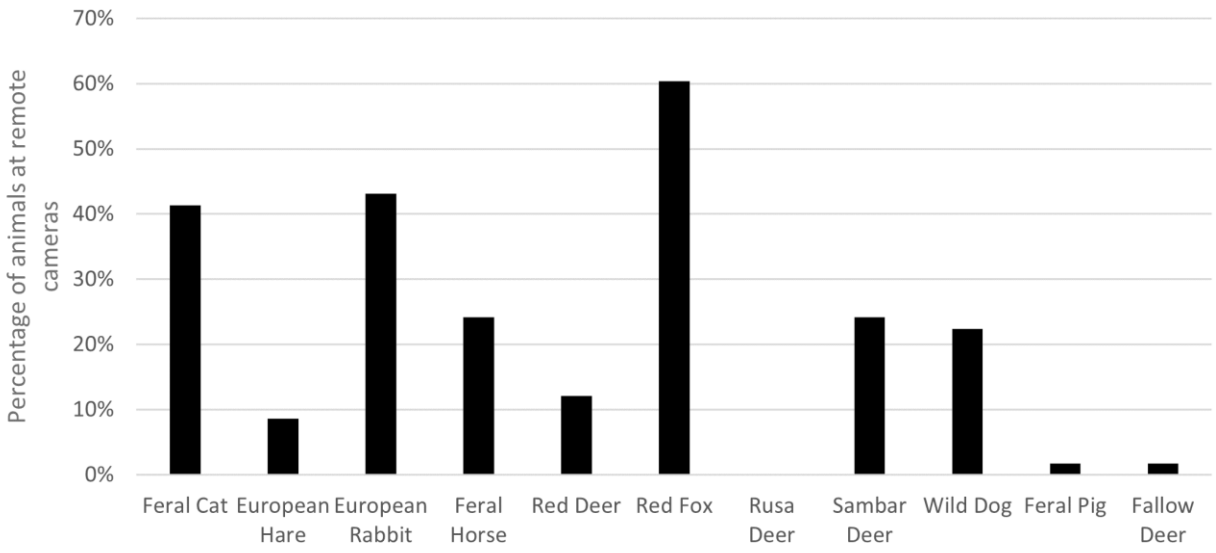


Plate 3.26 Percentage of feral animals at remote camera sites during Year 3

ii Comparative analysis- Year 1, Year 2 and Year 3

Between Year 1 and Year 2, a slight decline in the number of feral species was observed. During Year 1, ten feral species were recorded across 55 monitoring sites (92% of all monitoring sites surveyed in Year 1), while during Year 2, nine species were recorded across 52 monitoring sites (90% of all monitoring sites surveyed in Year 2). In Year 3, ten feral species were recorded across 51 monitoring sites (88% of all monitoring sites surveyed in Year 3).

Year 1, Year 2 and Year 3 shared the three most frequent feral species: European Rabbit, Red Fox and Feral Cat. The percentage of sites recording European Rabbit declined from Year 1 (67% of all Year 1 sites) over to Year 3 (43% of all Year 3 sites), as did the percentage of sites that recorded Feral Cat in Year 1 (67% of all Year 1 sites), in comparison to Year 3 (43% of all Year 3 sites). The percentage of sites that recorded Red Fox increased in Year 3 (60% of all Year 3 sites), in comparison to Year 1 (55% of all Year 1 sites) and Year 2 (50% of all Year 2 sites) (Plate 3.27).

Overall, the percentage of cameras that recorded feral animals declined or remained similar to Year 2 for all the species, except for the Red Deer and the Feral Pig, which were both recorded again in Year 3, after their absence in Year 2. Rusa Deer was recorded during Year 1 and Year 2, but not during Year 3.

A comparison of the percentage of feral animals recorded across all monitoring sites during Year 2 and Year 3 compared to Year 1 baseline is presented in Plate 3.27.

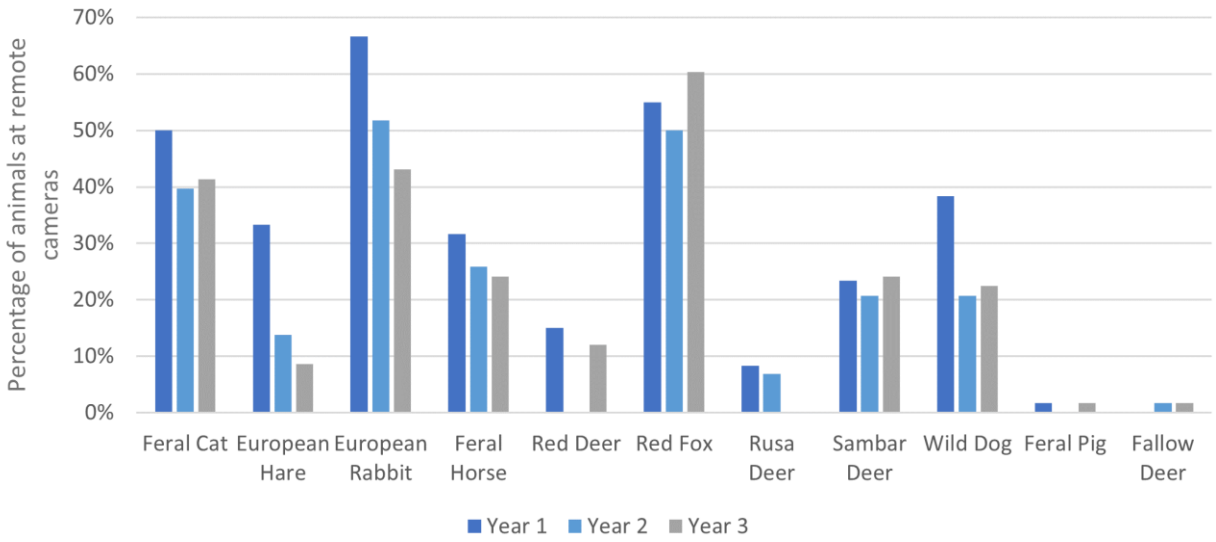


Plate 3.27 Percentage of feral animals recorded across all monitoring sites during Year 2 and Year 3 compared to baseline (Year 1)

3.5.2 Abundance monitoring

The objective of the feral animal abundance monitoring is to determine feral animal abundance within proximity to the project for control.

i Year 3

Five species of feral animals were recorded during Year 3, which include:

- European Rabbit (*Oryctolagus cuniculus*)
- Feral Horse (*Equus caballus*)
- Red Fox (*Vulpes vulpes*)
- Fallow Deer (*Dama dama*)
- Sambar Deer (*Cervus unicolor*).

During Year 3, the most abundant feral animal was European Rabbit (*Oryctolagus cuniculus*), which reached its highest abundancy at Rock Forest (4.6 animals/km annual abundance) and Tantangara Dam (1.9 animals/km annual abundance) management zones (Plate 3.28). The second and third most abundant feral animal species recorded during Year 3 were Feral Horse (*Equus caballus*) (2.3 animals/km annual abundance at Tantangara Dam) and Sambar Deer (*Cervus unicolor*) (0.1 animals/km annual abundance at Lobs Hole Ravine Road Bottom).

During Year 3, the management zone recording the highest abundance of feral animals was Rock Forest, which documented an average abundance of 4.6 feral animals/km, followed by Tantangara Dam (4.2 feral animals/km) and Lobs Hole Ravine Road Bottom (0.8 feral animals/km).

Feral animal abundance at monitoring sites is summarised in Table 3.14. The Year 3 abundance per km for each management zone is presented in Plate 3.28. Further detailed information including monitoring dates is provided in Appendix H.

Table 3.14 Total number of individuals (and abundance of feral animals per km) recorded within each monitoring location in Year 3

Monitoring event	LHRR Bottom	LHRR North	LHRR South	Marica	Rock Forest	Tantangara Dam	Tantangara Road
First							
European Rabbit	3 (0.2)	NA	1 (0.1)	1 (0.1)	6 (6.2)	36 (2.6)	1 (0.1)
Feral Horse	-	NA	-	-	-	50 (3.7)	13 (0.8)
Red Fox	1 (0.1)	NA	-	-	-	-	-
Sambar Deer	1 (0.1)	NA	1 (0.1)	-	-	-	-
Second							
European Rabbit	18 (1.4)	2 (0.5)	-	3 (0.2)	8 (3.9)	12 (1.3)	5 (0.2)
Feral Horse	-	-	-	-	-	4 (0.4)	4 (0.1)
Red Fox	1 (0.1)	-	-	-	-	1 (0.1)	-
Third							
European Rabbit	3 (0.2)	1 (0.2)	-	1 (0.1)	1 (0.5)	13 (1.4)	13 (0.4)
Feral Horse	-	-	-	-	-	3 (0.3)	3 (0.1)
Red Fox	-	-	1 (0.03)	-	-	-	-
Sambar Deer	6 (0.5)	-	-	-	-	-	-
Fourth							
European Rabbit	9 (0.7)	1 (0.2)	-	2 (0.1)	18 (8.7)	13 (1.4)	11 (0.4)
Feral Horse	-	-	-	-	-	34 (3.7)	4 (0.1)
Red Fox	-	1 (0.2)	-	-	-	-	-
Fallow Deer	-	-	-	-	-	1 (0.1)	-
Sambar Deer	-	-	1 (0.03)	-	-	-	-

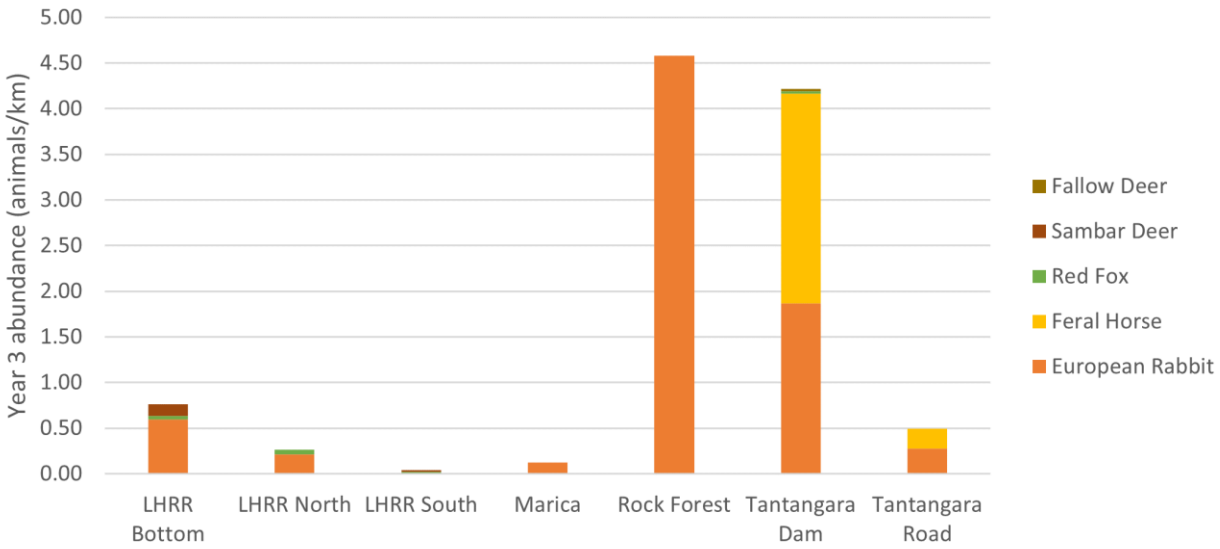


Plate 3.28 **Abundance of feral animals observed per km at each location across four monitoring events during Year 3**

ii Comparative analysis- Year 1, Year 2 and Year 3

During Year 1, Year 2 and Year 3, the same eight management zones were surveyed. The distances travelled during the three monitoring years is summarised in Table 3.15.

The overall number of feral animals recorded increased from five species in Year 1 to eight species in Year 2, to then return to five species in Year 3. No new species were recorded during Year 3.

Across Year 1, Year 2 and Year 3, the greatest annual abundance of feral animals was observed in Year 1 across five out of the seven management zones. Among the two remaining management zones, Rock Forest recorded the highest peak in feral animal abundance in Year 2, while Tantangara Dam recorded its peak in Year 3.

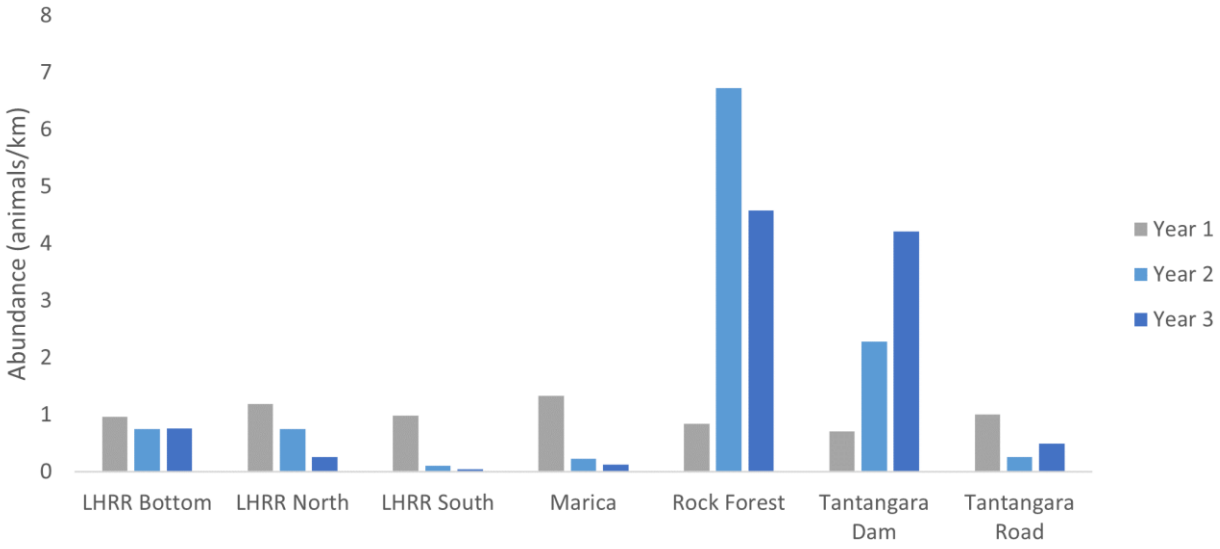
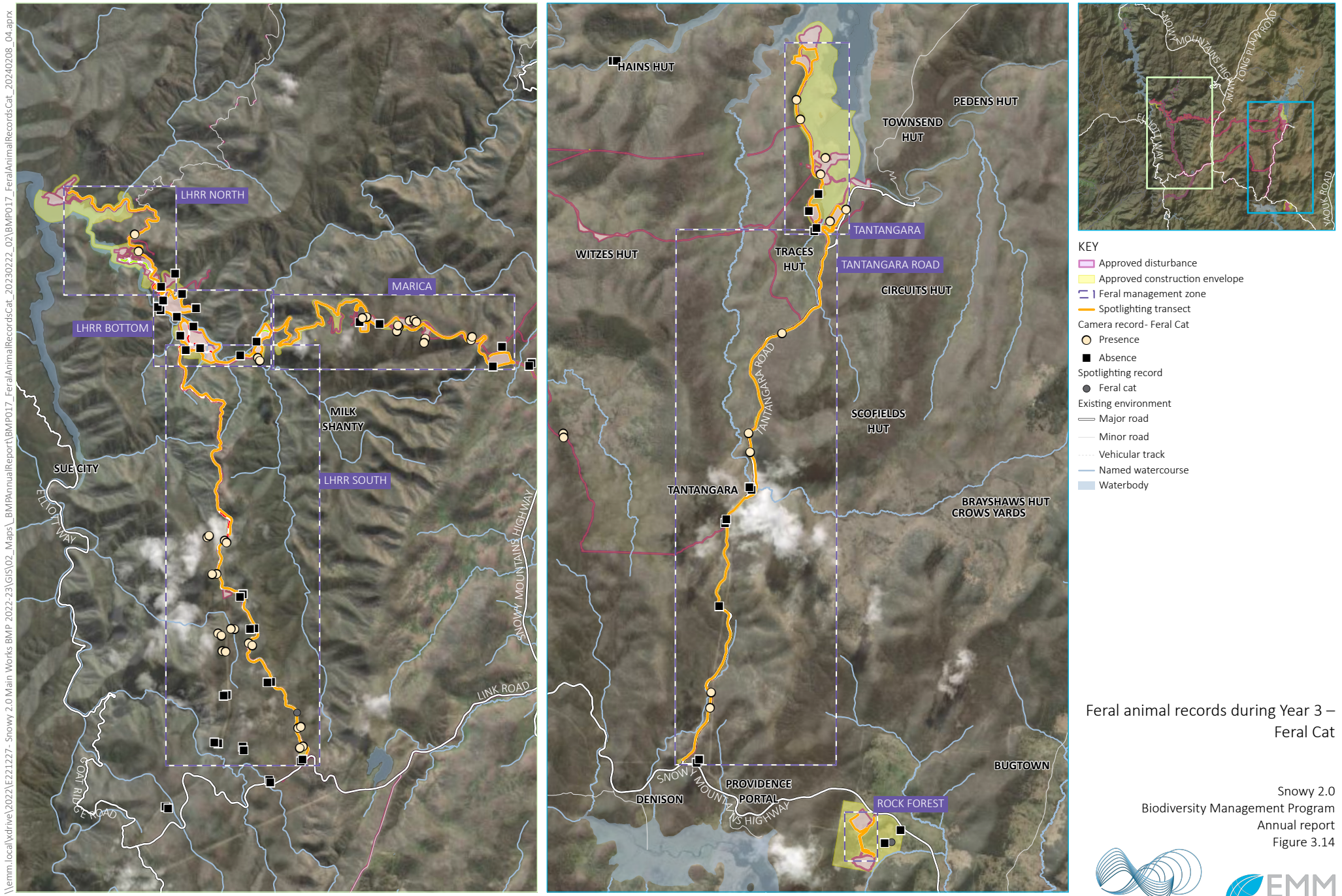


Plate 3.29 **Abundance of feral animals per km at each location during Year 3 compared to Year 2 and baseline (Year 1)**

Table 3.15 Distance travelled across monitoring events during Year 1, Year 2 and Year 3

Monitoring event	LHRR Bottom	LHRR North	LHRR South	Marica	Rock Forest	Tantangara Dam	Tantangara Road
Year 3							
First	18.0	NA	14.5	15.9	1.0	13.6	15.8
Second	12.5	4.0	28.6	14.6	2.1	9.1	30.5
Third	10.0	5.2	28.9	11.9	2.2	9.9	30.8
Fourth	14.6	9.8	27.3	14.5	1.9	7.0	31.7
Total	**55.1**	**19**	**99.3**	**56.9**	**7.2**	**39.6**	**108.8**
Year 2							
First	10.0	2.3	14.6	9.0	1.6	5.2	15.7
Second	15.9	6.7	14.5	8.8	1.6	8.3	15.6
Third	15.5	6.5	14.6	11.3	1.1	20.0	15.4
Fourth	6.8	4.4	14.2	14.3	1.2	13.4	15.7
Total	**48.1**	**20.0**	**57.9**	**43.4**	**5.5**	**46.9**	**62.4**
Year 1							
First	10.3	7.3	14.2	13.6	NA	8.3	15.3
Second	13.4	4.4	14.0	19.3	NA	8.3	16.1
Third	10.3	7.3	14.2	10.4	3.3	7.6	15.5
Fourth	12.3	4.9	14.4	14.6	1.3	9.0	15.6
Total	**46.2**	**23.8**	**56.8**	**57.9**	**4.6**	**33.2**	**62.5**



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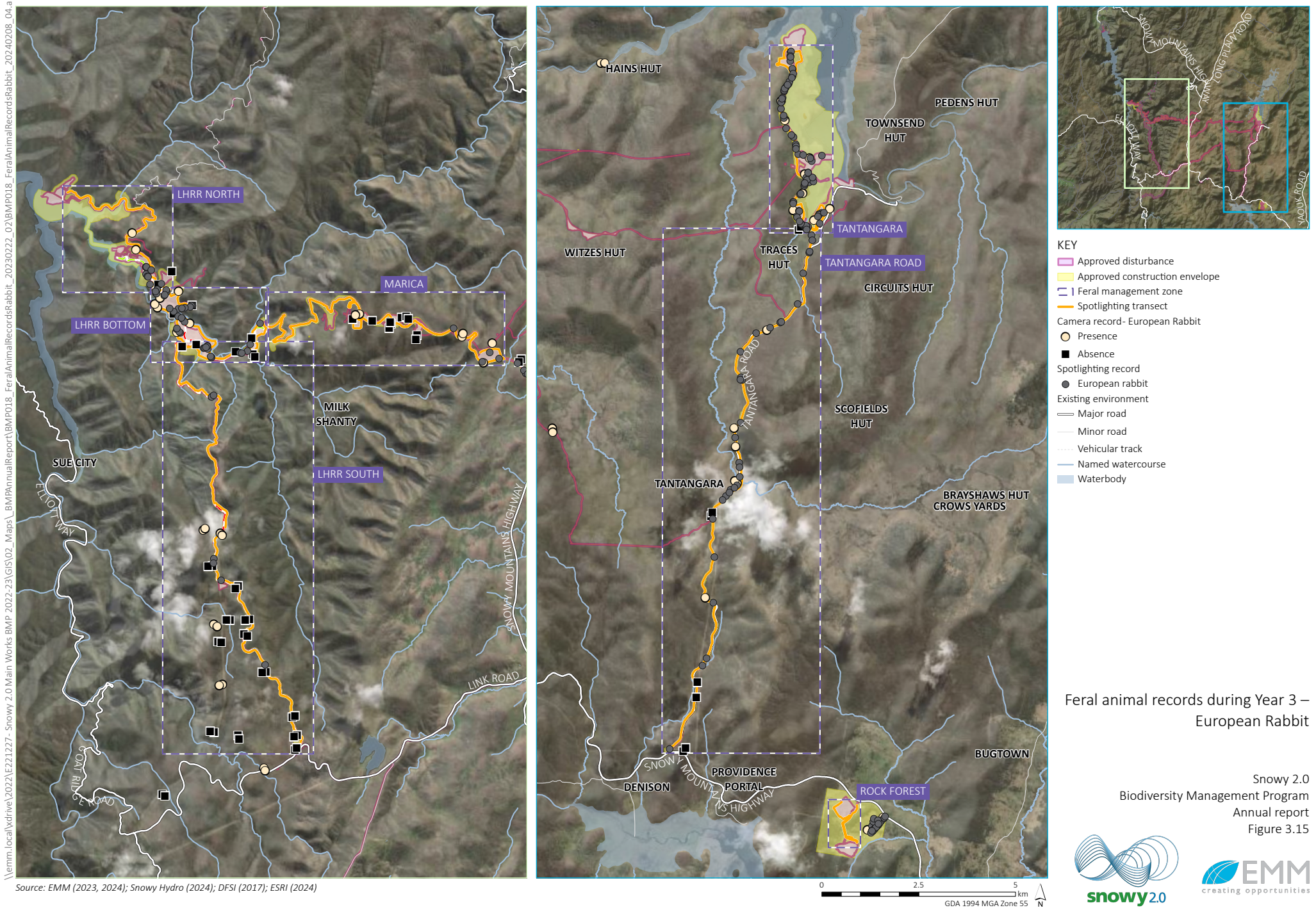
Source: EMM (2023, 2024); Snowy Hydro (2024); DFSI (2017); ESRI (2024)

Feral animal records during Year 3 – Feral Cat

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.14



Source: EMM (2023, 2024); Snowy Hydro (2024); DFSI (2017); ESRI (2024)

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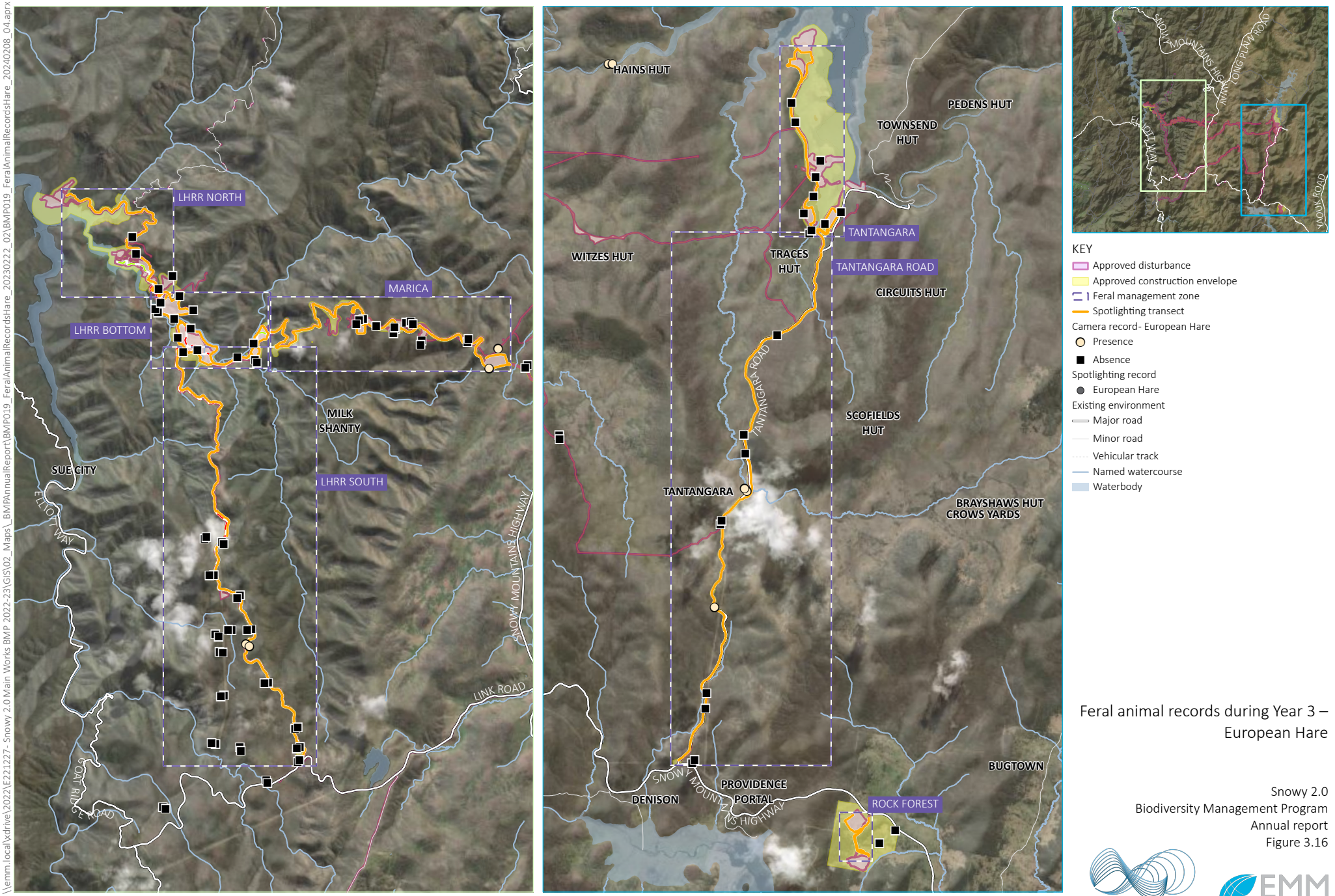
Feral animal records during Year 3 – European Rabbit

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.15



Source: EMM (2023, 2024); Snowy Hydro (2024); DFSI (2017); ESRI (2024)

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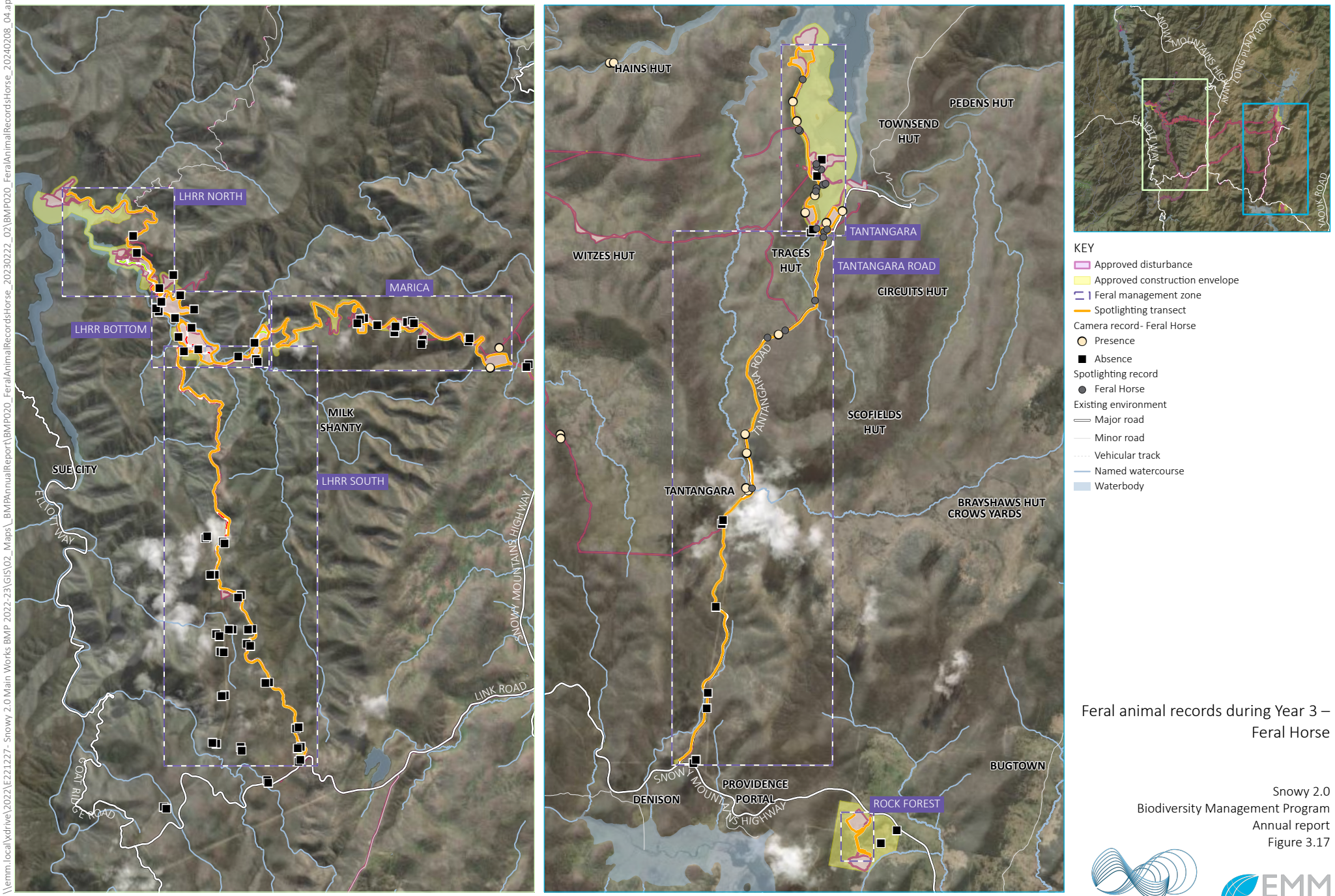
Feral animal records during Year 3 – European Hare

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.16



Source: EMM (2023, 2024); Snowy Hydro (2024); DFSI (2017); ESRI (2024)

