



**CADIA HILL TAILINGS COMPLETION MODIFICATION
BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT**

Prepared for Cadia Holdings Pty. Ltd.

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EXECUTIVE SUMMARY

FloraSearch was commissioned by Cadia Holdings Pty Ltd (CHPL) to conduct flora surveys and a biodiversity assessment on the site of proposed buttress construction for the Southern Tailings Storage Facility (STSF) at the Cadia Valley Operations (CVO), approximately 25 kilometres south of Orange in the central west of New South Wales (NSW) (Figure 1). CHPL is the owner and operator of the CVO, and is a wholly owned subsidiary of Newcrest Mining Limited. CHPL intends to submit a modification to Project Approval 06_0295 under section 4.55 of the *Environmental Planning and Assessment Act, 1979*. Since this proposal is a Modification (Modification 13) of a Major Project, the Biodiversity Offsets Scheme established under the *Biodiversity Conservation Act 2016* (BC Act) is applicable. The survey and assessment reported here were conducted using the Biodiversity Assessment Method (BAM) under the BC Act.

This report focuses on the aspects of Modification 13 that would affect native vegetation and threatened biodiversity, namely construction of additional buttressing for the STSF.

Fauna surveys and habitat assessments of the entire study area were undertaken by Biodiversity Monitoring Services (BMS) over six days; 13 to 15 February and between 4 and 7 June 2019. BMS undertook a detailed assessment of the potential for threatened fauna species to utilise the study area. Vegetation surveys of the study area were conducted by FloraSearch over two days (26 June 2017 and 12 June 2019) and included searches of relevant State and Commonwealth databases and a literature review to determine which threatened biodiversity has potential to occur on the study area.

The key findings of the surveys were:

Flora

- The development footprint includes two small patches of remnant White Box Woodland (totalling 0.31 hectares [ha]) that would be removed.
- Approximately 3.9 ha of exotic-dominated grassland would also be removed for Modification 13.
- Two introduced flora species recorded on the study area (Appendix 1) are considered to be High Threat Exotic weeds by the NSW Office of Environment and Heritage; *Carthamus lanatus* (Saffron Thistle) and *Hypericum perforatum* (St. John's Wort). The latter is listed as a Priority Weed for the Blayney Shire LGA under the NSW Biosecurity Act 2015. No weeds recognised as Weeds of National Significance by the Australian Weeds Committee were identified.
- It is considered that one Plant Community Type (PCT) occupied the study area pre-European settlement, namely:
 - PCT266 – *White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion.*

Threatened Biodiversity

- No threatened flora species or populations listed under the BC Act or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were identified on the study area by the survey. Two threatened fauna species, the Squirrel Glider (*Petaurus norfolcensis*) and the Little Lorikeet (*Glossopsitta pusilla*) were identified by the BMS survey. Both are listed as Vulnerable under the BC Act and neither is listed under the EPBC Act.
- The Squirrel Glider is a species credit species that would have a resident breeding population on the study area.

- An additional two species credit flora species, the Small Purple-pea (*Swainsona recta*) and the Silky Swainson-pea (*Swainsona sericea*), and three species credit fauna species, the Pink-tailed Legless Lizard (*Aprasia parapulchella*), Little Eagle (*Hieraaetus morphnoides*) and Superb Parrot (*Polytelis swainsonii*) were considered to have potential to utilise the site in absence of surveys within the months specified in the *Threatened Species Data Collection*.
- Thirty ecosystem credit fauna species were considered to have potential to use the resources on the study area for foraging as part of much larger foraging ranges and were accepted as potentially being present in the BAM Credit Calculator (BAMC).
- PCT266 in an appropriate condition can represent part of the listed Box-Gum Woodland threatened ecological community (TEC) listed under the BC Act and the EPBC Act as:
 - *White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community* (BC Act), and
 - *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community* (EPBC Act).

However, the two small patches of remnant White Box Woodland do not meet the Commonwealth criteria for protection under the EPBC Act.

Impact Avoidance and Mitigation

There are a number of established avoidance and mitigation measures at the CVO. These include:

- Clear marking of native vegetation immediately adjoining the proposed clearance areas, to avoid accidental damage during clearance activities.
- Vegetation removal in accordance with the Vegetation Clearance Protocol in the CVO Land and Biodiversity Management Plan, to ensure that harm is minimised to wildlife, particularly Squirrel Gliders, inhabiting hollows in hollow-bearing trees proposed for removal.
- Implementation of the CVO weed management strategy on the study area.
- Implementation of the CVO feral animal management plan and control as necessary.
- Prohibition of domestic pets on site.
- Prohibition of feeding wildlife.

Modification Impacts

Direct impacts of Modification 13 on biodiversity include:

- Loss of 0.31 ha of native vegetation (Box-Gum Woodland).
- Loss of 3.9 ha of exotic-dominated grassland.
- Loss of habitat for the Squirrel Glider and the Little Lorikeet.

Cumulative Impacts

The cumulative impacts of Modification 13 on native vegetation loss and reduction of fauna habitat are considered to be small and negligible in the regional context, but nevertheless represent a loss. However, this loss will be offset in accordance with the Biodiversity Offset Scheme.

Biodiversity Credit Report

The biodiversity credit report of the BAMC valued the loss of 0.31 ha of Box-Gum Woodland at 8 ecosystem credits. The BAMC valued the loss of habitat for the two threatened flora species assumed to be present and four threatened fauna species (three of which were assumed to be present) at 46 species credits.

Offset

CHPL proposes to acquit the liability of 8 ecosystem credits and 46 species credits by making a lump sum payment of \$86,308.64 to the Biodiversity Conservation Trust Fund.

Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act)

Two threatened species considered to have potential habitat in the study area are listed under the EPBC Act; the Swift Parrot (*Lathamus discolor*) and the Regent Honeyeater (*Anthochaera phrygia*). Neither species would be dependent on the site for breeding, and foraging visits would occur rarely, if at all. The small loss of potential habitat on the site is highly unlikely to have an adverse impact on either species and referral of Modification 13 to the Department of Environment and Energy is not required.

State Environmental Planning Policy 44

One of the remnant eucalypt species, *Eucalyptus albens* (White Box), on and around the study area is recognised as Koala food tree in Schedule 2 of State Environmental Planning Policy (SEPP) 44. However, the study area does not have an extant Koala population and therefore is not 'core' Koala habitat so that a SEPP 44 plan of management is not required.

1 INTRODUCTION

FloraSearch was commissioned by Cadia Holdings Pty Limited (CHPL) to conduct flora surveys and a biodiversity assessment on the site of proposed buttress construction for the Southern Tailings Storage Facility (STSF) at the Cadia Valley Operations (CVO), approximately 25 kilometres (km) south of Orange in the central west of New South Wales (NSW) (Figure 1). CHPL is the owner and operator of the CVO, and is a wholly owned subsidiary of Newcrest Mining Limited. CHPL intends to submit a modification to Project Approval 06_0295 under section 4.55 of the *Environmental Planning and Assessment Act, 1979*. Since this proposal is a Modification (Modification 13) of a Major Project, the Biodiversity Offsets Scheme (BOS) established under the *Biodiversity Conservation Act 2016* (BC Act) is applicable. The survey and assessment reported here were conducted using the Biodiversity Assessment Method (BAM) (OEH, 2017a) under the BC Act.

1.1 MODIFICATION OVERVIEW

The main activities associated with the Cadia Hill Tailings Completion Modification (Modification 13), include:

- increasing the tailings level from 560 metres Australian Height Datum (mAHD) (consolidated tailings level) to 713 mAHD (pre-consolidation tailings level);
- an additional 177 million tonnes (Mt) of capacity, equivalent to approximately seven years of additional deposition to this storage facility;
- decommissioning and closure of the existing ventilation adit VR101, located in the Cadia Hill open pit, which would be inundated by tailings;
- installation of a new ventilation adit within the currently approved disturbance footprint of Cadia East (outside of the Cadia Hill open pit);
- construction of additional buttressing for the STSF embankment; and
- a pit lake (i.e a “wet cover”) as the final landform of the Cadia Hill open pit, consistent with the approved final landform.

1.2 GENERAL DESCRIPTION OF THE DEVELOPMENT SITE

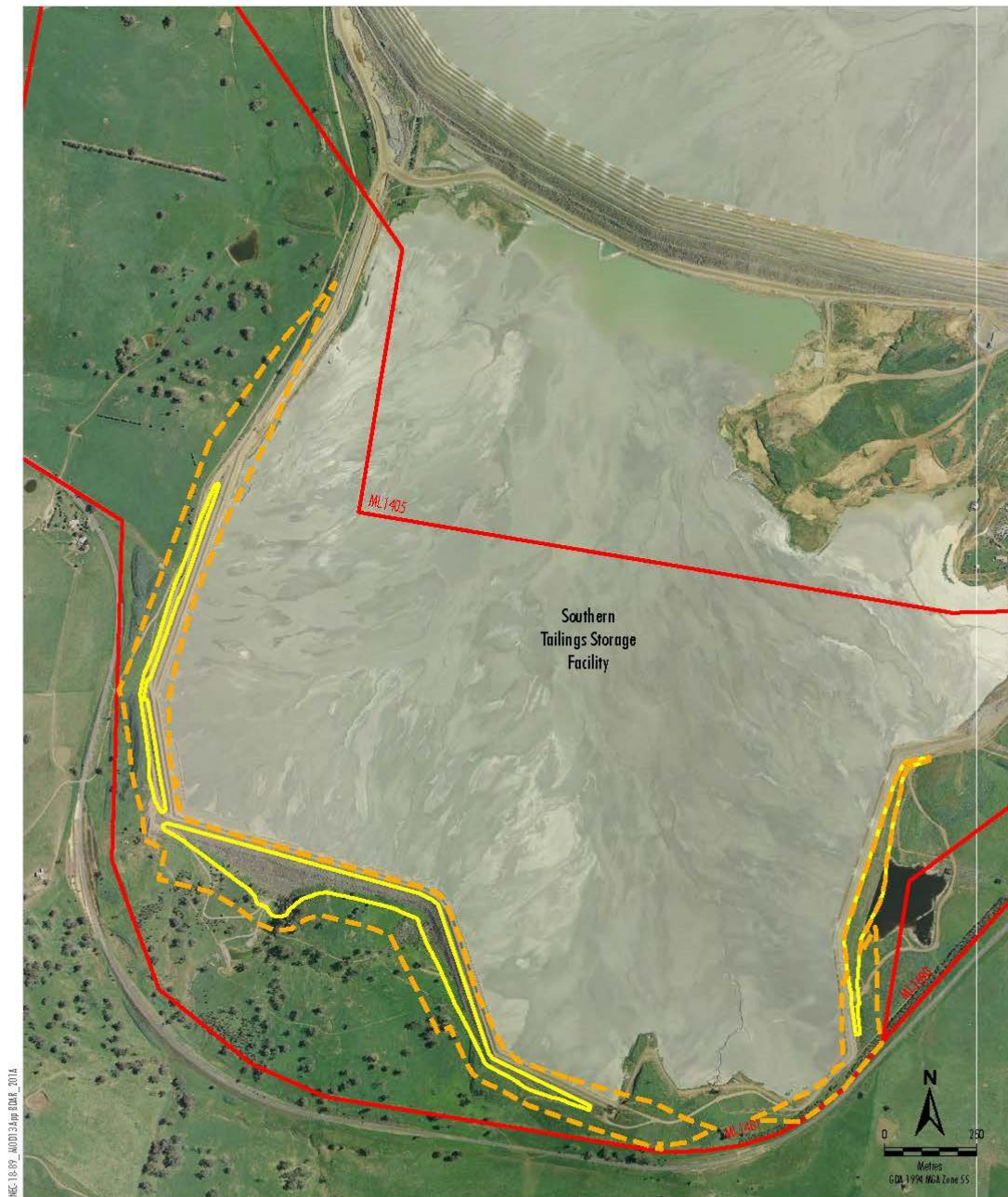
The area proposed to construct the STSF buttressing (the development footprint) and surrounds (the study area) (Figure 2) is the subject of this Biodiversity Development Assessment Report (BDAR). The development footprint comprises three separate sections on the western, southern and eastern sides of the STSF, totalling 13.5 hectares (ha) in area.

Much of the area affected by the proposal comprises disturbed ground that is part of the existing STSF wall structure (Figure 3). Disturbed ground comprises 9.2 ha of the footprint. The development footprint would extend onto small areas (3.9 ha) of former grazing land and earthed constructed slopes designated here as Exotic Dominated Grassland. The footprint also includes 0.31 ha of remnant Box Gum Woodland (Figure 3), which contains mature hollow-bearing live and dead *Eucalyptus albens* (White Box) trees with habitat features suitable for some threatened fauna species.



Figure 1

Figure 1. Regional Location of the Study Area.



REC 1809_A0013400_P001_2014

- LEGEND**
- Mining Lease Boundary
 - Proposed Southern Tailings Storage Facility Buttress (Development Footprint)
 - Study Area

Source: CHR (2018)
Orthophoto CVO - Flown November 2016

NEWCREST
MINING LIMITED
CADIA VALLEY OPERATIONS
Proposed Southern Tailings Storage Facility
Buttress

Figure 2

Figure 2. Proposed Southern Tailings Storage Facility Buttress.

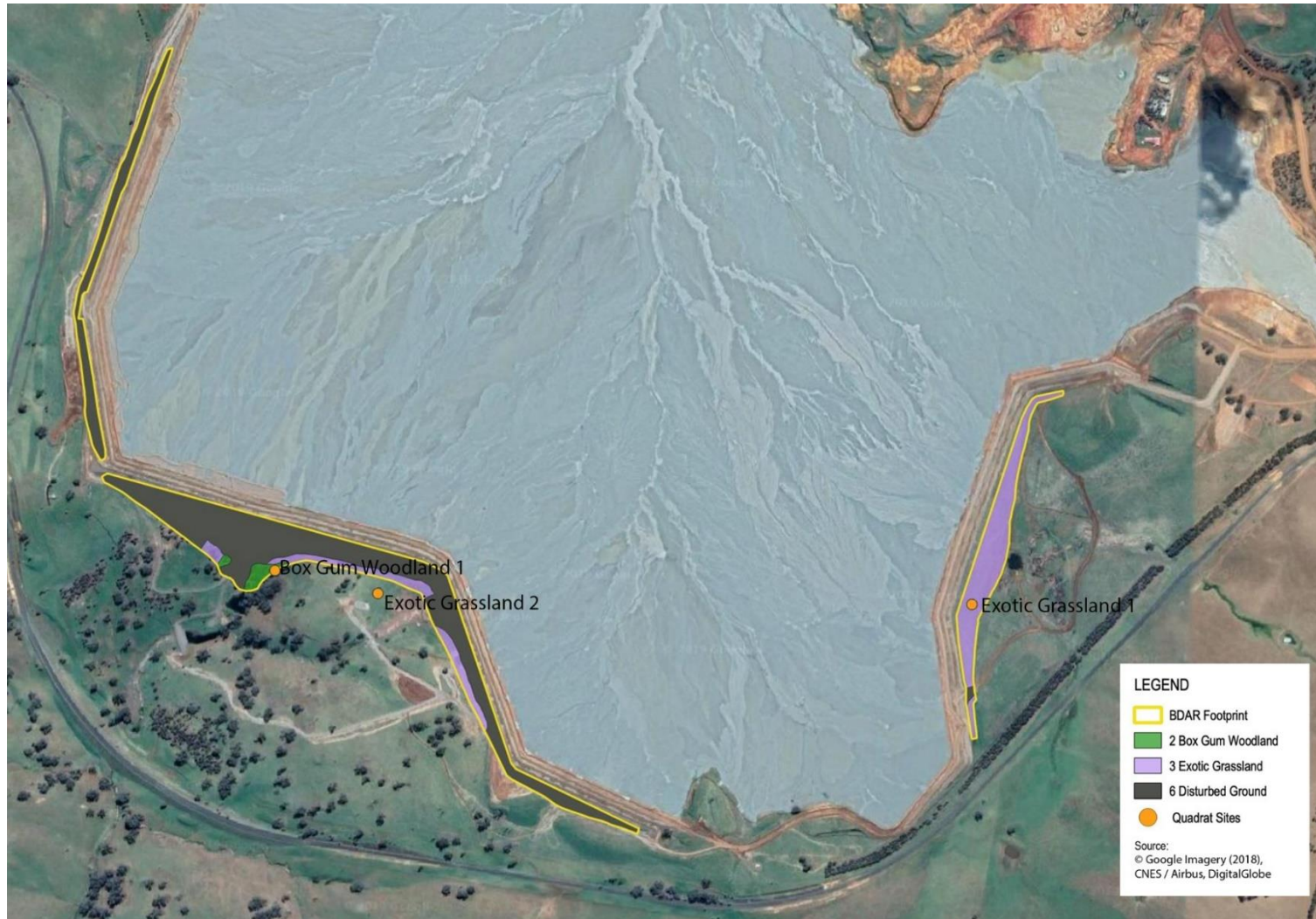


Figure 3. Disturbance Areas, Native Vegetation and Flora Quadrat Locations.

1.3 BIODIVERSITY ASSESSMENT METHOD

The assessment of impacts from Modification 13 on biodiversity are to be conducted in accordance with the BAM (OEH, 2017a) established under the BC Act. The BAM outlines the methodology that underpins the NSW BOS established under Part 6 of the BC Act.

The BAM (OEH, 2017a) requires the use of an online program (calculator) to assess biodiversity impacts and determine the biodiversity offset requirements for those impacts. Version 12 of the *Biodiversity Assessment Method Calculator* (BAMC or the Credit Calculator) (OEH, 2019a) was used for this assessment.

As specified by the BAM (OEH, 2017a), three stages of assessment are outlined in this report:

- Stage 1 summarises the biodiversity values of the development footprint that are entered into the Credit Calculator (e.g. landscape features, native vegetation and threatened species) (Section 2); and
- Stages 2 and 3 assess potential impacts on biodiversity, describe impact avoidance and mitigation measures and determine offset requirements (Section 3).

This BDAR has been prepared by Dr Colin Bower (FloraSearch), who is an accredited assessor under section 6.10 of the BC Act (assessor accreditation number BAAS18048).

1.4 BIODIVERSITY VALUES MAP

Version 6 of the Biodiversity Values Map was interrogated in May 2019 to determine whether any land considered likely to support biodiversity for which disturbance would pose a Serious and Irreversible Impact had been mapped on the study area and surrounds. The map showed that no such biodiversity had been mapped for the study area.

This was confirmed specifically for the Regent Honeyeater (*Anthochaera phrygia*) and Swift Parrot (*Lathamus discolor*) by consulting the Support Service Centre for Land Management and Biodiversity Conservation of the NSW Office of Environment and Heritage (email reply received on 3 June 2019).

1.5 STREAMLINED ASSESSMENT MODULE

This section provides justification for using the streamlined assessment module of the BAM for this assessment. The native vegetation on the development footprint comprises two small remnants of Box-Gum Woodland (0.31 ha). Owing to low floristic and structural diversity, the exotic-dominated grassland had a Vegetation Integrity Score of only 2.5 in BAMC (OEH, 2019a), which is below the threshold score of 15 to trigger entry into the Biodiversity Offsets Scheme for an Endangered Ecological Community (EEC) (OEH, 2017a).

The total area of the native vegetation clearance of 0.31 ha is below the 5 ha maximum area limit for application of the streamlined assessment module (BAM, Appendix 2 [OEH, 2017a]) on a site with a minimum lot size of 100 ha, as per the Blayney Shire Local Environment Plan 2012 (NSW Government, 2019). Accordingly, this report follows the requirements of the BAM streamlined assessment module (OEH, 2017a).

2 STAGE 1 – BIODIVERSITY ASSESSMENT

Stage 1 of the biodiversity assessment summarises the biodiversity values of the development footprint that are inputs into the BAMC.

2.1 LANDSCAPE FEATURES

Landscape features relevant to the study area are described in this section and illustrated on Figures 4 (Site Map) and 5 (Location Map).

This study area is assessed using the site-based assessment module within BAMC. Accordingly, a 1.5 km buffer zone was used to assess the landscape around the development site (Figure 5).

2.1.1 Regional Setting

The study area is located approximately 25 km south west of Orange in Central Western NSW (Figure 1), entirely within the following regions:

- the NSW South Western Slopes Bioregion and Inland Slopes Sub-region of the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995); and
- the Blayney Shire Local Government Area (LGA).

2.1.2 Mitchell Landscapes

Details of the Mitchell Landscapes within the development footprint are provided in Table 1 and shown on Figure 5. The footprint is predominantly within the Mandurama Slopes Mitchell Landscape (Department of Environment and Climate Change, 2002) (Table 1).

Table 1. Mitchell Landscapes in the Development Footprint.

Landscape Name	Percentage Cleared Estimate ¹	Area (ha)	Percent (%) of Development Footprint Covered by Landscape
Canobolas Sheet Basalts	94	1.51	11.3
Canobolas Slopes	96	0.53	3.9
Mandurama Slopes	79	11.4	84.8

¹ Sourced from the 'Over-cleared Landscapes Database' within the BioNet Vegetation Classification Database (OEH, 2019b).

2.1.3 Native Vegetation Extent

The study area is located in a highly cleared agricultural region. The 1.5 km buffer zone around the study area encompasses 1,788.8 ha, of which 195.6 ha (10.9%) is remnant native woodland (Figure 5) with most having been thinned historically. Within the development footprint the only native vegetation is two small patches of White Box Woodland totalling 0.31 ha in area.

2.1.4 Connectivity

No vegetation corridors exist within the study area or immediate surrounds (Figure 5).