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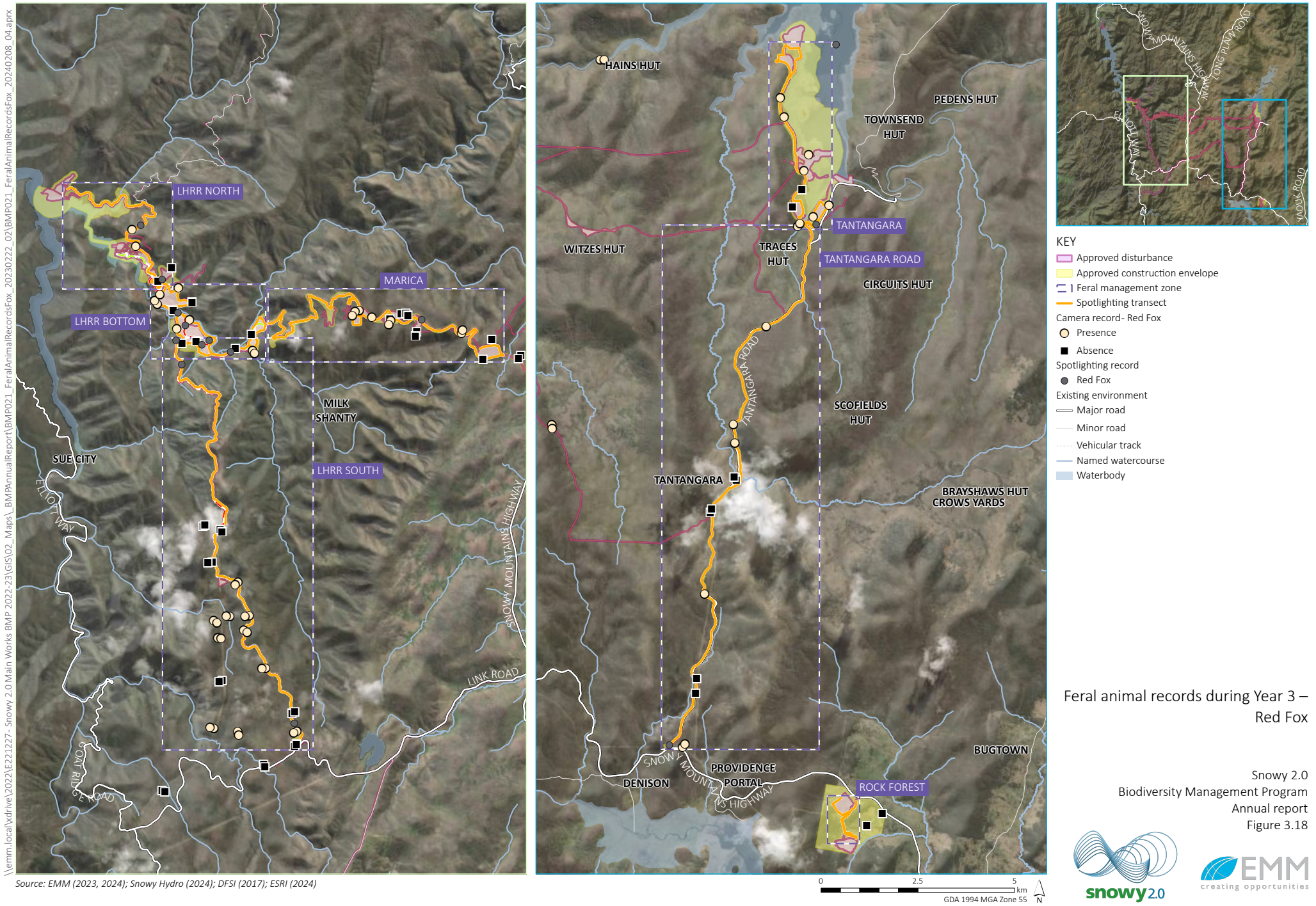
Feral animal records during Year 3 – Feral Horse

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.17



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Source: EMM (2023, 2024); Snowy Hydro (2024); DFSI (2017); ESRI (2024)

Feral animal records during Year 3 – Red Fox

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.18

snowy 2.0

EMM
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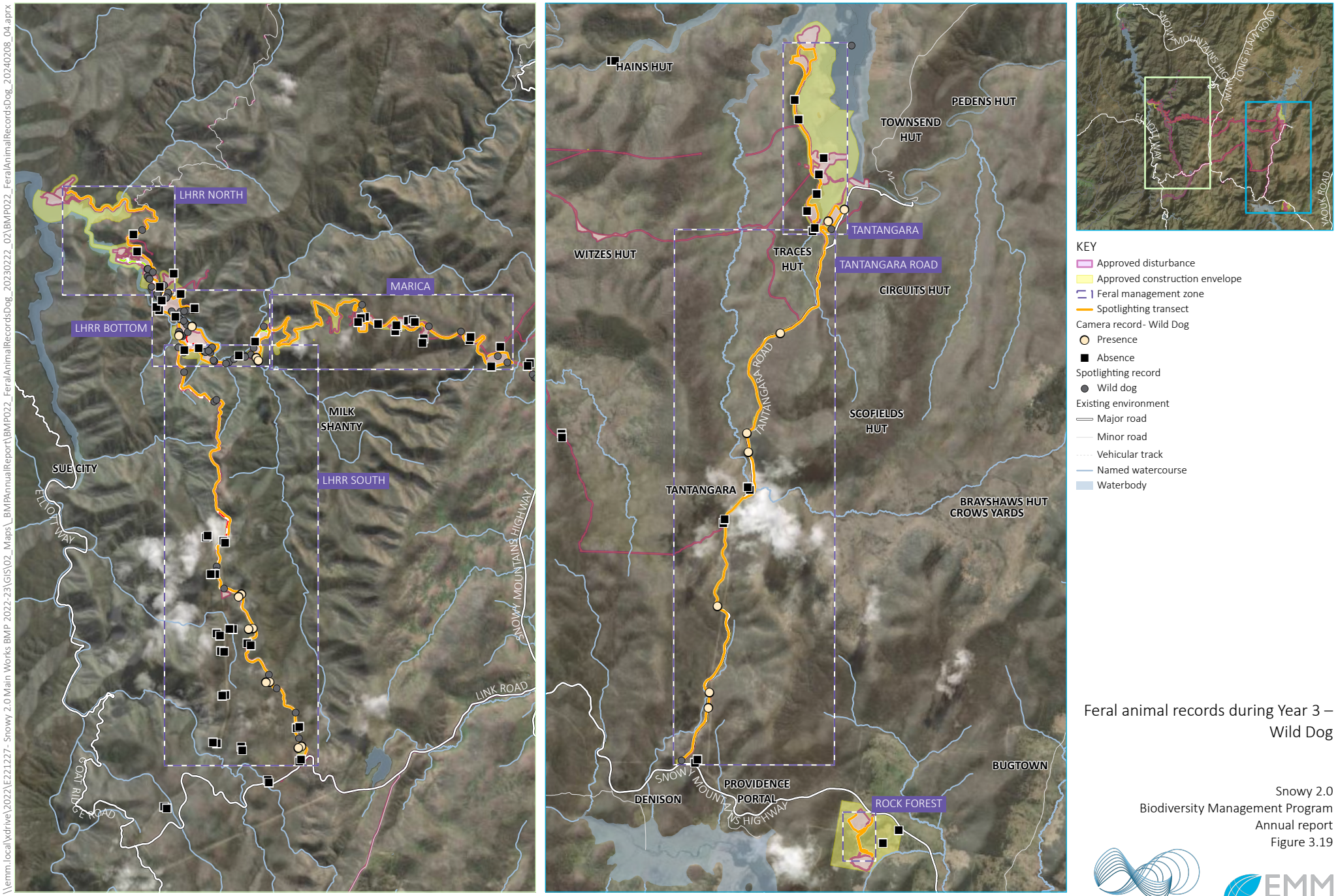

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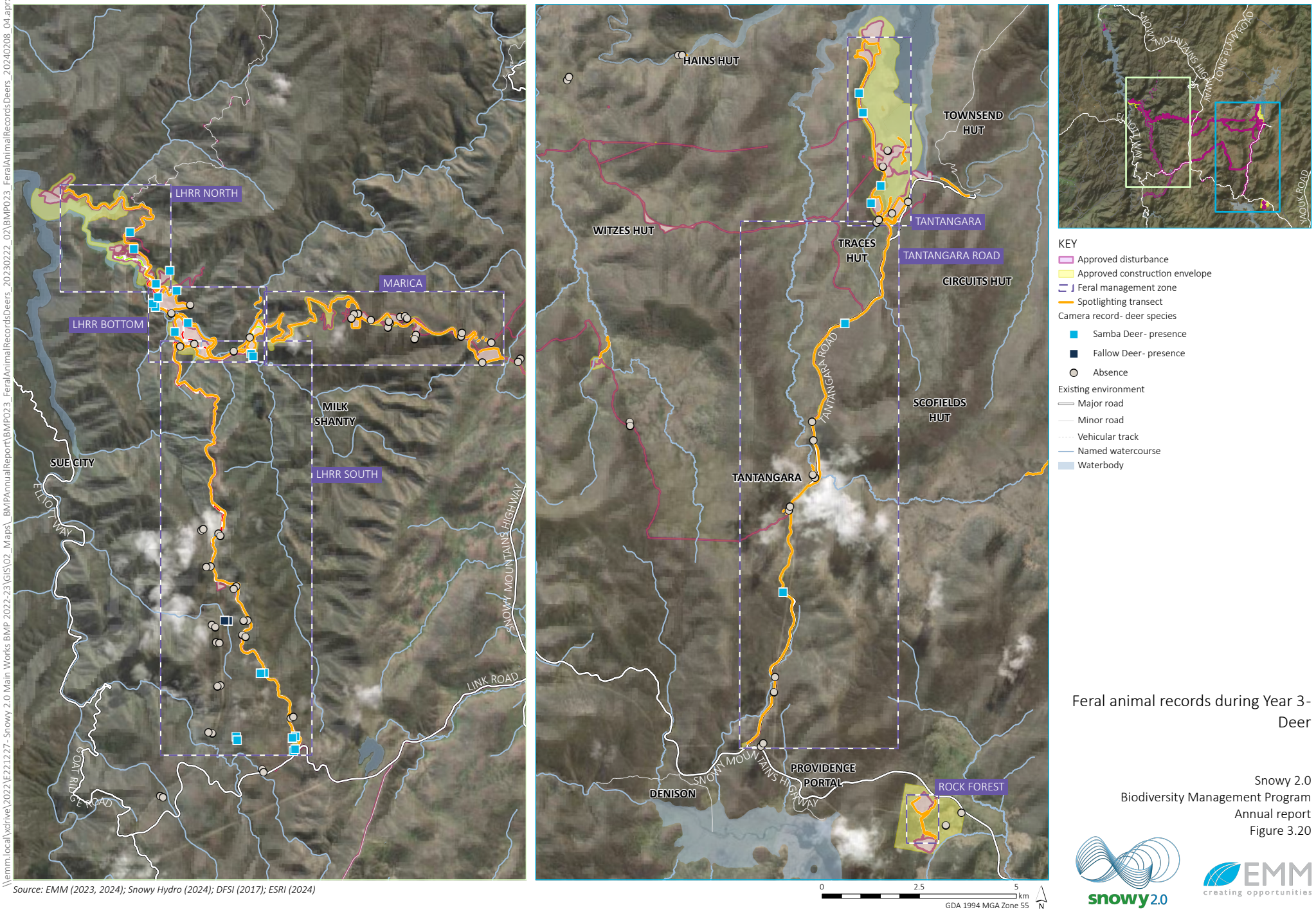
Source: EMM (2023, 2024); Snowy Hydro (2024); DFSI (2017); ESRI (2024)

Feral animal records during Year 3 – Wild Dog

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.19

snowy 2.0

EMM creating opportunities



Source: EMM (2023, 2024); Snowy Hydro (2024); DFSI (2017); ESRI (2024)

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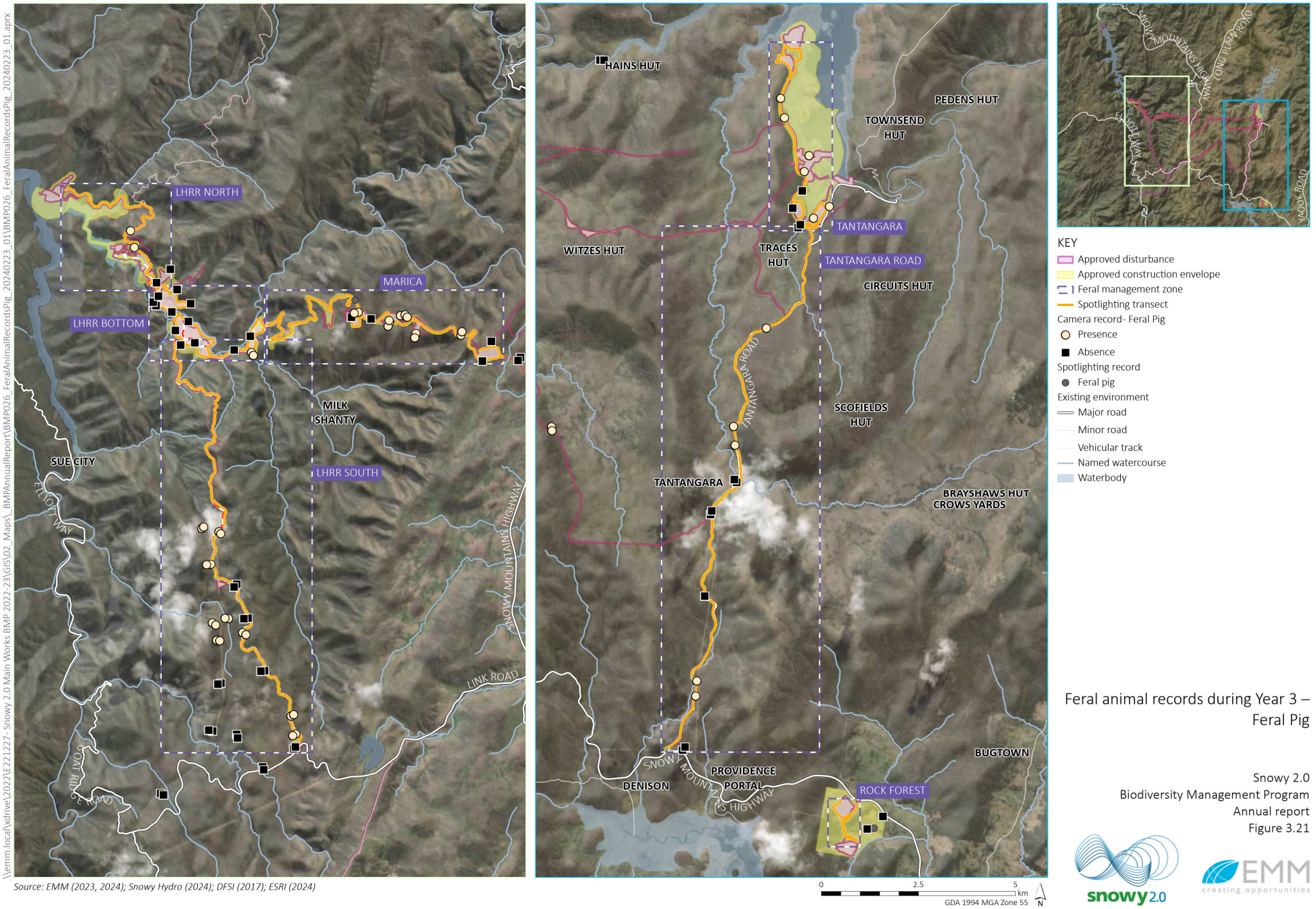
Feral animal records during Year 3- Deer

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.20



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Source: EMM (2023, 2024); Snowy Hydro (2024); DFSI (2017); ESRI (2024)

Feral animal records during Year 3 – Feral Pig

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.21

3.6 Weed and pathogen monitoring

3.6.1 Weed presence/absence

The objective of the weed presence/absence monitoring is to determine presence/absence and abundance of weeds within proximity of the project (roads and key project infrastructure) for routine control in accordance with the Weed, Pest and Pathogen Management Plan (FGJV 2020).

i Year 3

A total of ten priority weed species were recorded within 50 m of the main project roads, accommodation camps and key construction compounds and four priority weed species were recorded within 50 m of the threatened flora monitoring locations (Figure 3.22). Overall, ten priority weeds were recorded in Year 3.

For the purpose of weed presence/absence monitoring, eight management zones have been defined as:

- Bottom of Lobs Hole
- Lobs Hole Ravine Road Top
- Lobs Hole Ravine Road Bottom
- Marica
- Rock Forest
- Tantangara Dam
- Tantangara Road Bottom
- Tantangara Road Top.

The most frequent priority weed recorded was Spear Thistle (*Cirsium vulgare*), which was found in all management zones and threatened flora plots. Sweet Vernal Grass (*Anthoxanthum odoratum*) and Yorkshire Fog Grass (*Holcus lanatus*) were both found at seven out of the eight management zones, and at threatened flora plots. Out of the eight management zones inspected, Tantangara Dam had the greatest number of priority weeds (nine species), followed by Bottom of Lobs Hole and Lobs Hole Ravine Road Bottom (seven species).

Four priority weed species were found at 'dense' cover (>50%), such as Sweet Vernal Grass (*Anthoxanthum odoratum*), Blackberry (*Rubus* spp.) and St John's Wort (*Hypericum perforatum*). Dense cover of weeds was recorded across five management zones, such as Bottom of Lobs Hole, Lobs Hole Ravine Road bottom, Tantangara Dam, Tantangara Road bottom and Tantangara Road top.

In addition to the ten priority weed species recorded, an additional nine weed species (not listed in the Annexure A of the BMP) were recorded during weed monitoring surveys across all management zones and threatened flora plots. The nine additional weed species are Redtop Bent (*Agrostis gigantea*), Flaxleaf Fleabane (*Conyza bonariensis*), Flatweed (*Hypochaeris radicata*), Sheep Sorrel (*Rumex acetosella*), Dandelion (*Taraxacum officinale*), White Clover (*Trifolium repens*), Bentgrass (*Agrostis* spp.), Sow thistle (*Sonchus* spp.), Prickly Lettuce (*Lactuca* spp.). Amongst these species, Sheep Sorrel was observed across all management zones and at the threatened flora plots. Flatweed (*Hypochaeris radicata*) was observed across six management zones and at threatened flora plots. Dandelion (*Taraxacum officinale*) is the only weed species that was not found at any management zone, but just at the threatened flora plots (TF09 and TF08), where this weed is present in trace abundance. Sheep Sorrel recorded a 'dense' cover at Tantangara Road bottom and a 'medium' cover at Marica and Tantangara Dam.

Weed presence/absence within management zones is summarised in Table 3.16 and presented in Plate 3.30. Other weed species, which are not included in Annexure A of the BMP as priority weeds were surveyed in Year 2 and are listed in Table 3.17. Monitoring events and weed records are provided in Appendix I.1.

Table 3.16 Priority weed species recorded – Year 3

Species Name	Common Name	Management Zone								
		Bottom of Lobs Hole	Lobs Hole Ravine Road Bottom	Lobs Hole Ravine Road Top	Marica	Rock Forest	Tantangara Dam	Tantangara Road Bottom	Tantangara Road Top	Threatened flora plots*
Achillea millefolium	Milfoil/Yarrow									
Agrostis capillaris	Browntop Bent	✓	✓	✓			✓			
Anthoxanthum odoratum	Sweet Vernal Grass	✓		✓	✓	✓	✓	✓	✓	✓
Barbarea verna	Winter Cress									
Carduus nutans	Nodding Thistle									
Cirsium vulgare	Spear Thistle	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cotoneaster spp.	Cotoneaster									
Cytisus scoparius	Scotch Broom									
Dactylis glomerata	Cocksfoot	✓	✓	✓			✓	✓	✓	
Echium plantagineum	Patterson's Curse									
Echium vulgare	Vipers Bugloss									
Eragrostis curvula	African Lovegrass									
Genista monspessulana	Cape Broom									
Hieracium aurantiacum	Hawkweed									
Holcus lanatus	Yorkshire Fog Grass	✓	✓		✓	✓	✓	✓	✓	✓
Hypericum perforatum	St John's Wort	✓	✓	✓	✓		✓	✓	✓	
Juncus effusus	Large Rush									
Leucanthemum vulgare	Ox-eye Daisy				✓		✓	✓	✓	
Lupinus spp.	Lupins									
Lotus spp.	Bird's-foot Trefoil									
Marrubium vulgare	Horehound									
Mimulus moschatus	Musk Monkey Flower									
Nassella trichotoma	Serrated Tussock									
Onopordium acanthium	Scotch Thistle									

Table 3.16 Priority weed species recorded – Year 3

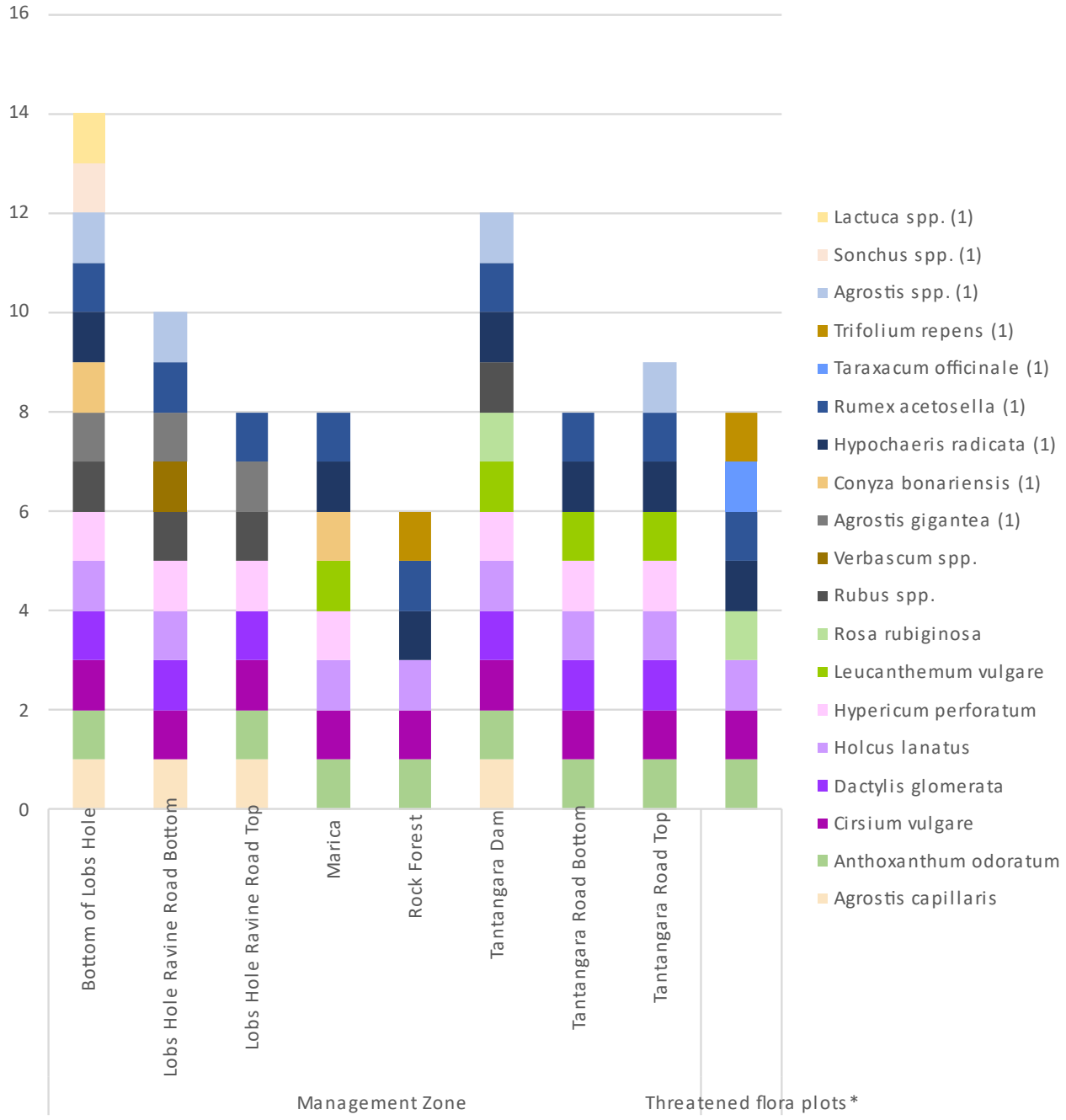
Species Name	Common Name	Management Zone								Threatened flora plots*
		Bottom of Lobs Hole	Lobs Hole Ravine Road Bottom	Lobs Hole Ravine Road Top	Marica	Rock Forest	Tantangara Dam	Tantangara Road Bottom	Tantangara Road Top	
Phleum pratense	Timothy Grass									
Pinus spp.	Pine									
Rosa rubiginosa	Sweet Briar						✓			✓
Rubus spp.	Blackberry	✓	✓	✓			✓			
Salix spp.	Willow									
Ulex nutans	Gorse									
Verbascum spp.	Mullein		✓							
Vinca spp.	Periwinkle									
Xanthium spp.	Bathurst Burr									

Notes: * Weed species was recorded within 50 m of a threatened flora monitoring plot.

Table 3.17 Other weed species recorded (not included in Annexure A) – Year 3

Species Name	Common Name	Management Zone								Threatened flora plots*
		Bottom of Lobs Hole	Lobs Hole Ravine Road Bottom	Lobs Hole Ravine Road Top	Marica	Rock Forest	Tantangara Dam	Tantangara Road Bottom	Tantangara Road Top	
Agrostis gigantea	Redtop Bent	✓	✓	✓						
Conyza bonariensis	Flaxleaf Fleabane	✓			✓					
Hypochaeris radicata	Flatweed	✓			✓	✓	✓	✓	✓	✓
Rumex acetosella	Sheep Sorrel	✓	✓	✓	✓	✓	✓	✓	✓	✓
Taraxacum officinale	Dandelion									✓
Trifolium repens	White Clover					✓				✓
Triticum aestivum	Common Wheat									
Agrostis spp.	Bentgrass	✓	✓				✓		✓	
Sonchus spp.	Sow thistle	✓								
Lactuca spp.	Lettuce	✓								

Notes: * Weed species was recorded within 50 m of a threatened flora monitoring plot.



Notes: * Weed species was recorded within 50 m of a threatened flora monitoring plot; and

(1) Species not listed as priority weeds in Annexure A of the BMP.

Plate 3.30 Weed species recorded in each management zone and at threatened flora plots during Year 3

ii Comparative analysis- Year 1, Year 2 and Year 3

Overall, a lower number of priority weed species was recorded during Year 3 (ten species) when compared to Year 2 (13 species) and Year 1 (16 species). As all species recorded in Year 3 had already been surveyed in Year 1 and Year 2, the occurrence of new priority weed species was not observed within proximity to project infrastructure. Three species that had been surveyed in Year 2 were not observed in Year 3, such as Milfoil/Yarrow (*Achillea millefolium*), Patterson's Curse (*Echium plantagineum*) and Musk Monkey Flower (*Mimulus moschatus*). Three species that had been recorded in Year 1 were not observed in Year 2 and Year 3, such as Vipers Bugloss (*Echium vulgare*), Bird's-foot Trefoil (*Lotus* spp.), Scotch Thistle (*Onopordium acanthium*).

The Ox-eye Daisy (*Leucanthemum vulgare*), a priority weed for the project, was not observed at threatened flora plots for the first time in Year 3. As per Year 2, this species still occurs at four management zones, such as Marica, Tantangara Dam, Tantangara Road Bottom and Tantangara Road Top.

In Year 1 and Year 2, the management zone with the greatest number of priority weed species was Tantangara Dam, with eleven species in both years. In Year 3, Tantangara Dam was still the management zone that recorded the greatest number of priority weed species, but only nine species were observed in the third monitoring year. The number of priority weed species was lower or remained constant the previous monitoring years across the majority of the management zones. However, Lobs Hole Ravine Road Bottom and Lobs Hole Ravine Road Top recorded an increase in the number of priority weed species across the years. Specifically, the number of priority weed species observed at Lobs Hole Ravine Road Bottom in Year 3 was 75% greater than Year 1 and 17% greater than Year 2; while the number of priority weed species observed at Lobs Hole Ravine Road Top in Year 3 was 20% greater than Year 1 and the same as Year 2. Threatened flora plots recorded a decline in the number of priority weeds surveyed in Year 3 (-56% in comparison to Year 1 and -60% in comparison to Year 2).

Three weeds, which are not listed in the Annexure A of the BMP, were recorded for the first time during Year 3. These are Bentgrass (*Agrostis* spp.), Sow thistle (*Sonchus* spp.) and Lettuce (*Lactuca* spp.). All the seven additional weed species recorded in Year 2 were again observed in Year 3, such as Redtop Bent (*Agrostis gigantea*), Flaxleaf Fleabane (*Conyza bonariensis*), Flatweed (*Hypochaeris radicata*), Sheep Sorrel (Rumex aceto*sella*), Dandelion (*Taraxacum officinale*), White Clover (*Trifolium repens*) and Common Wheat (*Triticum aestivum*).

A comparison of Year 1, Year 2 and Year 3 presence is presented in Plate 3.31.

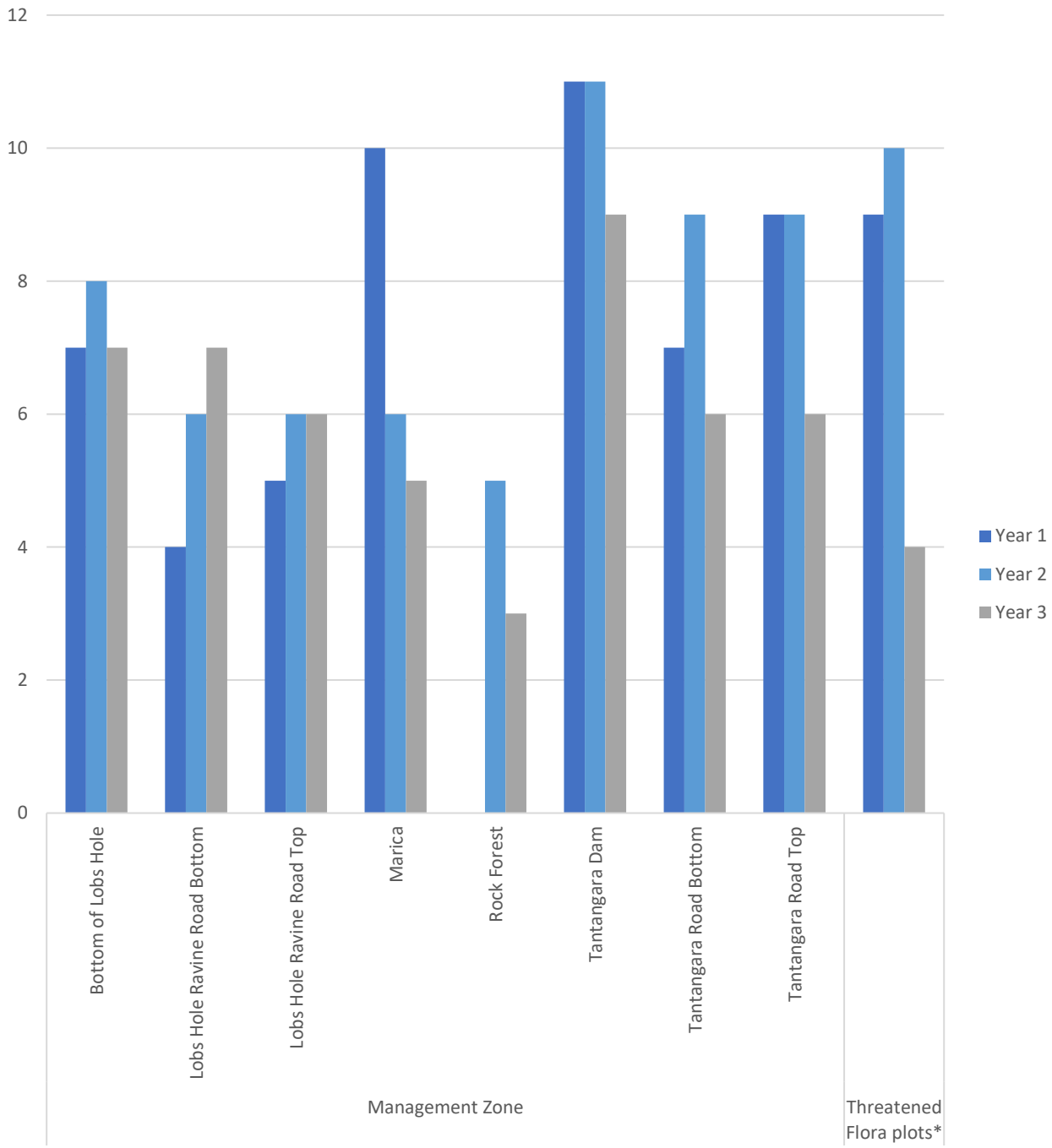
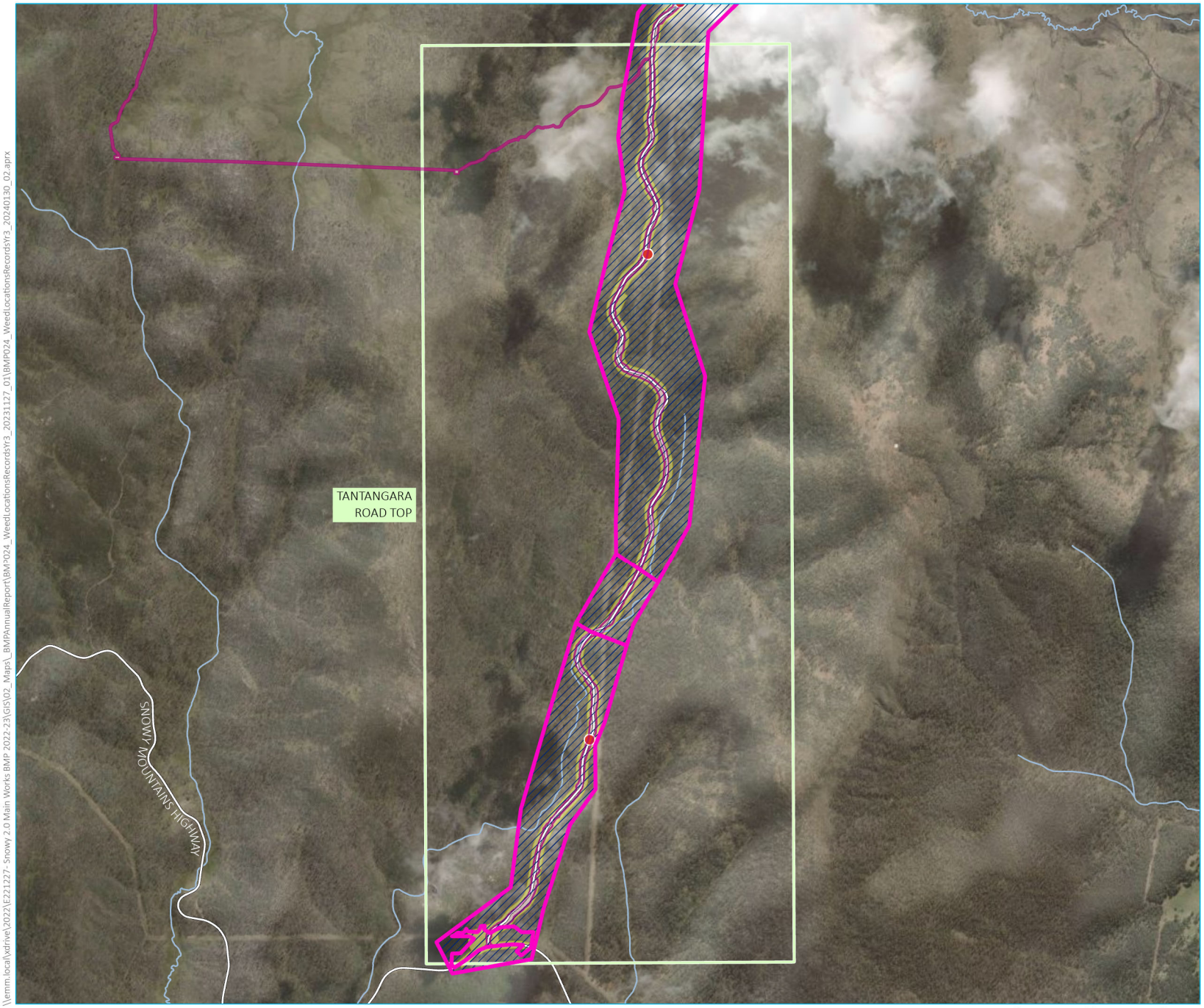
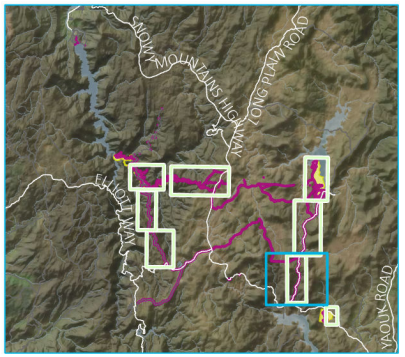


Plate 3.31 **Priority weed species recorded during Year 1, Year 2 and Year 3 across management zones and *threatened flora plots**





KEY

- Approved disturbance
- Approved construction envelope
- Weed management zone
- Weed record (point)
- Weed record
- Weed record (polygon)

Existing environment

- Major road
- Named watercourse
- Waterbody

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Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 0.5 1 km
GDA 1994 MGA Zone 55

N

Weed records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.22a

snowy 2.0

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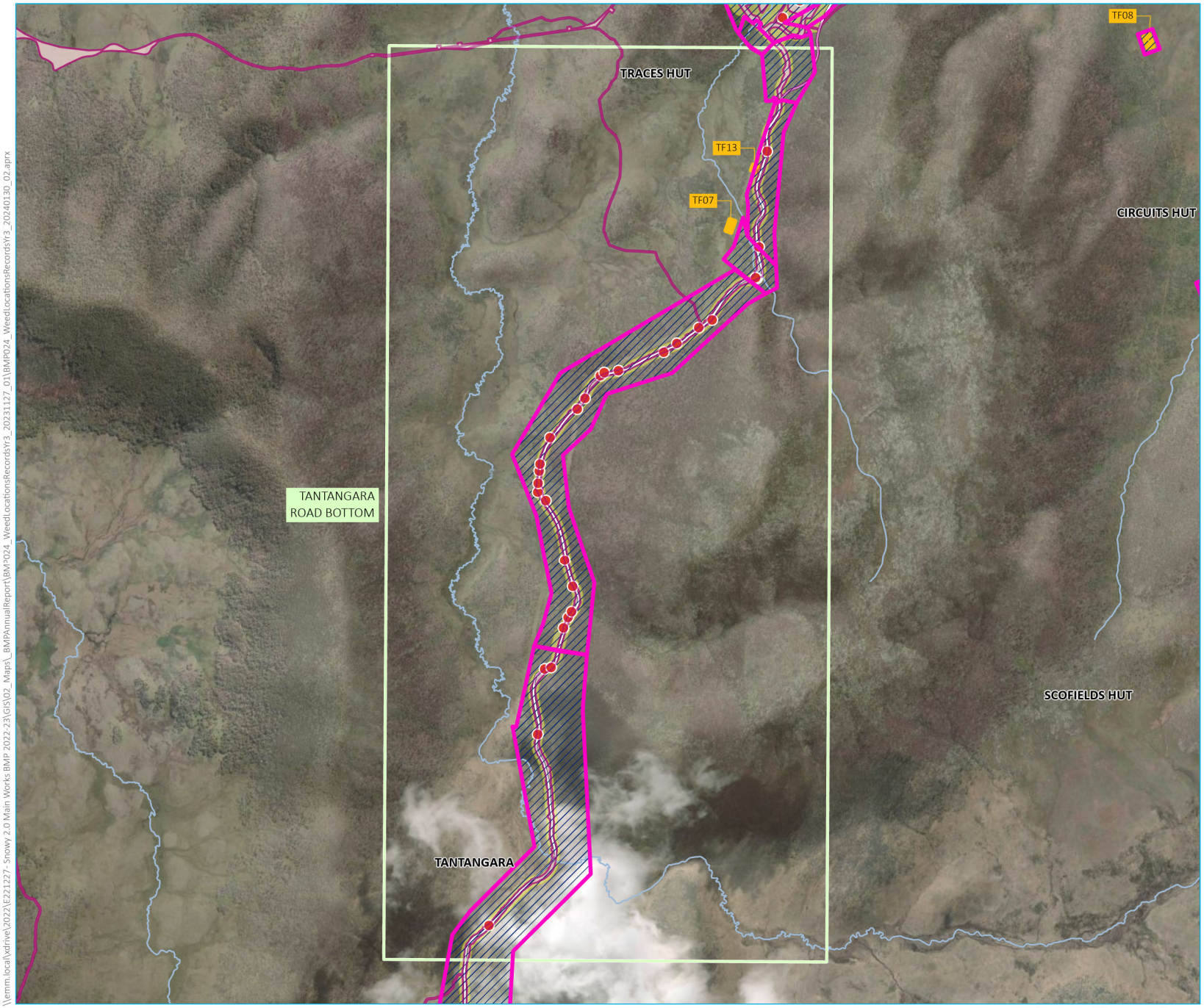

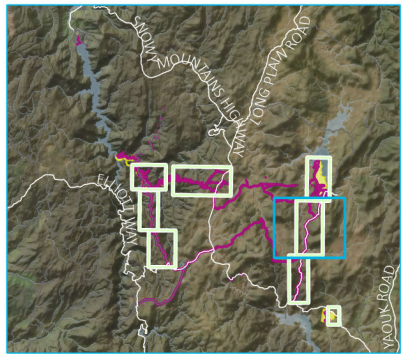

KEY

- Approved disturbance
- Approved construction envelope
- Weed management zone
- Weed record (point)
- Weed record
- Threatened flora monitoring location
- Weed record (polygon)

Existing environment

- Major road
- Named watercourse
- Waterbody

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Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 0.5 1 km
GDA 1994 MGA Zone 55

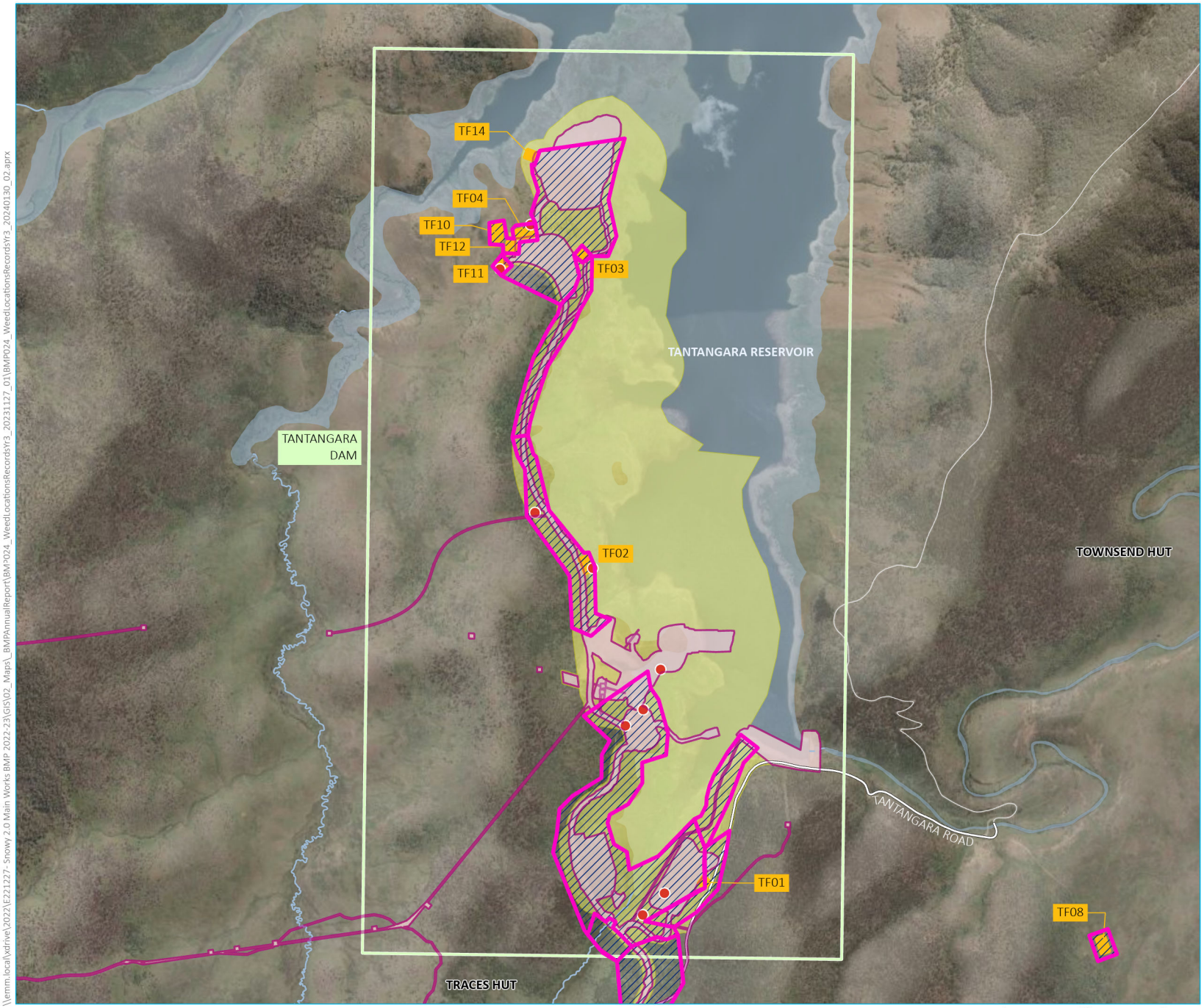
N

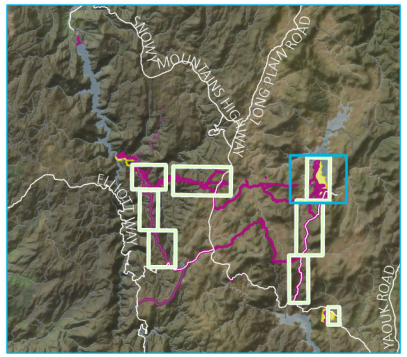
Weed records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.22b

snowy 2.0

EMM
creating opportunities





KEY

- Approved disturbance
- Approved construction envelope
- Weed management zone
- Weed record (point)
- Weed record
- Threatened flora monitoring location
- Weed record (polygon)

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

Weed records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.22c

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 0.5 1 km
GDA 1994 MGA Zone 55

N

snowy 2.0

EMM creating opportunities

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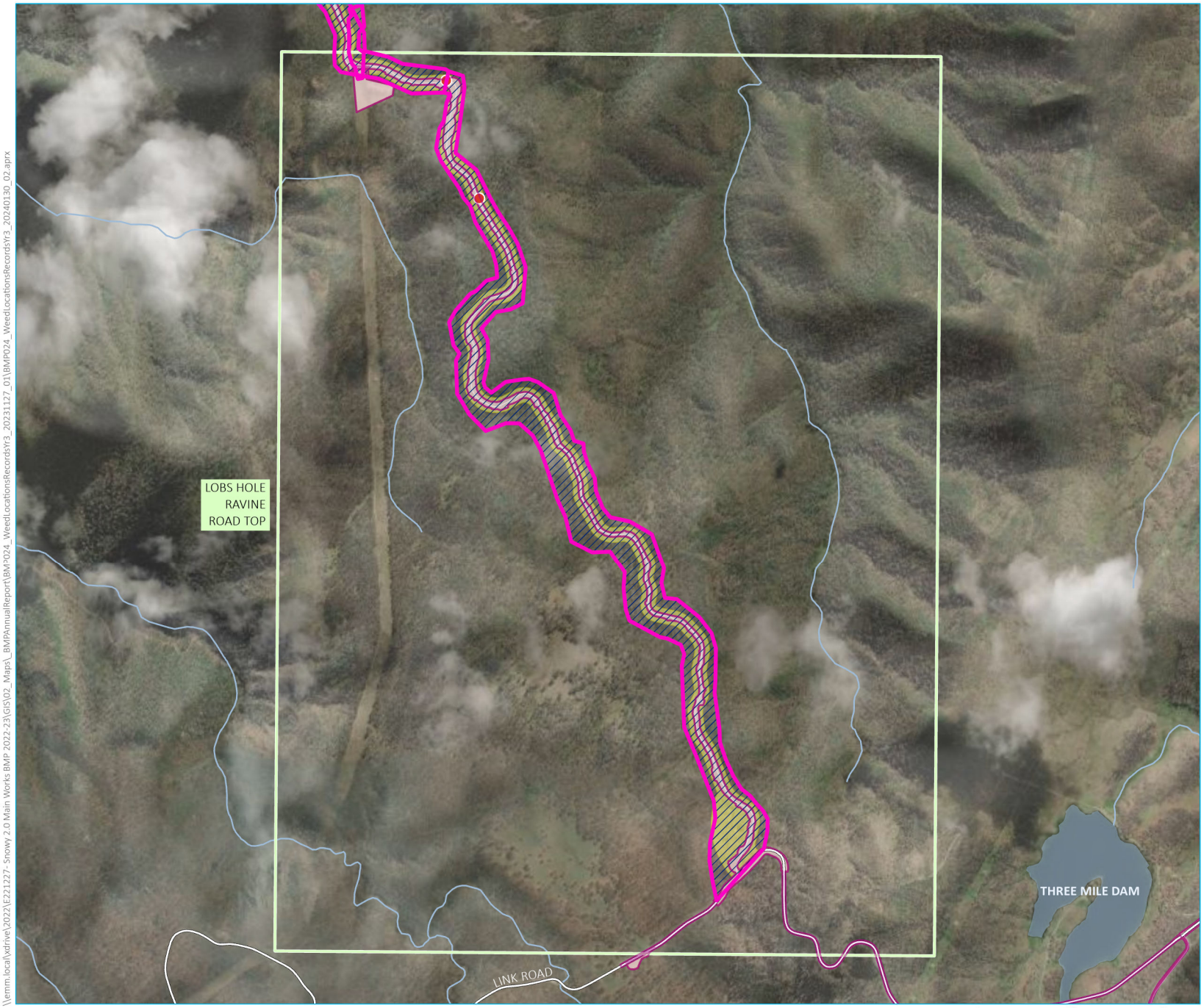

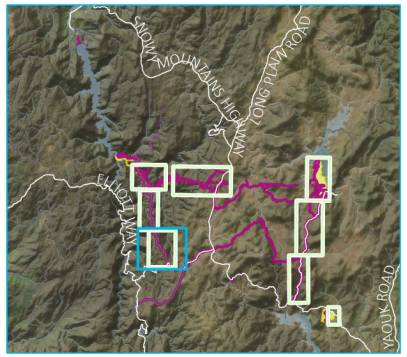

KEY

Approved disturbance
Approved construction envelope
Weed management zone
Weed record (point)
Weed record
Weed record (polygon)

Existing environment

Major road
Minor road
Named watercourse
Waterbody

Weed records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.22d

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 0.5 1 km
GDA 1994 MGA Zone 55

N

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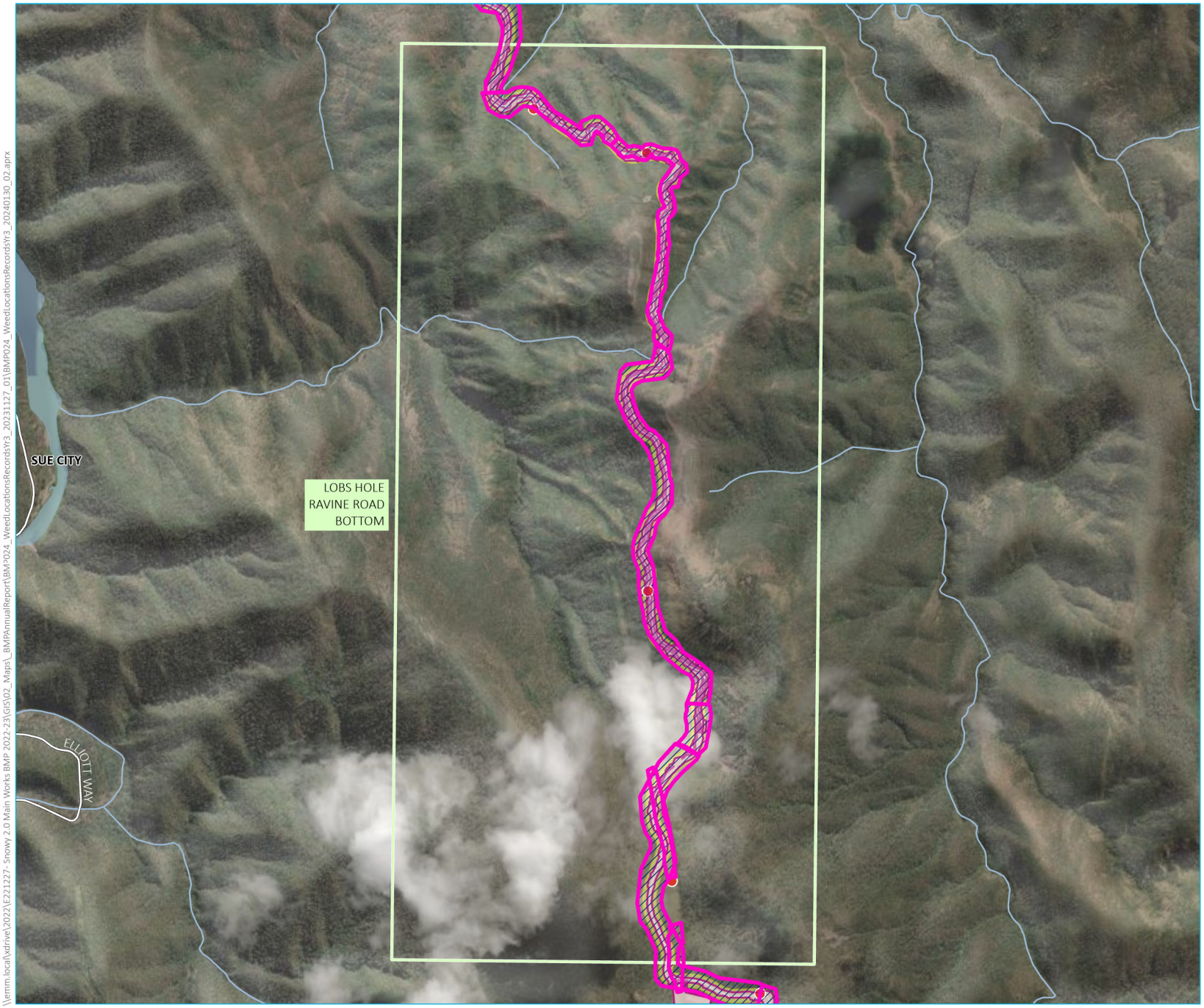

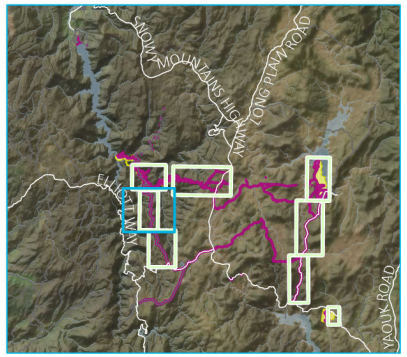

KEY

- Approved disturbance
- Approved construction envelope
- Weed management zone
- Weed record (point)
- Weed record
- Weed record (polygon)

Existing environment

- Major road
- Minor road
- Named watercourse
- Waterbody

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Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 0.5 1 km

GDA 1994 MGA Zone 55

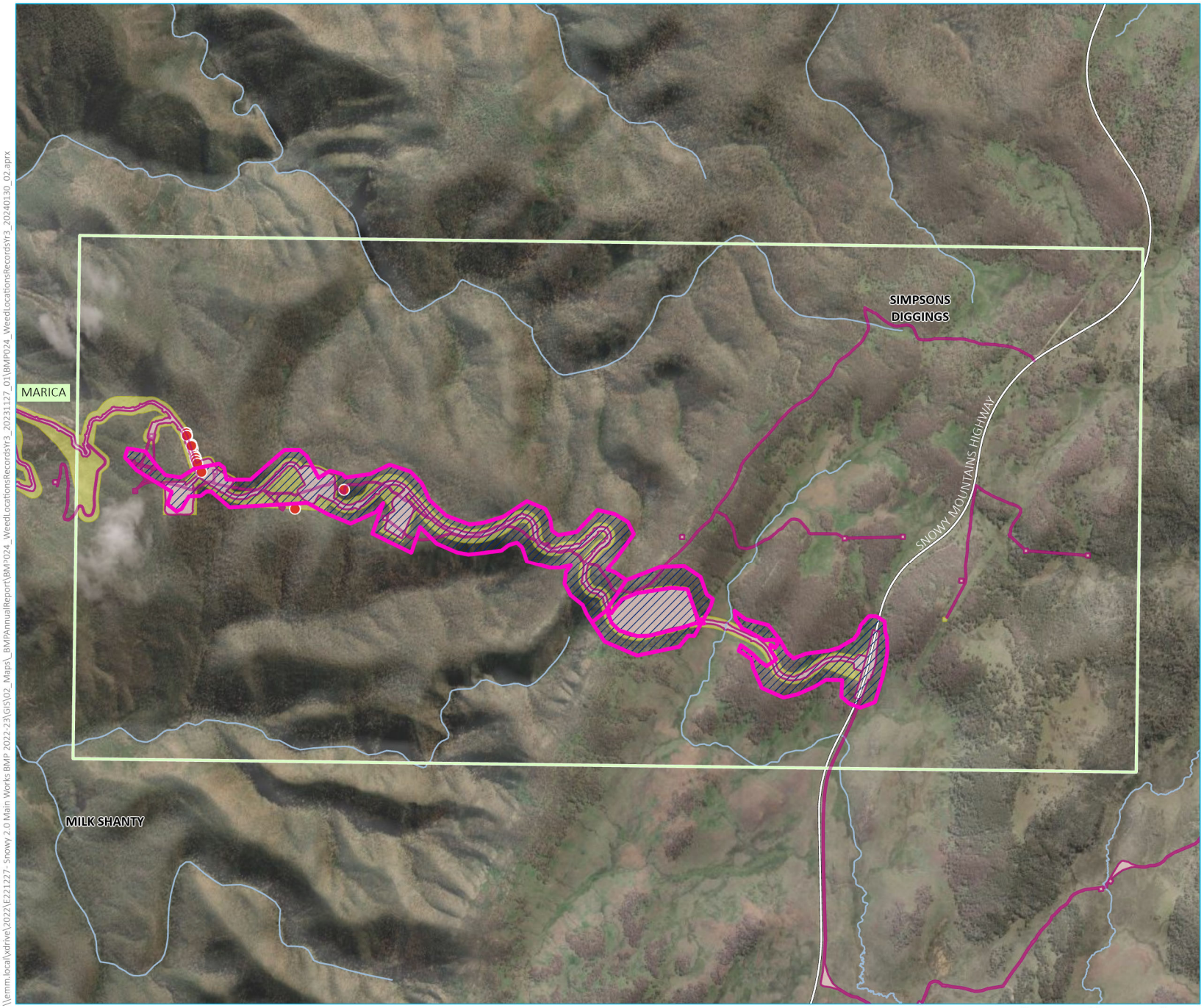
N

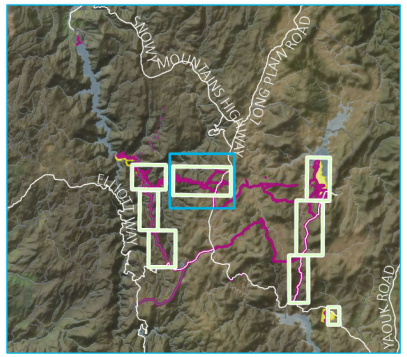
Weed records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.22e

snowy 2.0

EMM creating opportunities





KEY

- Approved disturbance
- Approved construction envelope
- Weed management zone
- Weed record (point)
- Weed record
- Weed record (polygon)

Existing environment

- Major road
- Named watercourse

Weed records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.22f

snowy 2.0

EMM
creating opportunities

0 0.5 1 km
GDA 1994 MGA Zone 55

N

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

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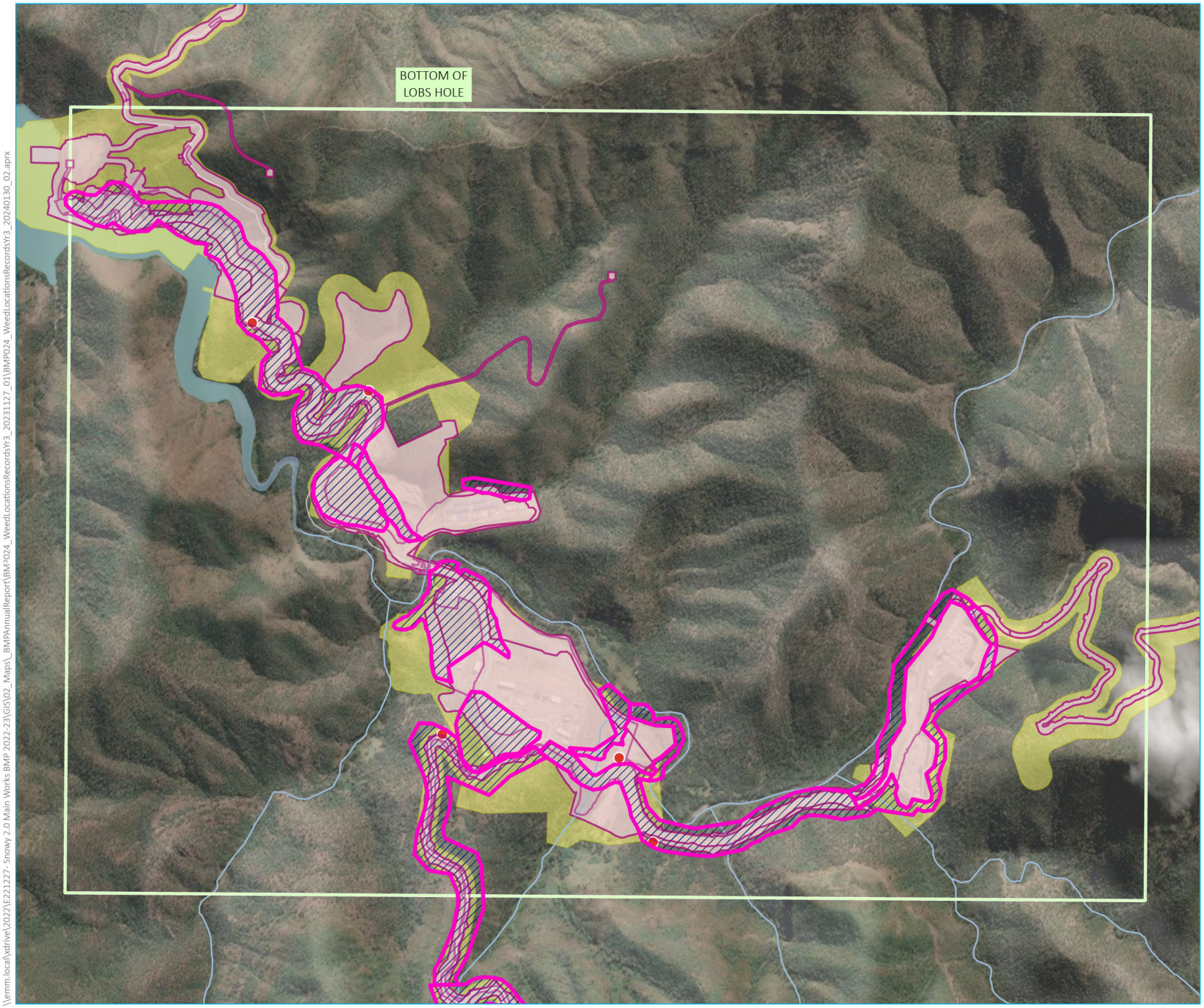