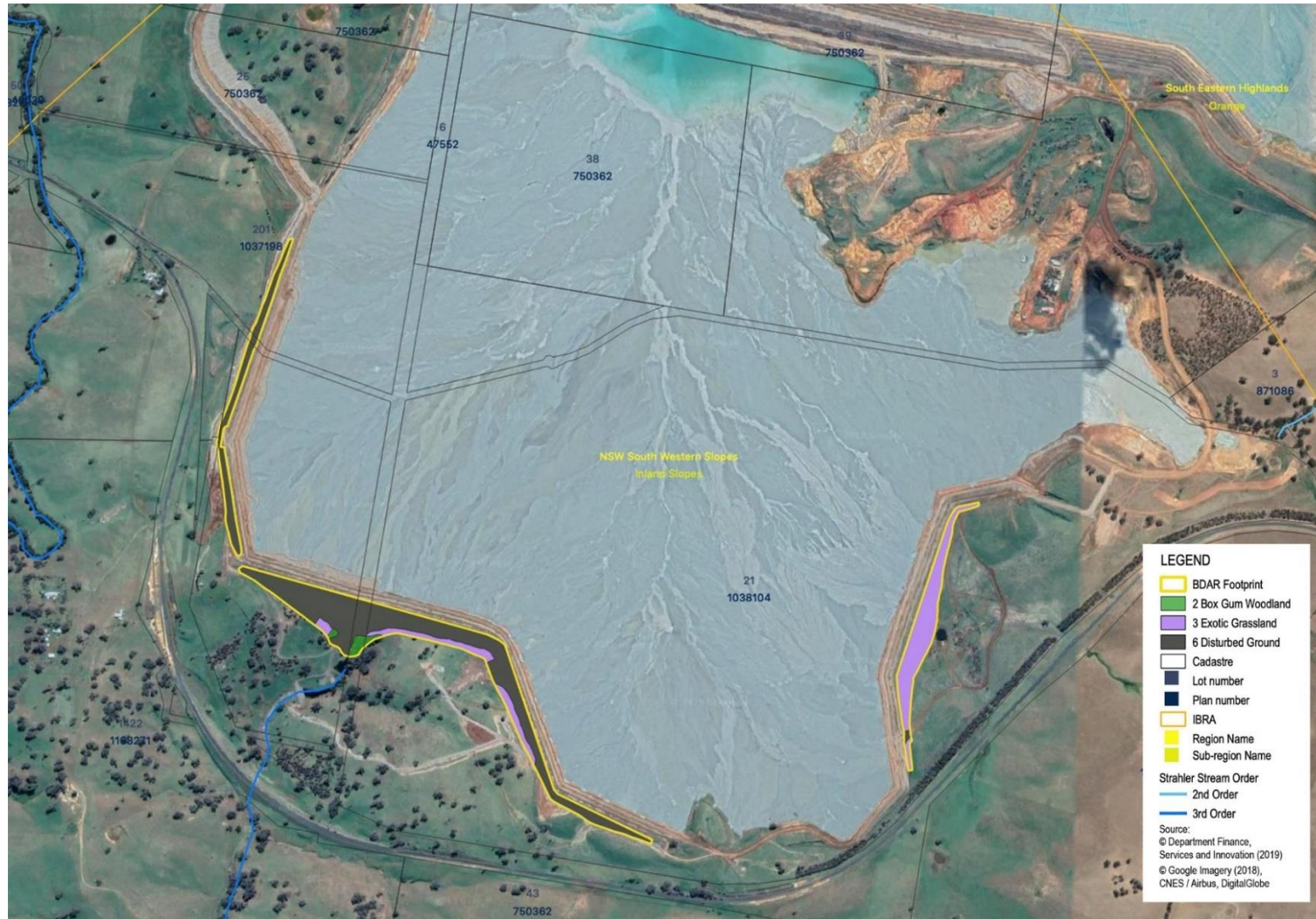


Figure 4. BAM Site Map of Study Area.

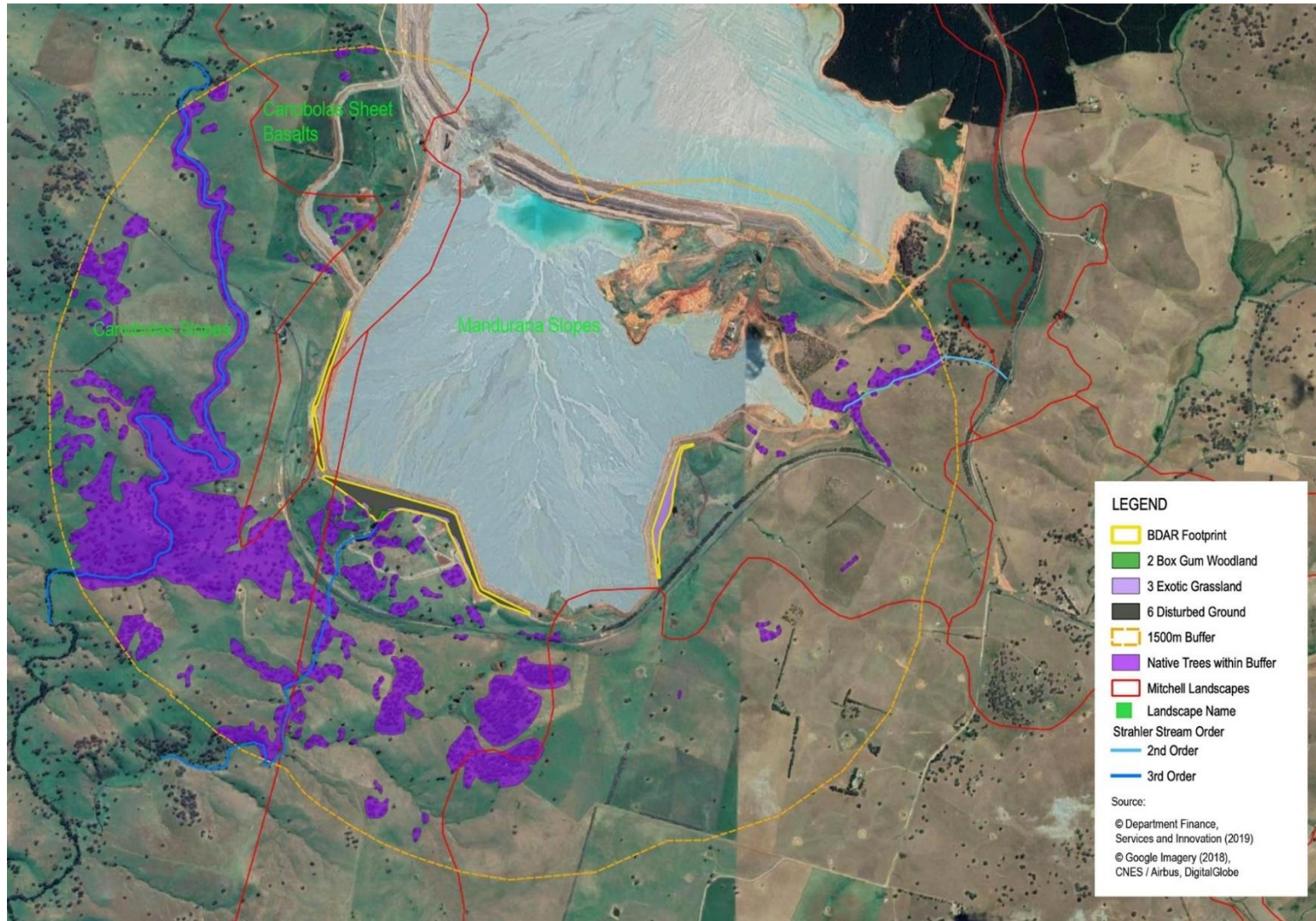


Figure 5. BAM Location Map of Study Area.

2.2 NATIVE VEGETATION

Native vegetation on the development footprint is described in this section based on site visits undertaken by FloraSearch on 26 June 2017 and 12 June 2019. The following sampling to document the vegetation was undertaken (Figure 3):

- Initial field mapping of vegetation communities was conducted on 26 June 2017 and revised on 12 June 2019.
- Three BAM compliant quadrats were carried out on 12 June 2019.

2.2.1 Plant Community Type

All that remains of the original pre-European tree cover on the development footprint are two small patches of remnant Box Gum Woodland (0.31 ha) dominated entirely by *Eucalyptus albens* (Appendix 1) in a steep gully at the south western margin of the STSF (Figure 3).

The native trees within the remnant woodland indicate that the most likely original Plant Community Type (PCT) (OEH, 2019c) on the development footprint is PCT266 – *White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion*. PCT266 belongs to the *Western Slopes Grassy Woodlands* vegetation class (OEH, 2019c).

2.2.2 Endangered Ecological Communities

PCT 266 is part of the *White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community* (BC Act) (OEH, 2019c). This community is commonly known as Box Gum Woodland. Remnants of Box Gum Woodland that meet Commonwealth criteria (Department of the Environment and Heritage [DEH], 2006) are listed as the *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community* (*Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act]). The Box Gum Woodland remnants on the study area do not meet the Commonwealth criteria for protection under the EPBC Act (DEH, 2006). In particular, the ground cover is highly degraded and lacks the required diversity of 12 non-grass native species (Appendix 1), including one important species, per 0.1 ha.

2.2.3 Vegetation Zones

The development footprint comprises two vegetation zones:

- Box Gum Woodland (0.31 ha), and
- Exotic-dominated grassland (3.9 ha)

The remainder of the 13.5 ha development footprint is disturbed land comprising the existing rock-fill STSF containment wall which lacks vegetation cover.

2.2.4 PCT266 - Box-Gum Woodland

One BAM quadrat was conducted in the larger Box Gum Woodland remnant to provide data for input to BAMC (Figure 3). The Box-Gum Woodland on the study area is part of a patch that is 12 ha in size. Data collected from the quadrat is provided in Table 2 and the summary vegetation integrity statistics from BAMC are given in Table 3.

Table 2. Inputs to BAMC for Box-Gum Woodland.

BAM attribute (400m ²)	No. of species	Foliage cover (%)
<i>Trees</i>	2	10
<i>Shrubs</i>	0	0
<i>Grasses / grass-like</i>	7	5
<i>Forbs</i>	6	2
<i>Ferns</i>	1	0.1
<i>Other</i>	0	0
<i>High Threat Exotics</i>	2	0.1
<i>Litter cover (1000m²)</i>	-	23
<i>Length of logs</i>	-	134

Table 3. Vegetation Integrity Statistics for Box-Gum Woodland.

Statistic	Score
Composition	72.2
Structure	28.6
Function	61.3
Vegetation Integrity	50.2

The Vegetation Integrity Score exceeds 15 so that the BOS is triggered for Modification 13. Since the vegetation is to be removed, the future vegetation integrity score is zero.

2.2.5 Exotic-dominated grassland

Two BAM quadrats were conducted in the exotic-dominated grasslands to provide data for input to BAMC (Figure 3). Data collected from the quadrats is provided in Table 4 and the summary vegetation integrity statistics from BAMC are given in Table 5.

Table 4. Inputs to BAMC for Exotic-dominated Grassland.

BAM attribute (400m ²)	Quadrat 1		Quadrat 2	
	No. of species	Foliage cover (%)	No. of species	Foliage cover (%)
<i>Trees</i>	0	0	0	0
<i>Shrubs</i>	0	0	0	0
<i>Grasses / grass-like</i>	2	0.2	1	1
<i>Forbs</i>	2	1.1	1	1
<i>Ferns</i>	0	0	0	0
<i>Other</i>	0	0	0	0
<i>High Threat Exotics</i>	0	0	0	0
<i>Litter cover (1000m²)</i>	-	11	-	32
<i>Length of logs</i>	-	0	-	4

Table 5. Vegetation Integrity Statistics for Exotic-dominated Grassland.

Statistic	Score
Composition	4.2
Structure	0.7
Function	5.6
Vegetation Integrity	2.5

The exotic dominated grassland has very low biodiversity value, having a Vegetation Integrity Score of only 2.5 and is not required to be offset. Since this vegetation is to be removed, the future vegetation integrity score is zero.

2.2.6 High Threat, Priority and Nationally Significant Weeds

Two introduced flora species recorded on the study area (Appendix 1) are considered to be High Threat Exotic weeds by the Office of Environment and Heritage (OEH) (2019d); *Carthamus lanatus* (Saffron Thistle) and *Hypericum perforatum* (St. John's Wort). One weed, *Hypericum perforatum*, is listed as a Priority Weed for the Blayney Shire LGA under the NSW *Biosecurity Act 2015* (Department of Primary Industries, 2019). No Weeds of National Significance as listed by the Australian Weeds Committee of the Commonwealth Government (www.weeds.org.au) were identified on the study area.

2.3 FAUNA SURVEY

Fauna surveys and an assessment of the likelihood of occurrence of threatened fauna species were conducted by Biodiversity Monitoring Services (BMS) (Appendix 2) who undertook:

- a desktop review of potential species to identify which would require targeted surveys in accordance with the BAM;
- targeted surveys for species that can be surveyed in the timeframe given;
- habitat assessment for those targeted species not able to be surveyed to determine how they should be considered in BAMC; and
- a Baseline Fauna Report (Appendix 2).

Fauna surveys of the study area were conducted over six days by BMS on 13 to 15 February, and between 4 and 7 June 2019. The surveys targeted threatened species predicted to occur on the study area by BAMC for PCT266 at the particular survey times. The following methods were used and results obtained.

The surveys encompassed the entire study area, owing to its small size and included non-threatened species as well as threatened species. No trapping or netting of animals was carried out. The methodology was guided by the Department of Environment and Conservation (2004):

- **Diurnal Birds:** In February, three locations (eastern, southern and western) were each observed three times for 60 minutes, alternating morning and afternoon observation periods. In June two further 30 minute observations were carried out in each area. Targeted species included the Gang-gang Cockatoo (*Callocephalon fimbriatum*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Square-tailed Kite (*Lophoictinia isura*), Barking Owl (*Ninox connivens*) and Bush Stone-curlew (*Burhinus grallarius*). Call playbacks were conducted in June for the Barking Owl (*Ninox connivens*) and Bush Stone-curlew. It was ascertained from OEH that the study area is not within a mapped important area for either the Regent Honeyeater or Swift Parrot.

- **Arboreal Mammals:** Three two hour spot-lighting sessions were carried out on foot in June in the wooded areas within and adjacent to the southern part of the development footprint. Three one hour vehicle based spot-lighting sessions were carried out in June in the eastern and western development areas. Searches for tree hollows, trunk scratches and scats were carried out as part of habitat assessments. Targeted species included Brush-tailed Phascogale (*Phascogale tapoatafa*), Squirrel Glider (*Petaurus norfolcensis*) and Koala (*Phascolarctos cinereus*).
- **Terrestrial Mammals:** Evidence of terrestrial animals was searched for across the development footprint. This included spot-lighting and searches for scats.
- **Bats:** Habitat constraints for Large Bent-winged Bat (*Miniopterus orianae oceanensis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) were assessed in February.
- **Reptiles and Frogs:** Opportunistic searches for reptiles and frogs were conducted.

2.3.1 Fauna Recorded by the Surveys

Nine species of mammals were recorded by the surveys, five native and four introduced, including one threatened species, the Squirrel Glider (*Petaurus norfolcensis*) (Appendix 2). Forty two species of birds were identified, including three introduced species and one threatened species, the Little Lorikeet (*Glossopsitta pusilla*). One reptile and three frogs were recorded, all native and none threatened.

2.3.2 Fauna Survey Limitations

The surveys undertaken by BMS (Appendix 2) missed the required survey timing for some of the threatened species whose ability to utilise the study area cannot therefore be ruled out. These species have been assumed present within BAMC for the purposes of this assessment. Species with potential habitat on the study area that were unable to be surveyed owing to seasonal timing include:

- Pink-tailed Legless Lizard (*Aprasia parapulchella*)
- Little Eagle (*Hieraaetus morphnoides*)
- Superb Parrot (*Polytelis swainsonii*)

2.4 THREATENED SPECIES

Threatened species relevant to Modification 13 are identified in this section. The BAM recognises two categories of threatened species:

- ecosystem credit species (i.e. species predicted to be present based on the PCTs present on the study area); and/or
- species credit species (i.e. species that cannot be reliably predicted by PCTs) (OEH, 2017a).

Threatened species that are ecosystem credit species and/or species credit species are pre-determined in the Credit Calculator and *BioNet Threatened Biodiversity Data Collection* (TBDC) (OEH, 2019e).

2.4.1 Data Sources

Five data sources were used to compile lists of threatened flora and fauna that may potentially occur on the study area (Tables 6 and 7):

- BAM online calculator – Lists of ecosystem credit species and species credit species generated by the BAMC using inputs on IBRA subregion, site location and vegetation integrity (OEH, 2019a).

- The NSW BioNet Threatened Biodiversity Data Collection (TBDC) (OEH, 2019e) – Provides data on vegetation types (PCTs), habitats and habitat constraints for threatened species.
- BioNet website – Searches of the NSW Atlas of Wildlife, NSW State Forests, Australian Museum and Royal Botanic Gardens Sydney databases (OEH, 2019f). The search area comprised a 20 x 20 km square centred on the study area. This search returned a list of threatened species known to occur within the search area.
- Commonwealth Department of the Environment and Energy (DEE) website – Protected Matters Search Tool (PMST) (DEE, 2019a). The search area comprised the same 20 x 20 km square as for the BioNet search. The PMST uses actual records and habitat modelling to return a list of 'protected matters' that are known or predicted to occur in the search area, including threatened species, migratory species, ecological communities, wetlands of international significance, and national and world heritage properties.
- Reports to CHPL of previous biodiversity surveys on CVO land. Summaries of studies published between 1995 and 2007 are given in Western Institute and Resource Strategies (2009) for fauna and FloraSearch and Resource Strategies (2009) for flora.

BAMC returned 31 ecosystem credit species, all fauna; and 23 species credit species, seven flora and 16 fauna species (Tables 6 and 7). Thirteen of the fauna species are dual ecosystem and credit species. All species returned by the BAMC require assessment within the calculator of the suitability for them of the habitat on the development footprint. This has been done for fauna by BMS (Appendix 2) and their conclusions have been adopted in this assessment.

The BioNet database search returned records of one flora species, the *Eucalyptus canobolensis* (Canobolas Candlebark) and two fauna species, the Southern Myotis (*Myotis macropus*) and the Little Pied Bat (*Chalinolobus picatus*) close to the study area that were not identified by BAMC. The potential for habitat of these species to occur on the site is also assessed in Tables 6 and 7.

The PMST search returned nine potentially occurring flora species and 22 fauna species. Assessment of these species is required to determine whether there is any obligation to further consider matters under the EPBC Act (e.g. referral to the Commonwealth DEE).

The total numbers of potentially occurring threatened species identified by the searches are 14 flora and 52 fauna species (Tables 6 and 7).

Table 6. Threatened Flora Species Returned by Database and Literature Searches of the Surrounding Region.

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Acacia ausfeldii</i>	Ausfeld's Wattle	Sp ⁶	Sp	-	-	Moderate	2.00	V	-	Nil	Generally confined to an area between Dubbo, Ulan and Mudgee, where it occurs on sandy soils in dry shrubby forests (OEH, 2019g). It is unlikely to have once occurred on the study area.
<i>Ammobium craspedioides</i>	Yass Daisy	Sp	Sp	-	✓	Moderate	2.00	V	V	Nil	Known principally from the Yass to Tumut area (OEH, 2019g) in less disturbed sites, it extends north to Lyndhurst Cemetery. Mainly occurs in Box-Gum Woodland (OEH, 2019g). The study area is too disturbed to support this species.
<i>Eucalyptus aggregata</i>	Black Gum	-	-	-	✓			V	V	Nil	Black Gum occurs south of Orange in high altitude, low lying swampy areas along Gosling Creek with deep clay soils. Such habitats do not occur on the study area.
<i>Eucalyptus canobolensis</i>	Mt Canobolas Candlebark	-	-	✓	-			V	E	Nil	Mt Canobolas Candlebark occurs on basaltic soils derived from the Mt Canobolas volcano at altitudes generally above 850 m (OEH, 2019g). The study area is below 850 m in altitude and lacks basaltic soils.
<i>Eucalyptus pulverulenta</i>	Silver-leaved Mountain Gum	-	-	-	✓			V	V	Nil	Grows in shallow soils in drier tableland forests, typically dominated by Brittle Gum (<i>E. mannifera</i>), Red Stringybark (<i>E. macrorhyncha</i>), Broad-leafed Peppermint (<i>E. dives</i>) and Apple Box (<i>E. bridgesiana</i>) (OEH, 2019g). The soils and plant community on the study area do not match known sites of this species.
<i>Euphrasia arguta</i>	-	Sp	Sp	-	✓	Very High	3.00	CE	CE	Nil	<i>Euphrasia arguta</i> has been recorded from grassy areas near rivers at elevations up to 700 m above sea level in central western NSW, and grassy forests or regrowth vegetation on the Northern Tablelands (DEE, 2019b). Suitable habitat is lacking on the study area.
<i>Grevillea wilkinsonii</i>	Tumut Grevillea	Sp	Sp	-	-	Very High	3.00	E	E	Nil	Only known from the Tumut – Gundagai area. Not known on the Central Tablelands or Central Western Slopes. Known from riverine habitats and a Serpentine rock outcrop (OEH, 2019g). Such habitats are lacking on the study area which is remote from the known distribution of this species.

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Leucochrysum albicans</i> var. <i>tricolor</i>	Hoary Sunray	-	-	-	✓			-	E	Nil	A plant principally of grasslands and grassy woodlands on relatively fertile soils, often clays or clay-loams derived from basalt or dolerite, or at higher altitudes, from sedimentary parent material. Fertile soils are present in the study area. The nearest record is approximately 60 km south-south-east near Trunkey Creek (OEH, 2019g). However, the habitats on the study area are considered to be too highly disturbed to support this species.
<i>Prasophyllum petilum</i> (syn. <i>P. sp. Wybong</i>)	-	-	Sp	-	✓	Very High	3.00	E	E	Low	Grows in open sites in natural temperate grassland, grassy woodland and in grassy Box-Gum Woodland. Highly susceptible to grazing, being retained only at little-grazed travelling stock reserves and in cemeteries (OEH, 2019g). The habitat on the study area may be too disturbed for this species, but it is considered likely to have once occurred.
<i>Swainsona recta</i>	Small Purple-pea	Sp	Sp	-	✓	High	2.00	E	E	Low	Small Purple-pea occurs mainly in the grassy understorey of Box-Gum Woodlands and open-forests in association with understorey dominants that include Kangaroo Grass (<i>Themeda australis</i>), poa tussocks (<i>Poa</i> spp.) and spear-grasses (<i>Austrostipa</i> spp.) (OEH, 2019g). The native understorey normally associated with this species has been severely disrupted on the study area, but it possibly once occurred there.
<i>Swainsona sericea</i>	Silky Swainson-pea	Sp	Sp	-	-	Moderate	2.00	V	-	Low	The Silky Swainson-pea was formerly a widespread, common species in Box-Gum Woodlands and is likely to have been common in the Cadia district (OEH, 2019g). It is very sensitive to grazing and is unlikely to have survived the long farming history and pasture improvement on the study area, but it is very likely to have once occurred there.

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Thesium australe</i>	Austral Toadflax	-	-	-	✓			V	V	Nil	Austral Toadflax was formerly widespread in grasslands and grassy woodlands in eastern Australia from the Bunya Mountains in Queensland to Tasmania. It is mainly hemiparasitic on Kangaroo Grass (<i>Themeda australis</i>) and possibly <i>Poa</i> species on a wide range of substrates (Department of Sustainability and Environment, 2003). Known only from near Portland on the Central Tablelands (OEH, 2019g) and not on the Central West Slopes.
<i>Tylophora linearis</i>	-	-	-	-	✓			V	E	Nil	Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands (OEH, 2019g) on coarse-grained sediments. Suitable habitat is absent from the study area.
<i>Zieria obcordata</i>	Granite Zieria	Sp	Sp	-	-	Very High	3.00	E	E	Nil	Grows in eucalypt woodland or shrubland dominated by species of <i>Acacia</i> on rocky hillsides (OEH, 2019g) and in <i>Eucalyptus</i> and <i>Callitris</i> dominated woodland in sandy loam amongst granite boulders (OEH, 2019g). Occurs at Wuuluman north east of Wellington. Plants are very susceptible to grazing. Granite geology does not occur on the study area.

¹ Biodiversity Assessment Method online Credit Calculator (OEH, 2019a)

² Threatened Biodiversity Data Collection (OEH, 2019e)

³ NSW Atlas of Wildlife (OEH, 2019f)

⁴ Protected Matters Search Tool (DoEE, 2019a)

⁵ Biodiversity Risk Weighting

⁶ Sp = Species Credit Species

E = Endangered, CE = Critically Endangered, V = Vulnerable.

Table 7. Threatened Fauna Species Returned by Database and Literature Searches of the Surrounding Region.

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area ⁵	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Synemon plana</i>	Golden Sun Moth	Sp	Sp	-	-	Very High	3.00	E	CE	Nil	The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut (OEH, 2019g). The species' historical distribution extended from Bathurst through the NSW Southern Tablelands to central and western Victoria and Bordertown in eastern South Australia. Occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which the ground layer is dominated by wallaby grasses <i>Austrodanthonia</i> spp (OEH, 2019g). Host grasses are rare on the study area.
<i>Maccullochella peelii</i> ⁶	Murray Cod	-	-	-	✓			-	V	Nil	These fish species occur in large permanent rivers with deep waterholes (DoEE, 2019b). No suitable permanent watercourses occur on or near the study area.
<i>Macquaria australasica</i> ⁶	Macquarie Perch	-	-	-	✓			-	E	Nil	
<i>Litoria booroolongensis</i>	Booroolong Frog	-	-	-	✓			E	E	Nil	The Booroolong Frog is a small riverine frog that inhabits rocky permanent streams ranging from small slow-flowing creeks to large rivers (DoEE, 2019b). Suitable rocky riverine habitat does not occur on the study area or surrounds.
<i>Litoria castanea</i>	Yellow-spotted Tree Frog	-	-	-	✓			CE	E	Nil	The Yellow-spotted Tree Frog requires large permanent ponds or slow flowing 'chain-of-ponds' streams with abundant emergent vegetation such as bulrushes and aquatic vegetation (OEH,2019g). Suitable habitat is absent from the study area.
<i>Aprasia parapulchella</i>	Pink-tailed Legless lizard	Sp	Sp	-	✓	Moderate	2.00	V	V	Low	The Pink-tailed Worm-lizard inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass (<i>Themeda australis</i>). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks (OEH, 2019g). Suitable habitat potentially occurs on the study area (Appendix 2).
<i>Delma impar</i>	Striped Legless Lizard	-	-	-	✓	-	-	V	V	Nil	Found mainly on the Southern Tablelands and South West Slopes in Natural Temperate Grassland but may also occur in grasslands with a high exotic component. Occasionally found in open Box-Gum Woodland. Shelters beneath logs and/or rocks in winter (OEH, 2019g). Predicted as potentially occurring on the study area by PMST (DoEE, 2019b), but is not known north of Goulburn.

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area ⁵	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Leipoa ocellata</i>	Mallee Fowl	-	-	-	✓	-	-	E	V	Nil	The Mallee Fowl was predicted to potentially occur on the study area by the PMST. Mallee Fowl are found in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or acacias. A sandy substrate and abundance of leaf litter are required for breeding (Benshemesh, 2007). Suitable habitat is absent from the study area and surrounding regions.
<i>Botaurus poiciloptilus</i>	Australasian Bittern	-	-	-	✓	-	-	E	E	Nil	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they occur over most of the state except for the far north-west (OEH, 2019g). They favour permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.). Suitable habitat is absent from the study area.
<i>Lophoictinia isura</i>	Square-tailed Kite	Ec/Sp	Ec/Sp	-	-	Moderate	1.50	V	-	Nil/Nil	Sparsely distributed throughout the state being resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast. Found in a variety of timbered habitats including dry woodlands and open forests with a preference for timbered watercourses (OEH, 2019g). A specialist hunter of passerines and insects in the tree canopy, picking most prey items from the outer foliage. Likely to prefer areas of continuous tree canopy cover for foraging which are absent from the study area and surrounds. No trees with large stick nests were found by the survey indicating a lack of breeding by birds of prey (Appendix 2).
<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle	Ec/Sp	Ec/Sp	-	-	Moderate	2.00	V	-	Nil/Nil	Occurs throughout NSW, but in the inland is concentrated near major watercourses, wetlands, lakes and large water supply dams (OEH, 2019f, OEH, 2019g). Such habitats are absent from the study area. No trees with large stick nests were found by the survey indicating a lack of breeding by birds of prey (Appendix 2).
<i>Circus assimilis</i>	Spotted Harrier	Ec	Ec	-	-	Moderate	-	V	-	Nil	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges. Occurs in grassy open woodland including <i>Acacia</i> and mallee remnants, inland riparian woodland, grassland and shrub steppe (OEH, 2019g). It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The habitats on the study area do not suit the foraging characteristics of this species, which prefers open flatter terrain.

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area ⁵	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Hieraaetus morphnoides</i>	Little Eagle	Ec/Sp	Ec/Sp	-	-	Moderate	1.50	V	-	High/Low	Occurs throughout NSW and soars over open country seeking prey (Blakers <i>et al.</i> , 1984). There is a record near Mandurama in OEH (2019f) and it is known to breed near Panuara (FloraSearch, 2014). It is likely to forage over the study area and surrounds. No trees with large stick nests were found by the survey indicating a lack of breeding by birds of prey (Appendix 2). The species has some potential to nest on the study area.
<i>Burhinus grallarius</i>	Bush Stone-curlew	Sp	Sp	-	-	High	2.00	E	-	Nil	Found throughout most of NSW, except for the tablelands and arid north west. Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber (OEH, 2019g). Study area is likely to be too disturbed for this species – exotic dominated ground cover and the presence of foxes and cats (Appendix 2).
<i>Rostratula australis</i>	Australian Painted Snipe	-	-	-	✓	-	-	E	E	Nil	Australian Painted Snipe inhabits freshwater swamps and marshes (Blakers <i>et al.</i> , 1984). Suitable habitat is absent from the study area.
<i>Calidris ferruginea</i>	Curlew Sandpiper	-	-	-	✓	-	-	E	CE, M	Nil	Forages mainly on coastal estuarine mudflats, but also in inland lakes and lagoons with extensive shallows (OEH, 2019g). Suitable habitat is absent from the study area.
<i>Numenius madagascariensis</i>	Eastern Curlew	-	-	-	✓	-	-	-	CE, M	Nil	The Eastern Curlew has a primarily coastal distribution on mudflats in estuaries. The species is found in all states, particularly the north, east, and south-east regions including Tasmania (DoEE, 2019b). Eastern curlews are rarely recorded in inland wetlands, which in any event are absent from the study area.
<i>Calyptorhynchus lathami</i>	Glossy Black Cockatoo	Ec/Sp	Ec/Sp	-	-	Moderate	2.00	V	-	Nil/Nil	The Glossy Black Cockatoo is dependent on the fruits of the Casuarinaceae (OEH, 2019g), which are absent from the study area.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Ec/Sp	Ec/Sp	-	-	Moderate	2.00	V	-	Low/Low	The Gang-gang Cockatoo is distributed from southern Victoria through south and central-eastern NSW. In NSW, it occurs from the south coast to the Hunter region, and inland to the Central Tablelands and south-west slopes (OEH, 2019g). In spring and summer, it is found in tall mountain forests and woodlands. In autumn and winter, the species often moves to lower altitudes to drier more open eucalypt forests and woodlands. However, it is not known from the western Central Tablelands or Central West Slopes and has only a low likelihood of occurrence.
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet	Ec	Ec	-	-	Moderate	-	V	-	Nil	A nomadic species found mainly in southern NSW along the Murray River (OEH, 2019g). Unlikely to occur on the study area.

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area ⁵	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Glossopsitta pusilla</i>	Little Lorikeet	Ec	Ec	-	-	Moderate	-	V	-	High	The Little Lorikeet is rarely recorded on the western Central Tablelands (OEH, 2019f), but has been recorded at Cadia. It is a nomadic species that forages on flowering eucalypts. It may potentially utilise remnant native eucalypts on the study area when they are in flower. Observed during the surveys.
<i>Polytelis swainsonii</i>	Superb Parrot	Ec/Sp	Ec/Sp	-	✓	Moderate	2.00	V	V	High/Moderate	The Superb Parrot occurs in tall grassy Box-Gum Woodlands and forests west of the Tablelands (Blakers <i>et al.</i> , 1984). There are many records of the species on the Western Slopes near the study area. It is commonly seen in Orange. Suitable breeding and/or feeding habitat potentially occurs on the study area (Appendix 2).
<i>Lathamus discolor</i>	Swift Parrot	Ec/Sp	Ec/Sp	-	✓	Very High	3.00	E	CE	Moderate/Nil	The Swift Parrot is a migratory species that breeds in Tasmania and winters on the mainland, where it feeds on flowering eucalypts (OEH, 2019g). There are two records near Orange (OEH, 2019f) and one record at Cadia. It requires winter flowering eucalypts, which include <i>Eucalyptus albens</i> that is present on the study area. The Swift Parrot is only regarded as a species credit species where areas of 'important' habitat have been mapped for it. The study area is not one of these areas (Appendix 2).
<i>Neophema pulchella</i>	Turquoise Parrot	Ec	Ec	-	-	Moderate	-	V	-	Nil	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks. Spends most of the day on the ground searching for the seeds of grasses and herbaceous plants, or browsing on vegetable matter (OEH, 2019g). The habitat on the study areas is considered too disturbed for this species, which prefers areas of near natural bushland.
<i>Ninox connivens</i>	Barking Owl	Ec/Sp	Ec/Sp	-	-	Moderate	2.00	V	-	Low/Nil	The Barking Owl is found throughout continental Australia except for the central arid regions (OEH, 2019g). The species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Preys on a range of small arboreal mammals and birds. This species may be an occasional visitor to the study area.
<i>Tyto novaehollandiae</i>	Masked Owl	Ec/Sp	Ec/Sp	-	-	Moderate	2.00	V	-	Low/Nil	Occurs over most of NSW (OEH, 2019g). Lives in dry eucalypt forests and woodlands from sea level to 1100 m. The typical diet consists of tree-dwelling and ground mammals, especially rats. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. May potentially forage on the study area (Appendix 2).

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area ⁵	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	Ec	Ec	-	-	Moderate	-	V	-	Low	There are several records of this subspecies near Orange (OEH, 2019f). It inhabits grassy woodlands with rough-barked trees at close to natural densities, sparse shrub cover and fallen timber on the ground (OEH, 2019g). The study area may be suitable for this species.
<i>Chthonicola sagittata</i>	Speckled Warbler	Ec	Ec	-	-	Moderate	-	V	-	Nil	A sedentary species of natural relatively undisturbed open woodland on rocky ridges or in gullies. Recorded sparsely but widely in the surrounding region in larger blocks of remnant woodland (OEH, 2019g; OEH, 2019f). It is considered unlikely to utilise the study area.
<i>Anthochaera phrygia</i>	Regent Honeyeater	Ec/Sp	Ec/Sp	-	✓	Very High	3.00	CE	CE	Low/Nil	A nomadic/migratory nectar-dependent species found in flowering eucalypts, which has been recorded rarely in the region around the study area (OEH, 2019f). Suitable Box woodland habitat, may occur on and around the study area. However, the study area is not considered to part of an 'important' area for this species and therefore does not require offsetting on its account (Appendix 2).
<i>Grantiella picta</i>	Painted Honeyeater	Ec	Ec	-	✓	Moderate	-	V	V	Nil	Inhabits Boree / Weeping Myall (<i>Acacia pendula</i>), Brigalow (<i>A. harpophylla</i>), Box-Gum Woodlands and Box-Ironbark Forests (OEH, 2019g). A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Abundant mistletoe is absent from the study area.
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater	Ec	Ec	-	-	Moderate	-	V	-	Nil	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts. Feeding territories are large making the species locally nomadic (OEH, 2019g). The Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 ha. The study area lacks the substantial areas of relatively undisturbed woodland required by this species.
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	Ec	Ec	-	-	Moderate	-	V	-	Nil	Distributed over most of NSW and the Hunter Valley except the tablelands and far west (OEH, 2019g). Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions. Generally occur in open habitats with structural diversity including shrubs and dense low trees such as Allocasuarinas and Acacias. Natural groundcovers are preferred. Habitats on the study area lack structural diversity and natural ground cover.

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area ⁵	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Petroica boodang</i>	Scarlet Robin	Ec	Ec	-	-	Moderate	-	V	-	Moderate	Breeds in high altitude eucalypt forest with an open understorey (Blakers <i>et al.</i> , 1984), such as occurs on Mt Canobolas. Juveniles disperse to more open country at lower altitudes in autumn. It is unlikely to breed on the study area but may utilise it as part of a wide foraging range in autumn and winter.
<i>Petroica phoenicea</i>	Flame Robin	Ec	Ec	-	-	Moderate	-	V	-	Moderate	The Flame Robin is commonly recorded on Mt Canobolas (OEH, 2019f). It breeds in high altitude forests and disperses to lower more open habitats in winter. It is unlikely to breed on the study area but may utilise it as part of a wide foraging range in autumn and winter.
<i>Melanodryas cucullata cucullata</i>	Hooded Robin	Ec	Ec	-	-	Moderate	-	V	-	Nil	Occurs over most of NSW except some coastal areas and the arid north west. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas (OEH, 2019g). Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Owing to past disturbance the study area lacks structural diversity and patches large enough to support the species (10 ha or larger).
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Ec	Ec	✓	-	Moderate	-	V	-	Nil	Birds of tall woodlands and open forests, usually with rough-barked eucalypts. Recorded sparsely in the surrounding region (OEH, 2019f). It is considered highly unlikely to occur on the study area which is too open owing to past clearing for livestock grazing.
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	Ec	Ec	✓	-	Moderate	-	V	-	Moderate	Found in larger blocks of woodland and dry sclerophyll forests, usually dominated by eucalypts (Scientific Committee, 2016). Also recorded in shrublands, heathlands and regenerating forests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs. May potentially utilise the study area.
<i>Stagonopleura guttata</i>	Diamond Firetail	Ec	Ec	-	-	Moderate	-	V	-	Nil	Widespread in open forest and woodland mostly on the inland side of the Great Dividing Range in eastern NSW (Blakers <i>et al.</i> , 1984). Favours open grassy woodlands with a native understorey. Habitat on the study area is dominated by exotic grasses rather than native species and unlikely to be suitable.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	Ec	Ec	-	✓	Moderate	-	V	E	Nil	Generally confined to extensive areas of native forest and woodland where it nests in rock caves or hollow logs (Edgar, 1983). The habitat on the study area and surrounds is too highly disturbed to be suitable for this species.

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area ⁵	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Sp	Sp	-	-	Moderate	2.00	V	-	Nil	Has a patchy distribution around the coast of Australia. In NSW mainly found east of the Great Dividing Range although occasionally to the west areas (OEH, 2019g). Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter; also heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Have large territories of 20 to over 100 ha. Not found in spot-lighting survey (Appendix 2).
<i>Phascolarctos cinereus</i>	Koala	Ec/Sp	Ec/Sp	-	✓	Moderate	2.00	V	V	Nil/Nil	Koalas are widespread in eastern NSW with large populations persisting in timbered country south of Bathurst in the Rockley – Newbridge – Wimbledon area (OEH, 2019f). However, there are no records close to the study area, the nearest being at Mullion Creek in 2011 and at Black Rock Range south east of Cargo in 2018 (OEH,2019f). Not found in survey (Appendix 2).
<i>Petaurus norfolcensis</i>	Squirrel Glider	Sp	Sp	-	-	Moderate	2.00	V	-	High	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range (OEH, 2019g). It has been recorded previously on CVO land close to the study area. Prefers mixed species stands with a shrub or Acacia mid-storey. Requires abundant tree hollows for refuge and nest sites. The study area survey identified a resident population of this species (Appendix 2).
<i>Petauroides volans</i>	Greater Glider	-	-	-	✓	-	-	-	V	Nil	There are many records for the Greater Glider on Mt Canobolas (OEH, 2019f), and a few in the Mullion Ranges north of Orange. It is found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows (DoEE, 2019b). The Greater Glider favours forests with a diversity of eucalypt species. The study area does not support potential habitat for this species.
<i>Petrogale penicillata</i>	Brush-tailed Rock Wallaby	Sp	Sp	-	✓	High	3.00		V	Nil	Occurs in the eastern third of NSW on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees (OEH,2019g). Suitable extensive rocky habitats are lacking on the study area.

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area ⁵	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Ec/Sp	Ec/Sp	✓	✓	Moderate	2.00	V	V	Low/Nil	The Grey-headed Flying Fox mostly occurs on the eastern side of the Great Dividing Range but may establish temporary roosts west of the divide when food supplies are abundant (OEH, 2019g). There are two records in OEH (2019f) close to Orange in 2006 and 2010. This species depends on eucalypt nectar and succulent fruits and may rarely utilise the study area (Appendix 2).
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	Ec	Ec	-	-	Moderate	-	V	-	Moderate	The Yellow-bellied Sheath-tail-bat has been recorded thrice at Cadia (Western Research Institute and Resource Strategies, 2009), on Mt Canobolas and north of the Freemantle Nature Reserve (OEH, 2019f). It roosts in tree hollows and forages over the tree canopy or open country. There is potential for it to roost and forage on the study area.
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	Ec/Sp	Ec/Sp	-	-	Moderate	3.00	V	-	Moderate/Nil	The Large Bent-winged Bat is widespread in the Orange region (OEH, 2019f). It roosts in caves and man-made structures such as mines and storm water drains and forages in wooded areas, flying above the tree tops. It is unlikely to have breeding habitat in the study area, but may forage over the woodland (Appendix 2).
<i>Myotis macropus</i>	Southern Myotis	-	-	✓	-		-	V	-	Nil	Forages over larger water bodies, which are lacking in the study area (OEH, 2019f).
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	-	Ec	-	-	Moderate	-	V	-	Nil	A moist forest species found on the coast and Great Dividing Range with trees taller than 20 m (OEH, 2019f). Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. The habitats on the study area are drier woodlands with trees well below 20 m in height.
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	Ec	Ec	-	✓	Moderate	-	V	V	Nil	Distributed in the Murray Darling Basin with the Pilliga Scrub region being a stronghold for this species. Inhabits mallee, bullock and box eucalypt communities, but it is more common in box/ironbark/cypress pine vegetation that occurs on the western slopes and plains (OEH, 2019g). Roosts in tree hollows, crevices, and under loose bark. Rare on the upper slopes and absent from the tablelands. Unlikely to occur on the study area.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	-	-	-	✓		-	V	V	Nil	Large-eared Pied Bat has been recorded at Ophir Reserve, Hill End and along the Belubula River (OEH, 2019f). It roosts in caves, mine tunnels and the abandoned nests of Fairy Martins, and forages over areas of continuous forest habitat (Greg Richards and Associates, 2000; 2005). Roosting habitat is absent for the study area and surrounds (Appendix 2).

Scientific Name	Common Name	Data Source				Sensitivity to Loss ²	BRW ^{2,5}	Conservation Status		Likelihood to be on Study Area ⁵	Assessment of Likelihood
		BAMC ¹	TBDC ²	BioNet ³	PMST ⁴			BC Act	EPBC Act		
<i>Chalinolobus picatus</i>	Little Pied Bat	-	-	✓	-	-	-	V	-	Nil	The Little-Pied Bat is found in inland NSW (including Western Plains and slopes). Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimil box woodlands areas (OEH, 2019g). Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. Absent from the upper slopes and tablelands and unlikely to occur on the study area.

¹ Biodiversity Assessment Method online Credit Calculator (OEH, 2019a): Ec = Ecosystem credit species; Sp = Species credit species.

² Threatened Biodiversity Data Collection (OEH, 2019e)

³ NSW Atlas of Wildlife (OEH, 2019f)

⁴ Protected Matters Search Tool (DEE, 2019a)

⁵ Species with two likelihoods recorded are dual ecosystem credit and species credit species. The first likelihood refers to ecosystem credits and the second to species credits.

⁶ NSW *Fisheries Management Act 1994*.

E = Endangered; CE = Critically Endangered; V = Vulnerable; M = Migratory.

2.4.2 Likelihood of Threatened Species Occurrence on the Study Area

BAMC allows the assessor to include or exclude from further consideration the candidate threatened species selected by the calculator if the species:

- has habitat constraints listed in the TBDC and none of these constraints are present on the development footprint;
- is vagrant in the area (taken as the record being well outside the species range or natural distribution); and
- is unable to use the habitat constraints listed in the TBDC, or known microhabitats that the species requires to persist on or use because the habitat constraints are degraded to the point where the species will no longer be present.

The likelihood of occurrence of each candidate species has been assessed in Tables 6 and 7 based on distribution records in the NSW Atlas of Wildlife (OEH, 2019f), and information in both the TBDC (OEH, 2019e) and referenced scientific publications. The assessment of BMS (Appendix 2) for fauna has been accepted in Table 7.

2.4.3 Ecosystem Credit Species

No flora species returned by BAMC were ecosystem credit species. Of the 31 ecosystem credit fauna species listed by BAMC (Table 7 and Appendix 4), 17 are considered unlikely to occur on the study area for the reasons given in Tables 6 and 7, and 15 are considered to have potential foraging habitat on the study area. Most potential foraging species are only likely to utilise the site rarely to occasionally as nomadic visitors. Three ecosystem credit species identified by the BAMC that have habitat constraints on the study area (OEH, 2019e) are excluded in BAMC as potentially occurring (BAM section 6.4.1.10) (Table 8).

Table 8. Ecosystem Credit Fauna Considered Unlikely to Occur on the Study Area.

Common Name	Scientific Name	Habitat Constraint on Study Area
White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>	Not within 1 km of a large water body.
Glossy Black Cockatoo	<i>Calyptorhynchus lathami</i>	Casuarinas and Allocasuarinas absent.
Painted Honeyeater	<i>Grantiella picta</i>	Mistletoes at lower than 5 per ha.

2.4.4 Species Credit Species

The seven candidate threatened flora species identified by BAMC (Table 6 and Appendix 6) are all species credit species. Five are considered unlikely to occur on the study area because of the high degree of site disturbance (Table 9). Three of these are also perennial shrubs and the field survey showed no shrubs remain on the site (Table 9). Two species credit flora species are considered to have potential habitat on the study area, *Swainsona recta* (Small Purple-pea) and *Swainsona sericea* (Silky Swainson-pea). Since survey timing was outside that recommended for these species, they are assumed to be present in BAMC. While there is some potential for these species to be present, given the poor condition of the vegetation on the study area, it is considered unlikely that either of these two flora species are actually present.

19 potential species credit fauna species were identified by BAMC (Table 7, Appendix 2).