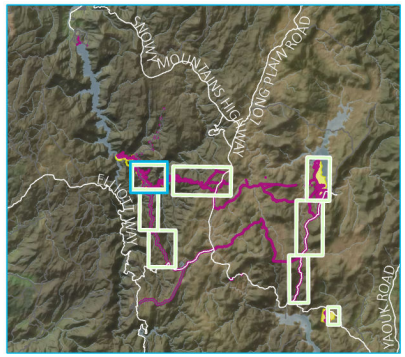

KEY

- Approved disturbance
- Approved construction envelope
- Weed management zone
- Weed record (point)
- Weed record
- Weed record (polygon)

Existing environment

- Minor road
- Named watercourse
- Waterbody

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Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 0.5 1 km

GDA 1994 MGA Zone 55

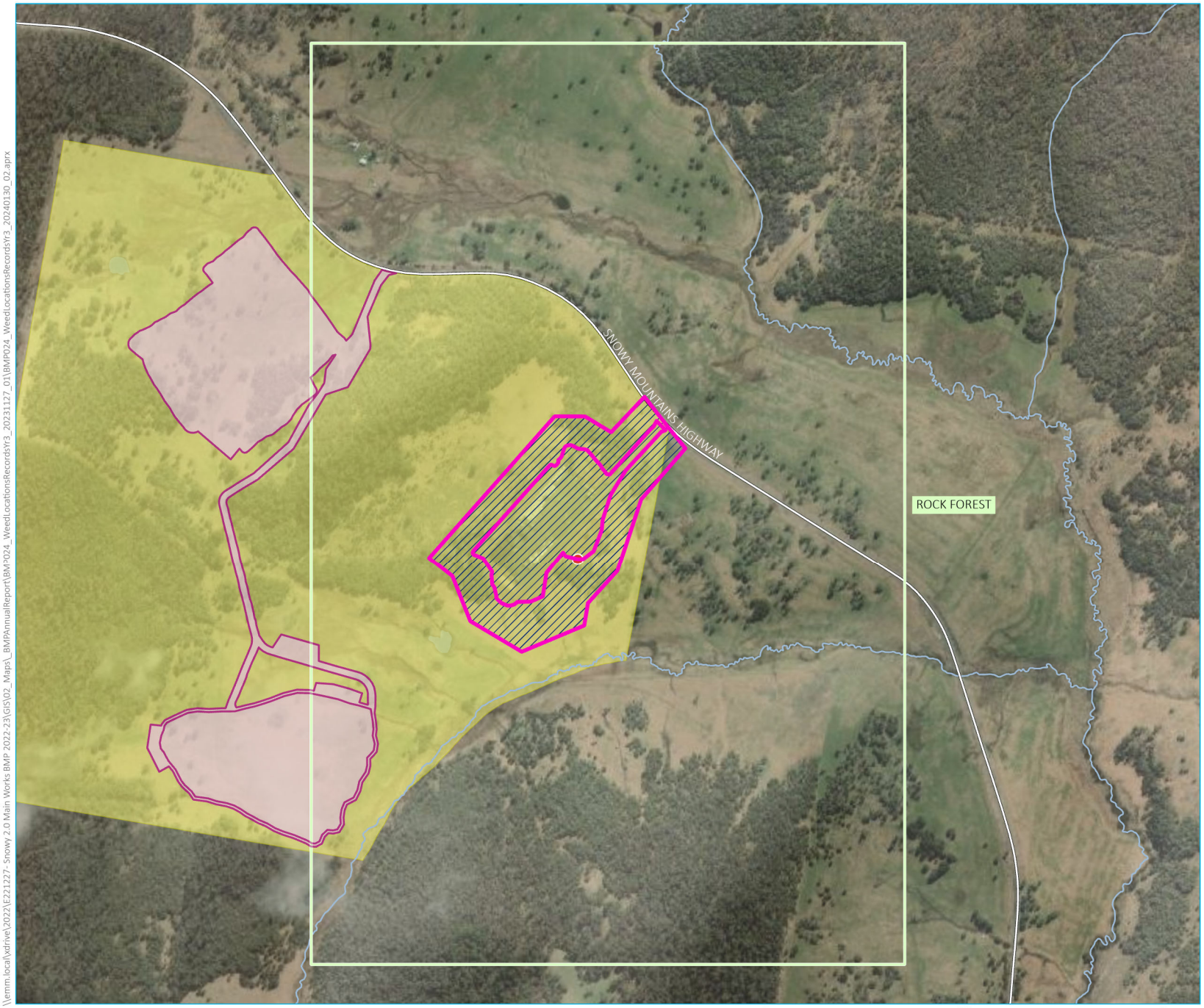
N

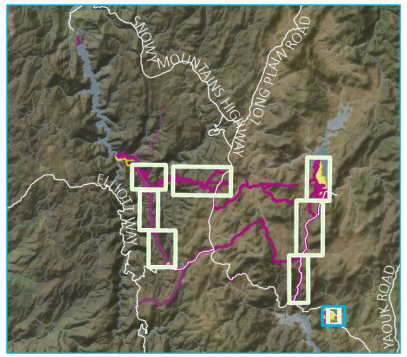
Weed records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.22g

snowy 2.0

EMM
creating opportunities





KEY

- Approved disturbance
- Approved construction envelope
- Weed management zone
- Weed record (point)
- Weed record
- Weed record (polygon)

Existing environment

- Major road
- Named watercourse
- Waterbody

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Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

Weed records during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.22h

snowy 2.0

EMM creating opportunities

3.6.2 *Phytophthora* presence/absence

The objective of the *Phythopthora* presence/absence monitoring is to monitor pathogens within proximity to project roads and key project infrastructure, specifically *P. cinnamomi* and *P. gregata*, to inform the location and extent of controls.

During Year 3, all the BMP Phytophthora sampling sites and 23 additional sites (PS01 – PS20) were surveyed. Locations of these 31 sites were as close as possible to the original Year 1 sites and newly established Year 2 sites. However, clearing in some areas meant two sites (PMS1 and PMS5) were discontinued as their location had been buried, while the adjacent four sites (Lobs02, PMS2, PMS3 and PMS4) had their location updated (Figure 3.23).

The results of the analysis showed that *Phytophthora cinnamomi* was detected at one sample site (PS03) and *Phytophthora pseudocryptogea/cryptogea* was detected at one sample site (PMS3). No additional areas within proximity have been tested at PS03, however two sites have been tested within proximity to PMS3 (PMS2 and PMS4) during the January testing. These sites tested negative to *Phytophthora* spp. detection. No further surveyes were completed. Pathogen sample sites and results are summarised in Table 3.18.

Table 3.18 Phytophthora presence/absence during Year 3 monitoring period

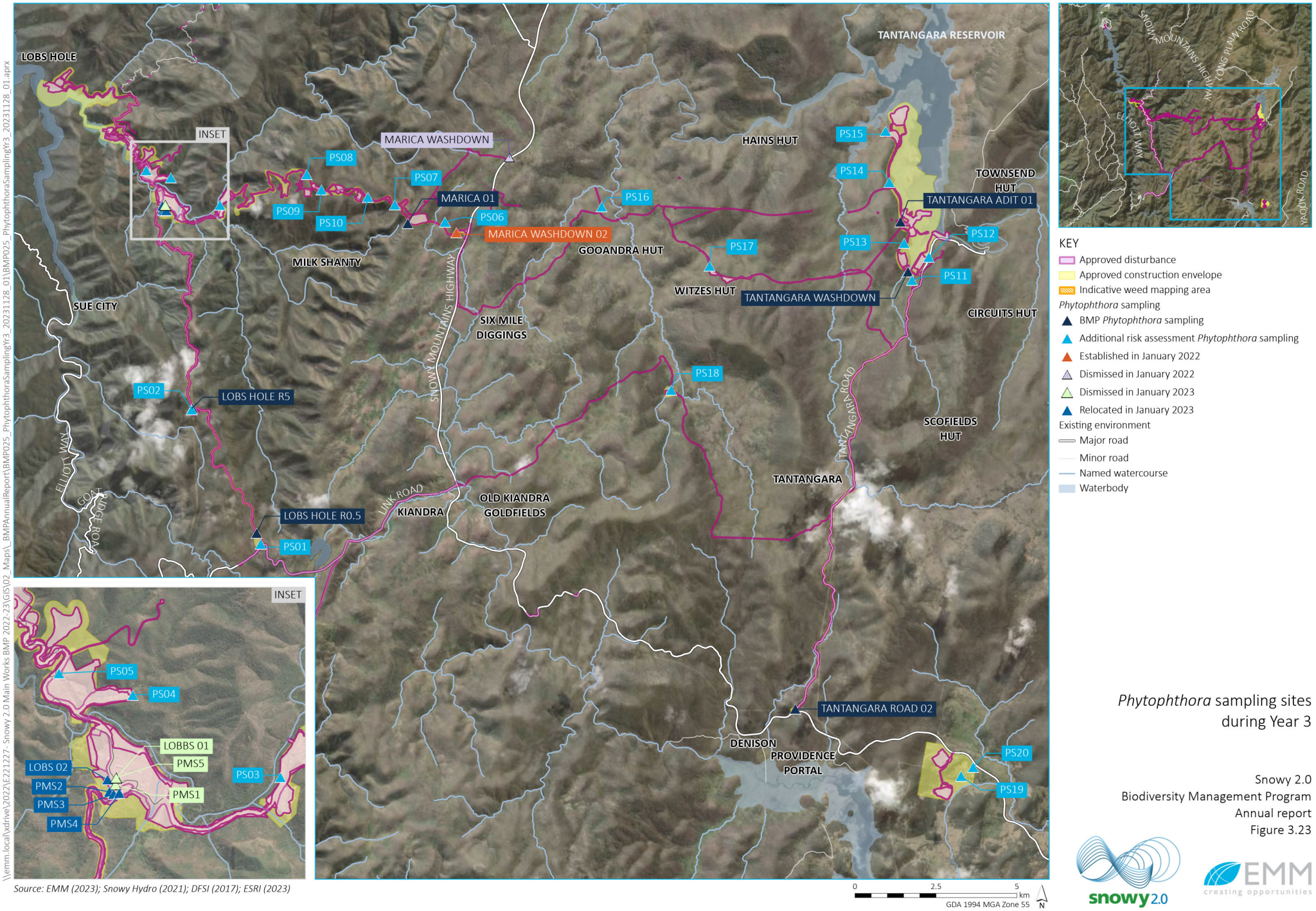
Site	Positive/negative
Lobs Hole R0.5	negative
Lobs Hole R5	negative
Lobs02	negative
Marica 01	negative
Marica Washdown	negative
PMS1	NA
PMS2	negative
PMS3	**positive** (*Phytophthora pseudocryptogea/cryptogea*)
PMS4	negative
PMS5	NA
PS01	negative
PS02	negative
PS03	**positive** (*Phytophthora cinnamomi*)
PS04	negative
PS05	negative
PS06	negative
PS07	negative
PS08	negative
PS09	negative
PS10	negative
PS11	negative

Table 3.18 Phytophthora presence/absence during Year 3 monitoring period

Site	Positive/negative
PS12	negative
PS13	negative
PS14	negative
PS15	negative
PS16	negative
PS17	negative
PS18	negative
PS19	negative
PS20	negative
Tantangara Adit 01	negative
Tantangara Road 02	negative
Tantangara Washdown	negative

Notes: NA = site dismissed in Year 3

During Year 1, three sites, Lobs01, PMS1 and PMS5, tested positive for *Phytopthora cryptogea/psueudocryptogea*, which is not a specie of concern for the BMP. In Year 2, a site adjacent to those that tested positive in Year 1 (Lobs02) was sampled and tested negative. In Year 3, PMS1 and PMS5 were dismissed, but an adjacent site (PMS3) tested positive for *Phytophthora pseudocryptogea/cryptogea*. In Year 3, one site (PS03) located at the eastern end of Lobs Hole tested positive for *Phytophthora cinnamomi*.



KEY

Approved disturbance
Approved construction envelope
Indicative weed mapping area

Phytophthora sampling

BMP *Phytophthora* sampling
Additional risk assessment *Phytophthora* sampling
Established in January 2022
Dismissed in January 2022
Dismissed in January 2023
Relocated in January 2023

Existing environment

Major road
Minor road
Named watercourse
Waterbody

Phytophthora sampling sites during Year 3

Snowy 2.0
Biodiversity Management Program
Annual report
Figure 3.23

Source: EMM (2023); Snowy Hydro (2021); DFSI (2017); ESRI (2023)

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4 Discussion

4.1 Threatened flora

i Clover Glycine

Comparing population data for Clover Glycine from the three monitoring years, there is a general decrease in total individuals from Year 1 to Year 3, with Year 2 typically showing fewer records than Year 3 at impact sites. This consistent pattern of the lowest records in Year 2 and a slightly higher count in Year 3 is seen across impact but not control sites, where Year 3 records (100) were lower than Year 2 (298). Nevertheless, the decline in the number of individuals from Year 1 to Year 3 is consistent across control and impact sites. This suggests that there could be several factors contributing to this decline, some of which may not be directly linked to the construction activities. The overall trend in decline of the species may include, but is not limited to, seasonal fluctuation and grazing pressures.

For the sites that have had a decrease in the total number of Clover Glycine individuals from Year 2 (TF04 and TF12) (Figure 2.1), the average percentage change from Year 2 to Year 3 is -100%, meaning that no individuals were recorded at those sites during Year 3. However, such percentage decline lies within the standard deviation of the percentage change observed at control sites in Year 3 ($\bar{X}$=344%, SD±772). As the percentage decrease for the impact sites is within the standard deviation for control sites, no adaptive management is triggered.

Clover Glycine populations are known to be affected by weed invasion, grazing pressure and altered fire regimes (Institute for Environmental Research, Department of Sustainability and Environment, 2010). Potential causes into species decline (or increase in abundance) require further investigation, as both control and impact sites have recorded a decline in species records.

Threatened flora plots were conducted at similar times within the year between Year 2 and Year 3 (early December and early January). Year 3 had above average rainfall for most of the year, January had a monthly total of 124 mm, the average is 64.8 mm. The monthly total for December was 131.4 mm, the average is 71.4 mm (Plate 4.1,Plate 4.2, BOM 2024). The average monthly temperatures experienced during the Year 3 monitoring period were 3.3°C to 4.5°C below the average across the “all years” mean temperature (Plate 4.2, BOM 2024). This possibly delayed flowering, resulting in a higher number of individuals being recorded during the second monitoring event.

Weed mapping within the threatened flora plot locations (see Section 3.6), indicates that weed invasion is likely to be contributing to the decline in total number of individuals. These plot locations have been recorded as almost weed-free with the exception being primarily ground covers, which have potential to increase in cover due to their invasive nature, such as Sweet Vernal Grass (*Anthoxanthum odoratum*), Spear Thistle (*Cirsium vulgare*) and Yorkshire Fog Grass (*Holcus lanatus*). These exotic species are listed within the BMP as priority weeds (Snowy Hydro and FGJV 2020). Cocksfoot (*Dactylis glomerata*) and St. John’s Wort (*Hypericum perforatum*) were recorded in the threatened flora monitoring plots during Year 2, however they were absent during Year 3, it is unclear whether this is due to seasonality, weed control activities or grazing.

Clover Glycine is known to be at threat from grazing pressures and trampling in a number of locations (Carter & Sutter 2010). Rabbits and horses were recorded proximity (Section 3.5) to the threatened flora plot locations, suggesting that grazing pressure and/or trampling may contribute to a decrease in the total number of individuals.

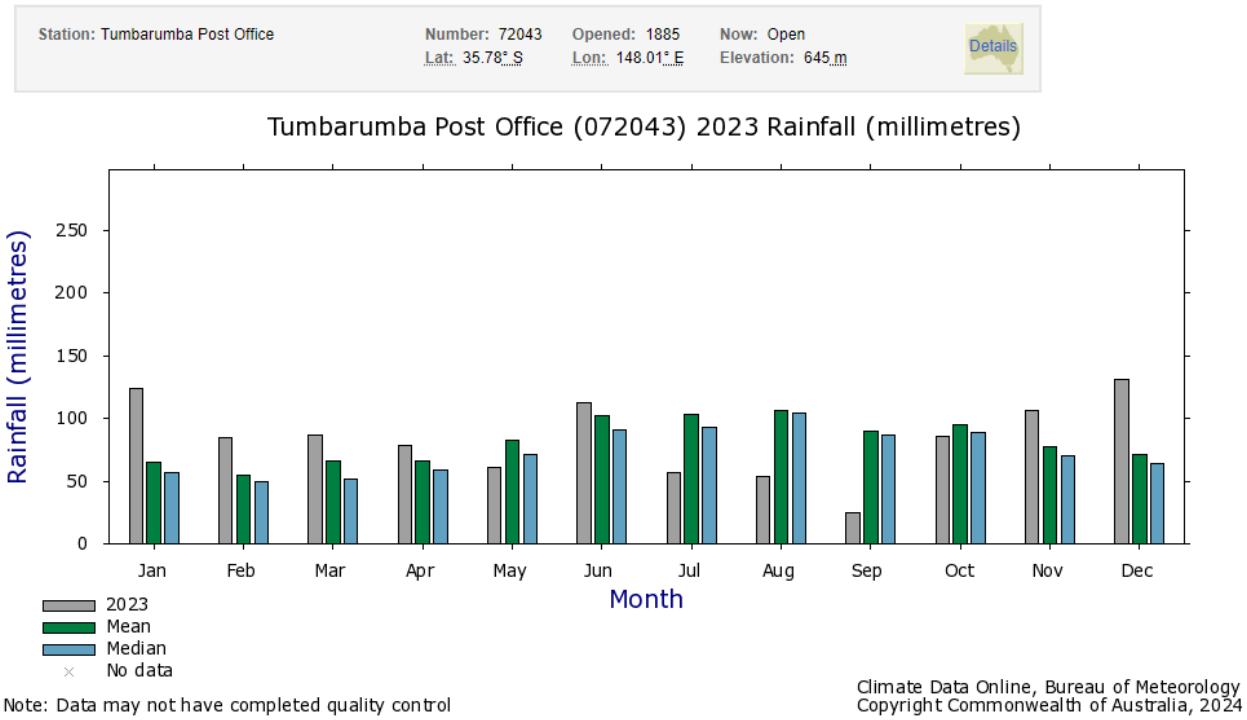


Plate 4.1 **Monthly rainfall measured at Tumbarumba Post Office station ID 073007 (BOM 2024)**

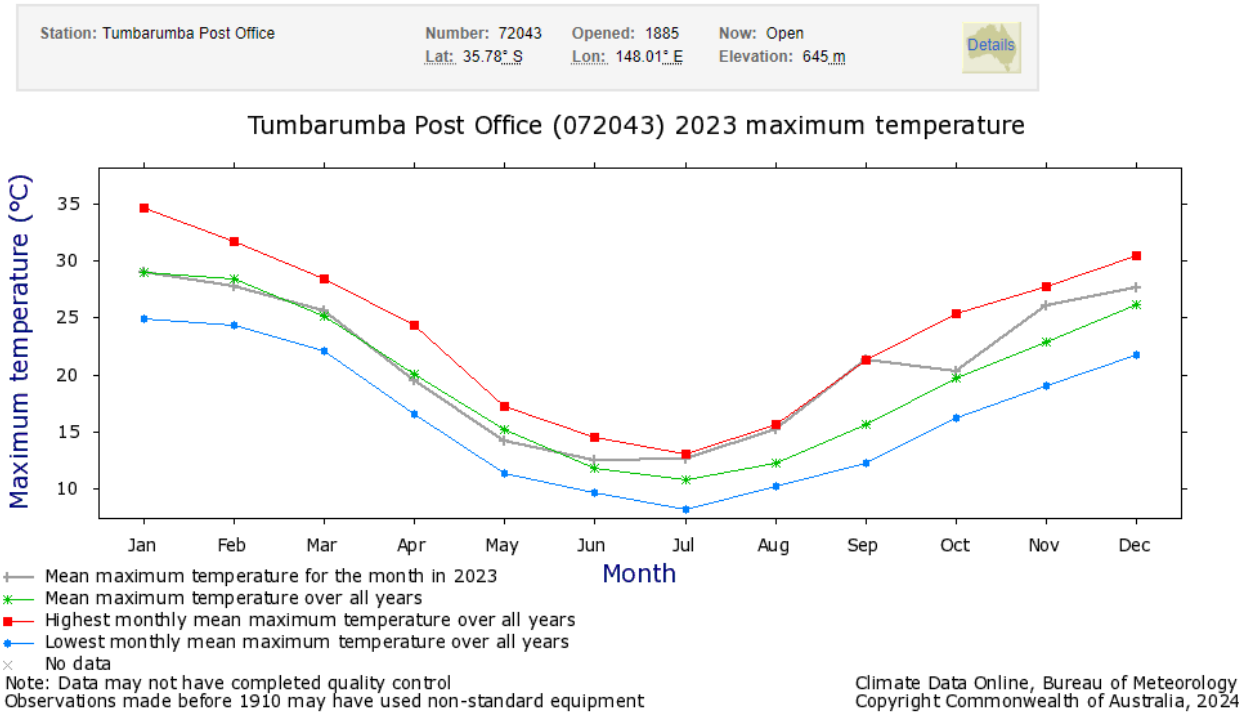


Plate 4.2 **Monthly temperature measured at Tumbarumba Post Office station ID 073007 (BOM 2024)**

ii Kiandra Leek Orchid

A total of 22 Kiandra Leek Orchid individuals were observed among all impact sites. All Year 3 impact records were collected at TF13, where the species had not been previously recorded. At control site TF09 there has been an increase from one Kiandra Leek Orchid to 40 individuals from Year 1 to Year 3. No percentage decline in the number of Kiandra Leek Orchid was observed over two consecutive monitoring periods or outside of the standard deviation observed at control sites ($\bar{X}$=7.85%, SD=±154) . Therefore, no adaptive management actions were triggered for this species in Year 3.

To accurately monitor the Kiandra Leek Orchid population, it is crucial to survey all monitoring sites each year. In Year 3, all monitoring plots were surveyed, except for TF01 and TF02. These two impact sites (TF01 and TF02) were unable to be relocated because records of Kiandra Leek Orchid (*Prasophyllum retroflexum*) and Glover Glycine (*Glycine latrobeana*) could not be found in adjacent suitable habitat to the plots that were cleared within the disturbance footprint. TF01 and TF02 never recorded this species in previous surveys. The exclusion of these monitoring sites is not considered to increase the likelihood of requiring adaptive management actions as a result.

Monitoring Kiandra Leek Orchid populations occur twice a year, between December and January, as per requirements of the BMP. In the last three monitoring years, the second monitoring survey that occurs in January have only recorded very low number (maximum of one individual per year). This pattern suggests that the timing of the second monitoring event (i.e., January), may not coincide with the peak flowering period for detecting Kiandra Leek Orchid in the Snowy Monaro region. As surveys have always occurred in December and January for the past three monitoring years, it is essential to continue with this schedule to ensure the statistical reliability of the data collected. Having small numbers in January is not considered to increase the likelihood of requiring adaptive management actions as a result.

iii Trigger for adaptive management

The triggers for adaptive management for this management action are:

- percentage decline in the number of plants observed within a single monitoring plot, observed over two consecutive monitoring periods and outside of the standard deviation observed at control sites, and
- decline must be observed in conjunction with a primary impact (e.g. increase in weed cover).

Adaptive management has not been triggered for Clover Glycine or Kiandra Leek Orchid.

A primary impact for the decline in the total number of Clover Glycine records has not been identified. Several causes may be influencing species decline, including differences in weather patterns and grazing from native and/or feral species. Some of these causes (weather) are not associated with the Main Works construction; however, increase in feral animals may be indirectly associated. The construction may potentially be allowing feral animals to traverse wider areas than prior to construction and extend their range within the KNP.

4.2 Small terrestrial mammal monitoring

4.2.1 Occupancy (presence/absence) monitoring

i Smoky Mouse

No Smoky Mouse were recorded during Year 3. There are 10 locations where the Smoky Mouse has not been recorded for more than a year: SM10, SM14, SM19, SM19, SM21, SM22, SM23, SM09, SM11, and SM17. Smoky Mouse has not been recorded for more than two years at three sites: SM05, SM24 and SM35.

In Year 3 Red Fox and Feral Cat have been recorded within proximity of camera sites with previous records of Smoky Mouse (Figure 3.18 and Figure 3.15). The Red Fox and Feral Cat are a primary threat to the Smoky Mouse due to predation potential (Commonwealth TSSC 2020). Feral species may be a cause in the decline of records at this location. A recent study conducted by Miritis et al. (2023) revealed that fox activity typically peaks shortly after an area is burnt, whereas small mammal activity demonstrates a more gradual increase. In their investigation, which included the sympatric rodent species, the Bush Rat (*Rattus fuscipes*), activity levels were observed to be at their lowest approximately eight months post-fire, steadily rising thereafter and reaching a peak around 18 months post-fire. The ongoing monitoring of the Smoky mouse as part of the BMP will provide valuable insights, facilitating comparisons as the habitat regenerates, to ascertain whether a similar temporal pattern is evident in the region.

At the location of SM05, a minimal presence of weeds has been recorded and include St John's Wort, Sheep Sorrel, Blackberry, Redtop Bent, Browntop Bent (*Agrostis capillaris*) and Cocksfoot. Whilst these species have the potential to alter habitat structure for Smoky Mouse, due to their limited occurrence this is unlikely as the cover has remained relatively stable across monitoring periods.

ii Eastern Pygmy Possum

Year 3 had the highest number of sites with Eastern Pygmy Possum recorded (20 sites) compared to the Year 1 and Year 2 (19 and 18 sites respectively) (Figure 3.3). In Year 3 there are two impact locations where the Eastern Pygmy Possum has not been recorded for more than two years; SM07, SM18 and one control site, SM02. Three impact sites (SM01, SM19 and SM35) and one control site (SM29) have recorded absences for greater than one year. However, given that the species was not recorded at these three impact sites during Year 1 (baseline surveys), SM01, SM19 and SM35 are not triggered for adaptive management. Notably, after one year of absence from six sites in Year 2, the Eastern Pygmy Possum has been detected at impact sites; SM05, SM10, SM20 and SM22, and control sites; SM04 and SM40.

There has been a trend in Year 2 and Year 3 that Eastern Pygmy Possum has not been recorded at impact or control sites during Q3. This is likely to the species being less active and going into torpor during these colder months from June to August (Geiser, 1993).

Similar to the Smoky Mouse, weed occurrence along Lobs Hole Ravine Road has been primarily recorded at low amounts (less than 1% cover). Common weed species include St John's Wort, Sheep Sorrel, Blackberry, Redtop Bent, Browntop Bent and Cocksfoot. SM18 occurs adjacent to medium amounts of St John's Wort (11-50% cover) in addition to the species listed above. As similar weeds are recorded at similar cover where the Eastern Pygmy Possum has been recorded in Year 3, is it unlikely that encroachment of weed species with the potential to alter habitat structure is impacting on the absence of the species.

In Year 2 Eastern Pygmy Possum was absent for more than one year from SM22, located at Marica to the west of the construction road. It was discussed in the Year 2 report that this may have been due to construction impacts and warranted further investigation. However during Year 3 Eastern Pygmy Possum was recorded during Q4. This shows that the Eastern Pygmy Possum is still utilising the site even though it is at a lower frequency than prior to construction.

The Red Fox and feral cat have been recorded adjacent to the construction road. Although these feral species have been recorded, abundance monitoring indicates that there is no increase in species abundance. As adjacent camera sites have recorded the Eastern Pygmy Possum and feral species have been recorded within proximity to these sites. Reducing predator abundance within the locality has the potential to help increase the number of Eastern Pygmy Possum and other small mammals.

iii Broad-toothed Rat

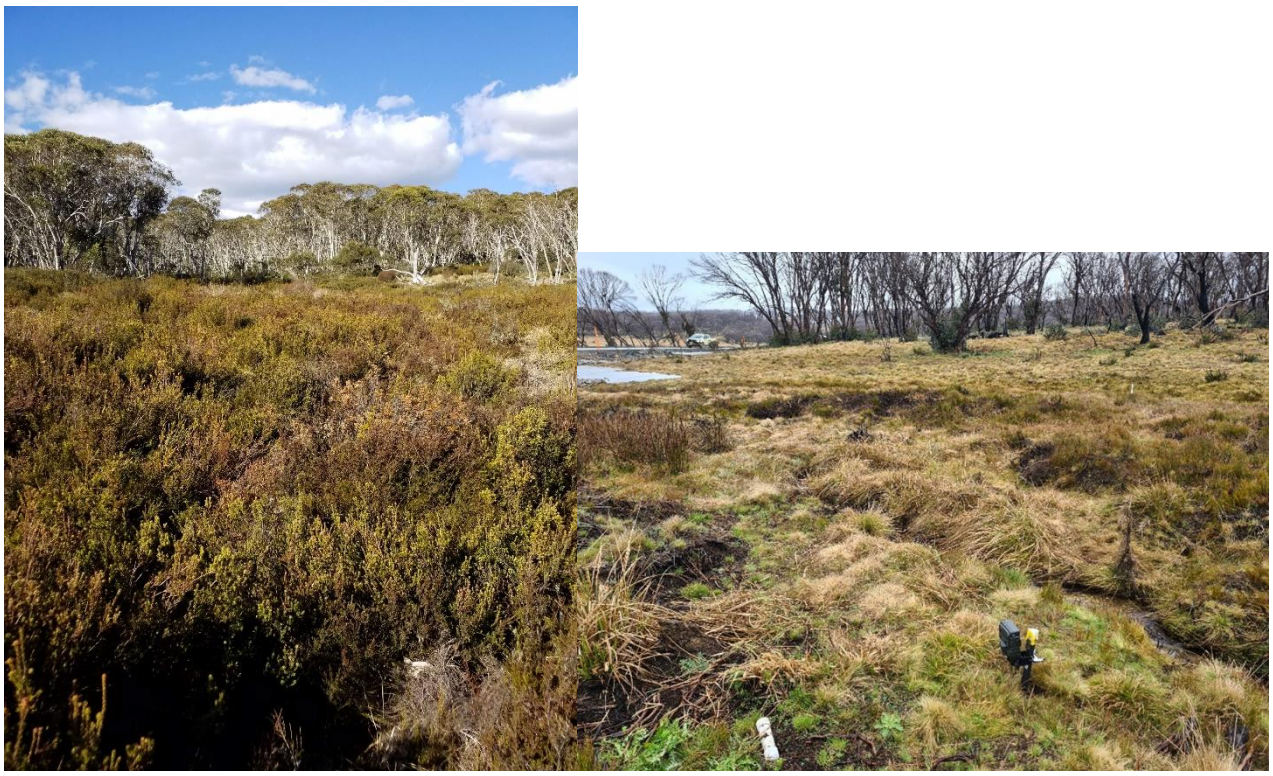
In Year 3 monitoring, a total of 10 sites documented the presence of the Broad-toothed Rat, comprising two impact sites and eight control sites. Notably, two camera sites (SM07 and SM36) have recorded the absence of the species for a period greater than one year. However, given that the species was not recorded at these two sites during Year 1 (baseline surveys), SM07 and SM36 are not triggered for adaptive management. The species appears to exhibit a tendency to inhabit areas proximal to Lobs Hole Ravine Road, notably around sites SM04, SM02, and SM01, as well as within the vicinity of Marica, particularly around sites SM28 (Figure 3.2).