Appendix 2 provides a detailed fauna survey and analysis of habitat constraints for each potential species credit fauna species. Key results are summarised below in Table 9 for species for which it was concluded the study area was unlikely to be suitable.

The Squirrel Glider was identified on the study area by the surveys and included as present in BAMC (Table 9). Appropriately timed field surveys and analysis of habitat constraints concluded that 14 of the 19 candidate species are absent from the study area (Table 9). Survey timing was outside that recommended for four other species, three of which are assumed to be present in BAMC; the Pink-tailed Legless Lizard, Little Eagle and Superb Parrot (Appendix 2). The Little Eagle and Superb Parrot were not detected by the survey, but are considered likely to forage sporadically on the study area with some potential to breed. Although the Pink-tailed Legless Lizard is assumed to be present, it is considered unlikely to occur owing to marginal habitat.

Table 9. Species Credit Flora and Fauna Considered Unlikely to Occur on the Study Area.

Common Name	Scientific Name	Reasons for Exclusion from BAMC
Flora		
Ausfeld's Wattle	<i>Acacia ausfeldii</i>	Site disturbance has removed former shrub layer. Survey determined shrubs were absent.
Yass Daisy	<i>Ammobium craspedioides</i>	This species is very sensitive to disturbance. The study area has been pasture-improved and heavily grazed and is considered highly unlikely to be suitable habitat.
-	<i>Euphrasia arguta</i>	This species is very sensitive to disturbance. The study area has been pasture-improved and heavily grazed and is considered highly unlikely to be suitable habitat.
Tumut Grevillea	<i>Grevillea wilkinsonii</i>	Known habitats of this species are absent from the study area (Table 6). Site disturbance has removed former shrub layer. Survey determined shrubs were absent.
Granite Zieria	<i>Zieria obcordata</i>	Known habitats of this species are absent from the study area (Table 6). Site disturbance has removed former shrub layer. Survey determined shrubs were absent.
Fauna		
Golden Sun Moth	<i>Synemon plana</i>	The flora survey found the study area and surrounds lack the extensive swards of Wallaby Grasses (<i>Rytidosperma</i> spp.) required by the Golden Sun Moth (Table 7).
Square-tailed Kite	<i>Lophoictinia isura</i>	Potential nests not detected.
White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>	Potential nesting habitat close to large waterbodies not present.
Bush Stone-curlew	<i>Burhinus grallarius</i>	Not identified by targeted survey.
Glossy Black Cockatoo	<i>Calyptorhynchus lathami</i>	Not identified by bird survey.
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	Not identified by targeted survey.
Swift Parrot	<i>Lathamus discolor</i>	Important habitat not present (confirmed by OEH). Not identified by bird surveys.
Barking Owl	<i>Ninox connivens</i>	Not identified by targeted survey.
Masked Owl	<i>Tyto novaehollandiae</i>	Not identified by nocturnal bird survey.
Regent Honeyeater	<i>Anthochaera phrygia</i>	Important habitat not present (confirmed by OEH). Not identified by bird surveys.
Koala	<i>Phascolarctos cinereus</i>	Not identified by targeted survey.

Brush-tailed Rock Wallaby	<i>Petrogale penicillata</i>	No rocky escarpments of cliff lines within 1 km of study area.
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	Camps not present.
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	Caves not present.

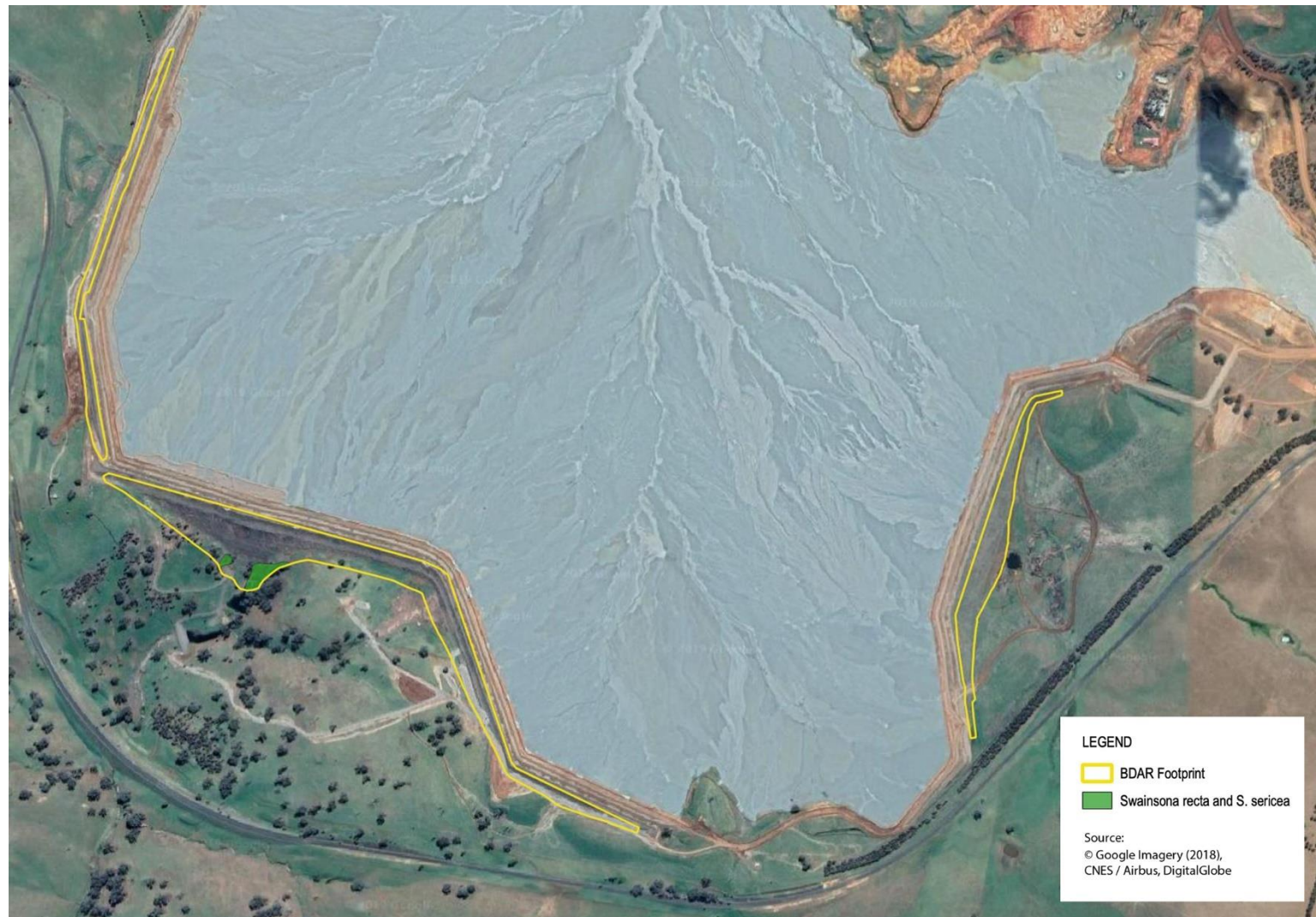


Figure 6. Species Polygons for *Swainsona recta* and *Swainsona sericea*.

Table 10 shows the six species credit species included in BAMC for offsetting. Species polygons for the Small Purple-pea and the Silky Swainson-pea are given on Figure 6. These species potentially occupy the same areas of remnant Box-Gum Woodland habitat. Species polygons for the four fauna species are given in Appendix 2.

Table 10. Species Credit Flora and Fauna Potentially Able to Utilise the Study Area.

Common Name	Scientific Name	Biodiversity Risk Weighting	Likelihood of Occurrence	Area (ha)
Flora				
Small Purple-pea	<i>Swainsona recta</i>	2.00	Low	0.31
Silky Swainson-pea	<i>Swainsona sericea</i>	2.00	Low	0.31
Fauna				
Pink-tailed Legless Lizard	<i>Aprasia parapulchella</i>	2.00	Low	0.31
Little Eagle	<i>Hieraaetus morphnoides</i>	1.50	Low	0.31
Superb Parrot	<i>Polytelis swainsonii</i>	2.00	High	0.31
Squirrel Glider	<i>Petaurus norfolcensis</i>	2.00	High	0.31

2.4.5 Threatened Species Listed under the EPBC Act

Two fauna species listed as Critically Endangered under the EPBC Act are considered to have a low probability of utilising the site; the Swift Parrot and Regent Honeyeater (Table 5). Both are nomadic species that are only likely to use the study area occasionally, if at all, for foraging when eucalypts are in flower. The site is unsuitable for breeding by the Regent Honeyeater and the Swift Parrot is a winter migrant to the mainland, breeding only in Tasmania. Potential food resources on the study area are limited to patches of mature *Eucalyptus albens* trees, which may attract both species in occasional seasons of high nectar flow. However, only 0.31 ha of these trees is proposed for removal, with very much larger areas being retained. Accordingly, the loss of these trees is highly unlikely to result in a significant adverse impact on either species and referral of Modification 13 to the DEE is not required.

2.4.6 State Environmental Planning Policy 44

NSW State Environmental Planning Policy (SEPP) 44 aims to protect habitat utilised by the Koala, which is known to occur sparsely on the Central West Slopes, mainly in forested habitats (OEH, 2019f). The dominant remnant eucalypt species on and around the development footprint is recognised as secondary Koala food trees (OEH, 2018), namely *Eucalyptus albens*, which is also listed as a Koala food tree in Schedule 2 of SEPP 44. Accordingly, there is a requirement under SEPP 44 for consideration of the site as potential Koala habitat. The site does not have an extant Koala population (Appendix 2). Therefore, it does not include 'core' Koala habitat and a SEPP 44 plan of management is not required.

3 STAGE 2 – IMPACT ASSESSMENT

Stage 2 involves assessing the potential direct and indirect impacts on biodiversity, describing impact avoidance and mitigation measures and determining the offset requirements.

3.1 MEASURES TO AVOID AND MINIMISE IMPACTS

Established measures to avoid and minimise impacts on biodiversity are summarised in this section and Table 10.

3.1.1 Vegetation Removal Strategy

Native vegetation immediately adjoining the proposed clearance areas will be clearly marked to avoid accidental damage during vegetation clearance activities. Vegetation removal will be conducted in accordance with the Vegetation Clearance Protocol in the Cadia Land and Biodiversity Management Plan, to minimise harm to wildlife that may be inhabiting hollows in the hollow-bearing trees that are proposed for removal. This is particularly important given that the mature *Eucalyptus albens* trees are known to support a population of vulnerable Squirrel Gliders, some of which are likely to be displaced by tree removal. It is important that:

- Tree removal is undertaken with consideration to seasonal factors (wherever practicable, vegetation clearance is undertaken during late summer/autumn).
- Felled trees are inspected for the presence of fauna. Injured fauna are captured using recommended techniques prescribed by WIRES and WIRES is contacted for first aid and temporary care of the animal.
- Uninjured fauna are relocated into surrounding native woodland.

3.1.2 Weed Management Strategy

The existing weed control measures undertaken at CVO would be extended to prevent unwanted priority and environmental plants from becoming established in and around the study area.

3.1.3 Animal Pest Management and Monitoring

The existing animal pest control measures undertaken at CVO would be extended to the study area, including destruction of the pest and/or removal of harbor/habitat where possible.

3.1.4 Summary of Avoidance and Mitigation Actions

Table 11 summarises avoidance and mitigation actions with expected outcomes, timing and management responsibility.

Table 11. Avoidance and Minimisation Measures, Responsibility and Timing.

Action	Outcome	Timing	Responsibility	Source
During Construction				
Native vegetation immediately adjoining the proposed clearance area is clearly marked to prevent accidental damage.	No damage to trees earmarked for protection and retention.	Throughout construction phase.	Site Manager.	CVO Land and Biodiversity Management Plan.
Inspection of felled trees for the presence of fauna.	Harm to hollow-dwelling wildlife minimised. Injured wildlife cared for and recovered by WIRES. Displaced wildlife released into appropriate habitat nearby.	During paddock clearing operations.	Environmental Superintendent.	CVO Land and Biodiversity Management Plan
Post Construction				
Weed management.	Noxious and high priority weeds controlled.	Annual inspections and control as required.	Environmental Superintendent.	CVO Land and Biodiversity Management Plan.
Pest Animal Management: Baiting, destruction of harbour and exclusion (e.g. fencing).	Pest animals, especially feral pigs, foxes, rabbits, wild dogs, feral cats and brown hares.	Annual inspections and control as required.	Environmental Superintendent.	CVO Land and Biodiversity Management Plan.
Site closure				
Incorporate development footprint into existing rehabilitation strategy.	Safe and sustainable landforms.	Following completion of construction.	Environmental Superintendent.	CVO Rehabilitation Strategy.

3.2 DIRECT AND INDIRECT IMPACTS

3.2.1 Direct Impacts

The development footprint includes two small patches of Box Gum Woodland (totalling 0.31 ha) that would be removed for Modification 13.

Approximately 3.9 ha of exotic-dominated grassland would also be removed.

3.2.2 Indirect Impacts

Inadvertent Impacts on Adjacent Habitat or Vegetation

Removal of 0.31 ha of Box Gum Woodland would be undertaken in accordance with the existing Vegetation Clearance Protocol outlined in the CVO Land and Biodiversity Management Plan, to avoid inadvertent impacts on adjacent habitat or vegetation.

Viability of Adjacent Habitat due to Noise, Dust and Light Spill

There may be some noise, dust and light spill impacts to adjacent habitat during construction of the buttressing. However, these impacts are likely to be negligible and are not expected to continue following completion of construction. It should be noted that the extant Squirrel Glider population is located adjacent to the existing buttress indicating that the local population either adapted to the disturbance when the STSF was first constructed or recolonised the area post-construction.

Weeds and Pathogens

No additional impacts relating to weeds and pathogens are expected, as the buttressing is an extension to the existing STSF embankment. Management of weeds and pathogens in the development footprint would be conducted in accordance with the existing weed management strategy.

Pests and Predatory Species

No additional impacts relating to pest animals and predatory species are expected, as the buttressing is an extension to the existing STSF embankment. The existing pest animal and predatory species control measures undertaken at CVO would be extended to the study area.

Increased Risk of Starvation, Exposure and Loss of Shelter

Impacts of Modification 13 on native vegetation and wildlife habitat are considered unlikely to occur beyond the development footprint, as evidenced by the continued health of adjoining native vegetation following the construction of the STSF. Accordingly, the project is unlikely to cause an increased risk of starvation, exposure and loss of shelter for fauna species inhabiting the wider locality.

Loss of Breeding Habitats

Modification 13 is not considered likely to indirectly cause loss of breeding habitats in the wider locality. Potential breeding habitat resides principally in the remnant native tree cover. There is no evidence the STSF has caused tree decline or loss in adjacent areas.

Fertiliser Drift

No additional impacts relating to fertiliser drift are expected, as land management in areas adjoining the development footprint is not expected to change. The existing land management measures undertaken at CVO (and detailed in the CVO Land and Biodiversity Management Plan) would continue to be applied to the study area.

Increased Risk of Fire

The existing fire management measures undertaken in accordance with the CVO Bushfire Management Plan would be extended to the study area, to prevent increased risk of fire.

Other Indirect Impacts

There would be no indirect impacts associated with the following:

- reduced viability of adjacent habitat due to edge effects;
- trampling of threatened flora species;
- inhibition of nitrogen fixation and increased soil salinity;
- rubbish dumping;
- wood collection;
- bush rock removal and disturbance; and
- disturbance to specialist breeding and foraging habitat.

3.3 PRESCRIBED IMPACTS

No prescribed biodiversity impacts are likely to occur as a result of Modification 13.

3.4 SUMMARY OF IMPACTS ON BIODIVERSITY

3.4.1 Serious and Irreversible Impacts

No threatened ecological communities, populations, flora or fauna species meet the criteria for Serious and Irreversible Impacts as a result of Modification 13 (OEH, 2017b) (Sections 2.2 and 2.3).

3.4.2 Vegetation Clearance Requiring Offsetting

Modification 13 would result in the loss of 0.31 ha of Box-Gum Woodland EEC (PCT266) having a current Vegetation Integrity Score of 50.2 and a future Vegetation Integrity Score of zero. BAMC valued the vegetation loss at 8 credits.

3.4.3 Vegetation Clearance Not Requiring Assessment or Offsetting

All other vegetation on the site comprises exotic-dominated ground cover which does not require offsetting. As stated in Section 2.2.4, the exotic dominated grassland has very low biodiversity value, having a Vegetation Integrity Score of only 2.5 and is not required to be offset.

3.4.4 Species Credit Species

The main impact on species credit species is the loss of 0.31 ha of Box-Gum Woodland, which is known habitat of the Squirrel Glider, potential habitat of the Small Purple-pea, Silky Swainson-pea, Superb Parrot and Little Eagle, and possible, but unlikely, habitat of the Pink-tailed Legless Lizard. The total credit liability for the six species credit species is 46 credits (Table 12).

Table 12. Biodiversity Credits for Species Credit Species (Appendix 3).

IBRA sub-region	Threatened Species	Conservation Status	Biodiversity Risk Weighting	No. of species credits
Upper Slopes	Small Purple-pea	Endangered	2.00	8
	Silky Swainson-pea	Vulnerable	2.00	8
	Pink-tailed Legless Lizard	Vulnerable	2.00	8
	Little Eagle	Vulnerable	1.50	6
	Superb Parrot	Vulnerable	2.00	8
	Squirrel Glider	Vulnerable	2.00	8
Total credits				46

3.4.5 Cumulative Impacts

The cumulative impacts of Modification 13 on remnant native vegetation loss are considered negligible given that 79 percent of the Mandurama Slopes Mitchell Landscape is estimated to have been cleared historically, i.e. 98,184 ha (Table 13). Modification 13 would add 0.31 ha to that loss, or 0.3×10^{-5} percent. However, this loss will be offset in accordance with the Biodiversity Offset Scheme. No losses would occur on the other two Mitchell Landscapes on the study area, Canobolas Slopes and Canobolas Sheet Basalts.

Table 13. Cumulative Losses of Native Vegetation in Affected Mitchell Landscapes.

Mitchell Landscape	Area of Landscape (ha)	Percent Cleared	Modification Clearance (ha)	Additional Clearance (%)
Mandurama Slopes	124,284	79	0.31	0.3×10^{-5}

Note: Sourced from the 'Over-cleared Landscapes Database' within the BioNet Vegetation Classification Database (OEH, 2019b)

3.5 BIODIVERSITY CREDIT REPORT

3.5.1 BAM Assessment Number

The Assessment Identification Number within the BAMC is 00016429/BAAS18048/19/00016430.

3.5.2 Ecosystem Credits for Removal of Native Vegetation

The biodiversity credit report output from the BAMC is provided as Appendix 3. The credit report indicates that the total area of native vegetation (0.31 ha) to be removed from the development footprint is valued at 8 ecosystem credits.

3.5.3 Species Credits for Threatened Species

The total species credits for two threatened flora species and four threatened fauna species is 46 (Table 12).

3.6 OFFSET

CHPL would make a payment to the NSW Biodiversity Trust Fund, administered by the NSW Biodiversity Conservation Trust, to acquit the liability of the 8 ecosystem credits and 46 species credits. The total cost of the payment has been determined the BAM calculator as \$86,308.64. The payment summary report is provided in Appendix 5.

CHPL would not:

- retire biodiversity credits in accordance with the like-for-like requirements or variation offset rules; or
- undertake rehabilitation of a site impacted by mining under a mining lease as a measure to offset impacts to the Box-Gum Woodland.

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APPENDIX 1

Flora Species Lists

APPENDIX 1. Flora Species Lists

	Quadrat	EG1 ¹		EG2		BG1	
Scientific Name	Common Name	Cover (%)	Nos.	Cover (%)	Nos.	Cover (%)	Nos.
CLASS FILICOPSIDA							
Aspleniaceae							
<i>Pleurosorus rufifolius</i>	Bristly Cloak Fern					<1	1
CLASS MAGNOLIOPSIDA							
SUBCLASS MAGNOLIIDAE							
Asteraceae							
* <i>Arctotheca calendula</i>	Capeweed					<1	20
* <i>Carthamus lanatus</i>	Saffron Thistle					<1	20
* <i>Chondrilla juncea</i>	Skeleton Weed	1	30			1	50
* <i>Cirsium vulgare</i>	Spear Thistle	<1	5			<1	20
* <i>Conyza sumatrensis</i>	Tall Fleabane	1	30				
* <i>Crepis capillaris</i>	Smooth Hawksbeard					1	100
* <i>Hypericum perforatum</i>	St. Johns Wort					<1	1
* <i>Hypochaeris radicata</i>	Flatweed	1	50				
* <i>Lactuca serriola</i>	Prickly Lettuce	<1	2				
<i>Senecio quadridentatus</i>	Cotton Fireweed					<1	1
* <i>Silybum marianum</i>	Variiegated Thistle	<1	1			1	100
* <i>Sonchus asper</i>	Prickly Sowthistle	<1	10				
* <i>Sonchus oleraceus</i>	Common Sowthistle					<1	50
Boraginaceae							
* <i>Echium plantagineum</i>	Paterson's Curse	1	50			1	1001
Brassicaceae							
* <i>Lepidium africanum</i>						<1	5
Chenopodiaceae							
<i>Einadia nutans</i>	Climbing Saltbush					1	200
Fabaceae - Faboideae							
* <i>Medicago minima</i>	Woolly Burr Medic	5	200	<1	1		
* <i>Trifolium subterraneum</i>	Subterranean Clover					2	500
Gentianaceae							
* <i>Centaurium erythraea</i>	Common Centaury	<1	1				
Geraniaceae							
* <i>Erodium cicutarium</i>	Common Storksbill	<1	40			2	500
<i>Geranium solanderi</i>	Native Geranium					<1	10
Lamiaceae							
* <i>Marrubium vulgare</i>	White Horehound					<1	2
* <i>Salvia verbenaca</i>	Vervain					5	1000
Malvaceae							
<i>Brachychiton populneus</i>	Kurrajong					<1	1
* <i>Malva parviflora</i>	Small-flowered Mallow					<1	1
* <i>Modiola caroliniana</i>	Red-flowered Mallow	<1	5			<1	10
Myrtaceae							
<i>Eucalyptus albens</i>	White Box					10	1
Onagraceae							
<i>Epilobium billiardiereanum</i>		1	50				
Oxalidaceae							
<i>Oxalis exilis</i>						<1	10
<i>Oxalis perennans</i>		<1	2				
Plantaginaceae							
* <i>Plantago lanceolata</i>	Lamb's Tongues	<1	6				
Polygonaceae							
* <i>Polygonum aviculare</i>	Wireweed	<1	1			<1	5
<i>Rumex brownii</i>	Swamp Dock			1	10	1	100
Rosaceae							
<i>Acaena echinata</i>						<1	301

Scientific Name	Common Name	EG1 ¹		EG2		BG1	
		Cover (%)	Nos.	Cover (%)	Nos.	Cover (%)	Nos.
Rubiaceae							
* <i>Galium aparine</i>	Goosegrass					<1	5
Solanaceae							
* <i>Solanum nigrum</i>	Black-berry Nightshade					<1	2
SUBCLASS LILIIDAE							
Cyperaceae							
<i>Carex inversa</i>				1	100	2	500
Lomandraceae							
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>						<1	3
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush					<1	1
Poaceae							
<i>Anthosachne scabra</i>	Wheatgrass					<1	10
<i>Austrostipa scabra</i>	Speargrass					<1	3
* <i>Avena barbata</i>	Bearded Oats					<1	20
* <i>Avena</i> sp.		20	000s				
<i>Bothriochloa macra</i>	Red Grass					1	200
* <i>Bromus catharticus</i>	Prairie Grass	<1	30			2	500
* <i>Dactylis glomerata</i>	Cocksfoot	10	200	80	3000	20	500
* <i>Eragrostis cilianensis</i>	Stinkgrass	<1	2				
* <i>Lolium perenne</i>	Perennial Ryegrass					5	1000
* <i>Phalaris aquatica</i>	Phalaris	30	300	5	200	5	100
<i>Rytidosperma racemosum</i>		<1	20			2	200
Typhaceae							
<i>Typha orientalis</i>	Broadleaf Cumbungi	<1	2				
Total Native Species							
		19					
Total Introduced Species							
		33					
Total Species							
		52					

¹ EG = Exotic-dominated Grassland; BG = Box-Gum Woodland

APPENDIX 2

Fauna Survey Report
(Biodiversity Monitoring Services)

**Cadia Valley Operations
Cadia Hill Tailings Completion Modification**

Fauna Survey Report



for
Newcrest Mining Limited

July 2019

Biodiversity Research Pty Ltd
trading as Biodiversity Monitoring Services
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Executive Summary

Biodiversity Monitoring Services were commissioned by Cadia Holdings Pty Ltd to undertake a baseline fauna survey in an area encompassing the proposed Cadia Hill Tailings Completion Modification associated with the Cadia Valley Operations. The study area is located in the Central Tablelands of New South Wales (NSW), approximately 25 kilometres southwest of Orange.

Fauna field surveys were undertaken in February and June 2019. The surveys included targeted surveys and habitat assessments for threatened fauna species listed under the NSW *Biodiversity Conservation Act, 2016* and Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* with potential to occur in the study area at the time of the survey. Survey techniques included bird surveys, call playbacks, spotlighting, evidence searches (e.g. for scats, tree scratches, nests and potential hollows) and habitat assessments.

Mapping of the study area shows large areas of disturbed ground surrounded by areas of exotic grassland. Suitable habitat for several threatened species still occurs, with resources such as occasional paddock and hollow-bearing trees, logs and flowering eucalypt feed trees. Other habitat constraint features, such as flowing rocky streams, native grassland and cliffs/caves were absent.

Fifty-five (55) species of vertebrate fauna were recorded during the surveys, comprising three amphibians, one reptile, 42 birds and nine mammals. Based on the survey results, the following species credit species remain relevant to the study area:

- Pink-tailed Legless Lizard (*Aprasia parapulchella*) (potential habitat present and species not targeted during surveys due to seasonal timing constraints);
- Little Eagle (*Hieraaetus morphnoides*) (potential habitat present and species not targeted during surveys due to seasonal timing constraints);
- Superb Parrot (*Polytelis swainsonii*) (potential habitat present and species not targeted during surveys due to seasonal timing constraints); and
- Squirrel Glider (*Petaurus norfolcensis*) (present).

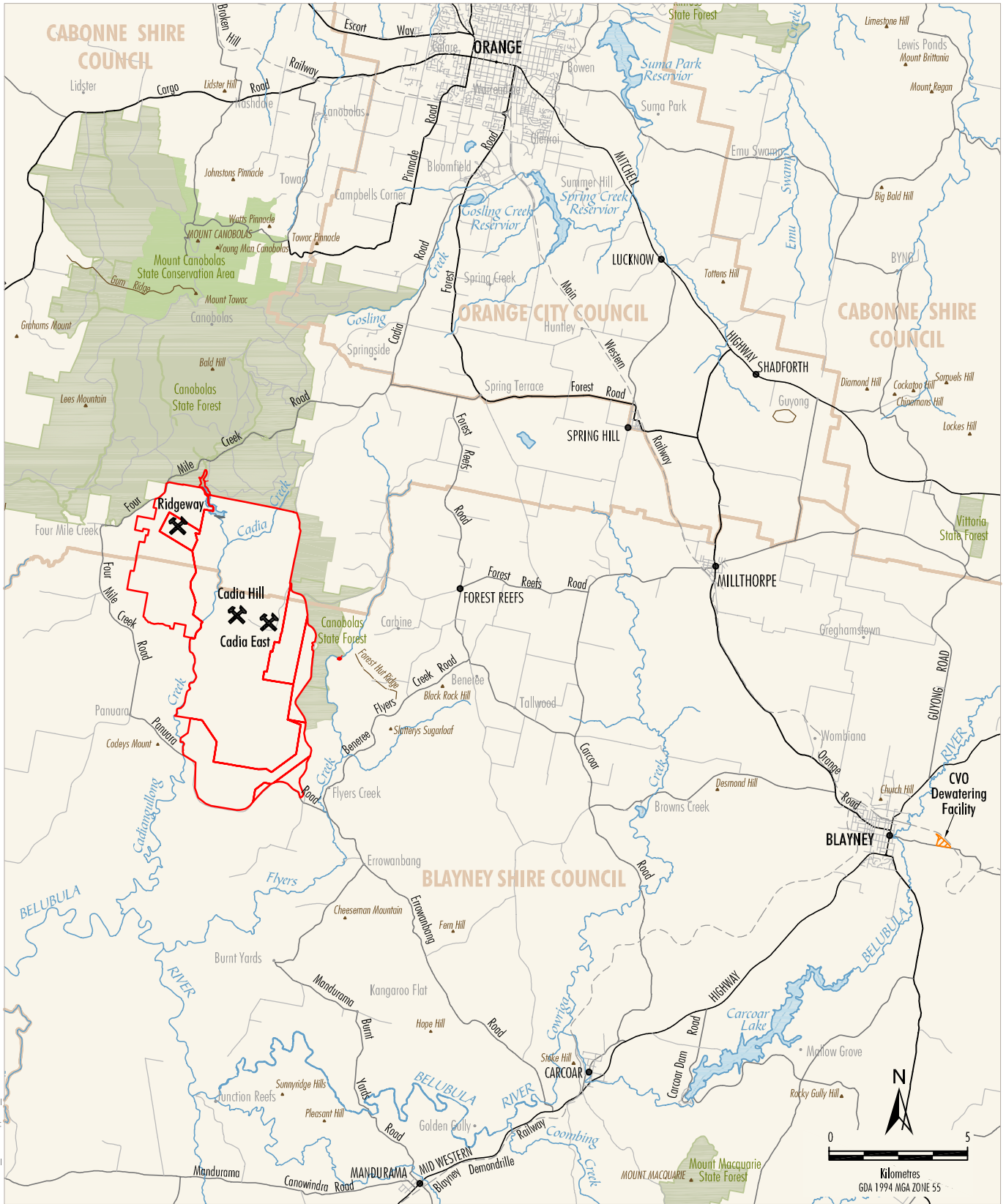
1.0 INTRODUCTION

1.1 BACKGROUND

The Cadia Valley Operations (CVO) are located approximately 25 kilometres (km) southwest of Orange, in the Central Tablelands of New South Wales (NSW) (**Figure 1-1**). Cadia Holdings Pty Limited (CHPL) is the owner and operator of the CVO, and is a wholly owned subsidiary of Newcrest Mining Limited.

CHPL intends to submit a modification to Project Approval 06_0295 under section 4.55 of the *Environmental Planning and Assessment Act, 1979*. The main activities associated with the Cadia Hill Tailings Completion Modification (Modification 13) include:

- increasing the tailings level from 560 metres (m) Australian Height Datum (AHD) (consolidated tailings level) to 713 mAHD (pre-consolidation tailings level);
- an additional 177 million tonnes (Mt) of capacity, equivalent to approximately seven years of additional deposition to this storage facility;
- decommissioning and closure of the existing ventilation adit VR101, located in the Cadia Hill open pit, which would be inundated by tailings;
- installation of a new ventilation adit within the currently approved disturbance footprint of Cadia East (outside of the Cadia Hill open pit);
- construction of additional buttressing for the Southern Tailings Storage Facility (STSF) embankment; and
- a pit lake (i.e. a “wet cover”) as the final landform of the Cadia Hill open pit, consistent with the approved final landform.



HEC18-a-01_MOD13_Aprr F52_101A



- LEGEND**
- Mining Lease/Mining Lease Application Boundary
 - Local Government Area
 - Road
 - - - Railway
 - NSW State Forest
 - NPWS Reserve

Source: Department of Lands NSW (2006);
Department of Industry (2017)



CADIA VALLEY OPERATIONS
Regional Location

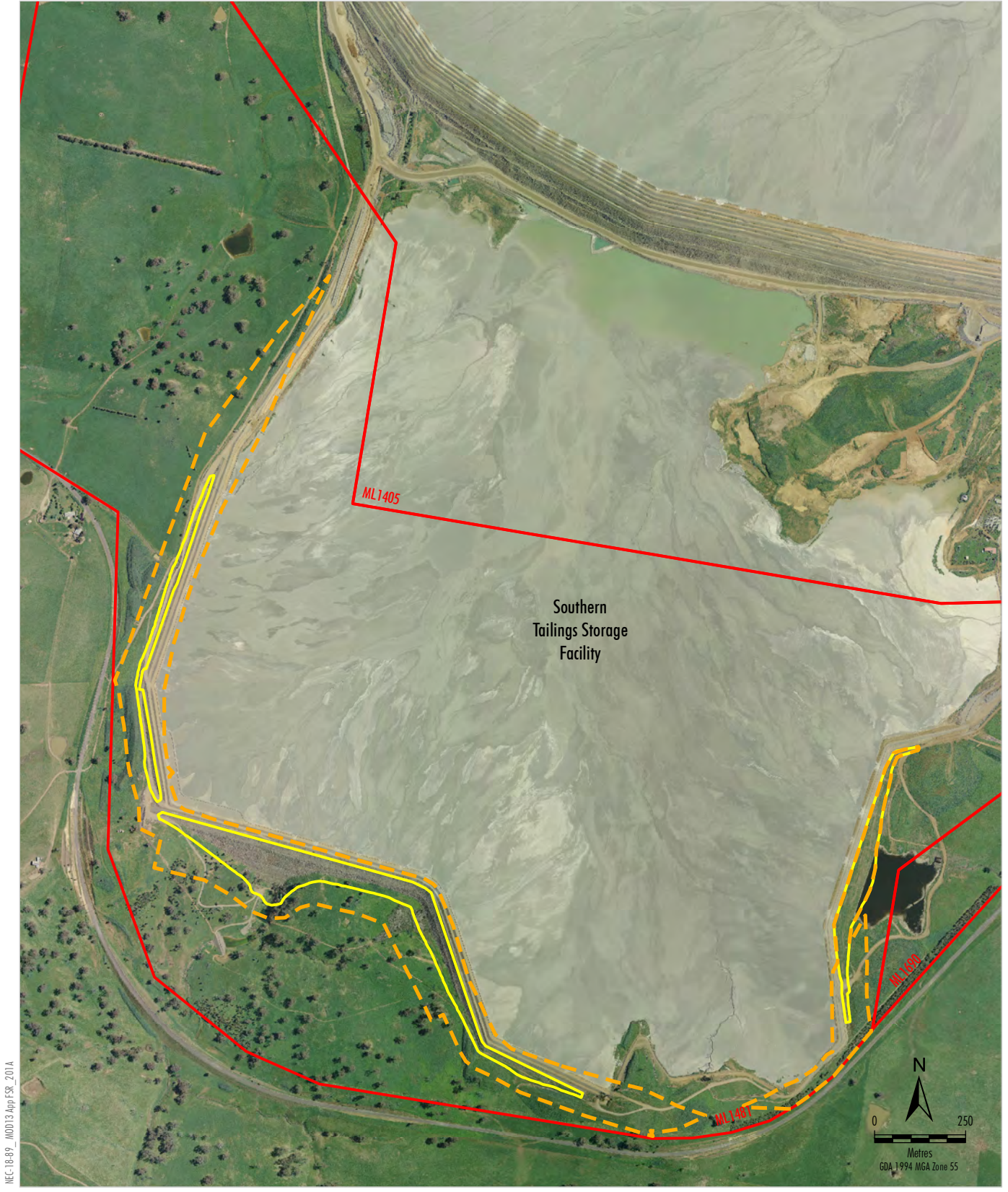
Figure 1-1

1.2 PURPOSE

Targeted surveys and habitat assessment were undertaken within the development footprint for the proposed STSF buttressing, in addition to the areas immediately adjacent (the study area) (**Figure 1-2**), collecting data on threatened fauna species and fauna habitat to inform this report.

Biodiversity Monitoring Services (BMS) has undertaken the following:

- conducted a desktop review of potential species and confirm which would require targeted surveys in accordance with the Biodiversity Assessment Method (BAM) (OEH, 2017);
- conducted field surveys within the study area for fauna species that can be surveyed in the timeframe given (by June 2019), in accordance with relevant State and Commonwealth guidelines (i.e. timing and duration of surveys, methods to locate species and methods to identify potential habitat);
- conducted targeted surveys for threatened fauna listed under the *Biodiversity Conservation Act, 2016* (BC Act) and *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) that could potentially occur within the study area, in accordance with relevant State and Commonwealth guidelines;
- described habitat features for threatened fauna species that could potentially occur within the study area;
- mapped and described suitable habitat for threatened fauna species; and
- prepared a Baseline Fauna Survey Report (as Appendix 2 to the Biodiversity Development Assessment Report [BDAR] prepared by FloraSearch) documenting the survey methods and results.



MEC-18-89 - MOD13 Apr-FSR_2014

- LEGEND**
- Mining Lease Boundary
 - Proposed Southern Tailings Storage Facility
 - Facility Buttress (Development Footprint)
 - Study Area

Source: CHPI (2018)
 Orthophoto CVO - Flown November 2016



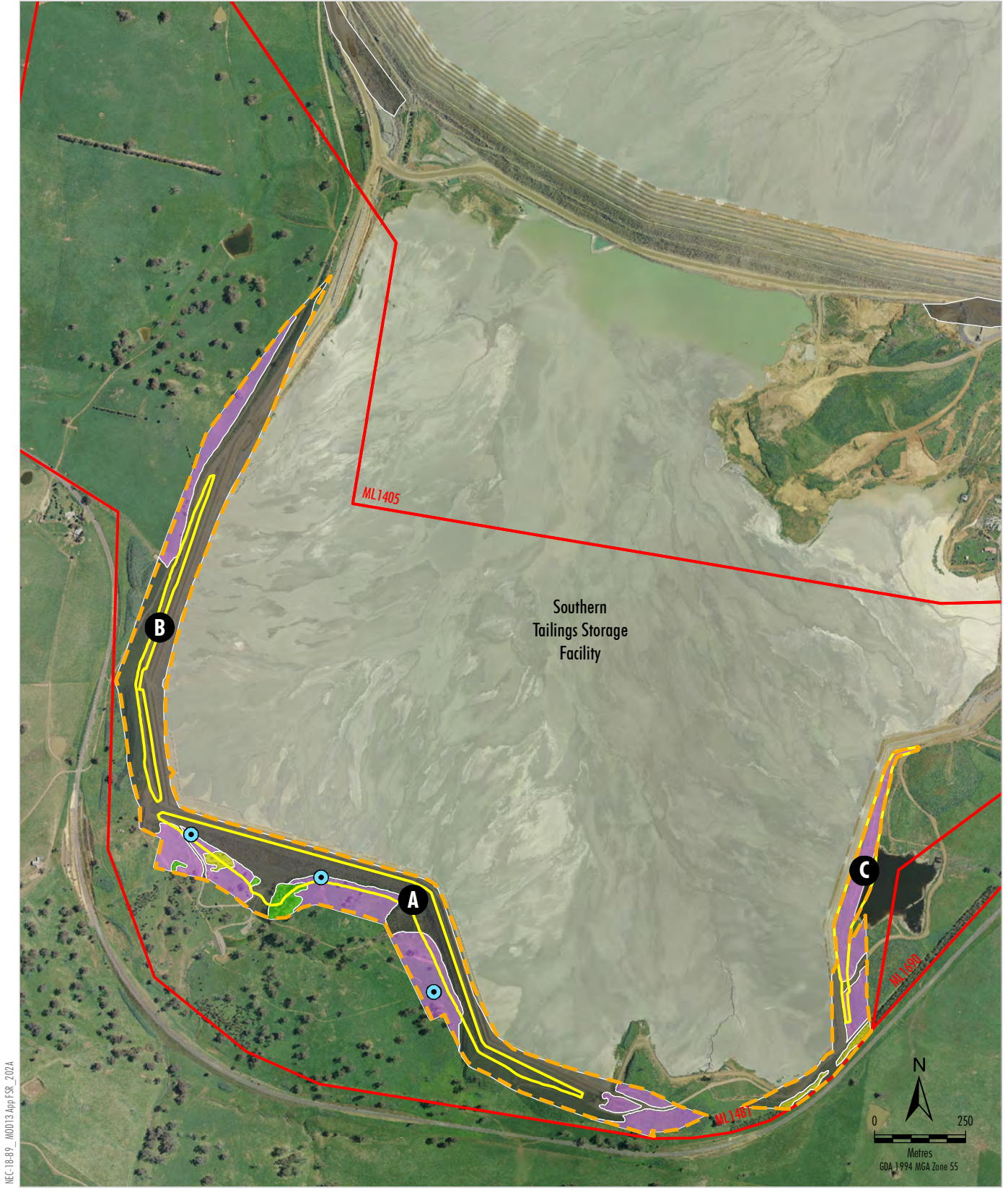
CADIA VALLEY OPERATIONS
Proposed Southern Tailings Storage Facility
Buttress

Figure 1-2

1.3 EXISTING ENVIRONMENT










In terms of the broader context, the study area sits amongst a landscape dominated by grazing lands with scattered paddock trees.

Detailed floristic descriptions are provided in the FloraSearch report. Initial mapping of the study area (**Figure I-3**) shows large areas of disturbed ground. Around this are some areas of exotic grassland (purple zone). In the eastern section, this consists mainly of pasture grasses. In the western section it consists mainly of a ground layer of exotic grass and forbs such as *Xanthium spinosum* (Bathurst Burr), thistles, *Echium plantagineum* (Paterson's Curse) and mallow. Some of Survey Area A (**Figure I-3**) marked as exotic grassland contains mature hollow-bearing *Eucalyptus albens* (White Box) trees (some living, some dead). These areas still retain habitat features that could be utilised by threatened fauna species. The middle of Survey Area A contains a gully with mature hollow-bearing *Eucalyptus albens* trees. There is a dam containing water in the bottom of this gully, and another intermittently wet dam below Study Area C (**Figure I-3**) (empty in February, but contained some water in June). Two sections of regrowth/plantings have been identified (yellow zone), one on the slope west of the gully, and another along the boundary fence in Study Area C (**Figure I-3**). These trees are approximately 6 m in height and under 25 centimetres (cm) diameter at breast height (DBH).



MEC-18-89 - MOD13 Apr/F5R_2024

LEGEND

- | | | | |
|---|--|---|--------------------|
|  | Mining Lease Boundary |  | 2 Box Gum Woodland |
|  | Proposed Southern Tailings Storage Facility Buttress (Development Footprint) |  | 3 Exotic Grassland |
|  | Study Area |  | 6 Disturbed Ground |
|  | Survey Area |  | 7 Plantings |
|  | Call Playback | | |

Source: CHPI (2018)
Orthophoto CVO - Flown November 2016



CADIA VALLEY OPERATIONS
Survey Sites and Call Playbacks

Figure 1-3

2.0 METHODS

A combination of desktop and database searches, habitat assessment and physical surveys were used to determine the potential presence of fauna in the study area.

2.1 DATABASE AND LITERATURE SEARCH

Threatened fauna previously recorded in the wider locality are summarised in **Table 2-1**.

Table 2-1: Threatened Fauna Previously Recorded in the Wider Locality

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class	BioNet Database ³	Previous Survey Results in the Wider Locality ⁴
		BC Act ¹	EPBC Act ²			
Birds						
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	Species/Ecosystem	-	a, b, c
<i>Lathamus discolor</i>	Swift Parrot	E	CE	Species/Ecosystem	-	c
<i>Neophema pulchella</i>	Turquoise Parrot	V	-	Ecosystem	-	a
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	-	Ecosystem	-	d, e
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	V	-	Ecosystem	-	c
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	Species/Ecosystem	-	f
<i>Artamus cyanopterus</i>	Dusky Woodswallow	V	-	Ecosystem	✓	-
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	Ecosystem	-	c, d
Mammals						
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	Species	-	g, h
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Species/Ecosystem	✓	-

<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V	-	Ecosystem	-	h, i, j, k
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	-	-	Species/Ecosystem	-	i, j, l

- ¹ Conservation status under the BC Act (current as at June 2019). CE = Critically Endangered, E = Endangered, V = Vulnerable.
- ² Conservation status under the EPBC Act (current as at June 2019). CE = Critically Endangered, E = Endangered, V = Vulnerable.
- ³ Office of the Environment and Heritage (2019b)
- ⁴ Previous survey results from Project area at given sampling sites sourced from the following:
- a = Resource Strategies (2000)
 - b = Resource Strategies (2002c)
 - c = Western Research Institute (2007)
 - d = James Warren and Associates (2000a)
 - e = Western Research Institute (2005)
 - f = Debus, pers. comm., 1999 in Resource Strategies (2000)
 - g = Resource Strategies (2008)
 - h = Resource Strategies (2002b)
 - i = Greg Richards and Associates (2000)
 - j = Greg Richards and Associates (2005)
 - k = Greg Richards and Associates (2007)
 - l = Biodiversity Monitoring Services (2018)

2.2 FIELD SURVEYS

2.2.1 SURVEY TIMING

The study area was visited between the 13th and 15th February 2019 to conduct target bird surveys. The study area was visited again for further target fauna surveys between 4th and 7th June 2019. This second lot of surveys included call playback, spotlighting, bird survey and habitat assessment. Both times, the study area was surveyed by Andrew Lothian using National Parks and Wildlife Service Scientific Licence No. SL101725 and Department of Primary Industry's Animal Research Authority No. TRIM 16/559.

2.2.2 SURVEY TECHNIQUES

The methodology follows that specified in the draft working guidelines produced by the Department of Environment and Conservation (DEC) (2004). Although these guidelines are

in draft form and still subject to review, they provide an important direction on survey methodology, including suggested survey effort. A summary of the survey effort in each survey period is given in **Table 2-2** and methodologies for each fauna type are summarised in **Table 2-3**.