Two camera locations which have been assessed as not providing suitable habitat had recorded the presence of the Broad-toothed Rat, SM01 and SM07. These camera sites are impact sites. These sites were assessed as not providing suitable habitat due to the lack of records during survey for the Main Works Biodiversity Development Assessment Report (BDAR) (EMM 2020c). Records of the Broad-toothed Rat were primarily concentrated outside of Lobs Hole and Lobs Hole Ravine Road, at Tantangara, Snowy Mountains Highway, Marica, and the Plateau. Records of the species on Lobs Hole Ravine Rd suggest that the species range extends further west into suitable habitat adjacent to the road.

Faecal pellet records at all faecal pellet sites recorded no change or an increase in records. All impact sites which recorded presence of faecal pellets in Year 2 were rare (old). In comparison, Year 3 results recorded faecal pellets at FP 17 during all quarterly monitoring periods, which Q3 and Q4 noted as having Abundant (fresh) faecal pellets present. FP19 recorded pellets during all quarterly monitoring periods which is significantly more than Year 2 where only Rare (old) faecal pellets were found during Q1.

The 2019/2020 bushfires affected much of KNP and included the location of these sites at Marica. Potential absence of the Broad-toothed Rat at this location during Year 2 may have been due to these bushfires. Habitat structure has changed significantly since previous records of the species and establishment of FP20 for the BMP surveys (Photograph 4.1). FP27 is a control site which was also burnt within the 2019/2020 bushfires, located approximately 2.8 km from FP20. In Year 2 it was recommended that FP20 remain in its current location for the opportunity to record the Broad-toothed Rat re-establishment in what would otherwise be considered previously burnt habitat. Interestingly, Broad-toothed Rat was recorded at FP20 during Year 3, recording the re-establishment of the species in the area post-fire.

As mentioned for Smoky Mouse, a study conducted by Miritis et al. (2023) revealed that fox activity typically peaks shortly after an area is burnt, whereas small mammal activity demonstrates a more gradual increase. In their investigation, which included the sympatric rodent species, the Bush Rat (*Rattus fuscipes*), activity levels were observed to be at their lowest approximately eight months post-fire, steadily rising thereafter and reaching a peak around 18 months post-fire. The ongoing monitoring of the Broad-toothed Rat as part of the BMP will provide valuable insights, facilitating comparisons as the habitat regenerates, to ascertain whether a similar temporal pattern is evident in the region.



Photograph 4.1 Site FP20 before (left) and after (right) the 2019/2020 bushfires

iv Triggers for adaptive management

The triggers for adaptive management for this management action are:

- absence of target species from a site during construction and operational monitoring, where the species was recorded during pre-construction/baseline surveys
- no changes in presence/absence at control sites
- absence recorded for greater than one year, and
- absence is combined with an observed increase or new occurrence of a primary impact (decline in habitat complexity, weeds, pathogens, or feral herbivores / predators).

Adaptive management has not been trigged for Smoky Mouse during Year 3 as the species was not recorded at either the impacts sites or control sites.

Two impact sites (SM07 and SM18) remain triggered for adaptive management as the Eastern Pygmy Possum was not observed in Year 3. Additional sites where absence of the species was recorded in Year 3 were not triggered for adaptive management as they did not record presence in Year 1 (baseline surveys).

No adaptive management has been triggered for Broad toothed-Rat (*Mastacomys fuscus*). Sites where absence of the species was recorded in Year 3 were not triggered for adaptive management as they did not record presence in Year 1 (baseline surveys).

Adaptive management actions include:

- initial investigation to document potential causation between decline and project related impacts (e.g. if initial investigation determines that habitat is unlikely to be suitable for Smoky Mouse, then the historic record would be deemed transient)

- development of a mitigation plan, in consultation with NSW DCCEEW and Commonwealth DCCEEW, addressing causes of decline as determined in initial investigation. This may include targeted weed control, increased monitoring, feral animal control or additional construction related mitigation measures; and
- if this is ineffective, additional offsets may be required.

The development of a mitigation plan is only required if the initial investigation documents a causation of the decline in target species and a project related impact.

4.2.2 Habitat characteristic monitoring

Overall, while no significant degradation in vegetation structure and habitat characteristics of occupied areas was observed, there were notable changes at specific locations. In particular, the increase in exotic vegetation below 0.5 m height at nine impact monitoring sites, which can diminish suitable habitat for small mammal species. Exotic species tend to dominate, forming monocultures that hinder small mammals' movement throughout an area and diminish available foraging habitat.

The nine sites where an increase in exotic vegetation below 0.5 m were: SM01, SM10, SM15, SM18, SM24, SM27, SM34, SM35 and SM36 (Figure 2.2). SM27 did not record targeted species in Year 1, 2 or 3 and is therefore not triggered for adaptive management. Of these sites SM01 and SM34 recorded the presence of Broad-toothed Rat and sites SM10, SM15 and SM24 recorded Eastern Pygmy Possum and therefore do not trigger adaptive management. Three sites, SM18, SM35 and SM36, did not record any of the small mammal target species in Year 3, but have previously recorded the species.

Compared to Year 1, none of the management zones recorded a substantial increase in the number of weed species (Plate 3.31) or feral animal sightings recorded during the abundancy surveys conducted in Year 3 (Plate 3.29). Native cover below 0.5 m has decreased 15 % on average between Year 2 and Year 3 at both impact and control sites. This may be due to a combination of cooler temperatures, above average rainfall and/or grazing from both native and feral animals.

Three impact sites (SM18, SM35 and SM36) have been triggered for adaptive management due observed degradation in vegetation structure and habitat characteristics and due to the absence of the target species.

i Triggers for adaptive management

The triggers for adaptive management for this management action are:

- observed degradation in vegetation structure and habitat characteristics of occupied habitat
- observed degradation is combined with an observed increase in weed cover or other project related impacts.

Three impact sites (SM18, SM35 and SM36) have been triggered for adaptive management due to observed degradation in vegetation structure and habitat characteristics and due to the absence of the target species.

Adaptive management actions include:

- initial investigation to document potential causation between decline and project related impacts
- development of a mitigation plan, in consultation with NSW DCCEEW and Cth DCCEEW, addressing causes of decline as determined in initial investigation. This may include targeted weed control or additional construction related mitigation measures, and

- if this is ineffective, presence/absence monitoring will be used to determine if any impacts to small terrestrial mammals will occur.

4.3 Frog monitoring

4.3.1 Occupancy (presence/absence) monitoring

i Alpine Tree Frog occupancy

The total number of Alpine Tree Frog records decreased by 12%, from 165 individuals in Year 2 to 146 individuals in Year 3. A decline occurred at impact site KPC01, where no frogs were recorded for the first time since Year 1 monitoring. Given the limited number of monitoring events (six) and low abundance at KPC01 during all monitoring events (range from 0 to 4), results are inconclusive. The result could indicate either an impact on the frog population or natural variations in numbers. Monitoring results in Year 4 may offer further insight into whether the decrease is due to natural fluctuations or potential impacts from construction, prompting the need for adaptive management.

Impact site TR01 had the highest number of individuals recorded at an impact site to date with 12 individuals being observed. Previously this site had three individuals recorded during each monitoring period in Year 2 and no Alpine Tree Frogs were observed during the first year of monitoring. Similarly, for TC02 with seven individuals being recorded during Year 3 monitoring with the previous height records being four during Year 2 monitoring.

The Year 2 monitoring report discussed a reduction in the number of individuals at ER02, a control site, from 43 recorded individuals in Year 1 to 24 in Year 2. However, the Year 3 monitoring results present a different trend, with a total of 40 individuals recorded during a single Year 3 monitoring event — the highest number of individuals documented at the site. This substantial increase in population suggests that the observed decline in the preceding year may have been part of a natural fluctuation rather than indicative of a sustained downward trend. The data highlights the dynamic nature of ecological systems and the importance of considering multiple years of monitoring to capture the inherent variability within populations.

ii Booroolong Frog occupancy

Despite decreases in total number of records for Booroolong Frog within Year 2 and 3, this is potentially due to insufficient data. During Year 2 and Year 3 surveys were highly restricted due to extreme weather events, preventing the field teams from safely accessing the rivers in which they inhabit. Similarly for Year 3 control site YR09 was inaccessible due to high water levels. It is recommended that a fourth year of data is captured to inform any potential adaptive management.

The monitoring data reveals a notable outlier at site YR06, where an unusually high count of 12 individuals was recorded during the December Year 1 monitoring event. Subsequent Year 2 and Year 3 monitoring at YR06, however, indicates a consistent pattern, with four individuals recorded during January of Year 2 and December of Year 3. Despite this stability, there was a substantial decrease of 67% from the initial Year 1 monitoring period to the subsequent years. This decline highlights the importance of considering temporal variations in frog populations. Further monitoring will provide more insights into the factors that may have led to the initial relatively high number of individuals recorded and subsequent decline at YR06.

iii Trigger for adaptive management

The trigger for adaptive management for this management action is:

- a decline in relative abundance (that upon review by species experts, is also considered as biologically significant) occurs during construction and/or operation at impact sites that does not also occur at the control sites, and

- a decline in relative abundance is accompanied by a decline in other monitoring parameters.

No decline in relative abundance has occurred at any impact sites for Alpine Tree Frog, therefore adaptive management is not required for this species.

Booroolong Frog has only been recorded at WC01 during Year 1 suggesting the need for adaptive management at this location. However, the record in Year 1 was limited to one individual, indicating a low abundance of the species at that site. Furthermore, survey efficacy was reduced by steep banks and high water levels, potentially impacting survey efficacy. The low abundance of suitable habitat features, such as cobble banks, may have contributed to the absence of frog sightings in subsequent years. Insufficient population data over the monitoring period precludes definitive conclusions regarding occupancy trends for the Booroolong Frog.

There is insufficient population data from the three years of monitoring to draw conclusions of any increase/decrease in occupancy for the Booroolong Frog. Adaptive management triggers and actions should be considered again after Year 4 results have been obtained.

4.3.2 Booroolong Frog habitat characteristic monitoring

In the month prior Year 3 data (November 2022) the rainfall was 188.9 mm, 107.9 mm above the average November rainfall of 81 mm. Despite the high rainfall and observed high river levels during monitoring events in Year 3 data collection (see Plate 4.3) these weather events have not substantially altered rocky breeding habitat and pools to indicate a decline in suitable habitat for the species.

In Year 3, the trends are similar those observed in Year 2, with riparian vegetation steadily increasing across most sites. The increase varies from 2% to 12%. However, YR05 and YR06 experienced a decrease in riparian vegetation by 2% and 12% respectively.

It was discussed in the Year 2 report that the increase in riparian vegetation may have been partially due to the differences in areas that were surveyed. This may have been a contributing factor, however that trend is also observed in Year 3. Overall, Year 3 saw a total increase of 0.33 ha in riparian vegetation cover.

As observed in previous years, where a reduction in one rocky habitat characteristic occurred, an increase of another habitat took place. At YR06, a decrease of 0.03 ha of cobble bank occurred, however an increase of 0.03 ha of riffle has occurred also. Rivers are dynamic systems influenced by many factors such as volume and intensity of rainfall, and changing topology, therefore it is likely to see some gradual changes overtime.

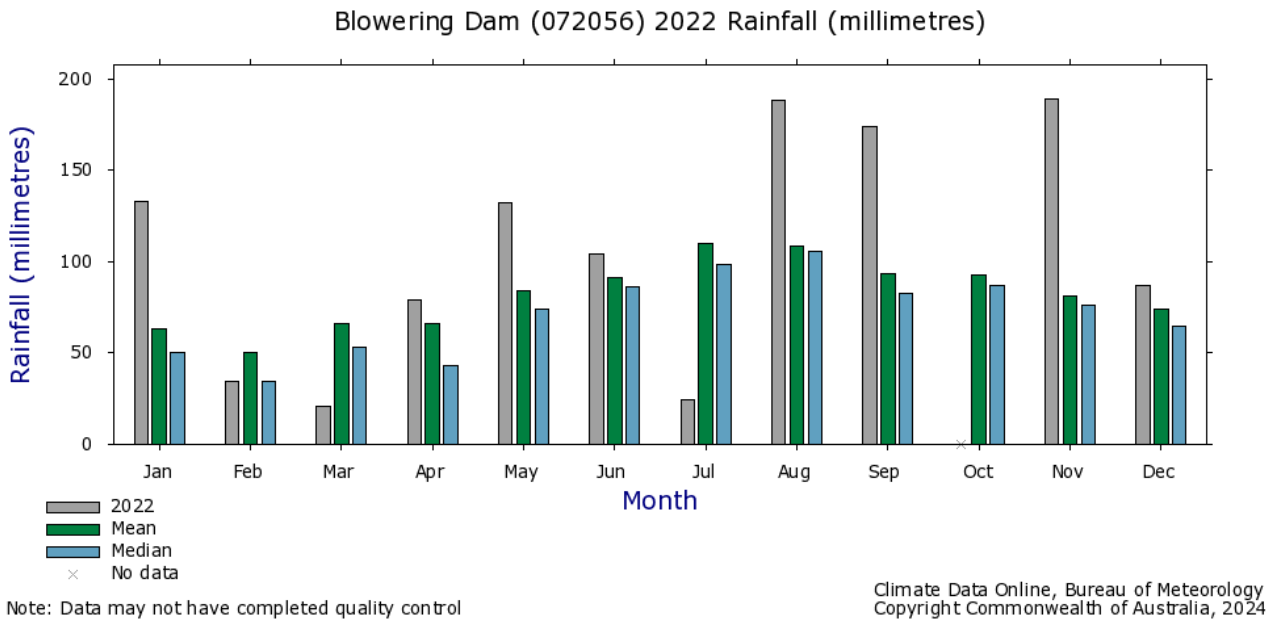


Plate 4.3 Monthly rainfall measured at Blowering Dam station ID 072056 (BOM 2024)

i Trigger for adaptive management

The trigger for adaptive management for this management action is:

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

No substantial changes in rocky habitat have occurred at impact sites; however, small changes have occurred between types of rocky habitat. Additional variables could contribute to the changes in rocky habitat extent such as weather and stream flow. The habitat characteristics should be compared to the frog occupancy monitoring to monitor the effects of these changes on the Booroolong Frog populations within these sites.

It is recommended that monitoring continue and gather more data to assess for habitat changes and make comparisons between frog occupancy at these sites.

4.4 Alpine She-oak Skink monitoring

All impact sites, except for TG04, have documented the presence of the Alpine She Oak within a one-year timeframe. Historically, the highest number of records at these impact sites was typically observed in November and December, suggesting that these months may be optimal for detecting the species' presence or absence. Notably, the latest monitoring data from October this year has revealed a noteworthy increase in the number of recorded Alpine She Oak Skinks. While previous records were prominent in November and December, this recent October data challenges the established pattern, indicating the need for ongoing analysis and consideration of potential shifts in the species' activity or detection patterns. This trend is similarly reflected in the control sites, where elevated numbers of individuals have historically been recorded in November and December.

Fluctuations in the number of individuals may be due to seasonal fluctuation in weather patterns and temperature, particularly for an ectothermic species influenced by external sources for temperature regulation. Fluctuations have the potential to be influenced by indirect impacts. Some priority actions for the Alpine She-oak Skink have been identified due to the potential threat to habitat for the species. These threats include habitat disturbance and modification, invasive weeds, particularly Orange Hawkweed (*Hieracium aurantiacum*), trampling, browsing or grazing and animal predation (Commonwealth TSSC 2009).

In the Year 2 monitoring report, it was highlighted that adaptive management measures might be necessary for Site TG05, as the Alpine She-oak Skink had been absent for nearly 12 months. However, during the October 2023 (Year 3) monitoring period, three individuals were recorded at this site. Consequently, adaptive management measures have not been triggered to date.

4.4.1 Triggers for adaptive management

The triggers for adaptive management for this management actions are:

- absence of target species from a site during construction and operational monitoring, where the species was recorded during pre-construction / baseline surveys
- no changes in presence/absence at control sites
- absence recorded for greater than one year, and
- absence is combined with an observed increase or new occurrence of a primary impact (weeds).

All impact sites have documented the presence of the Alpine She Oak within the past year, excluding TG04. TG04 had consistently shown null data since the initiation of baseline surveys in Year 1. Notably, TG04 was relocated to a new site within suitable Alpine She-oak Skink habitat in January 2023. As this new monitoring location has been part of the program for only a single year, it is necessary to accumulate more data before drawing any conclusions or initiating adaptive management measures.

4.5 Feral animal monitoring

4.5.1 Occupancy (presence/absence) and abundance monitoring

When assessing feral animal occupancy and abundance together, it appears that feral animal occupancy within and adjacent to the site has not significantly changed over the three years of monitoring. Monitoring continues to show that predatory species such as Feral Cat, Red Fox, and Wild Dog are present and occur in similar numbers to Year 1 monitoring results. This suggests that the level of predation within the site has not changed significantly. However, it is noteworthy that not all feral animals recorded via remote cameras were found during spotlighting surveys (e.g., Feral Cats not detected during spotlighting but recorded on cameras), indicating potential limitations in the detection methods. Year 3 results show a 10% increase in the percentage of Red Fox photos at camera sites compared to Year 2. Additionally, the percentage of Feral Cat photos saw a slight increase of 1% compared to the previous year. Given the absence of Smoky Mouse individuals recorded during Year 3, it is recommended that areas in proximity to previous Smoky Mouse records be prioritised for adaptive measurements. Similarly to Year 2, Red Foxes and Feral Cats have been sighted near Smoky Mouse habitats, highlighting the importance of triggering adaptive measurements to control these predators and to alleviate pressure on potentially recovering populations of Smoky Mouse.

The European Rabbit has been recorded within Tantangara Dam and Rock Forest at high densities again in Year 3 suggesting that the species has repopulated the area after adaptive measures were implemented in Year 2. The high density of European Rabbit in the area would provide additional sources of prey for Red Fox and Feral Cat and may contribute to population growth of these predators. It is recommended that control of European Rabbits is focused on these areas, namely Tantanargra Dam and Rock Forest, to curb the impact of European Rabbits on both local ecosystems and predator populations.

In the Year 2 report, it was highlighted that the increased rabbit population at Rock Forest could be attributed to project-related activities. Rock Forest, serving as a storage and logistics area, accommodates heavy vehicles for project deliveries, creating suitable habitat with increased open spaces for rabbits to traverse, forage, and breed. To mitigate the rabbit population, it is recommended to exclude European Rabbits from suitable harbors such as access under shipping containers, buildings, and large equipment that remain in place for extended periods. These areas serve as shelters and breeding grounds for rabbits, and reducing such opportunities is likely to aid in controlling their population in the area.

Similar to Year 2, Feral Horses have predominantly been sighted at Tantangara Dam and Tantangara Road, with reduced presence at Lobs Hole and Marica (Figure 3.17). The Feral Horse; and hoofed animals, such as deer, have the potential to alter habitat structure for threatened species. This could affect some of the threatened species on site such as the Brood-toothed Rat (Section 4.2.1iii) and Alpine She-oak Skink (Section 4.4), of which change in habitat structure is an ongoing threat (Commonwealth TSSC 2016; 2009).

During Year 3, Feral Pigs were observed at a single location (SM34-I) (Figure 3.21). While this species was captured by a camera during Year 1, it was notably absent in Year 2. It is advised to implement Feral Pig control measures to maintain a low population level within the area.

During feral animal spotlighting activities at the Tantangara management zone, it was observed that horses were attracted to salt piles used for road treatment on site. This has the potential to pose safety hazards by attracting horses into the work area and concentrating their grazing pressures in the surrounding area. To mitigate this issue, it is recommended that salt stocks be stored indoors or in a fenced area, out of reach of feral horses. By securing salt supplies in enclosed spaces, the likelihood of attracting wildlife, particularly horses, can be significantly reduced.

4.5.2 Trigger for adaptive management

The trigger for adaptive management for the feral animal occupancy and feral animal abundance management actions is:

- sighting of feral animals within proximity to known Smoky Mouse habitat or project infrastructure.

As sightings of feral animals have been located within proximity to Smoky Mouse habitat and project infrastructure, adaptive management has been triggered. The adaptive management action as outlined in the BMP states that sighting of feral animals triggers control in accordance with the Weed, Pest and Pathogen Management Plan (Appendix F of the BMP). The control is to be arranged by FGJV or Snowy Hydro.

Feral animals were recorded within proximity to project roads and infrastructure within Lobs Hole Ravine Road and Lobs Hole, Marica, Tantangara Dam, Tantangara Road and Rock Forest. It is recommended that control should prioritise European Rabbit, Horse and Sambar at Tantagara Dam and Rock Forest as a priority.

It is also recommended that occupancy and abundance of other feral animals is monitored in Year 4 to assess against threatened species occurrences within these sites, particularly where threatened species have recorded absences where previously present.

4.6 Weed presence/absence

In Year 3, six sites had a decrease in the number of priority weed species, one site remained the same and one increased. A total of 10 priority weeds recorded within Year 3. Overall, a lower number of priority weed species was recorded during Year 3 (ten species) when compared to Year 2 (13 species) and Year 1 (16 species).

Out of the eight management zones inspected, Tantangara Dam had the greatest number of weeds of concern (nine species), followed by Bottom of Lobs Hole and Lobs Hole Ravine Road Bottom (seven species).

The Ox-eye Daisy (*Leucanthemum vulgare*), a weed of key concern for the project, was not observed at threatened flora plots for the first time in Year 3. As per Year 2, this species still occurs at four management zones, such as Marica, Tantangara Dam, Tantangara Road Bottom and Tantangara Road Top.

In Year 1 and Year 2, the management zone with the greatest number of priority weed species was Tantangara Dam, with eleven species in both years. In Year 3, Tantangara Dam was still the management zone that recorded the greatest number of priority weed species, but only nine species were observed in the third monitoring year.

Three weeds, which are not listed in the Annexure A of the BMP, were recorded for the first time during Year 3. These are Bentgrass (*Agrostis* spp.), Sow thistle (*Sonchus* spp.) and Lettuce (*Lactuca* spp.).

The number of priority weed species occurring across the weed management zone has generally decreased from numbers recorded during Year 2. Six sites have had a decrease in the number of priority weed species, one remained unchanged and one (Lobs Hole Ravine Road Bottom) increased by one priority weed species. There has been a significant decrease in priority weed species recorded at the Threatened Flora Plots. Previously in Year 2 10 species were recorded and during Year 3 four species were recorded, a 60% reduction in the number of priority weeds recorded.

It is recommended that due to high or increasing weed species richness, the areas for priority management include:

- Bottom of Lobs Hole
- Lobs Hole Ravine Road Bottom
- Lobs Hole Ravine Road Top
- Tantangara Dam

Particular management at Lobs Hole Ravine Road and Tantangara Dam should be prioritised due to its link to other survey outcomes. Lobs Hole Ravine Rd has seen a change in habitat structure below 0.5 m, and also has species absences of Smoky Mouse and Eastern Pygmy Possum (see Section 4.2). Weed control at Tantangara Dam may also aid in reducing the potential impact from weed encroachment into suitable habitat for Alpine She-oak Skink.

Weed management should be targeted within high traffic areas and roadside bunds. This is where weed seed is likely to accumulate and spread due to potential transport from vehicles. It is recommended that those weeds which have a high occurrence across sites and a high propensity to spread seed be targeted. These species include, but are not limited to, Ox-eye Daisy, St John's Wort, Spear Thistle and Yorkshire Fog Grass.

It was previously recommended in Year 1 (EMM 2022a) that high priority weeds be identified for each management zone area using the list provided in the BMP (EMM 2020) and key weed species for threatened flora and fauna species. Priority weeds identified for each management zone would then be monitored each year over the construction period, with new occurrences of these priority weeds within each management zone mapped for control. This recommendation is reiterated in this Year 3 annual report as these changes are anticipated to yield more meaningful data that can be applied to inform the other monitoring components.

A list of priority weed species found in each management zone in Year 3 can be found in Section 3.6.1 and Appendix I.

4.6.1 Trigger for adaptive management

The triggers for adaptive management for this management action are:

- new occurrence of weeds within proximity to project infrastructure, and

- monitoring results are identifying increases in density of high priority weeds.

No new priority weeds have been recorded across the weed management zones. It recommended that weed control to be undertaken within the areas identified above.

4.7 Phytophthora presence/absence

During Year 3, one monitoring site (PS03) tested positive for *Phytophthora cinnamomi.* PS03 is located at the very eastern end of Lobs Hole. No additional areas within proximity to PS03 have tested positive.

4.7.1 Trigger for adaptive management

The triggers for adaptive management for this management action is:

- a soil sample which returns a positive result for Phytophthora species of concern such as *Phytophthora cinnamomi* or *Phytophthora gregata.*

One site, PS03, has been triggered for adaptive management as it recorded presence of *Phytophthora cinnamomi*.

Adaptive management actions include:

- conduct additional soil sample testing within suspected infection area to document extent, and
- ensure anthropogenic spread from infected areas is elimination by modifying site activities in the vicinity, controlling access, and revising hygiene procedures.

Adaptive management for Phytophthora includes conducting additional soil sample testing in proximity to PS03, and ensure anthropogenic spread from infected areas is eliminated by modifying site activities in the vicinity, controlling access, and revising hygiene procedures.

5 Summary of recommendations and triggers for adaptive management

Following the completion of the third year of the Main Works BMP, the following recommendations (Table 5.1) are made for consideration by Snowy Hydro, and for the program more broadly, for incorporation into the next year of monitoring (2023/24).

Table 5.1 Recommended amendments to the BMP and triggers for adaptive management

Monitoring component	Triggers for adaptive management	Recommendation
Threatened Flora monitoring	Not triggered	N/A
Small mammal occupancy monitoring	Adaptive management has not been trigged for Smoky Mouse during Year 3 as the species was not recorded at either the impacts sites or control sites. Two impact sites (SM07 and SM18) remain triggered for adaptive management as the Eastern Pygmy Possum was not observed in Year 3. Additional sites where absence of the species was recorded in Year 3 were not triggered for adaptive management as they did not record presence in Year 1 (baseline surveys). No adaptive management has been triggered for Broad toothed-Rat. Sites where absence of the species was recorded in Year 3 were not triggered for adaptive management as they did not record presence in Year 1 (baseline surveys).	An initial investigation into these absences of the Smoky Mouse, Eastern Pygmy Possum and Broad-toothed Rat will be required to document potential causation between decline and project related impacts.
Small mammal habitat characteristic monitoring	Three impact sites (SM18, SM35 and SM36) have been triggered for adaptive management due observed degradation in vegetation structure and habitat characteristics and due to the absence of the target species.	Investigation into the cause of species absence will be required.
Alpine Tree Frog occupancy monitoring	Not triggered	N/A
Booroolong Frog occupancy monitoring	Not triggered	Adaptive management triggers and actions are to be reviewed after Year 4 results have been obtained.
Booroolong Frog habitat characteristic monitoring	Not triggered	Adaptive management triggers and actions are to be reviewed after Year 4 results have been obtained.
Alpine She-oak Skink occupancy monitoring	Not triggered	N/A

Table 5.1 Recommended amendments to the BMP and triggers for adaptive management

Monitoring component	Triggers for adaptive management	Recommendation
Feral animal occupancy monitoring Feral animal abundance monitoring	Feral animal occupancy and abundance monitoring: Pest control in accordance with the Weed, Pest and Pathogen Management Plan (FGJV 2020) has been triggered.	The adaptive management action as outlined in the BMP states that sighting of feral animals triggers the Weed, Pest and Pathogen Management Plan (Appendix F of the BMP). The adaptive management is to be arranged by FGJV or Snowy Hydro. Priority areas for control include Lobs Hole Ravine Road and Marica with regards to proximity to Smoky Mouse habitat. Tantangara Dam and Rock Forest should also be prioritised with particular attention to the European Rabbit, Feral Cat and Red Fox, of which the latter two are known threats to the Smoky Mouse, Eastern Pygmy-possum and Broad-toothed Rat. It is recommended that the occupancy and abundance of feral species be monitored in the Year 4 monitoring period to assess occupancy and abundance changes across the site and compared to threatened species monitoring results, not just in relation to Smoky Mouse habitat.
Weed presence / absence monitoring	Not triggered	To help prevent the potential triggers of adaptive management actions It is recommended that due to weed diversity, the areas for priority management include: – Bottom of Lobs Hole – Lobs Hole Ravine Road Bottom – Lobs Hole Ravine Road Top – Tantangara Road Bottom Weed management should also target high traffic areas and roadside bunds. This is likely where weed seed is likely to accumulate and spread due to potential transport from vehicles. It is recommended that those weeds with a high occurrence across sites and with high propensity to spread seed be targeted. These species include, but are not limited to, Ox-eye Daisy, St John's Wort, Spear Thistle and Yorkshire Fog Grass.
Phytophthora spp. presence / absence monitoring	The adaptive management has been triggered due to a positive result from PS03 for *Phytophthora cinnamomi*	Conduct additional soil sample testing within suspected infection area to document extent. Ensure anthropogenic spread from infected areas is eliminated by modifying site activities in the vicinity, controlling access, and revising hygiene procedures. Additional soil samples will be needed to document the extent of the infection area at in proximity to PS03. Revised measures to limit anthropogenic spread may also need to be considered.