Table 2-2: Total fauna survey effort

Survey technique	Number of surveys (February)	Number of surveys (June)
Diurnal Bird Survey	9 (60 minutes each)	6 (30 minutes each)
Call Playback	0	3
Hand Spotlighting	0	3 (6 km total)
Vehicle Spotlighting Transects	0	3 (6 km total)

Table 2-3: Methods used to target threatened species

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class ³	Targeted survey methodology
		BC Act ¹	EPBC Act ²		
Amphibians					
<i>Litoria booroolongensis</i>	Booroolong Frog	E	E	Species	Habitat assessment. Not targeted due to survey timing.
Reptiles					
<i>Aprasia parapulchella</i>	Pink-tailed Legless Lizard	V	V	Species	Habitat assessment. Not targeted due to survey timing.
Birds					
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	Species/Ecosystem	Bird survey, nest tree survey.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	-	Species/Ecosystem	Habitat assessment. Not targeted due to lack of suitable habitat.
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	Species/Ecosystem	Habitat assessment. Not targeted due to survey timing.
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	Species	Bird survey, call playback, spotlight.
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V	E	Species/Ecosystem	Bird survey, nest tree survey.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	Species/Ecosystem	Bird survey, nest tree survey.
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	Species/Ecosystem	Habitat assessment. Not targeted due to survey timing.
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	Species/Ecosystem	Important area mapping consultation. Study area not in important area.
<i>Lathamus discolor</i>	Swift Parrot	E	CE	Species/Ecosystem	Important area mapping consultation. Study area not in important area.

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class ³	Targeted survey methodology
		BC Act ¹	EPBC Act ²		
<i>Ninox connivens</i>	Barking Owl	V	-	Species/Ecosystem	Spotlight, call playback.
Mammals					
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	Species	Spotlight.
<i>Phascolarctos cinereus</i>	Koala	V	V	Species/Ecosystem	Spotlight, call playback, scat/scratching search, habitat assessment/feed tree identification.
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	Species	Spotlight, call playback.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Species/Ecosystem	Habitat assessment. Not targeted due to survey timing and lack of suitable habitat (known breeding camps).
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	-	Species/Ecosystem	Habitat assessment. Not targeted due to lack of suitable habitat.

Note: Species highlighted are those surveyed by Biodiversity Monitoring Services.

- ¹ Conservation status under the BC Act (current as at June 2019). E = Endangered, V = Vulnerable.
- ² Conservation status under the EPBC Act (current as at June 2019). E= Endangered, V = Vulnerable.
- ³ Biodiversity credit class under the *Threatened Biodiversity Data Collection* (OEH, 2019a) (current as at July 2019).

The study area was of small enough size that the entirety of the area was surveyed in full. Visibility was good as trees were either absent or scattered, and access was sufficient to walk Study Area's A, B and C (**Figure I-3**).

Bird Surveys

DEC (2004) recommend a total of three 60 minute surveys to sample approximately 90 percent (%) of the species present in an area. February bird surveys and habitat assessment were conducted in three locations (Survey Areas A, B and C [**Figure I-3**]) over three days in February. A mix of morning and afternoon survey periods were used to account for

temporal changes in species' use of the study area. Species targeted during these surveys include Gang-gang Cockatoo (*Callocephalon fimbriatum*) and Square-tailed Kite (*Lophoictinia isura*). Habitat assessment focused on characteristics of the habitat that would be suitable for the species concerned (hollow bearing trees and stick nests).

Areas of fallen timber were searched during daylight hours in an attempt to flush Bush Stone-curlews that could be resting among the logs.

Six additional 30 minute bird surveys were conducted in the study area whilst on-site for habitat assessment over two afternoons in June (one in each of the three areas per day). These surveys aimed to pick up any of the threatened species associated with the Plant Community Type (PCT) in the Interim Biogeographic Regionalisation for Australia subregion (**Table 2-4**).

Table 2-4: Biobanking Report – South Eastern Highlands – fauna dual Species/Ecosystem Credit Species, filtered for PCT 266

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class ³	Survey Months for Each Species												
		BC Act ¹	EPBC Act ²		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Amphibians																	
<i>Litoria booroolongensis</i>	Booroolong Frog	E	E	Species	-	-	-	-	-	-	-	-	-	-	-	Yes	Yes
Reptiles																	
<i>Aprasia parapulchella</i>	Pink-tailed Legless Lizard	V	V	Species	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes	-
Birds																	
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	Species/Ecosystem	Yes	-	-	-	-	-	-	-	-	Yes	Yes	Yes	Yes
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	-	Species/Ecosystem	-	-	-	-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	Species/Ecosystem	-	-	-	-	-	-	-	-	Yes	Yes	Yes	-	-
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class ³	Survey Months for Each Species												
		BC Act ¹	EPBC Act ²		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V	E	Species/Ecosystem	-	-	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	-	
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	Species/Ecosystem	Yes	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes
<i>Lathamus discolor</i>	Swift Parrot	E	CE	Species/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	Species/Ecosystem	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes	-
<i>Ninox connivens</i>	Barking Owl	V	-	Species/Ecosystem	-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	Species/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	-
Mammals																	
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Phascolarctos cinereus</i>	Koala	V	V	Species/Ecosystem	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class ³	Survey Months for Each Species												
		BC Act ¹	EPBC Act ²		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Species/Ecosystem	-	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	-	Species/Ecosystem	Yes	Yes	-	-	-	-	-	-	-	-	-	-	Yes

Note: Species highlighted are those surveyed by Biodiversity Monitoring Services.

- ¹ Conservation status under the BC Act (current as at June 2019). CE = Critically Endangered, E = Endangered, V = Vulnerable.
- ² Conservation status under the EPBC Act (current as at June 2019). CE = Critically Endangered, E = Endangered, V = Vulnerable.
- ³ Biodiversity credit class under the *Threatened Biodiversity Data Collection* (OEH, 2019a) (current as at July 2019).

Habitat Assessment

To assess the suitability of the habitat in the study area for of each of the potential target Species Credit Species, assessment of habitat attributes was conducted (**Table 2-5**). Both February and June surveys involved assessment of habitat characteristics that would make the impact footprint suitable for threatened species, particularly those that could not be surveyed for in the time constraints.

Notes were made on the following attributes:

- Presence of paddock trees (live or dead)
- Presence of existing nests
- Presence and size of hollows
- Presence of feed/prey species
- Presence of rocky streams
- Presence of fallen timber
- Proximity to dams/watercourses
- Proximity to clifflines, caves, rocky overhangs, culverts, mine shafts (considering OEH, 2018b).

For Regent Honeyeater (*Anthochaera phrygia*) and Swift Parrot (*Lathamus discolor*), OEH consultation confirmed mapped important areas for the species were not present.

Table 2-5: Survey of threatened fauna habitat constraints

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class ³	Habitat Constraints identified in the <i>Threatened Biodiversity Data Collection</i> (OEH, 2019a)	Field Assessment of Habitat Constraints
		BC Act ¹	EPBC Act ²			
Amphibians						
<i>Litoria booroolongensis</i>	Booroolong Frog	E	E	Species	None	N/A
Reptiles						
<i>Aprasia parapulchella</i>	Pink-tailed Legless Lizard	V	V	Species	Rocky areas or within 50 m of rocky areas.	Visual observation of rocky areas present in the study area.
Birds						
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	Species/Ecosystem	Breeding constraint: Other (Nest trees).	Survey for nest trees that could provide breeding habitat.
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V	-	Species/Ecosystem	Breeding constraint: Hollow bearing trees (Living or dead tree with hollows greater than 15 cm diameter and greater than 5 m above ground). Foraging constraint: Other (Presence of <i>Allocasuarina</i> and <i>Casuarina</i> species)	Survey for Eucalypt trees with hollows greater than 15cm diameter, that could provide breeding habitat. Survey for <i>Allocasuarina</i> and <i>Casuarina</i> species that could provide foraging habitat.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	-	Species/Ecosystem	Breeding constraint: Other (Living or dead mature trees within suitable vegetation within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines).	Survey for living or dead mature trees that could provide breeding habitat within 1 km of large

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class ³	Habitat Constraints identified in the <i>Threatened Biodiversity Data Collection</i> (OEH, 2019a)	Field Assessment of Habitat Constraints
		BC Act ¹	EPBC Act ²			
						waterbodies and major watercourses.
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	Species/Ecosystem	<i>Breeding constraint: Other (Nest trees – live (occasionally dead) large old trees within vegetation).</i>	Survey for live and dead nest trees and large trees with vegetation that could provide breeding habitat.
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	Species	<i>Fallen/standing dead timber including logs.</i>	Survey for fallen/standing dead timber, including logs.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	Species/Ecosystem	<i>Breeding constraint: Hollow-bearing trees (Eucalypt tree species with hollows greater than 9 cm diameter).</i>	Survey for Eucalypt trees with hollows greater than 9cm diameter, that could provide breeding habitat.
<i>Lathamus discolor</i>	Swift Parrot	E	CE	Species/Ecosystem	<i>Breeding constraint: Other (As per mapped important areas – contact OEH for information).</i>	OEH important area mapping – not present.
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	Species/Ecosystem	<i>Living or dead E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. acrocarpa, E. polyanthemos, E. mannifera, E. intertexta with hollows greater than 5 cm diameter; greater than 4 m above ground or trees with a DBH of greater than 30 cm.</i>	Survey for living and dead paddock trees, flowering eucalypts and hollows greater than 5 cm, over 4 m above ground in trees with DBH greater than 30 cm.
<i>Ninox connivens</i>	Barking Owl	V	-	Species/Ecosystem	<i>Breeding constraint: Hollow-bearing tree (Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground).</i>	Survey for living and dead hollow-bearing trees (greater than 20 cm diameter and greater than 4 m above the ground).

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class ³	Habitat Constraints identified in the <i>Threatened Biodiversity Data Collection</i> (OEH, 2019a)	Field Assessment of Habitat Constraints
		BC Act ¹	EPBC Act ²			
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	Species/Ecosystem	<i>Breeding constraint: Other (As per mapped areas; contact OEH).</i>	OEH important area mapping – not present.
Mammals						
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	Species	<i>Hollow-bearing trees.</i>	Survey for all trees with hollows.
<i>Phascolarctos cinereus</i>	Koala	V	V	Species/Ecosystem	<i>Breeding constraint: Other (Areas identified via survey as important habitat (see comments)).</i>	Survey for paddock trees that could provide breeding habitat. Survey for scats and scratches on trees.
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	Species	<i>None</i>	N/A
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Species/Ecosystem	<i>Breeding constraint: Other (Breeding camps).</i>	Survey for breeding camps.
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	-	Species/Ecosystem	<i>Breeding constraint: Caves (Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding).</i>	Survey for caves that could provide breeding habitat.

Note: Species highlighted are those surveyed by Biodiversity Monitoring Services.

¹ Conservation status under the BC Act (current as at June 2019). CE = Critically Endangered, E = Endangered, V = Vulnerable.

² Conservation status under the EPBC Act (current as at June 2019). CE = Critically Endangered, E = Endangered, V = Vulnerable.

³ Biodiversity credit class under the *Threatened Biodiversity Data Collection* (OEH, 2019a) (current as at June 2019).

Call Playback

Nocturnal birds and mammals were surveyed for by call playback over three nights in June 2019. Calls of Koala (*Phascolarctos cinereus*), Squirrel Glider (*Petaurus norfolcensis*), Barking Owl (*Ninox connivens*) and Bush Stone-curlew (*Burhinus grallarius*) were played from a megaphone in Survey Area A, each night from a different location (**Figure I-3**). At each location, an initial listening period of 10 minutes was undertaken, followed by a quick spotlight of the immediate area. Each call was played for a period of 5 minutes, followed by a 10 minute listening period (except Bush Stone-curlew which used a 30 second/5 minute play/listen cycle). Surveys were conducted within 2 hours of sunset.

Spotlighting

Nocturnal birds and mammals were surveyed for by spotlighting in June 2019, after the completion of call playbacks. This involved traversing Survey Area A (**Figure I-3**) with a hand-held 30 Watt (W) spotlight, searching all trees within the study area. Three two-hour spotlight surveys were conducted over three nights in Study Area A (which contained many trees). Each walked transect covered at least 2 km.

Due to the lack of trees or potential habitat features in Study Area's B and C, spotlighting in these locations was restricted to vehicle based spotlight transects using a 100 W spotlight. Each vehicle transect was approximately 1 km in length (total 6 km over three nights).

Searches

Whilst conducting habitat assessment of the study area, additional signs of animal use were noted. This involved searches for scats and characteristic markings on tree trunks, feed species, raptor nests/perches and potential hollows.

2.2.3 TARGETED SURVEYS

The purpose of the February survey was to target Gang-gang Cockatoo and Square-tailed Kite. Administrative hold ups prevented accessing the study area during January when these species need to be surveyed for. However, the conditions experienced during February this year were very similar to those in January, and prior to the seasonal migration of Gang-gang Cockatoos across their range. During this period, habitat constraint surveys for Large Bent-winged Bat (*Miniopterus orianae oceanensis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) were conducted.

June surveys targeted nocturnal species such as Brush-tailed Phascogale (*Phascogale tapoatafa*), Bush Stone-curlew, Squirrel Glider, Barking Owl and Koala. Diurnal bird census targeted Glossy Black-Cockatoo. Habitat assessment was finalised for all potential Ecosystem and Species Credit Species.

3.0 WEATHER DURING THE TRAPPING SURVEY

Data from weather station at Orange Airport, NSW (Australian Bureau of Meteorology 2019) is given in **Table 3-1**.

Table 3-1: Weather records from Orange during 2019 surveys

Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)
09/02/2019	14.4	21.6	13.4
10/02/2019	6.4	21.6	0
11/02/2019	7.8	25.6	0
12/02/2019	10.5	28.1	0
13/02/2019	10.7	18.7	0
14/02/2019	8.1	24.6	0
15/02/2019	9.5	26.4	0
01/06/2019	-0.4	13.8	0
02/06/2019	0.3	13.2	0.2
03/06/2019	3.0	5.9	3.8
04/06/2019	1.1	8.0	11.4
05/06/2019	0.9	10.0	0
06/06/2019	-3.1	13.3	0.2
07/06/2019	-1.2	13.9	0

Minimum temperatures were one degree Celsius (°C) below average for June in Orange, but maximum temperatures were approximately equal to the long term average.

Rainfall this May was 50% above the long term average. April was well below the long term average of 44.9 millimetres (mm), with only 0.2 mm of rain falling. March rainfall was 30% below the long term average. February and January rainfall were close to the long term average. No rain fell during either survey period, though the spotlighting nights were subject to dew/frosts.

Moon phase during the June surveys was waxing crescent. Conditions during spotlighting and call playbacks were cold with no wind.

4.0 RESULTS

4.1 FAUNA HABITAT

General habitat features in the study area that apply to a number of the potential credit species include:

- Live paddock trees with up to approximately 150 cm DBH
- Dead paddock trees (stags)
- Fallen timber
- Flowering eucalypts (*Eucalyptus albens*, *Eucalyptus melliodora* [Yellow Box]) and Acacia shrubs
- Koala feed species (*Eucalyptus albens* and *Eucalyptus melliodora* – both considered secondary feed species on the western slopes and plains [DECC, 2008])
- Trees with hollows ranging from 5 cm – 30 cm in diameter, greater than 4 m above the ground
- Two dams and one creekline
- Scattered embedded rocks, surrounded almost completely by weed species

The study area is located on mostly previously disturbed land and exotic grasslands. In general, the habitats of the study area were low quality and lacking in sufficient features such as flowing rocky streams, caves and connected shrubby vegetation areas to provide cover from predator species. However, habitat constraints for some species such as paddock or hollow-bearing trees and flowering eucalypts were present. Descriptions of habitat areas are described and discussed further below. Habitat trees recorded in the study area are provided in **Table 4-1**.

4.2 THREATENED FAUNA SPECIES

Appendix B lists all fauna species observed in the study area during the two survey periods. Threatened species observed are highlighted.

Based on the survey results (**Table 4-2**), the following Species Credit Species remain relevant to the study area:

- Pink-tailed Legless Lizard (potential habitat present and species not targeted during surveys due to seasonal timing constraints);
- Little Eagle (potential habitat present and species not targeted during surveys due to seasonal timing constraints);
- Superb Parrot (potential habitat present and species not targeted during surveys due to seasonal timing constraints); and
- Squirrel Glider (present).

Table 4-1: Habitat trees in the study area

ID	Tree species	UTM Zone	Easting	Northing	Fauna present	Hollow-bearing	DBH (cm)	Height above ground	Hollow size (cm)	Species			
										Little Eagle	Gang-gang Cockatoo	Superb Parrot	Squirrel Glider
1	<i>Eucalyptus albens</i>	55	685330	6288509	-	Yes	-	>4 m	20-15	✓	-	✓	✓
2	<i>Eucalyptus albens</i>	55	685225	6288695	-	Yes	-	>4 m	20-30	✓	-	✓	✓
3	Stag	55	685218	6288687	-	Yes	-	>4 m	15-20	✓	-	✓	✓
4	<i>Eucalyptus albens</i>	55	685204	6288675	-	Yes	-	>4 m	20	✓	-	✓	✓
5	<i>Eucalyptus albens</i>	55	685223	6288708	-	Yes	-	>4 m	30	✓	-	✓	✓
6	Stag	55	685089	6288881	-	-	-	>4 m	None	✓	-	-	✓
7	<i>Eucalyptus albens</i>	55	684853	6289037	-	Yes	-	>4 m	30	✓	✓	✓	✓
8	<i>Eucalyptus albens</i>	55	684819	6288953	-	Yes	-	>4 m	15-20	✓	-	✓	✓
9	<i>Eucalyptus albens</i>	55	684822	6288949	-	Yes	-	>4 m	15	✓	-	✓	✓
10	<i>Eucalyptus albens</i>	55	684442	6289154	-	Yes	-	>4 m	15-20	✓	-	✓	✓

ID	Tree species	UTM Zone	Easting	Northing	Fauna present	Hollow-bearing	DBH (cm)	Height above ground	Hollow size (cm)	Species			
										Little Eagle	Gang-gang Cockatoo	Superb Parrot	Squirrel Glider
11	<i>Eucalyptus albens</i>	55	684799	6288903	Two Common Ringtail Possum	-	70	>4 m	None	✓	-	-	✓
12	<i>Eucalyptus albens</i>	55	684831	6288939	One Common Ringtail Possum	-	60	>4 m	None	✓	-	-	✓
13	<i>Eucalyptus albens</i>	55	685003	6288891	Southern Boobook	-	150	>4 m	None	✓	-	-	✓
14	<i>Eucalyptus albens</i>	55	684809	6289019	One Squirrel Glider	-	60	>4 m	None	✓	-	-	✓
15	<i>Eucalyptus albens</i>	55	684812	6288994	One Squirrel Glider	-	90	>4 m	None	✓	-	-	✓
16	<i>Eucalyptus albens</i>	55	685110	6288834	Southern Boobook	-	100	>4 m	None	✓	-	-	✓
17	<i>Eucalyptus albens</i>	55	684814	6288948	One Common Ringtail Possum	-	25	>4 m	None	✓	-	-	✓

ID	Tree species	UTM Zone	Easting	Northing	Fauna present	Hollow-bearing	DBH (cm)	Height above ground	Hollow size (cm)	Species			
										Little Eagle	Gang-gang Cockatoo	Superb Parrot	Squirrel Glider
18	Acacia	55	684745	6288897	One Squirrel Glider	-	-	>4 m	None	✓	-	-	✓
19	<i>Eucalyptus albens</i>	55	684783	6288887	Two Common Ringtail Possum	-	100	>4 m	None	✓	-	-	✓
20	<i>Eucalypt spp.</i>	55	684666	6289032	-	Yes	-	>4 m	10	✓	-	✓	✓
21	<i>Eucalyptus albens</i>	55	684791	6288996	-	Yes	-	>4 m	small-large	✓	✓	✓	✓
22	<i>Eucalyptus albens</i>	55	684787	6288976	-	Yes	-	>4 m	10-15	✓	-	✓	✓
23	<i>Eucalyptus albens</i>	55	684782	6288949	-	Yes	-	>4 m	10	✓	-	✓	✓
24	<i>Eucalyptus albens</i>	55	684776	6288937	-	Yes	-	>4 m	10-20	✓	-	✓	✓
25	<i>Eucalyptus albens</i>	55	684759	6288928	-	Yes	-	>4 m	10-15	✓	-	✓	✓

ID	Tree species	UTM Zone	Easting	Northing	Fauna present	Hollow-bearing	DBH (cm)	Height above ground	Hollow size (cm)	Species			
										Little Eagle	Gang-gang Cockatoo	Superb Parrot	Squirrel Glider
26	<i>Eucalypt spp.</i>	55	684756	6288920	-	Yes	-	>4 m	25	✓	-	✓	✓
27	Stag	55	684755	6288909	-	Yes	-	>4 m	10-20	✓	-	✓	✓
28	<i>Eucalyptus albens</i>	55	684792	6288900	-	Yes	-	>4 m	10-30	✓	-	✓	✓
29	<i>Eucalyptus albens</i>	55	684805	6288894	-	Yes	-	>4 m	15	✓	-	✓	✓
30	<i>Eucalyptus albens</i>	55	684870	6288892	-	Yes	-	>4 m	15	✓	-	✓	✓
31	<i>Eucalyptus albens</i>	55	684892	6288886	-	Yes	-	>4 m	10-25	✓	-	✓	✓
32	<i>Eucalyptus albens</i>	55	684895	6288968	-	Yes	-	>4 m	10	✓	-	✓	✓
33	<i>Eucalyptus albens</i>	55	684866	6289026	-	Yes	-	>4 m	10-20	✓	-	✓	✓
34	Stag	55	684834	6289013	-	Yes	-	>4 m	5-15	✓	-	✓	✓
35	<i>Eucalyptus albens</i>	55	684804	6288957	-	Yes	-	>4 m	5-10	✓	-	✓	✓

Note: Highlighted trees are those located within the study area.

Table 4-2: Fauna species survey results

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class ³	Survey Result
		BC Act ¹	EPBC Act ²		
Amphibians					
<i>Litoria booroolongensis</i>	Booroolong Frog	E	E	Species	The species is unlikely to utilise the study area due to lack of sufficient habitat.
Reptiles					
<i>Aprasia parapulchella</i>	Pink-tailed Legless Lizard	V	V	Species	Habitat constraints (Table 2-5) are present. Targeted surveys not undertaken within timing specified by OEH (2019a).
Birds					
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	Species/Ecosystem	Not recorded, despite targeted surveys. Habitat constraints (nests) (Table 2-5) are not present.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	-	Species/Ecosystem	Habitat constraints (rivers, lakes, large dams or creeks, wetlands and coastlines) (Table 2-5) are not present. No targeted surveys are required.
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	Species/Ecosystem	Habitat constraints (potential nest trees) (Table 2-5) are present. Targeted surveys not undertaken.
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	Species	Habitat constraints (dead timber) (Table 2-5) are present. Not recorded, despite targeted surveys.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	Species/Ecosystem	Not recorded, despite targeted surveys. Habitat constraints (suitable hollow bearing trees) (Table 2-5) are present.

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class ³	Survey Result
		BC Act ¹	EPBC Act ²		
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V	-	Species/Ecosystem	Not recorded, despite targeted surveys. Breeding habitat constraints (suitable hollow bearing trees) (Table 2-5) are present, but foraging constraints are not.
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	Species/Ecosystem	Habitat constraints (suitable hollow bearing trees) (Table 2-5) are present. Targeted surveys not undertaken within timing specified by OEH (2019a).
<i>Ninox connivens</i>	Barking Owl	V	-	Species/Ecosystem	Habitat constraints (suitable hollow bearing trees) (Table 2-5) are present. Not recorded, despite targeted surveys.
Mammals					
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	Species	Not recorded, despite targeted surveys.
<i>Phascolarctos cinereus</i>	Koala	V	V	Species/Ecosystem	Not recorded, despite targeted surveys.
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	Species	Recorded.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Species/Ecosystem	Habitat constraints (camps) (Table 2-5) are not present. No targeted surveys are required.
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	-	Species/Ecosystem	Habitat constraints (caves) (Table 2-5) are not present. No targeted surveys are required.

¹ Conservation status under the BC Act (current as at June 2019). E = Endangered, V = Vulnerable.

² Conservation status under the EPBC Act (current as at June 2019). E = Endangered, V = Vulnerable.

³ Biodiversity credit class under the *Threatened Biodiversity Data Collection* (OEH, 2019a) (current as at June 2019).

4.2.1 THREATENED FROG

Booroolong Frog (*Litoria booroolongensis*) is classified as a 'Species Credit Species' in the Threatened Biodiversity Data Collection (OEH, 2019a). The specified survey period for this species is November and December when adult males can be heard calling to attract a mate (OEH, 2019a). As this species was not surveyed for, its presence/absence was assessed by habitat survey.

Booroolong Frogs occur in and near flowing rocky streams (OEH, 2018a). There were two drainage lines in the study area with water in them, both in Survey Area A (**Figure I-3**). In one, water is seeping out of the bottom of the existing buttress into a series of two dams connected by a culvert (**Plate 4-1**). These dams have a fine sediment substrate and there is little flow into the top of the first dam. The second drainage line runs from the dog leg in Survey Area A (**Figure I-3**) and flows west down a depression into the top of the second dam. Whilst there was a decent flow in the creekline at the time of the June survey, the substrate is not rocky. Instead it consists of thick mats of pasture grass, *Typha spp.* (Cumbungi) and other flat weeds. There is a dam below Study Area C (**Figure I-3**) which was empty at the time of the February survey (**Plate 4-2**). It contained some water during the June survey, but there is no flow into or out of the dam. Instead it appears to represent a farm dam, fed by catchment of the surrounding pasture.

Due to lack of sufficient habitat in the study area, the Booroolong Frog is unlikely to utilise the study area.



Plate 4-1: Two dams located to the south of the existing STSF buttress. Substrate is sediment with no/little flow



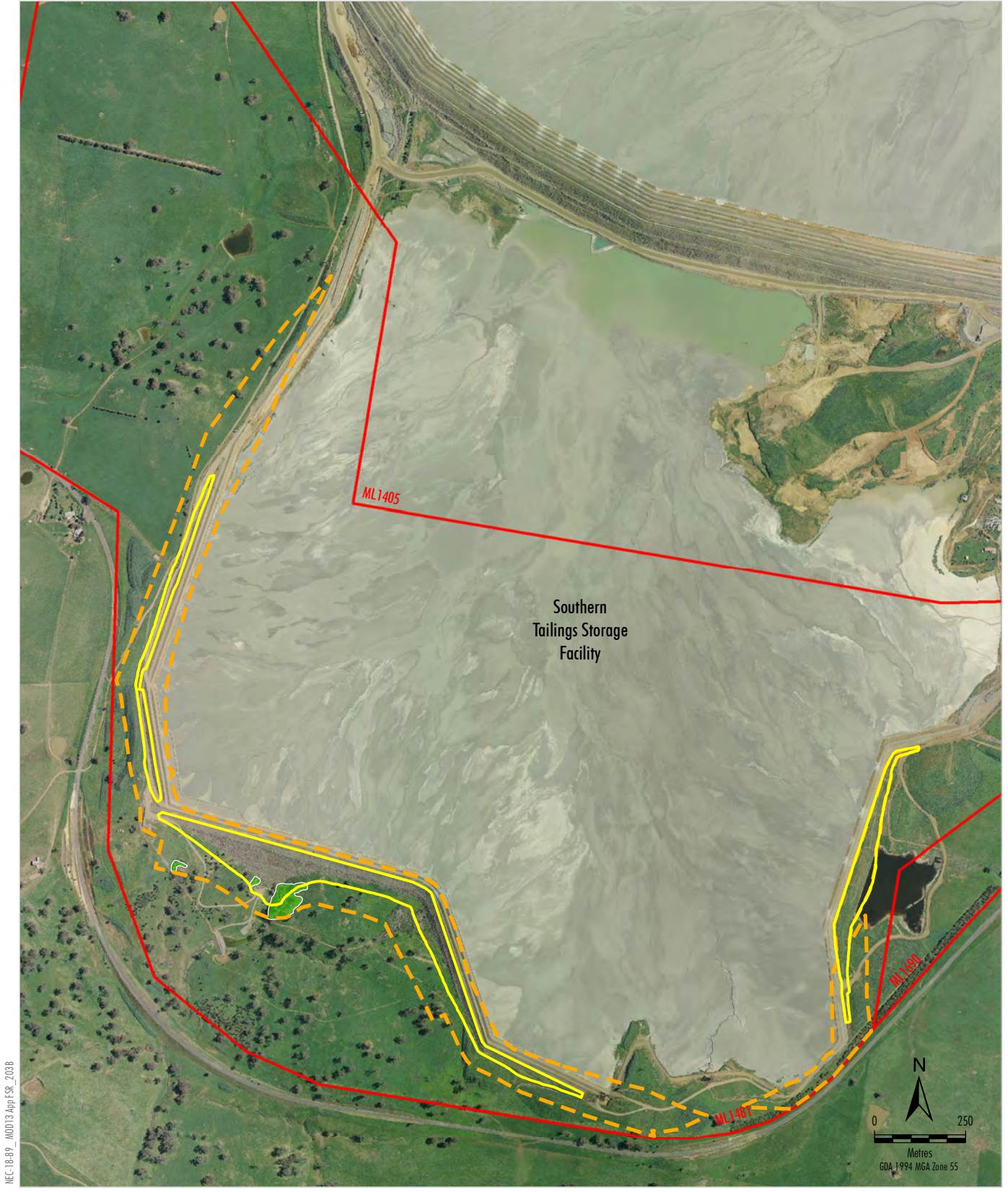
Plate 4-2: Farm dam in east of study area (in the brown depression at top right)

4.2.2 THREATENED REPTILE

Pink-tailed Legless Lizard (*Aprasia parapulchella*) is classified as a 'Species Credit Species' in the Threatened Biodiversity Data Collection (OEH, 2019a). The specified survey period is September through November when the species can be found under weathered rocks and logs feeding in ant nests (OEH, 2019a). Like most reptiles, they travel deeper underground to avoid the cooler surface temperatures in winter. As this species was not surveyed for, its presence/absence was assessed by habitat survey.

Known habitat for the Pink-tailed Legless Lizard is areas of sloping open woodland with a mostly native grassland ground layer (OEH, 2018a). Box-gum woodland, *Themeda australis* (Kangaroo Grass) and soils of volcanic origin are known associations (Wong *et al*, 2011). Habitat is well drained with scattered embedded rocks under which the species feeds and shelters. The lizard feeds on the larvae and eggs of ants and termites that nest under these rocks (OEH, 2018a). Leaf litter is low or absent and tree and shrub layers are often sparse. Though known habitat can contain exotic annual species, the presence of exotic rosette herbs and pasture grasses tend to be negatively associated with the species presence (Wong *et al*, 2011).

The study area contains most of the habitat features required for this species, though the dominance of exotic species in the ground layer reduces the quality of this habitat. Mapped exotic grassland (**Figure 1-3**) has been assessed as highly modified and not representative of derived native grassland (FloraSearch, 2019). The Pink-tailed Legless Lizard is therefore considered as highly unlikely to occur in the exotic grassland, and potential habitat is limited to native groundcover in the Box Gum Woodland (**Figure 4-1**).



MEC-18-89 - MOD13 Apr/FSR_2018

LEGEND

- Mining Lease Boundary
- Proposed Southern Tailings Storage Facility Buttress (Development Footprint)
- Study Area
- Pink-tailed Legless Lizard Habitat
Box Gum Woodland (PCT 266)

Source: CHPI (2018)
Orthophoto CVO - Flown November 2016



CADIA VALLEY OPERATIONS
Pink-tailed Legless Lizard Species Polygon

Figure 4-1

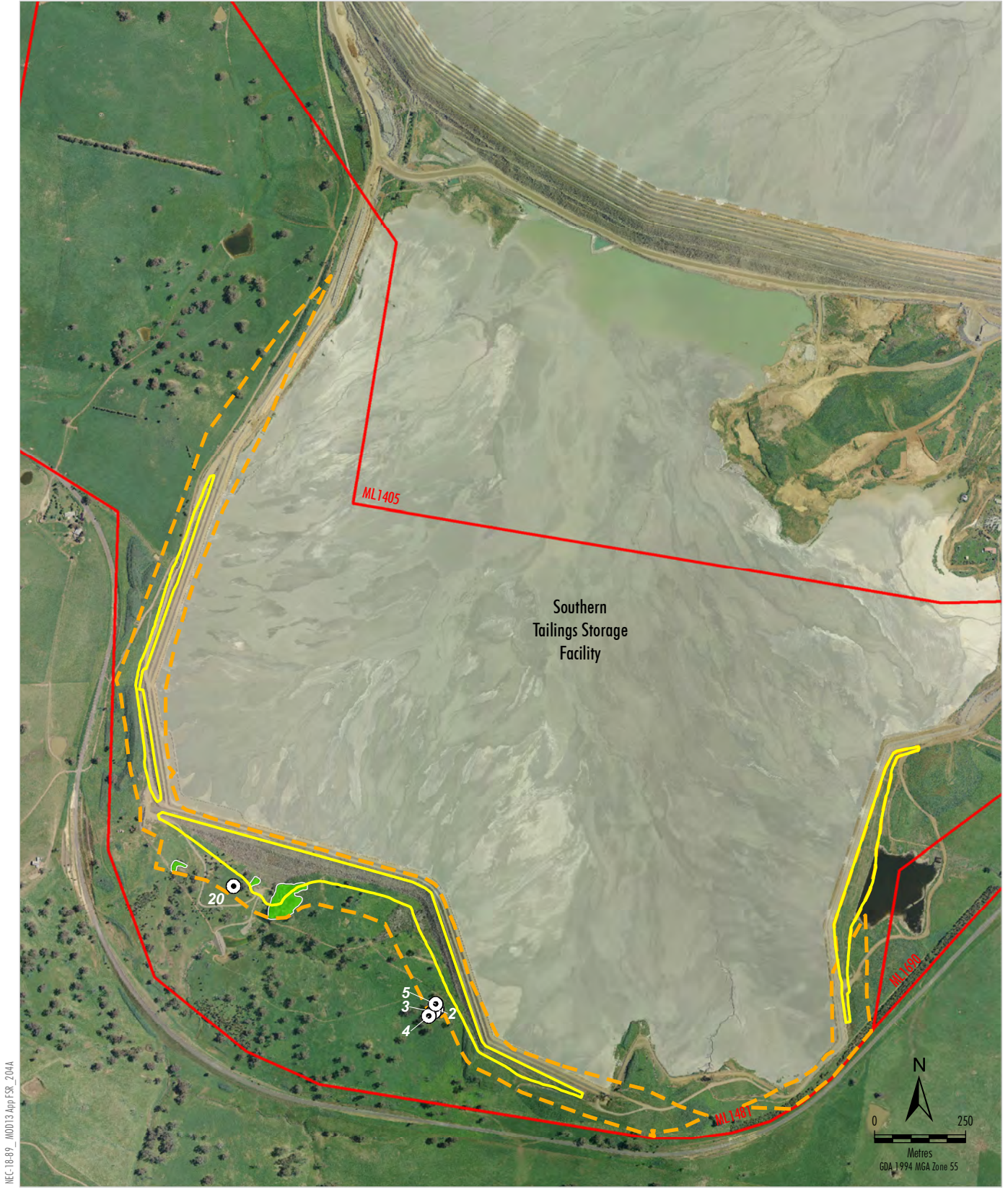
4.2.3 THREATENED BIRDS






Square-tailed Kite (*Lophoictinia isura*) was surveyed for in February, two weeks after the required survey period of September to January (OEH, 2019a) (due to logistical constraints). They are a spring-summer breeding migrant to the south eastern parts of Australia, nesting in trees along or near watercourses from July to February (Marchant and Higgins, 1993). As such, the survey effort and period for this species should be considered satisfactory. The presence of nest trees was specifically targeted as it is a recognised habitat constraint (OEH, 2019a). No potential Square-tailed Kite nests were found during the surveys.

White-bellied Sea-Eagle (*Haliaeetus leucogaster*) must be surveyed for between July and December when the species occupy large stick nests in emergent eucalypts proximal to water bodies (Marchant and Higgins, 1993; OEH, 2019a). One White-bellied Sea-Eagle has been sighted previously near Rodds Creek (*pers. comm.* CVO Environment Staff, 06/06/19). As surveys were not conducted for the species, habitat assessment was relied upon to assess the suitability of habitat. No large stick nests were observed in the study area. Survey Area C (**Figure I-3**) contains a small dam with a live paddock tree within 250 m. Survey Area A (**Figure I-3**) also contains small dam surrounded by living and dead paddock trees. Both water bodies are considered too small to support breeding habitat for the White-bellied Sea-Eagle.

Little Eagle (*Hieraaetus morphnoides*) must be surveyed for between August and October when the species occupy large stick nests in tall trees among remnant patches of woodland (Marchant and Higgins, 1993; OEH, 2019a). As surveys were not conducted for the species, habitat assessment was relied upon to assess the suitability of habitat. Survey Area A (**Figure I-3**) contains paddock trees (both living and dead), rendering the study area conducive to Little Eagle occupation (**Figure 4-2**).

Bush Stone-curlew (*Burhinus grallarius*) was surveyed for in June by spotlighting, call playback and diurnal flushing of habitat containing fallen logs. This species can be surveyed for year round (OEH, 2019a). The species was not sighted or heard during the three days/nights of survey, and can be considered absent from the study area. Foxes were spotlighted in the study area as well, reducing the likelihood of the species presence considerably.



LEGEND	
	Mining Lease Boundary
	Proposed Southern Tailings Storage Facility Buttress (Development Footprint)
	Study Area
Little Eagle Habitat	
	Box Gum Woodland (PCT 266)
	Paddock Trees that Provide Potential Habitat for the Little Eagle

Source: CHPI (2018)
 Orthophoto CVO - Flown November 2016



CADIA VALLEY OPERATIONS
 Little Eagle Species Polygon

Figure 4-2

Gang-gang Cockatoo (*Callocephalon fimbriatum*) was surveyed for in February, two weeks after the required survey period of October to January (OEH, 2019a) (due to logistical constraints). This species is an altitudinal migrant, moving from taller mountain forests in summer to lower elevation open woodlands in winter (Higgins, 1999). Due to the warm summer/autumn conditions experienced during 2019, it is unlikely that the Gang-gang Cockatoos left the area on their seasonal migration by mid February. As the study area is a lower elevation open woodland on the western slopes of the divide, they were surveyed for again in June to see if they were utilising the study area as a winter refuge. As such, the survey efforts and periods for this species should be considered satisfactory. Though the species was not seen during February or June surveys, the study area does contain suitable habitat parameters for Gang-gang Cockatoo occupation.

Glossy Black-Cockatoo (*Calyptorhynchus lathamii*) was surveyed for in June by diurnal bird census and habitat assessment. They are highly specialised, feeding on the seeds of *Casuarina* and *Allocasuarina* species (Higgins, 1999). Whilst the study area does contain some hollows that could be suitable nesting sites for the species, no Glossy Black-Cockatoos were observed during either survey period. This may be due to the lack of feed species present on site. The patch size and fragmented nature of the landscape in and around the study area also renders the habitat of low quality for this species.

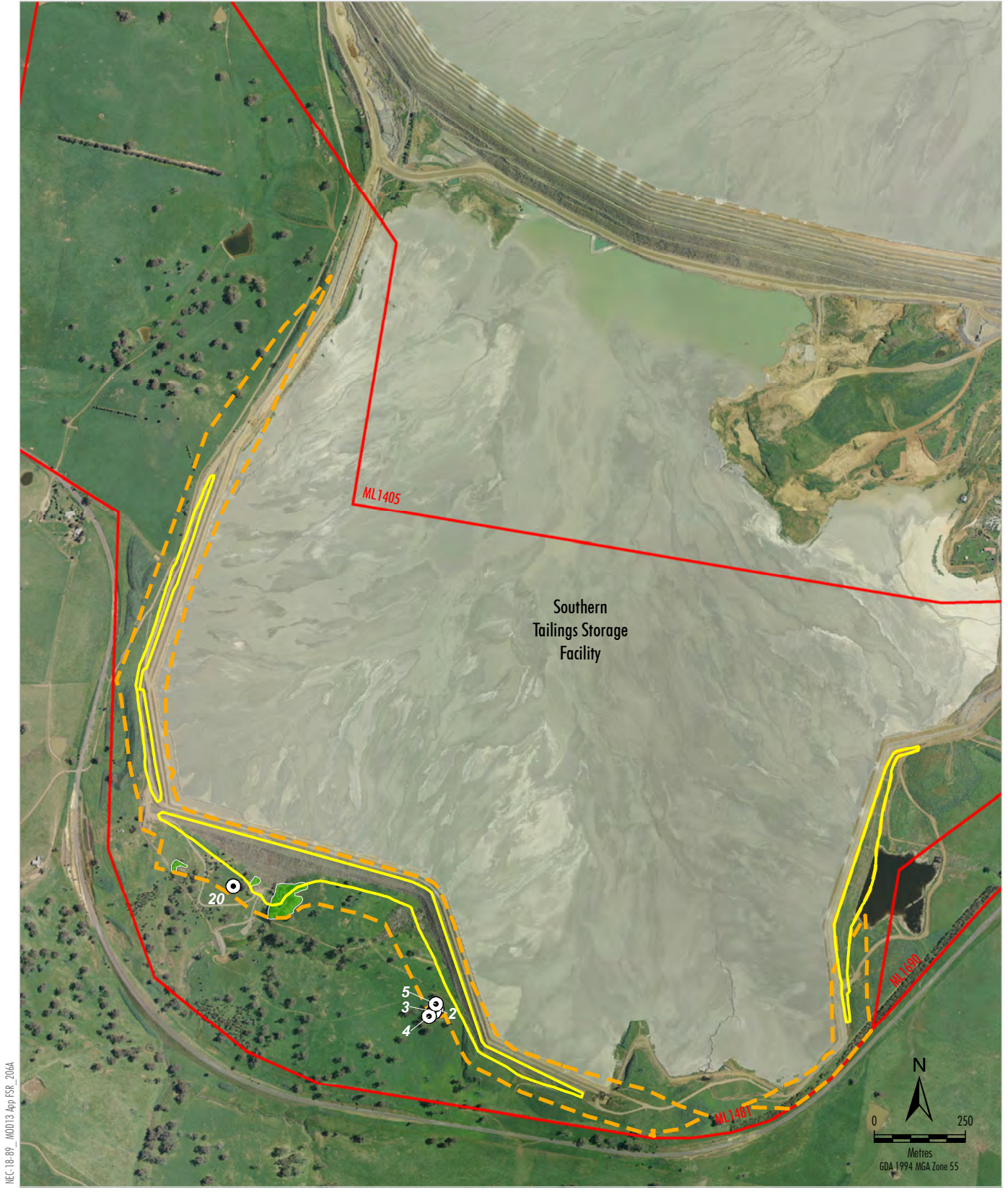
The study area contains a plethora of hollow bearing trees containing hollows greater than 9 cm in diameter. Other cockatoo species (Galah [*Eolophus roseicapilla*] and Sulphur-crested Cockatoo [*Cacatua galerita*]) were observed utilising the trees in the study area for roosts during both surveys. It is noted that a search of the OEH BioNet Database (2019a) indicated that isolated paddock trees are not considered important habitat for the Gang-gang Cockatoo, but they are for Glossy Black-Cockatoo.

Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) are included as Ecosystem Credit Species. As such, no surveys are required. They are only considered Species Credit Species if the study area lies in an area of mapped “important habitat” (OEH, 2019a). As important area maps for these species are not finalised yet, OEH was emailed for

confirmation on 31 May 2019. A return email from OEH on 3 June 2019 confirms that the study area is not within important areas for these species.






Superb Parrot (*Polytelis swainsonii*) must be surveyed for between September and November when the species are utilising nest hollows (OEH, 2019a). As surveys were not conducted for the species, habitat assessment was relied upon to assess the suitability of habitat. BioNet records show one Superb Parrot record from the north of the Cadia Mine in 2002 (OEH, 2019b). The study area contains many habitat features conducive to Superb Parrot occupation (**Figure 4-3**). Paddock trees (both living and dead), flowering eucalypts (*Eucalyptus albens* and *Eucalyptus melliodora*), and hollows greater than 5 cm, over 4 m above ground in trees with DBH greater than 30 cm were present in Survey Area A (**Figure 1-3**).

Barking Owl (*Ninox connivens*) was surveyed for in June by spotlighting and call playback. This species can be surveyed for from May to December (OEH, 2019a). The species was not sighted or heard during the three night survey, so can be excluded from the list of Species Credit Species. Habitat assessment did find paddock trees and hollows greater than 20 cm diameter over 4 m above ground.



MEC-18-89 - MOD13 Apr FSR_2064

LEGEND

- | | | | |
|---|--|---|--|
|  | Mining Lease Boundary |  | Superb Parrot Habitat
Box Gum Woodland (PCT 266) |
|  | Proposed Southern Tailings Storage Facility Buttress (Development Footprint) |  | Paddock Trees that Provide Potential Habitat for the Superb Parrot |
|  | Study Area | | |

Source: CHPI (2018)
Orthophoto CVO - Flown November 2016



CADIA VALLEY OPERATIONS
Superb Parrot Species Polygon

Figure 4-3

4.2.4 THREATENED MARSUPIALS

Brush-tailed Phascogale (*Phascogale tapoatafa*) was surveyed for in June by spotlighting. This arboreal carnivore can be surveyed for all year round (OEH, 2019a). The area contains rough barked paddock trees with a range of hollow sizes. However, the species was not sighted during the three night survey, even though every tree in and adjacent to Survey Area A (**Figure I-3**) was hand spotlighted each night.