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Appendix A

Summary of Year 3 monitoring results and recommendations

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Summary of Year 3 monitoring components, adaptive management triggers, and baseline and construction conditions

Monitoring component	Trigger for adaptive management	Summary of conditions and adaptive management triggers relevant to Y3 adaptive management triggers	Y3 Q1 – Construction condition	Q2 – Construction condition	Q3 – Construction condition	Q4 – Construction condition	Review of adaptive management triggers
Threatened flora monitoring	•Percentage decline in the number of plants observed within a single monitoring plot, observed over two consecutive monitoring periods and outside of the standard deviation observed at control sites. •Decline must be observed in conjunction with a primary impact (e.g. increase in weed cover).	•During Year 2, a total of 25 individuals of Clover Glycine (Glycine latrobeana) were recorded across five impact sites (TF02, TF03, TF04, TF12 and TF14) and 298 individuals across four control sites (TF07, TF08, TF09 and TF10). •A total of five individuals of Kiandra Leek Orchid (Prasophyllum retroflexum) were recorded at one impact site (TF04) and 87 individuals at three control sites (TF06, TF07 and TF09) during Year 2. No threatened flora species were recorded at two impact sites (TF11 and TF13) and one control site (TF05) during Year 2. TF01 has been cleared and was unable to be relocated as Kiandra Leek Orchid and Glover Glycine were unable to be located within the area adjacent to the footprint. TF05 was only surveyed once due to unsuitable weather conditions in December. It was recommended in the Year 2 annual report (EMM 2023) that the cleared plot TF01 is decommissioned in Year 3 and a replacement plot established where known records of target species occur. It was also recommended that plots TF05, TF11, TF13 are moved during the Year 3 monitoring period, to where the species are present and can be monitored.	•During Year 3, a total of 38 individuals of Clover Glycine were recorded at two impact sites (TF03 and TF14) and 100 individuals across five control sites (TF06, TF07 , TF08, TF09 and TF10). The records attributed to one control site (TF05) had been accidentally attributed to TF05 in the January report, instead of the correct control site (TF09) – their attribution has since been corrected and updated. •The records attributed to one impact site (TF13) and three control sites (TF06, TF07 and TF09) had been incorrectly reported in the Q1 report – their attribution has since been corrected and updated. The updated data reveals that 22 (instead of 2) individuals of Kiandra Leek Orchid were recorded at one impact site (TF13) and 51 (instead of 17) individuals were recorded at three control sites (TF06, TF07 and TF09). No threatened flora species were recorded at three impact sites (TF04, TF11 and TF12) and one control site (TF05). •During Year 3, the following actions were taken regarding the logistics of the threatened flora plots: –Two sites (TF05 and TF11) were relocated in December 2022. –One impact site (TF13) was not relocated as it recorded two individuals of Clover Glycine in December 2022. –TF04 and TF12 were micro sited in December 2022, as they had been partially buried. –TF01 and TF02 have been cleared and were not relocated as Kiandra Leek Orchid and Glover Glycine were unable to be located within the area adjacent to the footprint. One impact site (TF04) reported a decline in the number of Clover Glycine individuals recorded over two consecutive monitoring periods. The observed decline at this impact site falls within the range of variation observed at control sites, as indicated by the standard deviation.	Threatened Flora monitoring was not required to be undertaken during Q2	Threatened Flora monitoring was not required to be undertaken during Q3	Threatened Flora monitoring was not required to be undertaken during Q4	No adaptive management required for threatened flora plots in Year 3.
Small mammal presence/absence monitoring	•Absence of target species from a site during construction and operational monitoring, where the species was recorded during pre construction/baseline surveys. •No changes in presence/absence at control sites. •Absence recorded for greater than one year. •Absence is combined with an observed increase or new occurrence of a primary impact (decline in habitat complexity, weeds, pathogens, or feral herbivores/predators).	•During baseline survey (Y1 Q1), the Smoky Mouse (Pseudomys fumeus) was recorded at one impact site (SM05 I) and no control sies. •The Eastern Pygmy Possum (Cercartetus nanus) was recorded at seven impact sites (SM03 I, SM10 I, SM14 I, SM16 I, SM18 I, SM20 I, SM21 I) and seven control sites (SM02 C, SM04 C, SM06 C, SM08 C, SM09 C, SM11 C, SM17 C). •The Broad toothed Rat (Mastacomys fuscus) was recorded at three control sites (SM28 C, SM30 C, SM33 C) and no impact sites. •No monitoring sites recorded Broad toothed Rat scats. •During Year 2, adaptive management was triggered for the Smoky Mouse and Eastern Pygmy Possum. Specific sites which required prioritisation include SM05, SM24 and SM35 for the Smoky Mouse and SM05, SM07, SM10, SM18, SM20 and SM22 for the Eastern Pygmy Possum.	•The Smoky Mouse was not recorded at any impact or control sites. •The Eastern Pygmy Possum was recorded at seven impact sites (SM15 I, SM16 I, SM21 I, SM22 I, SM23 I, SM24 I and SM25 I) and two control sites (SM06 C and SM17 C). •The Broad toothed Rat was recorded at three control sites (SM30 C, SM32 C and SM39 C) and no impact sites. •Broad toothed Rat faecal pellet search was undertaken in February. One impact site (FP17) and two control sites (FP24 and FP32) recorded uncommon (old) Broad toothed Rat scats. Two impact sites (FP18 and FP19) and one control site (FP33) recorded rare (old) scats. Two control sites (FP26 and FP31) recorded rare (intermediate) scats. One impact site (FP20) has never recorded the presence of Broad toothed Rat faecal pellets. •During Y3 Q1, three cameras (SM36 I RC1, SM37 I RC1 and SM37 I RC2) were discovered missing, one camera was damaged and was reported unrepairable (SM36 I RC2) and another camera had its SD card stolen (SM31 C RC2). These camera locations will be replaced in Q2 where possible. •Fourteen camera locations (SM01 I RC1, SM03 I RC1, SM04 C RC1, SM10 I RC1, SM12 C RC1, SM17 C RC1, SM27 I RC1, SM30 C RC1, SM30 C RC2, SM31 C RC1, SM33 C RC1, SM34 I RC1, SM38 C RC2 and SM39 C RC1) did not capture a full 30 days of Q1 data.	•Smoky Mouse were not recorded at any impact or control sites. •Eastern Pygmy Possum were recorded at eight impact sites (SM05 I, SM14 I, SM15 I, SM16 I, SM21 I, SM23 I, SM24 I and SM25 I) and five control sites (SM06 C, SM09 C, SM13 C, SM40 C and SM41 C). •Broad toothed Rat were recorded at one impact site (SM34 I) and five control sites (SM02 C, SM30 C, SM32 C, SM33 C and SM39 C). •Broad toothed Rat faecal pellet search was undertaken in April and May. –Three impact sites recorded Broad toothed Rat faecal pellets (FP17 recorded uncommon and fresh scats, FP19 rare and fresh scats, FP20 rare and old scats). FP20 recorded Broad toothed Rat scats for the first time during the BMP surveys. This may be an indication that the species re establishment within previously burnt habitat has occurred. Impact site FP18 did not record any scats. –Six control sites recorded Broad toothed Rat faecal pellets (FP24 recorded rare and intermediate aged scats, FP26 common and intermediate aged scats, FP30 common and fresh scats, FP31 uncommon and intermediate aged scats, FP32 abundant and fresh scats and FP33 abundant and intermediate aged scats). Control site FP27 did not record any scats.	•Smoky Mouse were not recorded at any impact or control sites. •Eastern Pygmy Possum were not recorded at any impact or control sites. •Broad toothed Rat were recorded at two impact sites (SM01 I and SM34 I) and eight control sites (SM02 C, SM04 C, SM28 C, SM30 C, SM31 C, SM32 C, SM33 C and SM39 C). •Broad toothed Rat faecal pellet searches were undertaken in July and August. –Two impact sites recorded Broad toothed Rat faecal pellets (FP17 recorded abundant and fresh scats and FP19 recorded common scats of intermediate age). The other two impact sites (FP18 and FP20) did not record any scats in Q3. –Six control sites recorded Broad toothed Rat faecal pellets (FP30 and FP32 recorded abundant and fresh scats, while FP24, FP26 and FP30 recorded abundant scats of intermediate age; FP33 recorded uncommon scats of intermediate age). Control site FP27 did not record any scats in Q3 and is nearing the absence of the species for almost one year. The species was last observed at FP27 in October 2022.	•Smoky Mouse were not recorded at any impact or control sites. •Eastern Pygmy Possum were recorded at seven impact sites (SM03 I, SM10 I, SM20 I, SM21 I, SM22 I, SM24 I and SM25 I) and six control sites (SM04 C, SM06 C, SM09 C, SM12 C, SM13 C and SM40 C). •Broad toothed Rat were not recorded at any impact sites and eight control sites (SM02 C, SM04 C, SM28 C, SM30 C, SM31 C, SM32 C, SM33 C and SM39 C). •Broad toothed Rat faecal pellet searches were undertaken in October and November 2023. –Two impact sites recorded Broad toothed Rat faecal pellets (FP17 recorded abundant and fresh scats and FP19 recorded common scats of intermediate age). The other two impact sites (FP18 and FP20) did not record any scats in Q4. –All control sites recorded Broad toothed Rat faecal pellets (FP26 and FP32 recorded abundant (fresh) scats, FP24 and FP30 recorded abundant (old) scats. FP27 recorded rare scats of intermediate freshness, FP31 common and intermediate and FP33 common and old scats. •During Y3 Q4, two camera locations were not surveyed (SM34 and SM37). Cameras at SM37 were found missing in February 2023 and had not been replaced since. Six camera locations (SM28 C RC1, SM30 C RC1, SM32 C RC1, SM32 C RC2, SM33 C RC2 and SM38 C RC2) did not capture a full 30 days of Q4 data.	•Adaptive management has not been trigged for Smoky Mouse during Year 3 as the species was not recorded at either the impacts sites or control sites. •Two impact sites (SM07 and SM18) remain triggered for adaptive management as the Eastern Pygmy Possum was not observed in Year 3. Additional sites where absence of the species was recorded in Year 3 were not triggered for adaptive management as they did not record presence in Year 1 (baseline surveys). •No adaptive management has been triggered for Broad toothed-Rat (Mastacomys fuscus). Sites where absence of the species was recorded in Year 3 were not triggered for adaptive management as they did not record presence in Year 1 (baseline surveys).
Small mammal habitat characteristic monitoring	•Observed degradation in vegetation structure and habitat characteristics of occupied habitat. •Observed degradation is combined with an observed increase in weed cover or other project related impacts.	•During baseline surveys, the average percentage of native cover at impact sites ranged from 0% to 99%, compared to that of exotic which ranged from 0% to 66%. •The average percentage of native cover at control sites ranged from 0% to 95%, compared to that of exotic cover which ranged from 0% to 79%. •Two control sites (SM08 and SM11) were unable to be established due to inaccessibility along Dead Man's Fire Trail and were replaced during Year 2 (with SM40 and SM41).	•Vegetation structure remained comparable between impact and control sites. •The average percentage of native cover at impact sites ranged from 16% to 72%, compared to that of exotic which ranged from 1% to 12%. The average percentage of habitat structure cover at impact sites ranged from 1% to 15%. •The average percentage of native cover at control sites ranged from 9% to 78%, compared to that of exotic cover which ranged from 0% to 8%. The average percentage of habitat structure cover at control sites ranged from 0% to 8%. •By comparing Year 3 data with baseline data, three major differences were observed at impact sites. First, an increase (+12%) in the average native cover between 1–1.5 m, which was 3% in Year 1, 9% in Year 2 and 16% in Year 3. This may account for regeneration of canopy species after the 2019/2020 bushfires. Second, a decline (10%) in the average exotic cover below 0.5 m, which was 14% in Year 1, 19% in Year 2 and 12% in Year 3. Third, a decline (10%) in the average habitat structure cover below 0.5 m, which was 18% in Year 1, 25% in Year 2 and 15% in Year 3. Similar trends were also observed in control sites.	Small mammal habitat characteristic monitoring was not required to be undertaken during Q2.	Small mammal habitat characteristic monitoring was not required to be undertaken during Q3.	Small mammal habitat characteristic monitoring was not required to be undertaken during Q4. Year 4 data will be collected in November 2023.	Three impact sites (SM18, SM35 and SM36) have been triggered for adaptive management due observed degradation in vegetation structure and habitat characteristics and due to the absence of the target species.
Alpine Tree Frog occupancy monitoring	•A decline in relative abundance (which upon review by species experts, is also considered as biologically significant) occurs during construction and/or operation at impact sites that does not occur at the control sites. •Decline in relative abundance is accompanied by a decline in other monitoring parameters.	•During baseline surveys, 16 sightings of the Alpine Tree Frog (Litoria verreauxii alpina) were recorded at three of four impact sites (TC02, NC01, KPC01) and 144 sightings at all four control sites (TC03, ER02, MR01, NC03). No Alpine Tree Frogs were recorded at TR01. •During Year 2, 27 individuals of the Alpine Tree Frog were recorded at all four impact sites and 159 individuals were recorded within all four control sites.	•During Y3 Q1, all transects were surveyed. Overall, 21 Alpine Tree Frogs were recorded across three impact sites (TR01, TC02 and NC01). At the control sites, 125 Alpine Tree Frogs were recorded across all four sites. No Alpine Tree Frogs were recorded at one impact site (KPC01). A decline in relative abundance in respect to Year 1 data occurred at two out of four impact sites (NC01 and KPC01). The percentage decline between Year 1 and Year 3 populations at these impact sites is: •NC01: 71% •KPC01: 100% Between these two monitoring years (Year 1–Year 3), control sites declined by an average of 13%. A decline in relative abundance in respect to Year 2 data occurred at two out of four impact sites (NC01 and KPC01). The percentage decline between Year 2 and Year 3 populations at these impact sites is: •NC01: 82% •KPC01: 100%. Between these two monitoring years (Year 2–Year 3), control sites declined by 9%. There is the potential that the declines observed at two of the impact sites are biologically significant.	Alpine Tree Frog monitoring was not required to be undertaken during Q2.	Alpine Tree Frog occupancy monitoring was not required to be undertaken during Q3.	Alpine Tree Frog occupancy monitoring was not required to be undertaken during Q4.	No decline in relative abundance has occurred at any impact sites for Alpine Tree Frog, therefore adaptive management is not required for this species.
Booroolong Frog occupancy monitoring	•A decline in relative abundance (which upon review by species experts, is also considered as biologically significant) occurs during construction and/or operation at impact sites that does not occur at the control sites. •Decline in relative abundance is accompanied by a decline in other monitoring parameters.	•During Year 1 baseline surveys, twenty sightings of the Booroolong Frog (Litoria booroolongensis) were recorded at all four impact sites (WC01, YR02, YR05, YR06) and five sightings at the two control sites (YR08, YR09). •During Year 2, four sightings of the Booroolong Frog were recorded at one impact site (YR05) and four sightings were recorded at the two control sites (YR08, YR09). This survey was completed under many limitations, and it was recommended that a third year of data is captured to inform any potential adaptive management.	•During Y3 Q1, five Booroolong Frog monitoring sites were surveyed. One control transect (YR09) was not surveyed to due unsafe conditions. In total, nine Booroolong Frogs were recorded across three impact sites (YR02, YR05 and YR06). No Booroolong Frogs were recorded at one impact site (WC01). Five Booroolong Frogs were recorded across one control site (YR08). Comparison with Year 2 data is not reliable due to insufficient data. A decline in relative abundance in respect to Year 1 data occurred at three out of four impact sites (WC01, YR02 and YR05), whilst the control sites showed no change (0%). The percentage decline between Year 1 and Year 3 populations at impact sites are: •WC01: 100% •YR02: 50% •YR05: 71%. There is the potential that these declines are biologically significant.	Booroolong Frog monitoring was not required to be undertaken during Q2.	Booroolong Frog occupancy monitoring was not required to be undertaken during Q3.	Booroolong Frog occupancy monitoring was not required to be undertaken during Q4. Year 4 data will be collected in November 2023.	Adaptive management triggers and actions are to be reviewed after Year 4 results have been obtained.

Boorooolong Frog habitat characteristics monitoring	Observed degradation, change or loss of rocky (breeding) habitat at impact sites that does not also occur at the reference sites.	During Year 2, four impact transects (WC01, YR02, YR05 and YR06) and two control transects (YR08 and YR09) were surveyed. Results from the survey showed the following: –The average bed rock cover was 0.03 ha at impact transects and 0.03 ha at control transects. –The average cobble bank cover was 0.08 ha at impact transects and 0.02 ha at control transects. –The average mud bank cover was 0.005 ha at impact transects and 0.01 ha at control transects. –The average pool cover was 0.01 ha at impact transects and 0.004 ha at control transects. –The average riffle cover was 0.05 ha at impact transects and 0.04 ha at control transects. –The average riparian vegetation cover was 3.51 ha at impact transects and 1.54 ha at control transects. –The average rocky bank cover was 0.04 ha at impact transects and 0.05 ha at control transects. –The average run cover was 0.59 ha at impact transects and 0.26 ha at control transects. –The average cover of 'other' features (such as access tracks, cleared land or other vegetation) was 0.61 ha at impact transects and 0.31 ha at control transects. The total area mapped was 23.83 ha. It should be noted that for the purpose of Year 3 comparisons against adaptive management triggers, Year 2 data has been adjusted to account for the same sized survey area as Year 3. For this reason, the transect areas reported on in the Year 2 annual report (EMM, 2023) are different to the ones outlined above. This is due to a reduction in total area surveyed to create a standardised approach to frog habitat characteristic monitoring.	Boorooolong Frog habitat characteristic monitoring was undertaken in December 2022. All four impact transects (WC01, YR02, YR05 and YR06) and two control transects (YR08 and YR09) were surveyed. Results from the survey showed the following: –The average bed rock cover was 0.03 ha at impact transects and control transects. –The average cobble bank cover was 0.06 ha at impact transects and 0.03 ha at control transects. –The average mud bank cover was 0.01 ha at impact transects and 0.003 ha at control transects. –The average pool cover was 0.003 ha at impact transects and 0 ha at control transects. –The average riffle cover was 0.06 ha at impact transects and 0.04 ha at control transects. –The average riparian vegetation cover was 3.56 ha at impact transects and 1.61 ha at control transects. –The average rocky bank cover was 0.03 ha at impact transects and 0.04 ha at control transects. –The average run cover was 0.58 ha at impact transects and 0.27 ha at control transects. –The average cover of 'other' features (such as access tracks, cleared land or other vegetation) was 0.5 ha at impact transects and 0.24 ha at control transects. The total area mapped was 23.83 ha. The average extent of bed rock bank, riffles and rocky banks within impact sites are within the standard deviation observed at the control sites during Year 3. However, the average extent for cobble banks and runs are outside the standard deviation observed at control sites. The majority of 'rocky' habitat parameters have not changed when compared to control sites.	Boorooolong Frog habitat characteristic monitoring was not required to be undertaken during Q2.	Boorooolong Frog habitat characteristic monitoring was not required to be undertaken during Q3.	Boorooolong Frog habitat characteristic monitoring was not required to be undertaken during Q4. Year 4 data will be collected in November 2023.	Adaptive management triggers and actions are to be reviewed after Year 4 results have been obtained.
Alpine She-oak Skink occupancy monitoring	•Absence of target species from a site during construction and operational monitoring, where the species was recorded during pre construction/baseline surveys. •No changes in presence/absence at control sites. •Absence recorded for greater than one year. •Absence is combined with an observed increase or new occurrence of a primary impact (weeds or feral animals).	During Year 1 baseline surveys, two Alpine She oak Skinks (Cyclodomorphus praealtus) were recorded at a single impact site (TG02) and five Alpine She oak Skinks were recorded at three control sites (TG06, TG07, TG08). No Alpine She oak Skinks were recorded at four impact sites (TG01, TG03, TG05) and one control site (TG09). During Year 2, no adaptive management was triggered; however, it was raised that if no Alpine She oak Skinks were recorded at TG05 up to December 2022 (Year 3), adaptive management would be triggered (EMM, 2023). Impact site TG04 has not recorded any individuals since its establishment, in October 2021. It was recommended that TG04 be relocated due to having never recorded species presence.	During Y3 Q1, one Alpine She oak Skink was recorded at one impact site (TG02) and 16 individuals were recorded among all control sites (TG06, TG07, TG08 and TG11). No Alpine She oak Skinks were recorded at all other impact sites (TG03, TG04, TG05 and TG10). •TG05 is triggered for adaptive management. TG05 was last recorded the species on 8 December 2021. •Another impact site (TG03) last recorded the species on 24 March 2022, so is nearing an absence of Alpine She oak Skinks of greater than one year. The species was not recorded during pre construction/baseline surveys at this site. Adaptive management will be triggered if the species is not sighted in the March tile grid surveys (Year 3 Q2). •TG04 was relocated on 10 January 2023 from its previous location on the western side of Spoil Road to the east of Spoil Road, in potential suitable habitat. All control sites recorded presence of the species in the past year. Tantangara Dam management zone (where most impact sites are located) recorded the highest number of priority weeds (nine species) in Year 3 Q1 (see Table 1.20). Additionally, Tantangara Dam has also shown a substantially higher abundance of feral animals in comparison to previous years and other project areas.	During Y3 Q2 (March), no Alpine She oak Skinks were recorded at impact sites. Seven individuals were recorded across two control sites (TG08 and TG11). Adaptive management has been triggered for TG03 (impact site). •TG03 has recorded an absence of Alpine She oak Skinks for greater than 1 year. •No significant changes in presence/absence were recorded at control sites. All control sites recorded presence of the species in the past year. •Tantangara Dam management zone (where most impact sites are located) recorded the highest number of priority weeds (nine species) in year 3 (see Table 1.20, Y3 Q1 – Construction conditions). Moreover, Tantangara Dam has also shown a significantly higher abundance of feral animals in comparison to previous years. Adaptive management is still triggered for TG05 (impact site). TG05 last recorded the species on 8 December 2021.	Alpine She oak Skink monitoring was not required to be undertaken during Q3.	During Y3 Q4, Alpine She oak Skinks were recorded at three impact sites (TG02, TG03 and TG05) and two control sites (TG08 and TG11). No Alpine She oak Skinks were recorded at all other impact (TG04 and TG10) and control sites (TG06 and TG07). Adaptive management for TG03 and TG05 (impact sites) is no longer required, as these sites recorded the species during Q4.	All impact sites have documented the presence of the Alpine She Oak within the past year, excluding TG04. TG04 had consistently shown null data since the initiation of baseline surveys in Year 1. Notably, TG04 was relocated to a new site within suitable Alpine She Oak Skink habitat in January 2023. As this new monitoring location has been part of the program for only a single year, it is necessary to accumulate more data before drawing any conclusions or initiating adaptive management measures.
Feral animal occupancy monitoring	Sighting of feral animals within proximity to known Smoky Mouse habitat or project infrastructure.	Sighting of feral animals triggers control in accordance with the Weed, Pest and Pathogen Management Plan. Feral animal control to be undertaken within areas with feral records. During Year 2 (Q4), seven feral animal species were recorded during the fourth monitoring event across 49 sites (42% monitored sites): •European Hare was recorded at 1 site. •Feral Cat was recorded at 10 sites. •Feral Horse was recorded at 16 sites. •Rabbit was recorded at 24 sites. •Red Fox was recorded at 18 sites. •Sambar Deer was recorded at 3 sites. •Wild Dog was recorded at 4 sites. •Individuals of Cervid spp. were recorded at 4 sites. As sightings of feral animals had been located within proximity to Smoky Mouse habitat and project infrastructure, adaptive management had been triggered in Year 2 (Q4).	Seven feral animal species were recorded across 24 sites (41% monitored sites) comprising the following: •Feral Cat was recorded at 10 sites. •European Hare was recorded at 1 site. •European Rabbit was recorded at 11 sites. •Feral Horse was recorded at 5 sites. •Red Fox was recorded at 10 sites. •Sambar was recorded at 2 sites. •Wild Dog was recorded at 5 sites. One camera location (FC04A) had been cleared during Year 2 and the camera has not been reinstalled, therefore no Q1 data was collected at this location. One camera (FC09A) was discovered stolen in summer 2023 and reinstalled on January 12 2023. One camera location (FC14B) collected no Q1 data and 8 camera locations (FC04B, FC12A, FC13B, FC14A, FC14B, FC15A, FC16A and FC17B) did not capture a full 30 days of Q1 data due to technical issues.	Nine feral animal species were recorded across 39 sites (67% of monitored sites) comprising: •Feral Cat was recorded at 12 sites. •European Hare was recorded at 2 sites. •European Rabbit was recorded at 10 sites. •Feral Horse was recorded at 9 sites. •Red Deer was recorded at 7 sites. •Red Fox was recorded at 15 sites. •Sambar Deer was recorded at 5 sites. •Wild Dog was recorded at 6 sites. •Feral Pig was recorded at 1 site. One camera location (FC04A) had been cleared during Year 2 and the camera has not been reinstalled, therefore no Q2 data was collected at this location. Three cameras (FC08B, FC15A and FC17A) were missing at the time of collection in April 2023; amongst these, two cameras (FC15A and FC17A) had since been reinstalled on 6 June 2023. Nine camera locations (FC05B, FC08A, FC09B, FC12A, FC13A, FC18B, FC19A and FC20A) collected no Q2 data. Eleven camera locations (FC04B, FC05A, FC06A, FC06B, FC07A, FC09A, FC13B, FC14B, FC15B, FC16B and FC18A) did not capture a full 30 days of Q2 data.	Eight feral animal species were recorded across 35 sites (60% of monitored sites) comprising: •Feral Cat was recorded at 12 sites. •European Hare was recorded at 2 sites. •European Rabbit was recorded at 9 sites. •Feral Horse was recorded at 4 sites. •Red Fox was recorded at 17 sites. •Sambar Deer was recorded at 6 sites. •Wild Dog was recorded at 1 site. •Fallow Deer was recorded at 1 site. One camera location (FC04A) had been cleared during Year 2 and the camera has not been reinstalled; therefore, no Q3 data was collected at this location. Four cameras (FC17B, FC18B and FC19A) were collected by FG in May 2023 and were returned in September 2023; therefore, no Q3 data was collected at these locations. These cameras, together with FC20B, which was also recently collected by FG, will be reinstalled in Spring 2023. Two cameras (FC03B and FC21A) were missing at the time of collection in July August 2023. Nine camera locations (FC05A, FC05B, FC08A, FC09B, FC13A, FC13B, FC15B, FC16A and FC20A) collected no Q3 data. Six camera locations (FC06B, FC07A, FC09A, FC14A, FC14B and FC16B) did not capture a full 30 days of Q3 data.	Seven feral animal species were recorded across 32 sites (55% of monitored sites) comprising: •Feral Cat was recorded at 8 sites. •European Hare was recorded at 1 site. •European Rabbit was recorded at 9 sites. •Feral Horse was recorded at 10 sites. •Red Fox was recorded at 12 sites. •Sambar Deer was recorded at 5 sites. •Wild Dog was recorded at 5 sites. Three cameras (FC17B, FC18B and FC19A) were collected by FG in May 2023, and have been reinstalled in December 2023; therefore, no Q4 data was collected at these locations. One camera location (FC04A) had been cleared during Year 2 and the camera has not been reinstalled; therefore, no Q4 data was collected at this location. Two cameras (FC03B and FC21A) were missing at the time of collection in July August 2023 and have not been replaced; therefore, no Q4 data was collected at these locations. Four cameras (FC04B, FC08B, FC18A and FC19B) were missing at the time of collection in October 2023 and have not been replaced; therefore, no Q4 data was collected at these locations. Four cameras (FC07B, FC11A, FC11B and FC20B) presented corrupted data in Q4; therefore, no Q4 data was analysed for these locations. Six camera locations (FC05B, FC06B, FC08A, FC09B, FC16B and FC20A) collected no Q4 data. Eight camera locations (FC03A, FC07A, FC09A, FC13A, FC13B, FC14A, FC14B and FC15B) did not capture a full 30 days of Q4 data.	Feral animals were recorded within proximity to project roads and infrastructure within Lobs Hole Ravine Road and Lobs Hole, Marica, Tantangara Dam, Tantangara Road and Rock Forest. This has triggered the adaptive managment and it is recommended that control should prioritise European Rabbit, Horse and Sambar at Tantagara Dam and Rock Forest as a priority.
Feral animal abundance monitoring	Sighting of feral animals within proximity to known Smoky Mouse habitat or project infrastructure.	During Year 2 (Q4), spotlighting was completed at Marica, Lobs Hole, Rock Forest, Tantangara Road and Tantangara Dam. •Three feral animals were recorded across the Main Works project area: –81 individuals of Rabbit –6 individuals of Feral Horse –2 individuals of Red Fox. •Average abundance for each road/key infrastructure area: –Lobs Hole Ravine Road Bottom = 0.15 animals/km (Rabbit) –Lobs Hole Ravine Road North = 0.68 animals/km (Rabbit and Red Fox) –Lobs Hole Ravine Road South = 0.14 animals/km (Rabbit and Red Fox) –Marica = 0.14 animals/km (Rabbit –Rock Forest = 13.68 animals/km (Rabbit) –Tantangara Dam = 4.03 animals/km (Rabbit) –Tantangara Road = 0.7 animals/km (Rabbit and Feral Horse). As sightings of feral animals had been located within proximity to Smoky Mouse habitat and project infrastructure, adaptive management had been triggered in Year 2 (Q4).	Spotlighting was completed at Marica, Lobs Hole, Rock Forest, Tantangara Road and Tantangara Dam. Lobs Hole Ravine Road North was not surveyed because of roadworks. •Four feral animal species were recorded across the Main Works project area: –48 individuals of Rabbit –63 individuals of Feral Horse –1 individual of Red Fox –2 individuals of Sambar Deer. •Average abundance for each road/key infrastructure area: –Lobs Hole Ravine Road Bottom = 0.28 animals/km (Rabbit, Red Fox and Sambar Deer) –Lobs Hole Ravine Road South = 0.14 animals/km (Rabbit and Sambar Deer) –Marica = 0.06 animals/km (Rabbit) –Rock Forest = 6.19 animals/km (Rabbit) –Tantangara Dam = 6.32 animals/km (Rabbit and Feral Horse) –Tantangara Road = 0.89 animals/km (Rabbit).	Spotlighting was completed at Marica, Lobs Hole, Rock Forest, Tantangara Road and Tantangara Dam. Only part of Lobs Hole Ravine Road North was surveyed as advised by the client, due to high activity on site. •Three feral animal species were recorded across the Main Works project area: –48 individuals of Rabbit –8 individuals of Feral Horse –2 individuals of Red Fox. •Average abundance for each road/key infrastructure area: –Lobs Hole Ravine Road Bottom = 1.52 animals/km (Rabbit and Red Fox) –Lobs Hole Ravine Road North = 0.50 animals/km (Rabbit) –Marica = 0.21 animals/km (Rabbit) –Rock Forest = 3.88 animals/km (Rabbit) –Tantangara Dam = 1.86 animals/km (Rabbit, Red Fox and Feral Horse) –Tantangara Road = 0.29 animals/km (Rabbit and Feral Horse). Lobs Hole Ravine Road South recorded no feral animals.	Spotlighting was completed at all management zones. Lobs Hole Ravine Road North and Tantangara Dam were only partially surveyed because of construction works limiting access. •Four feral animal species were recorded across the Main Works project area: –32 individuals of Rabbit –6 individuals of Feral Horse –6 individuals of Sambar Deer –1 individual of Red Fox. •Average abundance for each road/key infrastructure area: –Lobs Hole Ravine Road Bottom = 0.9 animals/km (Rabbit and Sambar Deer) –Lobs Hole Ravine Road North = 0.19 animals/km (Rabbit) –Lobs Hole Ravine Road South = 0.03 animals/km (Red Fox) –Marica = 0.08 animals/km (Rabbit). –Rock Forest = 0.45 animals/km (Rabbit). –Tantangara Dam = 1.63 animals/km (Rabbit and Feral Horse) –Tantangara Road = 0.52 animals/km (Rabbit and Feral Horse).	Spotlighting was completed at all management zones. Lobs Hole Ravine Road North and Tantangara Dam were only partially surveyed because of construction works limiting access. •Four feral animal species were recorded across the Main Works project area: –54 individuals of Rabbit –38 individuals of Feral Horse –1 individual of Red Fox –1 individual of Fallow Deer –1 individual of Sambar Deer. •Average abundance for each road/key infrastructure area: –Lobs Hole Ravine Road Bottom = 0.62 animals/km (Rabbit) –Lobs Hole Ravine Road North = 0.20 animals/km (Rabbit and Red Fox) –Lobs Hole Ravine Road South = 0.04 animals/km (Sambar Deer) –Marica = 0.14 animals/km (Rabbit) –Rock Forest = 9.74 animals/km (Rabbit) –Tantangara Dam = 6.86 animals/km (Rabbit, Feral Horse and Fallow Deer) –Tantangara Road = 0.47 animals/km (Rabbit and Feral Horse).	Sightings of feral animals have been located within proximity to Smoky Mouse habitat and project infrastructure,adaptive management has been triggered. Feral animals were recorded within proximity to project roads and infrastructure within Lobs Hole Ravine Road and Lobs Hole, Marica, Tantangara Dam, Tantangara Road and Rock Forest. It is recommended that control should prioritise European Rabbit, Horse and Sambar at Tantagara Dam and Rock Forest as a priority.
Weed presence / absence monitoring	•New occurrence of weeds within proximity to project infrastructure. •Monitoring results are identifying increases in density of high priority weeds.	In Year 1, sixteen priority weed species were recorded within 50 m of the main project roads, accommodation camps and key construction compounds and within 50 m of the threatened flora monitoring locations: •Milfoil/Yarrow (Achillea millefolium) •Browntop Bent (Agrostis capillaris) •Sweet Vernal Grass (Anthoxanthum odoratum) •Spear Thistle (Cirsium vulgare) •Cocksfoot (Dactylis glomerata) •Patterson's Curse (Echium plantagineum) •Vipers Bugloss (Echium vulgare) •Yorkshire Fog Grass (Holcus lanatus) •St John's Wort (Hypericum perforatum) •Ox eye Daisy (Leucanthemum vulgare) •Bird's foot Trefoil (Lotus spp.) •Musk Monkey Flower (Mimulus moschatus) •Scotch Thistle (Onopordium acanthium) •Sweet Briar (Rosa rubiginosa) •Blackberry (Rubus spp.) •Mullein (Verbascum spp.). In Year 2, no new priority weed species were recorded. However, among the weed species recorded in Year 2, six species not considered as priority weed species were recorded: •Redtop Bent (Agrostis gigantea) •Flaxleaf Fleabane (Conyza bonariensis) •Flatweed (Hypochaeris radicata) •Sheep Sorrel (Rumex acetosella) •Dandelion (Taraxacum officinale) •White Clover (Trifolium repens) •Common Wheat (Triticum aestivum).	In Year 3, no new priority weed species were recorded. Ten priority weed species were recorded within 50 m of the main project roads, accommodation camps and key construction compounds and within 50 m of the threatened flora monitoring locations: •Browntop Bent (Agrostis capillaris) •Sweet Vernal Grass (Anthoxanthum odoratum) •Spear Thistle (Cirsium vulgare) •Cocksfoot (Dactylis glomerata) •Yorkshire Fog Grass (Holcus lanatus) •St John's Wort (Hypericum perforatum) •Ox eye Daisy (Leucanthemum vulgare) •Sweet Briar (Rosa rubiginosa) •Blackberry (Rubus spp.) •Mullein (Verbascum spp.). Tantangara Dam (nine species), Bottom of Lobs Hole (seven species) and Lobs Hole Ravine Road Bottom (seven species) recorded the greatest numbers of priority weed species. Ten species not considered as priority weed species were also recorded: •Redtop Bent (Agrostis gigantea) •Flaxleaf Fleabane (Conyza bonariensis) •Flatweed (Hypochaeris radicata) •Sheep Sorrel (Rumex acetosella) •Dandelion (Taraxacum officinale) •White Clover (Trifolium repens) •Common Wheat (Triticum aestivum) •Bentgrass (Agrostis spp.) •Sow thistle (Sonchus spp.) •Lettuce (Lactuca spp.).	Weed presence/absence monitoring was not required to be undertaken during Q2.	Weed presence/absence monitoring was not required to be undertaken during Q3.	Weed presence/absence monitoring was not required to be undertaken during Q4.	This adaptive measures has not been triggered, howerver to it is recommended that due to high or increasing weed species richness, the areas for priority management include: • Bottom of Lobs Hole • Lobs Hole Ravine Road Bottom • Lobs Hole Ravine Road Top • Tantangara Dam

Phytophthora presence/absence monitoring	A soil sample returns a positive result for Phytophthora species of concern such as Phytophthora cinnamomi or Phytophthora gregata.	•Of the eight samples taken during baseline surveys (conducted during Q2 of Year 1), Phytophthora spp. was detected in one soil sample from Lobs Hole (Lobs01). No dieback was observed during surveys. Further tests confirmed the species to be Phytophthora cryptogea/psueudocryptogea. Additional soil sampling was required within the suspected infection area to document the extent. The original location (Lobs01) was resampled (PMS5), and an additional four sites surrounding the infected area (PMS1, PMS2, PMS3 and PMS4). Phytophthora cryptogea/psueudocryptogea was detected in PMS1 and PMS5, confirming presence within the bottoms of Lobs Hole. Given the results of the additional testing, soil samples were taken from an additional 20 locations across the Snowy 2.0 project area. The additional 20 samples tested negative for Phytophthora spp. •All samples taken in Year 2 were negative. No additional testing was required.	Locations of some soil samples were slightly altered due to the evolving construction footprint. All the original sampling sites and 23 additional sites were sampled in January 2023 and tested for Phytophthora spp. presence. The results of the analysis showed the following: •Phytophthora cinnamomi was detected at one sample site (PS03). Adaptive management has been triggered. No additional areas within proximity have been tested at PS03.	Phytophthora presence/absence monitoring was not required to be undertaken during Q2.	Phytophthora presence/absence monitoring was not required to be undertaken during Q3.	Phytophthora presence/absence monitoring was not required to be undertaken during Q4.	Adaptive management for Phytophthora include Conducting additional soil sample testing within suspected infection area to document extent. Ensure anthropogenic spread from infected areas is elimination by modifying site activities in the vicinity, controlling access, and revising hygiene procedures.

Appendix B
Site locations summary

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Table B.1 Monitoring site locations

			Threatened flora		Small Mammals		Alpine She-oak Skink	Frogs			Feral Animal	Pathogens
Location	Site	GPS coordinates	Monitoring plots	Habitat Characteristic Transects*	Motion Camera	Faecal Pellet Search	Tile Grid	Alpine Tree Frog Transect	Booroolong Frog Transect	Booroolong Drone Survey	Camera	Soil sampling
Circuits Trail	NC03	E653086 N6029900						✓				
	TF05 (relocated - old location)	E653562 N6030119	-									
	TF05 (relocated in December 2022)	E652628 N6034864	✓									
	TF08	E652134 N6036239	✓									
	TF09	E652604 N6034294	✓									
Dead Mans	SM04-C-RC1	E627513 N6028084		✓	✓						✓	
	SM04-C-RC2	E627488 N6028175		✓	✓						✓	
	SM06-C-RC1	E627084 N6029494		✓	✓						✓	
	SM06-C-RC2	E627005 N6029469		✓	✓						✓	
	SM09-C-RC1	E627054 N6030585		✓	✓						✓	
	SM09-C-RC2	E626973 N6030598		✓	✓						✓	
	SM12-C-RC1	E626863 N6031047		✓	✓						✓	
	SM12-C-RC2	E626949 N6030991		✓	✓						✓	
	SM13-C-RC1	E627190 N6031165		✓	✓						✓	
	SM13-C-RC2	E627280 N6031156		✓	✓						✓	
	SM40-C-RC1	E626870 N6028263		✓	✓						✓	
	SM40-C-RC2	E626771 N6028286		✓	✓						✓	
LHRR Bottom	FC05 A	E625172 N6040255									✓	
	FC05 B	E625522 N6039454									✓	
	FC06 A (relocated - old location)	E626304 N6039273									-	
	FC06 A (relocated in January 2023)	E626275 N6039278									✓	
	FC06 B (relocated - old location)	E625818 N6039058									-	
	FC06 B (relocated in January 2023)	E625843 N6039152									✓	
	FC07 A	E625910 N6038584									✓	
	FC07 B (relocated - old location)	E626243 N6038815									-	
	FC07 B (relocated in May 2023)	E626297 N6038780									✓	
	FC08 A	E626410 N6038267									✓	

Table B.1 Monitoring site locations

			Threatened flora		Small Mammals		Alpine She-oak Skink	Frogs			Feral Animal	Pathogens
Location	Site	GPS coordinates	Monitoring plots	Habitat Characteristic Transects*	Motion Camera	Faecal Pellet Search	Tile Grid	Alpine Tree Frog Transect	Booroolong Frog Transect	Booroolong Drone Survey	Camera	Soil sampling
	FC08 B	E626044 N6038209									✓	
	FC09 A	E627425 N6038082									✓	
	FC09 B (relocated - old location)	E627839 N6038435									-	
	FC09 B (relocated in May 2023)	E627880 N6038450									✓	
	Lobs01 (dismissed in Year3)	E626169 N6038412										-
	Lobs02 (established in Year3)	E626078 N6038392										✓
	PMS1 (dismissed in Year3)	E626160 N6038341										-
	PMS2 (relocated in Year 3)	E626097 N6038269										✓
	PMS3 (relocated in Year 3)	E626140 N6038244										✓
	PMS4 (relocated in Year 3)	E626199 N6038253										✓
	PMS5 (dismissed in Year3)	E626166 N6038409										-
	PS03	E627852 N6038421										✓
	PS04	E626340 N6039260										✓
	PS05	E625578 N6039489										✓
	SM19-I-RC1	E625424 N6039246		✓	✓						✓	
	SM19-I-RC2	E625396 N6039202		✓	✓						✓	
	SM20-I-RC1	E627814 N6038071		✓	✓						✓	
	SM20-I-RC2	E627887 N6038000		✓	✓						✓	
	WC01	E627781 N6038027						✓	✓			
	YR02	E626236 N6038909						✓	✓			
	YR05	E626886 N6038200						✓	✓			
	YR06	E627711 N6038318						✓	✓			
	YR08	E628062 N6039040						✓	✓			
	YR09	E628064 N6039368						✓	✓			
LHRR North	FC03 A	E624757 N6041147									✓	
	FC03 B	E624854 N6040718									✓	
	FC04 A	E625424 N6039813									✓	
	FC04 B	E625779 N6040158									✓	

Table B.1 Monitoring site locations

			Threatened flora		Small Mammals		Alpine She-oak Skink	Frogs			Feral Animal	Pathogens
Location	Site	GPS coordinates	Monitoring plots	Habitat Characteristic Transects*	Motion Camera	Faecal Pellet Search	Tile Grid	Alpine Tree Frog Transect	Booroolong Frog Transect	Booroolong Drone Survey	Camera	Soil sampling
LHRR South	Lobbs hole R0.5	E628985 N6028294										✓
	Lobs Hole, R5	E626999 N6032166										✓
	PS01	E629107 N6027958										✓
	PS02	E626985 N6032115										✓
	SM01-I-RC1	E629002 N6027853		✓	✓						✓	
	SM01-I-RC2	E628957 N6027805		✓	✓						✓	
	SM03-I-RC1	E629013 N6028188		✓	✓						✓	
	SM03-I-RC2	E628934 N6028144		✓	✓						✓	
	SM05-I-RC1	E628889 N6028648		✓	✓						✓	
	SM05-I-RC2	E628957 N6028685		✓	✓						✓	
	SM07-I-RC1	E628205 N6029818		✓	✓						✓	
	SM07-I-RC2	E628113 N6029804		✓	✓						✓	
	SM10-I-RC1	E627642 N6030795		✓	✓						✓	
	SM10-I-RC2	E627729 N6030742		✓	✓						✓	
	SM14-I-RC1	E627783 N6031169		✓	✓						✓	
	SM14-I-RC2	E627675 N6031155		✓	✓						✓	
	SM15-I-RC1	E627492 N6032042		✓	✓						✓	
	SM15-I-RC2	E627422 N6031971		✓	✓						✓	
	SM16-I-RC1	E626828 N6032555		✓	✓						✓	
	SM16-I-RC2	E626716 N6032542		✓	✓						✓	
	SM17-C-RC1	E626639 N6033514		✓	✓						✓	
	SM17-C-RC2	E626591 N6033477		✓	✓						✓	
	SM18-I-RC1	E627032 N6033393		✓	✓						✓	
	SM18-I-RC2	E627079 N6033341		✓	✓						✓	
Link Road	SM02-C-RC1	E628187 N6027266		✓	✓						✓	
	SM02-C-RC2	E628156 N6027339		✓	✓						✓	
	SM41-C-RC1	E625604 N6026619		✓	✓						✓	
	SM41-C-RC2	E625533 N6026657		✓	✓						✓	

Table B.1 Monitoring site locations

			Threatened flora		Small Mammals		Alpine She-oak Skink	Frogs			Feral Animal	Pathogens
Location	Site	GPS coordinates	Monitoring plots	Habitat Characteristic Transects*	Motion Camera	Faecal Pellet Search	Tile Grid	Alpine Tree Frog Transect	Booroolong Frog Transect	Booroolong Drone Survey	Camera	Soil sampling
Marica	FC10 A	E630446 N6038925									✓	
	FC10 B	E630950 N6038880									✓	
	FC11 A	E631414 N6038842									✓	
	FC11 B	E631880 N6038926									✓	
	FC12 A	E634047 N6038305									✓	
	FC12 B (relocated - old location)	E633816 N6037796									-	
	FC12 B (relocated in May 2023)	E633976 N6038088									✓	
	Marica Washdown (dismissed in Year2)	E636787 N6039884										✓
	Marica Washdown02 (established in Year2)	E635151 N6037569										-
	Marica01 (microsited in Year 3)	E633655 N6037849										✓
	PS06	E634797 N6037898										✓
	PS07	E633241 N6038437										✓
	PS08	E630531 N6039358										✓
	PS09	E630983 N6038878										✓
	PS10	E632420 N6038653										✓
	SM21-I-RC1	E630622 N6039053		✓		✓				✓		
	SM21-I-RC2	E630517 N6039030		✓		✓				✓		
	SM22-I-RC1	E631437 N6038798		✓		✓				✓		
	SM22-I-RC2	E631388 N6038695		✓		✓				✓		
	SM23-I-RC1	E631707 N6038968		✓		✓				✓		
	SM23-I-RC2	E631825 N6038988		✓		✓				✓		
	SM24-I-RC1	E632106 N6038509		✓		✓				✓		
	SM24-I-RC2	E632076 N6038398		✓		✓				✓		
	SM25-I-RC1	E633267 N6038464		✓		✓				✓		
	SM25-I-RC2	E633291 N6038553		✓		✓				✓		
	SM26-I-RC1	E633937 N6038389		✓		✓				✓		
	SM26-I-RC2	E633825 N6038391		✓		✓				✓		

Table B.1 Monitoring site locations

			Threatened flora		Small Mammals		Alpine She-oak Skink	Frogs			Feral Animal	Pathogens
Location	Site	GPS coordinates	Monitoring plots	Habitat Characteristic Transects*	Motion Camera	Faecal Pellet Search	Tile Grid	Alpine Tree Frog Transect	Booroolong Frog Transect	Booroolong Drone Survey	Camera	Soil sampling
	SM27-I-RC1	E634736 N6037814		✓	✓	✓ FP20					✓	
	SM27-I-RC2	E634796 N6037889		✓	✓						✓	
Plateau	PS16	E639636 N6038371										✓
	PS17	E642962 N6036535										✓
	PS18	E641780 N6032723										✓
	SM28-C-RC1	E637149 N6039490		✓	✓						✓	
	SM28-C-RC2	E637048 N6039567		✓	✓	✓ FP27					✓	
	SM29-C-RC1	E639235 N6040472		✓	✓						✓	
	SM29-C-RC2	E639130 N6040449		✓	✓						✓	
	SM30-C-RC1	E641243 N6042194		✓	✓	✓ FP32					✓	
	SM30-C-RC2	E641108 N6042164		✓	✓						✓	
	SM31-C-RC1	E641023 N6040021		✓	✓						✓	
	SM31-C-RC2	E640974 N6039933		✓	✓	✓ FP31					✓	
	SM32-C-RC1	E643931 N6040579		✓	✓	✓ FP26					✓	
	SM32-C-RC2	E643829 N6040582		✓	✓						✓	
	SM33-C-RC1	E641583 N6048457		✓	✓	✓ FP33					✓	
	SM33-C-RC2	E641675 N6048502		✓	✓						✓	
	SM35-I-RC1	E642590 N6031051		✓	✓						✓	
	SM35-I-RC2	E642579 N6031152		✓	✓						✓	
	TC02	E641967 N6033078						✓				
	TC03	E641113 N6042194						✓				
	TG06	E640403 N6048376					✓					
	TG07	E637664 N6039759					✓					
	TG08	E640520 N6042278					✓					
	TG11 (established in Year2)	E638672 N6037478					✓					
Rock Forest	FC21 A	E650261 N6021525									✓	
	FC21 B	E649945 N6021155									✓	
	PS19	E650712 N6020805										✓

Table B.1 Monitoring site locations

Location	Site	GPS coordinates	Threatened flora		Small Mammals		Alpine She-oak Skink	Frogs			Feral Animal	Pathogens
			Monitoring plots	Habitat Characteristic Transects*	Motion Camera	Faecal Pellet Search	Tile Grid	Alpine Tree Frog Transect	Booroolong Frog Transect	Booroolong Drone Survey	Camera	Soil sampling
	PS20	E651092 N6021074										✓
Snowy Mountains Highway	ER02	E636682 N6027218						✓				
	SM38-C-RC1	E639865 N6025701		✓	✓	✓ FP30					✓	
	SM38-C-RC2	E639926 N6025774		✓	✓						✓	
	TF06	E637158 N6027887	✓									
	TG09 (dismissed in Year 2)	E637448 N6027921					-					
Tantangara Dam	FC17 A (relocated - old location)	E649735 N6036813									-	
	FC17 A (relocated in Year 3)	E649657 N6036805									✓	
	FC17 B (relocated - old location)	E649325 N6036515									-	
	FC17 B (relocated in May 2023)	E649359 N6036549									✓	
	FC18 A (relocated - old location)	E648789 N6036772									-	
	FC18 A (relocated in January 2023)	E648791 N6036831									✓	
	FC18 B	E649036 N6037217									✓	
	FC19 A (relocated - old location)	E649088 N6037712									-	
	FC19 A (relocated in January 2023)	E649171 N6037744									✓	
	FC19 B (relocated - old location)	E649211 N6038123									-	
	FC19 B (relocated in January 2023)	E649083 N6038232									✓	
	FC20 A (relocated - old location)	E648577 N6039095									-	
	FC20 A (relocated in August 2023)	E648543 N6039165									✓	
	FC20 B	E648480 N6039651									✓	
	KPC01	E649204 N6036660						✓				
	MR01	E650944 N6037180						✓				
	TR01	E649460 N6037893						✓				
	PS11	E649248 N6036091										✓
	PS12	E649732 N6036815										✓
	PS13	E648960 N6037255										✓
	PS14	E648517 N6039121										✓

Table B.1 Monitoring site locations

Location	Site	GPS coordinates	Threatened flora		Small Mammals		Alpine She-oak Skink	Frogs			Feral Animal	Pathogens
			Monitoring plots	Habitat Characteristic Transects*	Motion Camera	Faecal Pellet Search	Tile Grid	Alpine Tree Frog Transect	Booroolong Frog Transect	Booroolong Drone Survey	Camera	Soil sampling
	PS15	E648386 N6040640										✓
	SM34-I-RC1	E649008 N6036345		✓	✓	✓ FP19					✓	
	SM34-I-RC2	E648968 N6036254		✓	✓						✓	
	Tantangara Adit 01	E648848 N6037892										✓
	Tantangara Washdown	E649087 N6036362										✓
	TF01 (dismissed in December 2021)	E649623 N6036633	-									
	TF02 (dismissed in December 2022)	E648880 N6038633	-									
	TF03	E648860 N6040585	✓									
	TF04 (relocated - old location)	E648496 N6040723	-									
	TF04 (relocated in December 2022)	E648491 N6040753	✓									
	TF10	E648323 N6040726	✓									
	TF11 (relocated - old location)	E648348 N6040518	-									
	TF11 (relocated in December 2022)	E648397 N6040498	✓									
	TF12 (relocated - old location)	E648410 N6040641	-									
	TF12 (relocated in December 2022)	E648378 N6040643	✓									
	TF14	E648527 N6041215	✓									
	TG03	E649050 N6036311					✓					
	TG04 (relocated – old location)	E648381 N6040583					-					
	TG04 (relocated in January 2023)	E648807 N6040689					✓					
	TG05	E649190 N6037463					✓					
	TG10 (established in Year2)	E648681 N6041395					✓					
Tantangara Road	FC13 A	E646294 N6024195									✓	
	FC13 B	E646308 N6024598									✓	
	FC14 A	E646533 N6026805									✓	
	FC14 B (Year 1 location)	E646510 N6027314									-	
	FC14 B (Year 2 location)	E646762 N6026426									-	

Table B.1 Monitoring site locations

			Threatened flora		Small Mammals		Alpine She-oak Skink	Frogs			Feral Animal	Pathogens
Location	Site	GPS coordinates	Monitoring plots	Habitat Characteristic Transects*	Motion Camera	Faecal Pellet Search	Tile Grid	Alpine Tree Frog Transect	Booroolong Frog Transect	Booroolong Drone Survey	Camera	Soil sampling
	FC14 B (relocated in April 2023)	E646507 N6027276									✓	
	FC15 A	E647297 N6030683									✓	
	FC15 B	E647266 N6031168									✓	
	FC16 A	E648102 N6033700									✓	
	FC16 B	E648503 N6033965									✓	
	NC01	E647317 N6029902						✓				
	SM36-I-RC1	E647364 N6029737		✓	✓	✓ FP18					✓	
	SM36-I-RC2	E647294 N6029806		✓	✓						✓	
	SM37-I-RC1	E646622 N6028813		✓	✓	✓ FP17					✓	
	SM37-I-RC2	E646539 N6028870		✓	✓						✓	
	SM39-C-RC1	E645970 N6022761		✓	✓	✓ FP24					✓	
	SM39-C-RC2	E646038 N6022838		✓	✓						✓	
	Tantangara Road 02	E645605 N6022864										✓
	TF07	E648824 N6034781	✓									
	TF13	E649017 N6035235	✓									
	TG01	E646591 N6025193					✓					
	TG02	E647238 N6029571					✓					

Appendix C
Limitations

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C.1 Limitations

Details of survey limitations and gaps in data collection for year 3 are outlined in Table C.1 below.

Table C.1 BMP limitations and gaps in Year 3

Monitoring Component	Limitation / Gap
Threatened Flora	In Year 3, the inability to relocate two monitoring sites that had previously been cleared. These two impact sites (TF01 and TF02) were unable to be relocated because records of Kiandra Leek Orchid (*Prasophyllum retroflexum*) and Clover Glycine (*Glycine latrobeana*) could not be found in adjacent suitable habitat to the plots that were cleared within the disturbance footprint. TF01 never recorded these species in previous surveys, while TF02 recorded Clover Glycine in both Year 1 and Year 2. The exclusion of these monitoring sites is not considered to increase the likelihood of requiring adaptive management actions for Kiandra Leek Orchid as a result. Nonetheless, the exclusion may influence the results of the Clover Glycine monitoring.
Remote cameras (Small mammals and Feral animal occupancy)	In Year 3, remote cameras faced several challenges. Some cameras were removed due to safety concerns after inadvertently flashing on passing vehicles; these cameras were reinstalled with their flash off. Instances of theft resulted in the loss of some equipment, while a number of cameras experienced battery depletion, attributed to heightened vehicle activity in the area or false triggers, compromising their functionality and data collection capabilities. For further details on the number of cameras that reported issues during Year 3, refer to Appendix A.
Small terrestrial mammal habitat characteristics	n/a
Frog occupancy	In Year 3, two transects (YR05 and YR09) encountered limitations due to unsafe river conditions caused by high water flow. This led to the cancellation of the affected portion of the transect, ensuring the safety of field staff. This resulted in incomplete data collection for that specific area. Impacts from heavy rainfall events that resulted in longer periods of higher-than-normal water levels and faster flowing river conditions along the transects may have had temporary impacts on the availability of Booroolong Frog refuge and "basking" habitat. Habitat like exposed rocks in high flowing sections and adjacent slow flowing pools, where this species is mostly found, become inundated. Therefore, the ability to detect this species is constrained as either the species is seeking refuge higher up the riverbanks or flushed further downstream to other areas. High and faster flowing water was observed to have the greatest impact at Wallaces Creek for the detectability of Booroolong Frog. This creek is skinner and habitat features were observed to be underwater where previous records of this species have been recorded. This was noted in the results from WC01, which did not record the presence of this species during Year 2 or Year 3 (and only one record in Year 1).
Booroolong Frog habitat characteristics	In Year 3, adjustments were made to address the limitations encountered in Year 2 in relation to the Booroolong Frog habitat characteristics survey. In Year 2, the mapped area was larger than that of Year 1, which made it challenging to compare the two monitoring years. In Year 3, the mapping extents of the three monitoring years were overlaid, and the extent covered in Year 1, Year 2 and Year 3 was then used to identify a new boundary for each transect. In Year 3, the imagery for Year 1, Year 2 and Year 3 were clipped to the new boundary and calculations for the area of each stream feature were re-run to improve consistency across years. As a result, while the analysis improved in Year 2 and Year 3, it was not as suitable for comparison with Year 1.
Alpine She-oak Skink occupancy	One monitoring event missed the chance to survey an Alpine She-oak skink site due to access challenges (unsuitable road conditions).
Feral animal abundance	Access issues hindered feral spotlighting work and weed monitoring efforts, due to high construction activity on site. Access restrictions were navigated by attempting alternate routes or attempting surveys at a later date when safe. This resulted in some surveys being conducted outside of the recommended survey time or in some instances, missed altogether, especially at Lobs Hole Ravine Road North and Tantangara Spoil Road.

Table C.1 BMP limitations and gaps in Year 3

Monitoring Component	Limitation / Gap
Weed presence/absence	Access issues hindered feral spotlighting work and weed monitoring efforts, due to high construction activity on site. Access restrictions were navigated by attempting alternate routes or attempting surveys at a later date when safe. This resulted in some surveys being conducted outside of the recommended survey time or in some instances, missed altogether, especially at Lobs Hole Ravine Road North.
Phytophthora	Locations of some soil samples were slightly altered due to evolving construction footprint. However, every effort was made to ensure that the soil samples were taken as close as possible to the original locations.

Appendix D

Threatened flora monitoring periods and records

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D.1 Monitoring periods

Table D.1 Threatened flora monitoring periods summary – Year 2

Monitoring period	Monitoring event	Monitoring dates
Quarter 1	First	13 December 2022 – 17 December 2022
	Second	9 January 2023 – 15 January 2023

D.2 Records

Table D.2 Threatened flora monitoring periods summary – Year 3

Monitoring Site	Scientific Name	Common Name	Number of Individuals	Easting*	Northing*
TF03	*Glycine latrobeana*	Clover Glycine	6	648853	6040604
			5	648855	6040596
			1	648853	6040604
			1	648856	6040597
			1	648858	6040585
TF06	*Glycine latrobeana*	Clover Glycine	4	648824	6034824
	Prasophyllum retroflexum	Kiandra Leek Orchid	1	637147	6027877
			1	637181	6027864
			2	637145	6027864
			1	637110	6027884
			4	637116	6027883
			1	637144	6027885
TF07	*Glycine latrobeana*	Clover Glycine	1	648819	6034823
			2	648819	6034823
	Prasophyllum retroflexum	Kiandra Leek Orchid	1	648838	6034805
			1	648831	6034767
TF08	*Glycine latrobeana*	Clover Glycine	12	652136	6036197
			1	652142	6036203
			4	652129	6036210
			1	652138	6036200
			1	652142	6036225
			1	652142	6036225

Table D.2 Threatened flora monitoring periods summary – Year 3

Monitoring Site	Scientific Name	Common Name	Number of Individuals	Easting*	Northing*
			2	652150	6036219
			1	652162	6036204
			2	652171	6036198
			1	652171	6036198
			1	652134	6036206
			2	652168	6036202
			3	652174	6036199
TF09	*Glycine latrobeana*	Clover Glycine	3	652595	6034323
			2	652591	6034315
			1	652590	6034317
			6	652576	6034303
			2	652576	6034303
			5	652589	6034301
			1	652587	6034321
			2	652589	6034320
			1	652603	6034274
			2	652569	6034309
			13	652574	6034300
			9	652569	6034298
			6	652568	6034299
			3	652576	6034313
			2	652584	6034309
			1	652598	6034277
			1	652600	6034325
	Prasophyllum retroflexum	Kiandra Leek Orchid	10	652593	6034304
			4	652597	6034287
			7	652597	6034318
			1	652586	6034308
			2	652595	6034297
			12	652594	6034292

Table D.2 Threatened flora monitoring periods summary – Year 3

Monitoring Site	Scientific Name	Common Name	Number of Individuals	Easting*	Northing*
			2	652611	6034310
			1	652604	6034328
			1	652618	6034302
			7	652597	6034318
			1	652586	6034308
TF10	*Glycine latrobeana*	Clover Glycine	1	648299	6040759
TF13	*Prasophyllum retroflexum*	Kiandra Leek Orchid	2	648617	6034073
			10	648625	6034068
			1	648624	6034066
			2	648616	6034063
			1	648607	6034083
			1	648611	6034094
			1	648625	6034108
			4	648617	6034118
TF14	*Glycine latrobeana*	Clover Glycine	2	648516	6041196
			1	648518	6041193
			1	648500	6041196
			1	648497	6041199
			1	648526	6041199
			6	648547	6041213
			6	648508	6041198
			6	648531	6041214

D.3 Photo points

Table D.3 Threatened flora photo points – Year 3

Monitoring site	Monitoring event	
	First: December 2022	Second: January 2023
TF01	Not conducted – plot cleared.	Not conducted – plot cleared.
TF02	Not conducted – plot cleared.	Not conducted – plot cleared.
TF03		

Table D.3 Threatened flora photo points – Year 3

Monitoring site	Monitoring event	
	First: December 2022	Second: January 2023
TF04		

Table D.3 Threatened flora photo points – Year 3

Monitoring site	Monitoring event	
	First: December 2022	Second: January 2023
TF05		

Table D.3 Threatened flora photo points – Year 3

Monitoring site	Monitoring event	
	First: December 2022	Second: January 2023
TF06		

Table D.3 Threatened flora photo points – Year 3

Monitoring site	Monitoring event	
	First: December 2022	Second: January 2023
TF07		
TF08		

Table D.3 Threatened flora photo points – Year 3

Monitoring site	Monitoring event	
	First: December 2022	Second: January 2023
TF09		

Table D.3 Threatened flora photo points – Year 3

	Monitoring event	
Monitoring site	**First: December 2022**	**Second: January 2023**
TF10		

Table D.3 Threatened flora photo points – Year 3

Monitoring site	Monitoring event	
	First: December 2022	Second: January 2023
TF11		

Table D.3 Threatened flora photo points – Year 3

Monitoring site	Monitoring event	
	First: December 2022	Second: January 2023
TF12		

Table D.3 Threatened flora photo points – Year 3

	Monitoring event	
Monitoring site	**First: December 2022**	**Second: January 2023**
TF13		

Table D.3 Threatened flora photo points – Year 3

Monitoring site	Monitoring event	
	First: December 2022	Second: January 2023
TF14		

Appendix E

Small terrestrial mammal monitoring periods and records

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E.1 Occupancy

E.1.1 Monitoring periods

Table E.1 Small mammal occupancy monitoring periods summary – Year 3

Monitoring period	Monitoring event	Monitoring dates*
Q1 (Construction)	First	1 December 2021–28 February 2022
Q2 (Construction)	Second	1 March 2022–31 May 2022
Q3 (Construction)	Third	1 June 2022–31 August 2022
Q4 (Construction)	Fourth	1 September 2022–30 November 2022

Notes: *Dates are based on the 30 day period of camera data processed and tagged.

E.1.2 Remote camera records

Table E.2 Small terrestrial mammal remote camera records – Year 3

	Smoky Mouse				Eastern Pygmy Possum				Broad-toothed Rat			
Camera ID	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
SM01-I-RC1											1	
SM01-I-RC2												
SM02-C-RC1											1	
SM02-C-RC2										1	1	1
SM03-I-RC1								1				
SM03-I-RC2												
SM04-C-RC1								1				
SM04-C-RC2											1	1
SM05-I-RC1												
SM05-I-RC2						1						
SM06-C-RC1					1	1		1				
SM06-C-RC2					1	1		1				
SM07-I-RC1												
SM07-I-RC2												
SM09-C-RC1						1		1				
SM09-C-RC2												

Table E.2 Small terrestrial mammal remote camera records – Year 3

	Smoky Mouse				Eastern Pygmy Possum				Broad-toothed Rat			
Camera ID	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
SM10-I-RC1												
SM10-I-RC2								1				
SM12-C-RC1								1				
SM12-C-RC2								1				
SM13-C-RC1						1		1				
SM13-C-RC2												
SM14-I-RC1												
SM14-I-RC2						1						
SM15-I-RC1					1	1						
SM15-I-RC2												
SM16-I-RC1					1							
SM16-I-RC2						1						
SM17-C-RC1					1							
SM17-C-RC2					1							
SM18-I-RC1												
SM18-I-RC2												
SM19-I-RC1												
SM19-I-RC2												
SM20-I-RC1								1				
SM20-I-RC2												
SM21-I-RC1					1	1		1				
SM21-I-RC2						1		1				
SM22-I-RC1												
SM22-I-RC2					1			1				
SM23-I-RC1					1	1						
SM23-I-RC2												
SM24-I-RC1								1				

Table E.2 Small terrestrial mammal remote camera records – Year 3

	Smoky Mouse				Eastern Pygmy Possum				Broad-toothed Rat			
Camera ID	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
SM24-I-RC2					1	1		1				
SM25-I-RC1								1				
SM25-I-RC2					1	1						
SM26-I-RC1												
SM26-I-RC2												
SM27-I-RC1												
SM27-I-RC2												
SM28-C-RC1											1	1
SM28-C-RC2												
SM29-C-RC1												
SM29-C-RC2												
SM30-C-RC1									1	1	1	
SM30-C-RC2									1	1	1	1
SM31-C-RC1											1	1
SM31-C-RC2	NA				NA				NA			
SM32-C-RC1										1	1	1
SM32-C-RC2									1	1	1	1
SM33-C-RC1											1	
SM33-C-RC2										1	1	1
SM34-I-RC1										1	1	
SM34-I-RC2												
SM35-I-RC1												
SM35-I-RC2												
SM36-I-RC1	NA				NA				NA			
SM36-I-RC2	NA				NA				NA			
SM37-I-RC1	NA		NA		NA		NA		NA		NA	
SM37-I-RC2	NA		NA		NA		NA		NA		NA	

Table E.2 Small terrestrial mammal remote camera records – Year 3

	Smoky Mouse				Eastern Pygmy Possum				Broad-toothed Rat			
Camera ID	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
SM38-C-RC1												
SM38-C-RC2												
SM39-C-RC1											1	1
SM39-C-RC2									1	1	1	1
SM40-C-RC1						1		1				
SM40-C-RC2								1				
SM41-C-RC1												
SM41-C-RC2						1						

Notes:

1. I – impact site.
2. C – control site.
3. Highlighted cells represent sites with unsuitable habitat for that species.
4. Blank cells represent absence of species.
5. NA – data missing due to camera moved, stolen or lost data.

E.2 Habitat characteristic

E.2.1 Monitoring period

Table E.3 Small mammal habitat characteristics monitoring period summary – Year 2

Monitoring Period	Monitoring dates
Quarter 1	7 November 2022–3 December 2022

E.2.2 Records

Table E.4 Average percentage cover (native, exotic, and habitat structure) at three height intervals (<0.5 m, 0.5–1 m, 1–1.5 m) – Year 3

Site type	Site	<0.5 m			0.5–1 m			1–1.5 m		
		Native	Exotic	Habitat structure	Native	Exotic	Habitat structure	Native	Exotic	Habitat structure
Control	SM02	82%	1%	6%	32%	0%	2%	43%	0%	0%
	SM04	76%	0%	4%	14%	0%	1%	4%	0%	1%
	SM06	42%	0%	24%	9%	0%	1%	20%	0%	1%
	SM09	76%	0%	7%	10%	0%	0%	8%	0%	1%
	SM12	68%	3%	5%	16%	0%	0%	6%	0%	0%
	SM13	77%	4%	7%	9%	1%	1%	2%	0%	1%
	SM17	83%	2%	10%	27%	2%	0%	27%	0%	0%
	SM26	95%	0%	8%	2%	5%	2%	2%	0%	0%
	SM28	98%	8%	0%	0%	0%	0%	0%	0%	0%
	SM29	69%	44%	33%	4%	4%	0%	3%	0%	0%
	SM30	96%	2%	0%	4%	0%	0%	0%	0%	1%
	SM31	95%	30%	6%	0%	0%	2%	0%	0%	0%
	SM32	24%	27%	0%	69%	0%	0%	0%	0%	0%
	SM33	88%	7%	3%	12%	0%	0%	0%	0%	0%
	SM38	95%	5%	0%	1%	0%	0%	0%	0%	0%
	SM39	80%	3%	8%	19%	0%	0%	14%	0%	0%
	SM40	76%	0%	7%	16%	0%	0%	7%	0%	0%
	SM41	91%	0%	11%	45%	0%	2%	26%	0%	1%

Table E.4 **Average percentage cover (native, exotic, and habitat structure) at three height intervals (<0.5 m, 0.5–1 m, 1–1.5 m) – Year 3**

Site type	Site	<0.5 m			0.5–1 m			1–1.5 m		
		Native	Exotic	Habitat structure	Native	Exotic	Habitat structure	Native	Exotic	Habitat structure
Impact	SM01	68%	15%	10%	23%	0%	0%	10%	0%	3%
	SM03	59%	0%	5%	15%	0%	3%	20%	0%	2%
	SM05	62%	0%	17%	10%	0%	3%	13%	0%	0%
	SM07	42%	0%	13%	22%	0%	8%	26%	0%	3%
	SM10	48%	7%	45%	11%	0%	3%	53%	0%	0%
	SM14	71%	0%	21%	28%	0%	3%	26%	0%	0%
	SM15	80%	17%	16%	6%	0%	4%	18%	0%	1%
	SM16	82%	0%	18%	26%	0%	0%	18%	0%	1%
	SM18	91%	10%	8%	11%	1%	0%	14%	0%	1%
	SM19	43%	31%	24%	10%	5%	3%	19%	28%	2%
	SM20	43%	20%	8%	11%	7%	0%	21%	6%	0%
	SM21	87%	0%	2%	32%	0%	0%	17%	0%	0%
	SM22	82%	0%	9%	45%	0%	1%	24%	0%	0%
	SM23	70%	0%	30%	39%	0%	3%	21%	0%	2%
	SM24	77%	1%	29%	36%	0%	0%	19%	0%	0%
	SM25	65%	0%	36%	28%	0%	3%	7%	0%	0%
	SM27	78%	31%	1%	0%	3%	1%	0%	0%	0%
	SM34	89%	56%	2%	10%	0%	1%	0%	0%	0%
	SM35	84%	63%	12%	5%	0%	0%	0%	0%	2%
	SM36	95%	2%	1%	8%	0%	0%	0%	0%	1%
	SM37	92%	0%	0%	3%	0%	1%	0%	0%	0%

Appendix F

Frog monitoring periods and records

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F.1 Monitoring periods

Table F.1 Frog occupancy monitoring period summary – Year 3

Monitoring period	Monitoring event	Monitoring dates
Alpine Tree Frog		
Quarter 1	First	16 January 2023–20 January 2023
	Second	23 January 2023–27 January 2023
Booroolong Frog		
Quarter 1	First	6 December 2022–7 December 2022*
	Second	20 December 2022–21 December 2022*

Notes: *One transect (YR09) was not completed due to unsafe conditions.

F.2 Records

Table F.2 Frog records – Year 2

Scientific Name	Common Name	Monitoring Site	Count of Individuals	Easting	Northing
Litoria verreauxii alpina	Alpine Tree Frog	ER02	2	636678	6027697
			1	636754	6027342
			1	636650	6027618
			4	636642	6027649
			1	636642	6027649
			2	636644	6027581
			3	636648	6027571
			17	636631	6027462
			6	636654	6027427
			1	636759	6027069
			2	636480	6027009
		MR01	2	650564	6037400
			3	650741	6037341
			1	650990	6037140
			4	651069	6037050
			4	651194	6036960
			2	650576	6037398

Table F.2 Frog records – Year 2

Scientific Name	Common Name	Monitoring Site	Count of Individuals	Easting	Northing
			3	650744	6037338
			3	651054	6037081
			2	651230	6036957
		NC01	2	647273	6030008
		NC03	1	653249	6030035
			1	653178	6029891
			3	652918	6029805
			2	652922	6029808
			1	652984	6029820
			3	653175	6029873
			2	653339	6030129
			1	653318	6030143
		TC02	2	641942	6033232
			2	642010	6033210
			1	642010	6033210
			1	641941	6033308
			1	641917	6033001
		TC03	10	640856	6041986
			10	640815	6041990
			1	641312	6042376
			1	640748	6042014
			9	640849	6041980
			5	640847	6041979
			1	641334	6042363
			1	641322	6042365
			2	641276	6042360
			6	641211	6042295
			1	641203	6042270
		TR01	1	649609	6037840
			1	649575	6037895
			8	649575	6037915

Table F.2 Frog records – Year 2

Scientific Name	Common Name	Monitoring Site	Count of Individuals	Easting	Northing
			2	649561	6037987
Litoria booroolongensis	Booroolong Frog	YR02	1	626091	6039021
		YR05	1	626832	6038006
			1	626833	6037998
			1	626832	6038006
			1	626838	6038007
		YR06	1	627536	6038158
			1	627550	6038158
			1	627540	6038153
			1	627730	6038296
		YR08	2	628037	6038996
			1	628036	6039005
			1	628038	6039005
			1	628045	6039014

Notes: Datum GDA Zone 55.

Appendix G

Alpine She-oak Skink monitoring periods and records

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G.1 Monitoring periods

Table G.1 Alpine She-oak Skink occupancy monitoring periods summary – Year 3

Monitoring period	Monitoring event	Monitoring dates
Q4 (Construction)	November*	28 November 2022–3 December 2022
Q1 (Construction)	December	13 December 2022–17 December 2022
	January	6 January 2023–11 January 2023
Q2 (Construction)	February	9 February 2023–17 February 2023
	March*	2 April 2022–3 April 2022
Q4 (Construction)	October	11 October 2023–17 October 2023

Notes: *TG10 was not completed in November due to safety concerns on site and TG06 was not completed in October 2023 due to access issues.

G.2 Records

Table G.2 Alpine She-oak Skink records – Year 3

Monitoring Site	Count of Individuals	Easting	Northing
TG02	1	647237	6029570
TG05	3	649189	6037462
TG06	1	640402	6048376
TG07	2	637663	6039758
TG08	3	640520	6042277
TG11	18	638672	6037477

Notes: Datum GDA Zone 55.

Appendix H

Feral animal monitoring periods and records

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H.1 Occupancy

H.1.1 Monitoring periods

Table H.1 Feral animal occupancy monitoring periods summary – Year 3

Monitoring period	Monitoring event	Monitoring dates*
Q1 (Construction)	First	1 December 2022–28 February 2023
Q2 (Construction)	Second	1 March 2023–31 May 2023
Q3 (Construction)	Third	1 June 2023–31 August 2023
Q4 (Construction)	Fourth	1 September 2023–30 November 2023

Notes: *Dates are based on the 30-day period of camera data processed and tagged.

H.1.2 Remote cameras data

Table H.2 Feral animal remote camera presence/absence

Site name	Feral Cat				European Hare				European Rabbit				Feral Horse				Red Fox				Deer*				Wild Dog				Feral Pig			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
FC03 A		1	1							1	1	1									1	1	1									
FC03 B			NA	NA			NA	NA			NA	NA			NA	NA			NA	NA			NA	NA			NA	NA			NA	NA
FC04 A	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA
FC04 B																						1	1									
FC05 A												1																				
FC05 B																	1				1											
FC06 A																																
FC06 B																																
FC07 A									1								1											1				
FC07 B											1						1				1	1	1									
FC08 A																																
FC08 B				NA				NA				NA				NA				NA				NA				NA				NA
FC09 A	NA				NA				NA				NA				NA				NA				NA				NA			
FC09 B																																
FC10 A																		1														
FC10 B																		1				1										
FC11 A																																
FC11 B	1		1																													

Table H.2 Feral animal remote camera presence/absence

Site name	Feral Cat				European Hare				European Rabbit				Feral Horse				Red Fox				Deer*				Wild Dog				Feral Pig			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
FC12 A								1																								
FC12 B												1				1																
FC13 A				1																												
FC13 B																									1							
FC14 A					1					1									1						1							
FC14 B	NA				NA				NA				NA				NA				NA			1	NA				NA			
FC15 A	1								1				1			1	1								1							
FC15 B				1									1	1		1				1					1			1				
FC16 A		1											1	1		1						1										
FC16 B									1				1				1								1							
FC17 A	1											1	1			1			1						1							
FC17 B		1	NA				NA		1	1	NA			1	NA				NA				NA				NA				NA	
FC18 A				NA				NA	1			NA		1		NA				NA			1	NA				NA				NA
FC18 B			NA				NA		1		NA				NA				NA				NA				NA				NA	
FC19 A			NA	NA			NA	NA	1		NA	NA			NA	NA			NA	NA			NA	NA			NA	NA			NA	NA
FC19 B		1								1	1								1			1										
FC20 A																																
FC20 B			1							1	1			1					1				1									
FC21 A			NA	NA			NA	NA		1	NA	NA			NA	NA			NA	NA		1	NA	NA			NA	NA			NA	NA

Table H.2 Feral animal remote camera presence/absence

Site name	Feral Cat				European Hare				European Rabbit				Feral Horse				Red Fox				Deer*				Wild Dog				Feral Pig			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
FC21 B																																

H.2 Abundance

H.2.1 Monitoring periods

Table H.3 Feral animal abundance monitoring periods summary – Year 3

Monitoring period	Monitoring event	Monitoring dates
Q1 (Construction)	First	10-11 March 2023
Q2 (Construction)	Second	7-8 June 2023
Q3 (Construction)	Third	23-24 August 2023
Q4 (Construction)	Fourth	7-8 November 2023

H.2.2 Abundance data

Table H.4 Feral animal abundance (animals/km) – Year 3

Feral animal total and abundance	LHRR Bottom	LHRR North	LHRR South	Marica	Rock Forest	Tantangara Dam	Tantangara Road
First monitoring event (Q1)							
Distance (km)	18.00	NA	14.50	15.90	0.97	13.60	15.80
Feral Cat (total)	-	NA	-	-	-	-	-
Feral Cat (abundance)	-		-	-	-	-	-
Rabbit (total)	3.00	NA	1.00	1.00	6.00	36.00	1.00
Rabbit (abundance)	0.17		0.07	0.06	6.19	2.65	0.06
European Hare (total)	-	NA	-	-	-	-	-
European Hare (abundance)	-		-	-	-	-	-
Feral Horse (total)	-	NA	-	-	-	50.00	13.00
Feral Horse (abundance)	-		-	-	-	3.68	0.82
Red Fox (total)	1.00	NA	-	-	-	-	-
Red Fox (abundance)	0.06		-	-	-	-	-
Wild Dog (total)	-	NA	-	-	-	-	-
Wild Dog (abundance)	-		-	-	-	-	-
Rusa Deer (total)	-	NA	-	-	-	-	-
Rusa Deer (abundance)	-		-	-	-	-	-
Sambar (total)	1.00	NA	1.00	-	-	-	-
Sambar (abundance)	0.06		0.07	-	-	-	-
Second Monitoring event (Q2)							
Distance (km)	12.48	4.04	28.64	14.56	2.06	9.12	30.52
Feral Cat (total)	-	-	-	-	-	-	-
Feral Cat (abundance)	-	-	-	-	-	-	-
Rabbit (total)	18.00	2.00	-	3.00	8.00	12.00	5.00
Rabbit (abundance)	1.44	0.50	-	0.21	3.88	1.32	0.16
European Hare (total)	-	-	-	-	-	-	-
European Hare (abundance)	-	-	-	-	-	-	-
Feral Horse (total)	-	-	-	-	-	4.00	4.00
Feral Horse (abundance)	-	-	-	-	-	0.44	0.13
Red Fox (total)	1.00	-	-	-	-	1.00	-
Red Fox (abundance)	0.08	-	-	-	-	0.11	-

Table H.4 Feral animal abundance (animals/km) – Year 3

Feral animal total and abundance	LHRR Bottom	LHRR North	LHRR South	Marica	Rock Forest	Tantangara Dam	Tantangara Road
Wild Dog (total)	-	-	-	-	-	-	-
Wild Dog (abundance)	-	-	-	-	-	-	-
Rusa Deer (total)	-	-	-	-	-	-	-
Rusa Deer (abundance)	-	-	-	-	-	-	-
Sambar (total)	-	-	-	-	-	-	-
Sambar (abundance)	-	-	-	-	-	-	-
Third monitoring event (Q3)							
Distance (km)	10.00	5.24	28.89	11.91	2.24	9.85	30.76
Feral Cat (total)	-	-	-	-	-	-	-
Feral Cat (abundance)	-	-	-	-	-	-	-
Rabbit (total)	3.00	1.00	-	1.00	1.00	13.00	13.00
Rabbit (abundance)	0.24	0.25	-	0.07	0.49	1.43	0.43
European Hare (total)	-	-	-	-	-	-	-
European Hare (abundance)	-	-	-	-	-	-	-
Feral Horse (total)	-	-	-	-	-	3.00	3.00
Feral Horse (abundance)	-	-	-	-	-	0.33	0.10
Red Fox (total)	-	-	1.00	-	-	-	-
Red Fox (abundance)	-	-	0.03	-	-	-	-
Wild Dog (total)	-	-	-	-	-	-	-
Wild Dog (abundance)	-	-	-	-	-	-	-
Rusa Deer (total)	-	-	-	-	-	-	-
Rusa Deer (abundance)	-	-	-	-	-	-	-
Sambar (total)	6.00	-	-	-	-	-	-
Sambar (abundance)	0.48	-	-	-	-	-	-
Fourth monitoring event (Q4)							
Distance (km)	14.59	9.76	27.27	14.49	1.85	6.99	31.73
Feral Cat (total)	-	-	-	-	-	-	-
Feral Cat (abundance)	-	-	-	-	-	-	-
Rabbit (total)	9.00	1.00	-	2.00	18.00	13.00	11.00
Rabbit (abundance)	0.72	0.25	-	0.14	8.74	1.43	0.36
European Hare (total)	-	-	-	-	-	-	-

Table H.4 Feral animal abundance (animals/km) – Year 3

Feral animal total and abundance	LHRR Bottom	LHRR North	LHRR South	Marica	Rock Forest	Tantangara Dam	Tantangara Road
European Hare (abundance)	-	-	-	-	-	-	-
Feral Horse (total)	-	-	-	-	-	34.00	4.00
Feral Horse (abundance)	-	-	-	-	-	3.73	0.13
Red Fox (total)	-	1.00	-	-	-	-	-
Red Fox (abundance)	-	0.25	-	-	-	-	-
Wild Dog (total)	-	-	-	-	-	-	-
Wild Dog (abundance)	-	-	-	-	-	-	-
Fallow Deer (total)	-	-	-	-	-	1.00	-
Fallow Deer (abundance)	-	-	-	-	-	0.11	-
Rusa Deer (total)	-	-	-	-	-	-	-
Rusa Deer (abundance)	-	-	-	-	-	-	-

Appendix I
Weed and pathogen monitoring

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I.1 Weeds

I.1.1 Monitoring periods

Table I.1 Weed monitoring periods summary – Year 3

Monitoring period	Monitoring dates
Quarter 1	13 December 2022 – 17 December 2022 and 9 January 2023 – 15 January 2023

I.1.2 Weed records

Table I.2 Weed records (polygons) Year 3

Weed Management Zone	Estimated cover				Count	Area (ha)	Easting	Northing
	Dense	Medium	Light	Trace				
Bottom of Lobs Hole		*Rubus* spp., *Hypericum perforatum*		*Rumex acetosella, Agrostis* spp., *Verbascum virgatum, Dactylis glomerata*	10000	16.97	625993.2	6037918
				Hypericum perforatum	0	6.76	626136.7	6038334
	Rubus spp., *Hypericum perforatum*			*Verbascum virgatum, Holcus lanatus, Rumex acetosella, Anthoxanthum odoratum, Agrostis capillaris, Agrostis gigantea*	0	5.44	627854.8	6038515
	Rubus spp., *Hypericum perforatum*			*Verbascum virgatum, Holcus lanatus, Rumex acetosella, Anthoxanthum odoratum, Agrostis capillaris, Agrostis gigantea*	0	1.81	626834.3	6038320
		Hypericum perforatum		*Verbascum thapsus, Rubus* spp., *Holcus lanatus, Rumex acetosella, Agrostis capillaris, Agrostis gigantea, Anthoxanthum odoratum*	0	2.25	626636.4	6038377
		Hypericum perforatum		*Conyza bonariensis, Phalaris* spp., *Verbascum virgatum, Rubus* spp., *Holcus lanatus, Rumex acetosella, Anthoxanthum odoratum, Agrostis capillaris, Agrostic gigantea, Hypochaeris radicata*	0	20.57	627286.9	6038092
		Hypericum perforatum		*Verbascum virgatum, Rubus* spp., *Agrostis capillaris, Rumex acetosella, Cirsium vulgare, Conyza bonariensis, Hypochaeris radicata*	0	10.99	625992.3	6038810
		Hypericum perforatum	*Rubus* spp.	*Holcus lanatus, Rumex acetosella*	0	2.67	625686.6	6039324
		Rubus spp., *Hypericum perforatum*			0	1.49	626169.3	6039344

Table I.2 Weed records (polygons) Year 3

Weed Management Zone	Estimated cover				Count	Area (ha)	Easting	Northing
	Dense	Medium	Light	Trace				
				Hypericum perforatum	0	5.85	625548.4	6039310
			Hypericum perforatum, Conyza bonariensis	*Rubus* spp., *Hypochaeris radicata, Cirsium vulgare, Sonchus* spp., *Lactuca* spp.	0	29.79	625147.3	6040065
Lobs Hole Ravine Road bottom			*Hypericum perforatum, Agrostis* spp., *Verbascum* spp., *Cirsium vulgare, Dactylis glomerata*	*Rubus* spp.	10000	27.54	626997	6032675
			Hypericum perforatum, Holcus lanatus	*Rubus* spp., *Dactylis glomerata, Rumex acetosella*	10000	2.36	627001.2	6032323
	Rubus spp.		*Hypericum perforatum*	*Rumex acetosella, Rubus* spp., *Agrostis gigantea, Agrostis capillaris, Dactylis glomerata*	1000	3.80	627121.9	6033629
		Rubus spp., *Hypericum perforatum*		*Cirsium vulgare, Verbascum* spp., *Agrostis* spp., *Dactylis glomerata, Rubus* spp., *Rumex acetosella*	0	23.59	626892.4	6034820
		Hypericum perforatum		*Rubus* spp., *Holcus lanatus, Verbascum* spp., *Rumex acetosella*	0	3.37	626922.8	6033081
		Rubus spp.	*Hypericum perforatum*	*Rumex acetosella, Rubus* spp., *Agrostis gigantea, Agrostis capillaris, Dactylis glomerata*	0	10.32	626907.5	6036516
	Rubus spp., *Hypericum perforatum*			*Verbascum virgatum, Agrostis* spp., *Rumex acetosella, Cirsium vulgare*	9000	8.27	626267.2	6037162

Table I.2 Weed records (polygons) Year 3

Weed Management Zone	Estimated cover				Count	Area (ha)	Easting	Northing
	Dense	Medium	Light	Trace				
Lobs Hole Ravine Road top			*Anthoxanthum odoratum, Cirsium vulgare, Dactylis glomerata, Hypericum perforatum, Rumex acetosella, Rubus* spp.*, Agrostis gigantea, Agrostis capillaris, Dactylis glomerata*		0	95.67	628286.2	6029784
Marica		*Hypochaeris radicata, Anthoxanthum odoratum, Rumex acetosella*		*Cirsium vulgare*	30000	35.27	635206.8	6037610
		Anthoxanthum odoratum, Rumex acetosella		*Verbascum virgatum, Hypochaeris radicata Holcus lanatus*	3000	37.31	633986.8	6037990
		Rumex acetosella		*Hypochaeris radicata, Hypericum perforatum, Conyza bonariensis, Verbascum virgatum, Rumex acetosella*	1000	16.44	633981.7	6037980
				Hypochaeris radicata, Hypericum perforatum, Conyza bonariensis, Verbascum virgatum, Rumex acetosella	100	115.21	632274.1	6038668
Rock Forest		*Anthoxanthum odoratum*	*Hypochaeris radicata*	*Holcus lanatus*	10000	21.49	650908.1	6020891
		Anthoxanthum odoratum	*Rumex acetosella, Holcus lanatus, Trifolium repens*	*Cirsium vulgare, Hypochaeris radicata, Verbascum thapsus*	10000	7.96	650899.4	6020899
Tantangara Dam		*Anthoxanthum odoratum*	*Hypericum perforatum*	*Leucanthemum vulgare, Rosa rubiginosa, Hypochaeris radicata, Holcus lanatus*	10000	0.62	648859.4	6040588

Table I.2 Weed records (polygons) Year 3

Weed Management Zone	Estimated cover				Count	Area (ha)	Easting	Northing
	Dense	Medium	Light	Trace				
Tantangara Dam				*Anthoxanthum odoratum, Rumex acetosella, Hypochaeris radicata, Cirsium vulgare, Holcus lanatus, Hypericum perforatum*	200	4.71	648401.1	6040671
	Anthoxanthum odoratum			*Rosa rubiginosa, Holcus lanatus, Rubus* spp., *Rumex acetosella, Agrostis capillaris, Hypericum perforatum, Cirsium vulgare, Leucanthemum vulgare*	30000	18.94	648722.3	6038758
			Anthoxanthum odoratum	*Hypochaeris radicata, Holcus lanatus, Dactylis glomerata, Cirsium vulgare, Rumex acetosella, Hypericum perforatum*	10000	7.93	649585.5	6036605
		Anthoxanthum odoratum, Rumex acetosella		*Cirsium vulgare, Holcus lanatus, Agrostis* spp., *Leucanthemum vulgare, Hypochaeris radicata*	10000	4.28	649018.1	6036281
		Anthoxanthum odoratum	*Cirsium vulgare*	*Holcus lanatus, Rumex acetosella, Hypochaeris radicata*	10000	81.50	649119.3	6036940
		Anthoxanthum odoratum, Rubus spp.		*Rumex acetosella, Verbascum thapsus, Lucanthemum vulgare, Dactylis glomerata, Hypochaeris radicata, Cirsium vulgare, Holcus lanatus*	30000	12.42	648671.1	6040015
			Holcus lanatus	*Hypericum perforatum, Anthoxanthum odoratum, Rumex acetosella, Cirsium vulgare*	10000	45.46	648762.9	6040823
	Anthoxanthum odoratum			*Dactylis glomerata, Hypericum perforatum, Verbascum thapsus, Rumex acetosella, Verbascum virgatum, Cirsium vulgare, Rubus* spp.	9000	8.96	649743.5	6037229

Table I.2 Weed records (polygons) Year 3

Weed Management Zone	Estimated cover				Count	Area (ha)	Easting	Northing
	Dense	Medium	Light	Trace				
Tantangara Road bottom			*Anthoxanthum odoratum, Leucanthemum vulgare, Hypochaeris radicata, Dactylis glomerata, Verbascum thapsus, Rumex acetosella*		10000	23.47	649120.7	6035129
			Anthoxanthum odoratum	*Hypochaeris radicata, Dactylis glomerata, Verbascum thapsus, Leucanthemum vulgare, Cirsium vulgare, Hypericum perforatum, Rumex acetosella*	10000	136.41	647826.7	6033102
			Leucanthemum vulgare, Anthoxanthum odoratum	*Cirsium vulgare, Rumex acetosella, Verbascum thapsus, Dactylis glomerata, Holcus lanatus, Hypochaeris radicata*	10000	11.03	648998.9	6034493
	Anthoxanthum odoratum, Rumex acetosella			*Cirsium vulgare, Dactylis glomerata, Holcus lanatus, Leucanthemum vulgare, Hypochaeris radicata, Verbascum thapsus*	10000	17.68	649281.9	6036026
Tantangara Road top	*Anthoxanthum odoratum*			*Holcus lanatus, Rumex acetosella, Hypericum perforatum, Hypochaeris radicata, Leucanthemum vulgare*	0	6.66	645632.3	6022817
	Anthoxanthum odoratum			*Anthoxanthum odoratum, Holcus lanatus, Dactylis glomerata, Cirsium vulgare, Hypericum perforatum, Rumex acetosella, Agrostis* spp.	0	93.75	645992.2	6023728
			Anthoxanthum odoratum, Rumex acetosella	*Dactylis glomerata, Hypericum perforatum, Cirsium vulgare, Holcus lanatus, Verbascum thapsus, Hypochaeris radicata*	10000	327.76	646966.1	6028351
			Anthoxanthum odoratum, Leucanthemum vulgare	*Holcus lanatus, Dactylis glomerata, Rumex acetosella, Cirsium vulgare, Hypochaeris radicata*	10000	18.39	646484.7	6025144

Table I.2 Weed records (polygons) Year 3

Weed Management Zone	Estimated cover				Count	Area (ha)	Easting	Northing
	Dense	Medium	Light	Trace				
TF08		*Anthoxanthum odoratum*	*Rumex acetosella, Hypochaeris radicata, Trifolium repens*	*Holcus lanatus, Cirsium vulgare, Taraxacum officinalis*	10000	2.15	652134.4	6036238
TF09			*Holcus lanatus, Acetosella vulgaris*	*Taraxacum officinale, Cirsium vulgare*	1000	2.13	652604.5	6034294

Notes: Datum GDA Zone 55.

Table I.3 Weed records (points) Year 3

Weed Management Zone	Estimated cover				Count	Easting	Northing
	Dense	Medium	Light	Trace			
Tantangara Dam		*Hypericum perforatum*			1000	648532.0488	6040776.06
Marica				*Leucanthemum vulgare*	2	630720.5845	6038993.943
				Leucanthemum vulgare	2	630690.7972	6039054.547
				Leucanthemum vulgare	2	630683.0487	6039077.482
				Leucanthemum vulgare, Hypericum perforatum	20	630676.574	6039096.588
				Leucanthemum vulgare	2	630656.8622	6039162.514
				Leucanthemum vulgare	2	630652.0923	6039180.093
				Leucanthemum vulgare	1	630618.423	6039256.612

Notes: Datum GDA Zone 55.

I.2 Pathogens

I.2.1 Monitoring periods

Monitoring period	Monitoring dates
Quarter 1	13 December 2022 – 17 December 2022 and 9 January 2023 – 15 January 2023

I.2.2 Records

Table I.4 *Phytophthora* testing records

Monitoring Site	Positive/negative	Phytophthora species	Easting	Northing
Lobs Hole R0.5	negative	-	628986.08	6028301.74
Lobs02*	negative	-	627006.79	6032167.69
Lobs Hole R5	negative	-	626078.40	6038392.54
Marica Washdown	negative	-	633654.92	6037848.92
Marica 01	negative	-	636790.89	6039873.62
PMS1**	NA	NA	NA*	NA*
PMS2*	negative	-	626097.32	6038268.52
PMS3*	positive	*Phytophthora pseudocryptogea/cryptogea*	626140.36	6038243.78
PMS4*	negative	-	626198.65	6038253.10
PMS5**	NA	NA	NA*	NA*
PS01	negative	-	629110.26	6027957.45
PS02	negative	-	626986.84	6032115.67
PS03	positive	*Phytophthora cinnamomi*	627856.04	6038416.25
PS04	negative	-	626338.31	6039259.48
PS05	negative	-	625578.40	6039483.15
PS06	negative	-	634797.41	6037894.79
PS07	negative	-	633248.88	6038426.32
PS08	negative	-	630530.77	6039358.53
PS09	negative	-	630985.93	6038888.11
PS10	negative	-	632420.92	6038656.74
PS11	negative	-	649211.54	6036103.73
PS12	negative	-	649727.14	6036813.06
PS13	negative	-	648968.80	6037243.49
PS14	negative	-	648511.23	6039117.35

Table I.4 *Phytophthora* testing records

Monitoring Site	Positive/negative	Phytophthora species	Easting	Northing
PS15	negative	-	648397.76	6040692.26
PS16	negative	-	639633.51	6038366.10
PS17	negative	-	642964.91	6036538.37
PS18	negative	-	641781.91	6032719.89
PS19	negative	-	650723.00	6020807.48
PS20	negative	-	651097.06	6021081.87
Tantangara Adit 01	negative	-	648851.77	6037901.79
Tantangara Road 02	negative	-	645607.26	6022875.93
Tantangara Washdown	negative	-	649089.84	6036364.32

Notes: *Four sites (Lobs02, PMS2, PMS3 and PMS4) had their location updated and **two sites (PMS1 and PMS5) were dismissed due to the clearing activity on site. Datum GDA Zone 55.

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