Koala (*Phascolarctos cinereus*) was surveyed for in June by spotlighting and call playback. This species can be surveyed for all year round (OEH, 2019a). The species was not sighted or heard during the three night June survey, nor during diurnal census in February. No scats or characteristic scratches on trees were observed during habitat assessment.

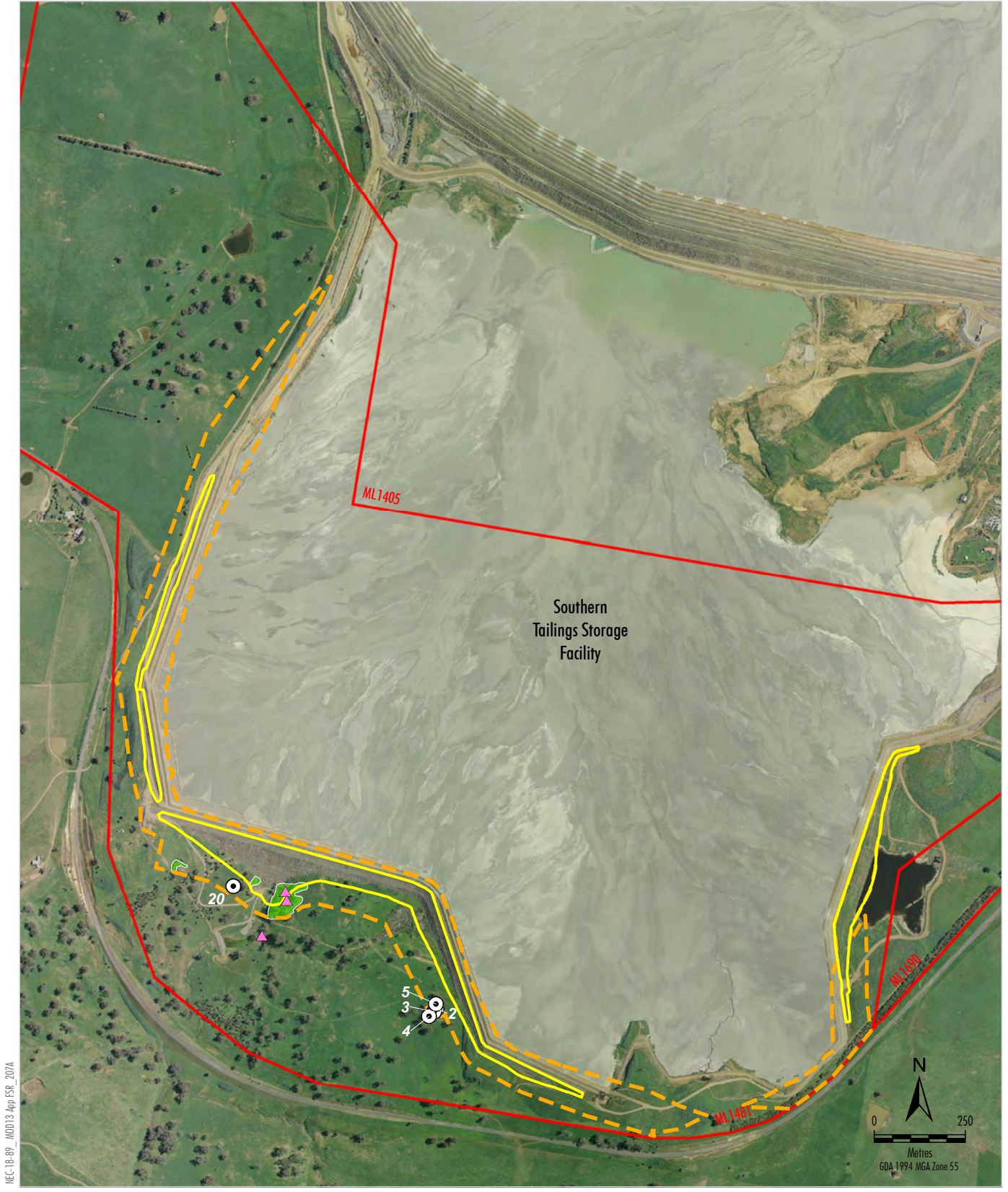
Habitat assessment did find a number of paddock trees with DBH greater than 50 cm in Survey Area A (**Figure I-3**). These consisted predominantly of *Eucalyptus albens* and some *Eucalyptus melliodora*, both listed feed species for Koala.

The land would be considered potential Koala habitat under State Environmental Planning Policy (SEPP) 44 (NSW *Environmental Planning & Assessment Act 1979*) definition, as greater than 15% of the trees in the upper strata in the study area are *Eucalyptus albens*, which is listed as a feed tree species on Schedule 2. No core koala habitat exists as no individuals were sighted.

Two Squirrel Gliders (*Petaurus norfolcensis*) were spotlighted in Survey Area A within the development footprint (and a third outside of, but in close proximity to, the development footprint). Two were spotted inhabiting large *Eucalyptus albens* trees on the first night of June survey. One more Squirrel Glider was spotted in a grove of *Acacia dealbata* (Silver Wattle) next to the dam on the second night (**Plate 4-3**), though this sighting is just outside the study area. All sightings were on the eastern slope of the gully and are mapped in **Figure 4-4**. BioNet records show three additional sightings of Squirrel Gliders proximal to Cadia mine between 2002 and 2018 (OEH, 2019b).



Plate 4-3: Squirrel Glider (head down) spotlighted in grove of *Acacia dealbata* which form part of the foraging habitat for this species in the study area (southern sighting from Figure 4-4, 05/06/19)



MEC-18-89 MOD13 Apr FSR 2024

- LEGEND**
- Mining Lease Boundary
 - Proposed Southern Tailings Storage Facility Buttress (Development Footprint)
 - Study Area
 - ▲ Squirrel Glider
 - Squirrel Glider Habitat
 - Box Gum Woodland (PCT 266)
 - Paddock Trees that Provide Potential Habitat for the Squirrel Glider

Source: CHPI (2018)
Orthophoto CVO - Flown November 2016



CADIA VALLEY OPERATIONS
Squirrel Glider Species Polygon

Figure 4-4

4.2.5 THREATENED BATS

Grey-headed Flying-fox (*Pteropus poliocephalus*) must be surveyed for between October and December when the species are utilising breeding camps (OEH, 2019a). As on-site surveys were not conducted for the species, habitat assessment was relied upon to assess the suitability of habitat. Survey Area A contains flowering eucalypts (*Eucalyptus albens* and *Eucalyptus melliodora*), which could be utilised by Flying-fox for foraging. There are no known breeding camps in the area, with BioNet records showing only one sighting of Grey-headed Flying-fox near Rodds Creek (east of the study area) in 2018 (OEH, 2019b).

Large Bent-winged Bat (*Miniopterus orianae oceanensis*) is listed as a dual Species and Ecosystem Credit Species. The specified survey period for this species is December through February when females have migrated to a number of known maternity roosts (OEH, 2019a). Surveys were not conducted for this species, but an assessment was carried out to assess its potential as a Species Credit Species. The Large Bent-winged Bat is known from the Cadia site from previous surveys conducted by BMS in 2018 (BMS, 2018). The 0.5 m diameter metal culvert connecting the two dams in Survey Area A (**Figure I-3**) was checked for the presence of roosting bats and was found to be empty

5.0 CONCLUSION

Target fauna surveys of the study area were carried out in accordance with the BAM (OEH, 2017). February and June surveys showed no presence of Brush-tailed Phascogale, Koala, Bush Stone-curlew, Barking Owl, Gang-Gang Cockatoo, Glossy Black-Cockatoo or Square-tailed Kite. Habitat assessment ruled out the requirement to survey for one other Species Credit Species (Booroolong Frog), due to the lack of suitable habitat on the study area.

Spotlighting and call playback were conducted in June to survey for Koala, Squirrel Glider, Brush-tailed Phascogale, Barking Owl and Bush Stone-curlew. Two Squirrel Gliders were the only one of these species found to be present in the Survey Area A (**Figure I-3**) within the development footprint (and a third outside of, but in close proximity to, the development footprint). One additional threatened species was located (Little Lorikeet) during the February bird surveys.

Of the species targeted during the surveys, the Squirrel Glider is the only Species Credit Species recorded within the study area. A number of other species were not surveyed for due to time constraints. Pink-tailed Legless Lizard, Superb Parrot and Little Eagle are assumed present and retained as Species Credit Species.

Ecosystem Credit Species to be retained include Square-tailed Kite, White-bellied Sea-eagle, Little Eagle, Gang-gang Cockatoo, Superb Parrot, Regent Honeyeater, Swift Parrot, Barking Owl, Koala, Grey-headed Flying-fox and Large Bent-winged Bat.

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27 July 2019

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7.0 APPENDICES

7.1 APPENDIX A: BUTTRESS AREA PLATES



Plate A7-1: Eastern buttress area looking south. No trees



Plate A7-2: Western buttress area looking south. Only one young *Eucalyptus melliodora* tree (pictured) in area



Plate A7-3: South eastern buttress area looking north. Scattered (mapped) *Eucalyptus albens* trees with hollows and a weed/grass ground layer



Plate A7-4: South eastern buttress area looking west over the deep gully to the south western area. *Eucalyptus albens* trees on the right contain Squirrel Gliders and some large hollows (within the study area)



Plate A7-5: South western buttress area looking south. One mature *Eucalyptus albens* tree (mapped and pictured) that was used as a perch by raptor species. Most trees were young regrowth

7.2 APPENDIX B: FAUNA SPECIES LOCATED WITHIN THE STUDY AREA

Scientific name	Common name	NSW status ¹	Commonwealth status	Observation type
Amphibians				
<i>Crinia signifera</i>	Common Eastern Froglet	P	-	Heard
<i>Pseudophryne bibronii</i>	Bibron's Toadlet	P	-	Heard
<i>Litoria verreauxii</i>	Verreaux's Tree Frog	P	-	Heard
Reptiles				
<i>Chelodina longicollis</i>	Eastern Snake-necked Turtle	P	-	Sighted
Birds				
<i>Chenonetta jubata</i>	Australian Wood Duck	P	-	Sighted
<i>Anas superciliosa</i>	Pacific Black Duck	P	-	Sighted
<i>Anas gracilis</i>	Grey Teal	P	-	Sighted
<i>Aythya australis</i>	Hardhead	P	-	Sighted
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	P	-	Sighted
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron	P	-	Sighted
<i>Egretta novaehollandiae</i>	White-faced Heron	P	-	Sighted
<i>Falco cenchroides</i>	Nankeen Kestrel	P	-	Sighted
<i>Falco longipennis</i>	Australian Hobby	P	-	Sighted
<i>Falco berigora</i>	Brown Falcon	P	-	Sighted
<i>Elanus axillaris</i>	Black-shouldered Kite	P	-	Sighted
<i>Haliastur sphenurus</i>	Whistling Kite	P	-	Sighted
<i>Gallinula tenebrosa</i>	Dusky Moorhen	P	-	Sighted
<i>Fulica atra</i>	Eurasian Coot	P	-	Sighted
<i>Turnix spp.</i>	Button-quail spp.	P	-	Sighted
<i>Eolophus roseicapilla</i>	Galah	P	-	Sighted
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	P	-	Sighted
<i>Glossopsitta concinna</i>	Musk Lorikeet	P	-	Sighted
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	Sighted
<i>Platycercus elegans</i>	Crimson Rosella	P	-	Sighted
<i>Psephotus haematonotus</i>	Red-rumped Parrot	P	-	Sighted
<i>Ninox novaeseelandiae</i>	Southern Boobook	P	-	Spotlighted and heard
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	P	-	Sighted
<i>Cormobates leucophaea</i>	White-throated Treecreeper	P	-	Sighted
<i>Malurus cyaneus</i>	Superb Fairy-wren	P	-	Sighted
<i>Sericornis frontalis</i>	White-browed Scrubwren	P	-	Sighted
<i>Ptilotula penicillatus</i>	White-plumed Honeyeater	P	-	Sighted
<i>Anthochaera carunculata</i>	Red Wattlebird	P	-	Sighted
<i>Pachycephala rufiventris</i>	Rufous Whistler	P	-	Heard
<i>Rhipidura leucophrys</i>	Willie Wagtail	P	-	Sighted
<i>Grallina cyanoleuca</i>	Magpie-lark	P	-	Heard
<i>Cracticus torquatus</i>	Grey Butcherbird	P	-	Sighted

Scientific name	Common name	NSW status ¹	Commonwealth status	Observation type
<i>Cracticus tibicen</i>	Australian Magpie	P	-	Sighted
<i>Strepera graculina</i>	Pied Currawong	P	-	Sighted
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	P	-	Sighted
<i>Corvus coronoides</i>	Australian Raven	P	-	Sighted
<i>Sturnus vulgaris</i>	Common Starling	U	-	Sighted
<i>Hirundo neoxena</i>	Welcome Swallow	P	-	Sighted
<i>Passer domesticus</i>	House Sparrow	U	-	Sighted
<i>Anthus novaeseelandiae</i>	Australian Pipit	P	-	Sighted
<i>Neochmia temporalis</i>	Red-browed Finch	P	-	Sighted
<i>Carduelis carduelis</i>	European Goldfinch	U	-	Sighted
Mammals				
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	Spotlighted
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	P	-	Spotlighted
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	P	-	Sighted
<i>Macropus robustus</i>	Common Wallaroo	P	-	Sighted
<i>Wallabia bicolor</i>	Swamp Wallaby	P	-	Sighted
<i>Vulpes vulpes</i>	Fox	U	-	Spotlighted
<i>Felis catus</i>	Cat	U	-	Tracks
<i>Lepus europaeus</i>	Brown Hare	U	-	Spotlighted
<i>Oryctolagus cuniculus</i>	Rabbit	U	-	Spotlighted

Note: Threatened species are highlighted

¹ Species status (current as at June 2019). P = Protected species, V = Vulnerable species, U = Introduced species.

APPENDIX 3

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00016429/BAAS18048/19/00016430	Cadia Southern Tailings Storage Facility	04/07/2019
Assessor Name	Report Created	BAM Data version *
	01/08/2019	12
Assessor Number	BAM Case Status	Date Finalised
	Open	To be finalised
Assessment Revision	Assessment Type	
0	Part 4 Developments (Small Area)	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAIL	Ecosystem credits
White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion								
1	266_Woodland	50.2	0.3	0.25	High Sensitivity to Potential Gain	2.00	TRUE	8

BAM Credit Summary Report

2	266_Grassland	2.5	3.9	0.25	High Sensitivity to Potential Gain	2.00	TRUE	0
							Subtotal	8
							Total	8

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAll	Species credits	
<i>Aprasia parapulchella</i> / Pink-tailed Legless Lizard (Fauna)							
266_Woodland	50.2	0.3	0.25	2	False	8	
						Subtotal	8
<i>Hieraetus morphnoides</i> / Little Eagle (Fauna)							
266_Woodland	50.2	0.3	0.25	1.5	N/A	6	
						Subtotal	6
<i>Petaurus norfolcensis</i> / Squirrel Glider (Fauna)							
266_Woodland	50.2	0.3	0.25	2	False	8	
						Subtotal	8
<i>Polytelis swainsonii</i> / Superb Parrot (Fauna)							
266_Woodland	50.2	0.3	0.25	2	N/A	8	
						Subtotal	8
<i>Swainsona recta</i> / Small Purple-pea (Flora)							
266_Woodland	50.2	0.3	0.25	2	False	8	
						Subtotal	8



BAM Credit Summary Report

<i>Swainsona sericea / Silky Swainson-pea (Flora)</i>						
266_Woodland	50.2	0.3	0.25	2	False	8
					Subtotal	8

APPENDIX 4

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00016429/BAAS18048/19/00016430	Cadia Southern Tailings Storage Facility	04/07/2019
Assessor Name	Report Created	BAM Data version *
	01/08/2019	12
Assessor Number	Assessment Type	BAM Case Status
	Part 4 Developments (Small Area)	Open
	Assessment Revision	Date Finalised
	0	To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	<i>Ninox connivens</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Corben's Long-eared Bat	<i>Nyctophilus corbeni</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Diamond Firetail	<i>Stagonopleura guttata</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Flame Robin	<i>Petroica phoenicea</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

BAM Predicted Species Report

Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Hooded Robin (south-eastern form)	<i>Melanodryas cucullata cucullata</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Koala	<i>Phascolarctos cinereus</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Little Eagle	<i>Hieraaetus morphnoides</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Little Lorikeet	<i>Glossopsitta pusilla</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Masked Owl	<i>Tyto novaehollandiae</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Purple-crowned Lorikeet	<i>Glossopsitta porphyrocephala</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Regent Honeyeater	<i>Anthochaera phrygia</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Scarlet Robin	<i>Petroica boodang</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Speckled Warbler	<i>Chthonicola sagittata</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Spotted Harrier	<i>Circus assimilis</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Square-tailed Kite	<i>Lophoictinia isura</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Superb Parrot	<i>Polytelis swainsonii</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Swift Parrot	<i>Lathamus discolor</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Turquoise Parrot	<i>Neophema pulchella</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Varied Sittella	<i>Daphoenositta chrysoptera</i>	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

BAM Predicted Species Report

Yellow-bellied Sheathail-bat	Saccolaimus flaviventris	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
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Threatened species not within the area of these PCT's

Common Name	Scientific Name	Vegetation Types(s)
Glossy Black-Cockatoo	Calyptrorhynchus lathami	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
Painted Honeyeater	Grantiella picta	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
White-bellied Sea-Eagle	Haliaeetus leucogaster	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

APPENDIX 5
BAM Payment Report

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00016429/BAAS18048/19/00016430	61	0	02/08/2019
Assessor Name	Assessor Number	Proposal Name	BAM Case Status
		Cadia Southern Tailings Storage Facility	Open
	Assessment Type	Date Finalised	
	Part 4 Developments (Small Area)	To be finalised	

PCT list

Include	PCT common name	Credits
Yes	266 - White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	8

Species list

Include	Species	Credits
Yes	<i>Aprasia parapulchella</i> (Pink-tailed Legless Lizard)	8
Yes	<i>Petaurus norfolcensis</i> (Squirrel Glider)	8
Yes	<i>Polytelis swainsonii</i> (Superb Parrot)	8
Yes	<i>Swainsona recta</i> (Small Purple-pea)	8
Yes	<i>Swainsona sericea</i> (Silky Swainson-pea)	8
Yes	<i>Hieraaetus morphnoides</i> (Little Eagle)	6



Biodiversity payment summary report

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

IBRA sub region	PCT common name	Baseline price	Dynamic coefficient	Market coefficient	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Inland Slopes	266 - White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion Warning: This PCT has NO trades recorded	\$4,248.35	0.71782200	2.51860000	19.99%	\$20.00	1.0000	\$6,009.29	8	\$48,074.34

Subtotal (excl. GST) **\$48,074.34**

GST **\$4,807.43**

Total ecosystem credits (incl. GST) \$52,881.77

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10061	<i>Aprasia parapulchella</i> (Pink-tailed Legless Lizard)		\$506.66	19.9900%	\$20.00	8	\$5,023.53
10604	<i>Petaurus norfolcensis</i> (Squirrel Glider)		\$434.47	19.9900%	\$20.00	8	\$4,330.56



Biodiversity payment summary report

10645	<i>Polytelis swainsonii</i> (Superb Parrot)		\$725.00	19.9900%	\$20.00	8	\$7,119.42
10782	<i>Swainsona recta</i> (Small Purple-pea)		\$865.08	19.9900%	\$20.00	8	\$8,464.08
10783	<i>Swainsona sericea</i> (Silky Swainson-pea)		\$158.64	19.9900%	\$20.00	8	\$1,682.82
20131	<i>Hieraaetus morphnoides</i> (Little Eagle)		\$506.66	19.9900%	\$20.00	6	\$3,767.65
Subtotal (excl. GST)							\$30,388.06
GST							\$3,038.81
Total species credits (incl. GST)							\$33,426.87
Grand total							\$86,308.64

APPENDIX 6

BAM Candidate Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00016429/BAAS18048/19/00016430	Cadia Southern Tailings Storage Facility	04/07/2019
Assessor Name	Report Created	BAM Data version *
	01/08/2019	12
Assessor Number	Assessment Type	BAM Case Status
	Part 4 Developments (Small Area)	Open
	Assessment Revision	Date Finalised
	0	To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

List of Species Requiring Survey

Name	Presence	Survey Months												
<i>Aprasia parapulchella</i> Pink-tailed Legless Lizard	Yes (assumed present)	<table border="1"> <tr> <td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td> </tr> <tr> <td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td> </tr> </table>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun									
Jul	Aug	Sep	Oct	Nov	Dec									
<i>Polytelis swainsonii</i> Superb Parrot	Yes (assumed present)	<table border="1"> <tr> <td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td> </tr> <tr> <td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td> </tr> </table>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun									
Jul	Aug	Sep	Oct	Nov	Dec									
<i>Petaurus norfolcensis</i> Squirrel Glider	Yes (surveyed)	<table border="1"> <tr> <td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td> </tr> <tr> <td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td> </tr> </table>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun									
Jul	Aug	Sep	Oct	Nov	Dec									
<i>Swainsona recta</i> Small Purple-pea	Yes (assumed present)	<table border="1"> <tr> <td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td> </tr> <tr> <td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td> </tr> </table>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun									
Jul	Aug	Sep	Oct	Nov	Dec									
<i>Swainsona sericea</i> Silky Swainson-pea	Yes (assumed present)	<table border="1"> <tr> <td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td> </tr> <tr> <td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td> </tr> </table>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun									
Jul	Aug	Sep	Oct	Nov	Dec									

<i>Hieraetus morphnoides</i> Little Eagle	Yes (assumed present)	Jan	Feb	Mar	Apr	May	Jun
		Jul	Aug	Sep	Oct	Nov	Dec

List of Species Not On Site

Name
<i>Ammobium craspedioides</i> Yass Daisy
<i>Burhinus grallarius</i> Bush Stone-curlew
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo
<i>Grevillea wilkinsonii</i> Tumut Grevillea
<i>Lathamus discolor</i> Swift Parrot
<i>Lophoictinia isura</i> Square-tailed Kite
<i>Miniopterus schreibersii oceanensis</i> Eastern Bentwing-bat
<i>Ninox connivens</i> Barking Owl
<i>Petrogale penicillata</i> Brush-tailed Rock-wallaby
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale
<i>Phascolarctos cinereus</i> Koala
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox
<i>Synemon plana</i> Golden Sun Moth
<i>Tyto novaehollandiae</i> Masked Owl
<i>Anthochaera phrygia</i> Regent Honeyeater
<i>Zieria obcordata</i> Zieria obcordata
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo
<i>Acacia ausfeldii</i> Ausfeld's Wattle
<i>Euphrasia arguta</i> Euphrasia arguta
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle