

WAMBO COAL PTY LIMITED



WAMBO COAL MINE LONGWALL 24 TO 26 MODIFICATION

MODIFICATION REPORT

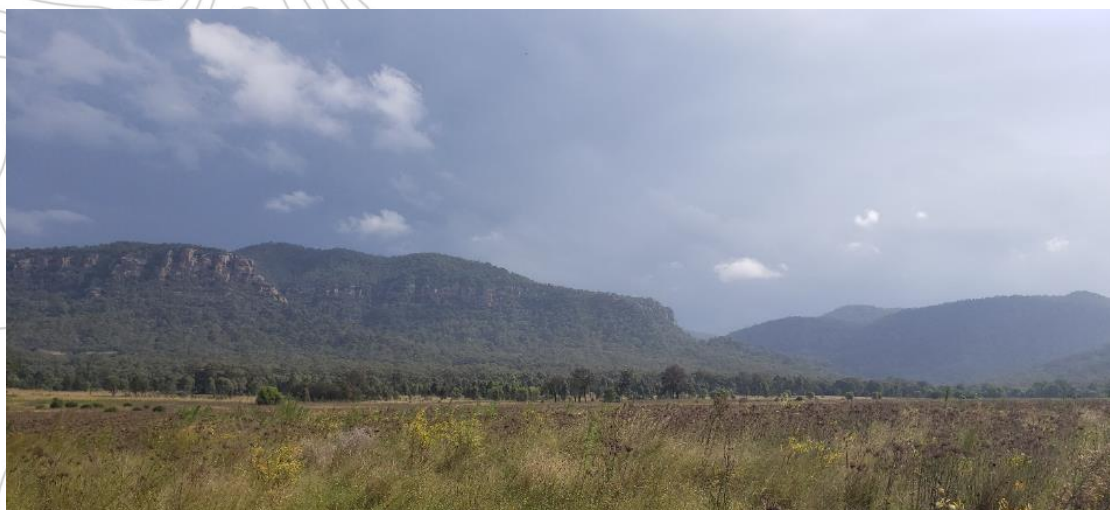
For the Modification of DA 305-7-2003 (MOD 19)
Optimisation and Continued Operation
of the Approved South Bates Extension Underground Mine

APPENDIX F

Biodiversity Review

Wambo Coal Mine Longwalls 24-26 Modification Biodiversity Review

Wambo Coal Pty Ltd



DOCUMENT TRACKING

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Project Number	22COF1435
Project Manager	Tom Schmidt
Prepared by	Liam Scanlan, Shawn Ryan, Tom Schmidt
Reviewed by	Alex Pursche, Daniel Magdi
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Template 2.8.1

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Abbreviations

Abbreviation	Description
BAM	Biodiversity Assessment Method
BAMCC	Biodiversity Assessment Method Credit Calculator
BC Act	<i>NSW Biodiversity Conservation Act 2016</i>
CEEC	Critically Endangered Ecological Community
DotE	Former Commonwealth Department of the Environment
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	<i>NSW Environment Planning and Assessment Act 1979</i>
EPBC Act	<i>Commonwealth Environment Protection and Biodiversity Conservation Act 1999</i>
GDE	Groundwater Dependent Ecosystem
HBT	Hollow-bearing tree
IBRA	Interim Biogeographic Regionalisation of Australia
MNES	Matters of National Environmental Significance
NSW	New South Wales
PCT	Plant Community Type
PMST	Protected Matters Search Tool
SIC	Significant Impact Criteria
TEC	Threatened Ecological Community
VEC	Vulnerable Ecological Community
WCPL	Wambo Coal Pty Ltd

1. Introduction

The Wambo Coal Mine is situated approximately 15 kilometres (km) west of Singleton, near the village of Warkworth, New South Wales (NSW) (Figure 1), and is operated in accordance with Development Consent (DA 305-7-2003). The Wambo Coal Mine is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

The South Bates Extension Underground Mine is a component of the approved Wambo Coal Mine (Figures 1 and 2) comprising Longwalls 17 to 25 in the Whybrow Seam. WCPL is seeking to modify Development Consent (DA 305-7-2003) under section 4.55(2) of the NSW *Environmental Planning & Assessment Act 1979* (EP&A Act) to allow for the reorientation of the approved Longwall 24 and Longwall 25, and the addition of Longwall 26 (the Modification) (Figure 2).

Eco Logical Australia Pty Ltd (ELA) has been engaged by WCPL to prepare a Biodiversity Review for the Modification.

1.1. Purpose of report

A Biodiversity Review is required to identify the biodiversity values relevant to the Modification and to determine whether the Modification would result in an increase in impacts on biodiversity values as defined in the NSW *Biodiversity Conservation Act 2016* (BC Act) and NSW *Biodiversity Conservation Regulation 2016* (BC Regulation). The Biodiversity Review also assesses whether the Modification would result in a significant impact on relevant Matters of National Environmental Significance (MNES) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.2. Study area

The study area covers approximately 306 hectares (ha) and includes the following (Figure 3):

- Modified Underground Mining Area (118 ha) – the component of the modified Longwalls 24 to 26 located outside the approved South Bates Extension Underground Mine mining area
- Approved Underground Mining Area No Longer Required (145 ha) – the component of the approved South Bates Extension Underground Mine mining area that would no longer be undermined
- Approved Underground Mining Area Required (43 ha) – the component of the modified Longwalls 24 to 26 located inside the approved South Bates Extension Underground Mine mining area.

Note that “mining area” above refers to the limit of the extent of predicted measurable vertical subsidence associated with each component (i.e. modified Longwalls 24 to 26 and the approved South Bates Extension Underground Mine longwalls).

1.3. Survey and assessment objectives

The objectives of the survey and assessment, include:

- Identification of Plant Community Types (PCTs), Threatened Ecological Communities (TECs) and collection of vegetation integrity plot data as per the Biodiversity Assessment Method, 2020 (BAM) (applying the minimum plot requirements)
- Calculation of vegetation integrity scores for all vegetation zones within the study area using the BAM Credit Calculator (BAMCC)
- Mapping of PCTs, TECs, threatened species habitats and key biodiversity values known or likely to occur in the study area
- Habitat assessments, inspection of potentially significant features such as North Wambo Creek, and consideration of the biodiversity values as defined in the BC Regulation
- Inspection of Waterfall Creek and associated drainage lines to provide an indication of the potential occurrence of Groundwater Dependent Ecosystems (GDEs) in and adjacent to the Modified Underground Mining Area, including inspection of vegetation along Waterfall Creek for approximately 1 km downstream of the Modified Underground Mining Area
- Comparisons of the biodiversity values as defined in the BC Act and BC Regulation present between the Modified Underground Mining Area and the Approved Underground Mining Area No Longer Required.

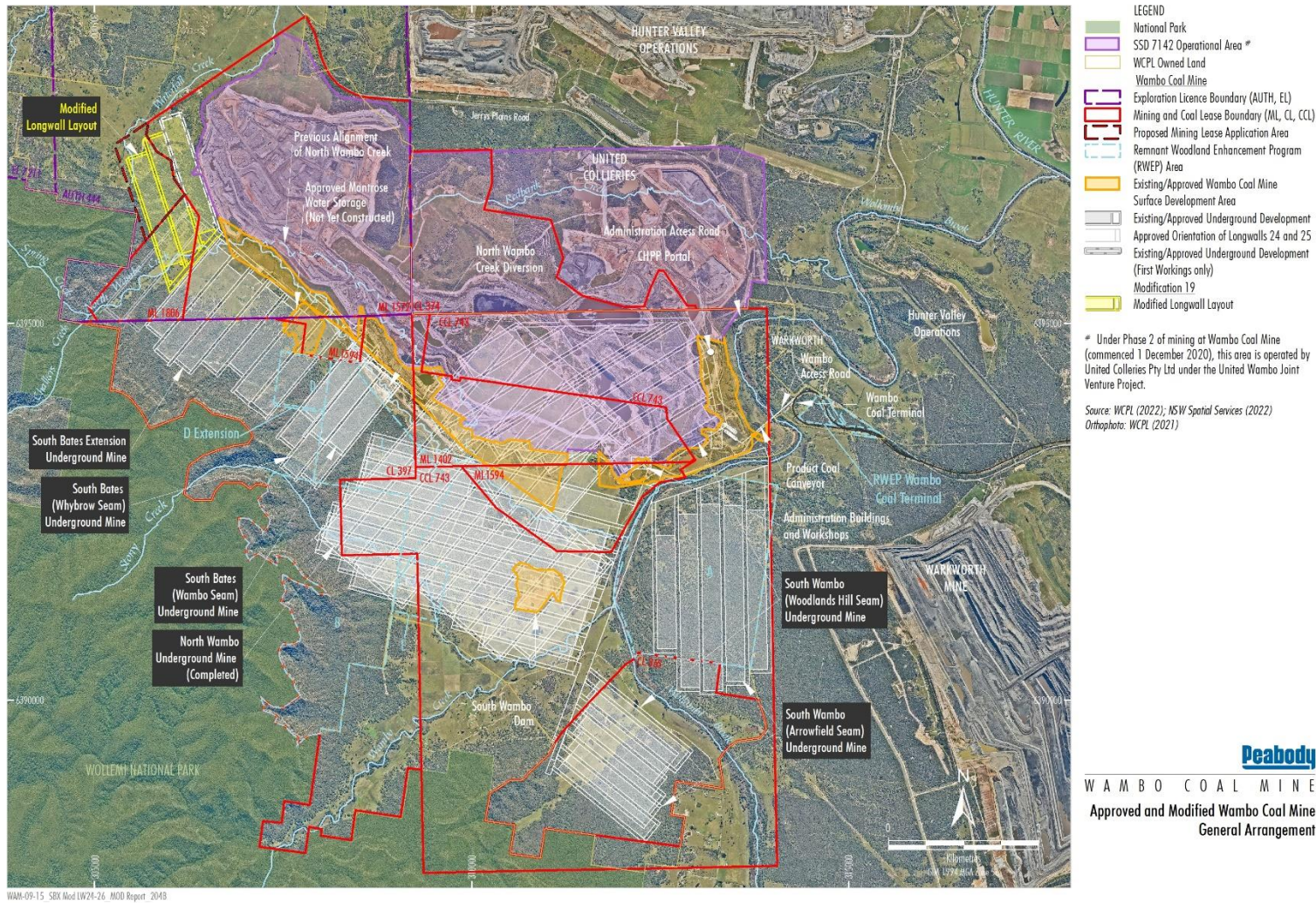


Figure 1: Approved and modified Wambo Coal Mine general arrangement

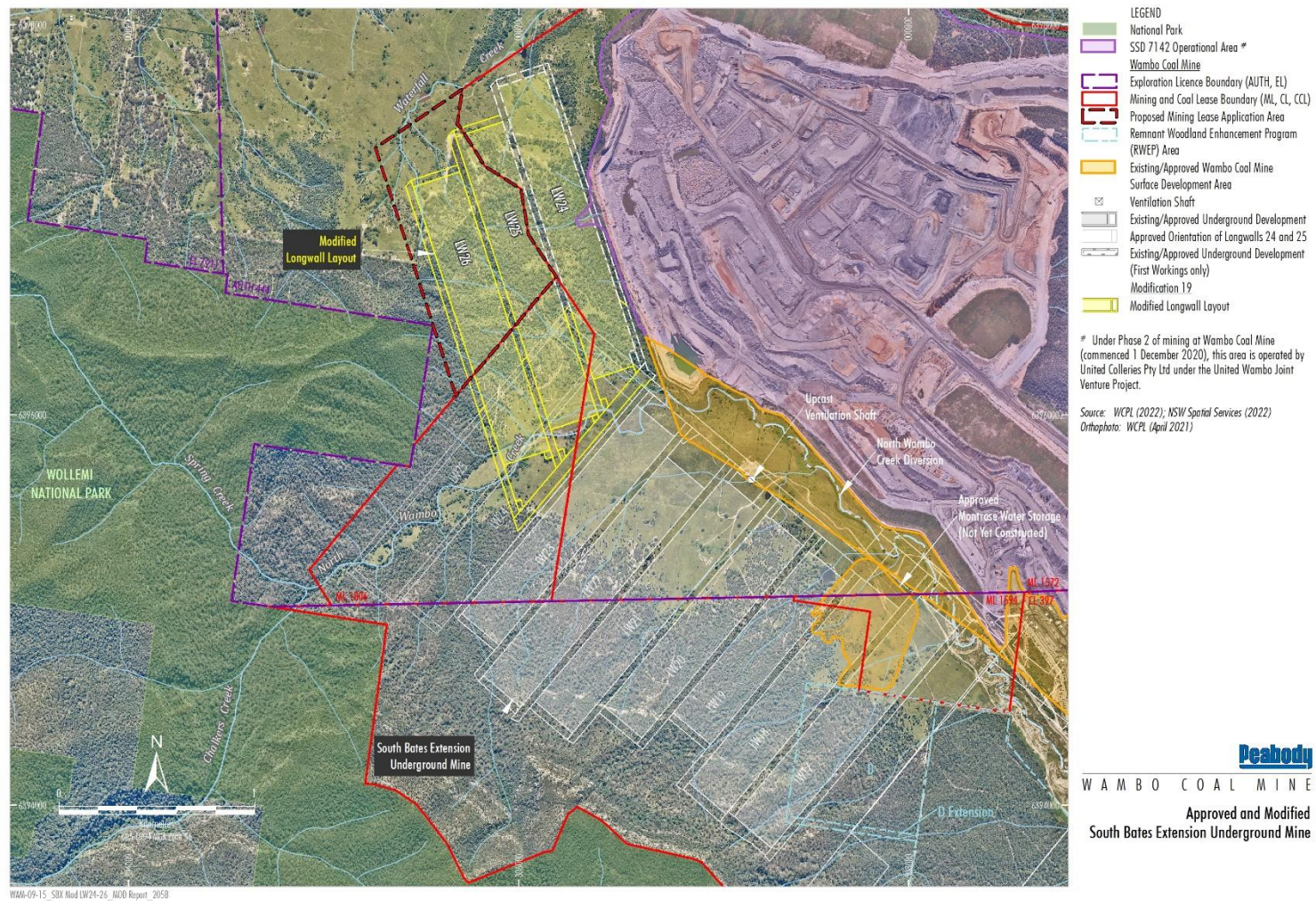


Figure 2: Approved and modified South Bates Extension Underground Mine

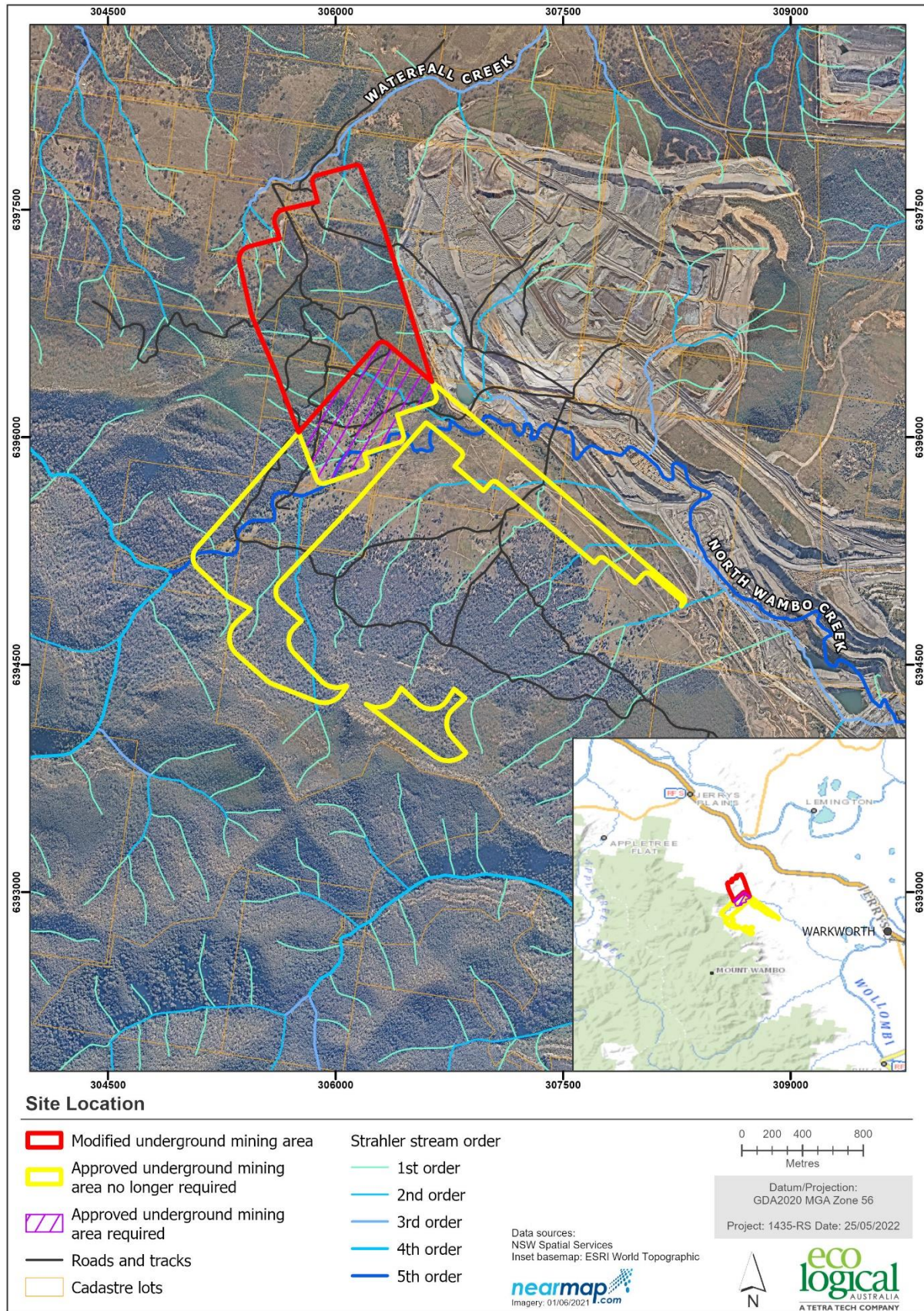


Figure 3: Study area location

2. Methodology

2.1. Desktop assessment

A desktop assessment including database searches was completed and the information sources reviewed included:

- BioNet (Atlas of NSW Wildlife) search (5 km radius of the study area) (Department of Planning and Environment [DPE] 2022a)
- EPBC Protected Matters Search Tool (PMST) (5 km radius of the study area) (Department of Agriculture, Water and Environment [DAWE] 2022)
- Wambo Coal Mine Annual Biodiversity Monitoring records (2014-2021)
- South Bates Extension Modification Flora Assessment (FloraSearch 2017), prepared for WCPL
- South Bates Extension Modification Fauna Assessment (ELA 2017), prepared for WCPL
- South Bates Underground Extension Drilling and Seismic Exploration – Ecological Assessment (ELA 2020), prepared for WCPL
- The Upper Hunter Strategic Assessment Statement of Consistency Report (Umwelt 2016), prepared for the United Wambo Open Cut Coal Mine Project (a joint venture between WCPL and United Collieries Pty Limited [Glencore])
- The Wambo Development Project Environmental Impact Statement (Resource Strategies, 2013), prepared for WCPL
- DPE - NSW Threatened Species Profiles (DPE 2022b)
- The Plant Information Network System of the Royal Botanic Gardens and Domain Trust (PlantNET 2022).

2.2. Field surveys

2.2.1. Vegetation integrity assessment

Vegetation integrity surveys in accordance with the BAM were completed within the study area by ELA ecologist and BAM Accredited Assessor Shawn Ryan and ELA ecologist Liam Scanlan in March and April 2022.

A total of 32 full-floristic vegetation integrity plots were surveyed to identify PCTs and to assess the composition, structure and function components of each vegetation zone in accordance with the BAM.

At each survey site, the following information was collected:

- Site ID
- Name of recorder(s)
- Date
- Plot orientation, slope, and aspect
- Easting and northing at either end of the 50 metres (m) transect
- Site photographs
- A plot-based 400 m² full floristic survey
- A plot and transect survey (20 m x 50 m).

Within the 20 m x 20 m quadrat, the following data was collected at each plot-based full floristic survey site:

- Species name: Scientific name and common name
- Stratum (& layer): in which each species occurs
- Cover: an estimate of the appropriate cover measure for each recorded species: from 1-5% and then to the nearest 5%
- Abundance: A relative measure of the number of individuals or shoots of a species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, or specify a number greater than 1000 if required
- Form: (T) Tree; (S) Shrub; (G) Grass and grass like (F) Forb; (E) Fern; (O) other.

Within each plot survey, the following information was collected:

- Within a 20 m x 20 m quadrat the number of native species present
- Within a 50 m x 20 m quadrat the number of large trees, tree regeneration, tree stem size class, total length of fallen logs, number of hollow-bearing trees (HBT)
- Within five 1 m x 1 m sub-plots litter cover.

Vegetation integrity scores were calculated using three summary scores for the composition, structure and functional attributes. The summary scores are automatically calculated through importing the data into the online BAMCC (Case number 00032687). These scores are calculated based on comparison and relative weighting of the PCT benchmark data.

Field data collected within vegetation integrity plots is included in Appendix A and Appendix B. The location of vegetation integrity plots is shown on Figure 4. Several plots completed within the Approved Underground Mining Area Required were used in calculations for both the Modified Underground Mining Area and the Approved Underground Mining Area No Longer Required to achieve the required number of plots.

2.2.2. Rapid Data Point (RDP) sampling

The study area was traversed by vehicle on existing tracks, and off-track by foot (Figure 4).

Rapid data plots (RDPs) are less comprehensive than vegetation integrity plots but are an efficient way to systematically record vegetation community observations to assist with aerial interpretation of vegetation types. At each RDP the dominant canopy, midstorey and groundcover species; structural cover condition; vegetation structure; exotic species and cover; threatened species and count; soil texture; vegetation condition; landform element and pattern; notes; photo number; surveyor and date were recorded.

A portion of the Approved Underground Mining Area No Longer Required could not be accessed by foot due to steep, rocky terrain and persistent rainy weather created hazardous conditions. In lieu of access by foot, a drone was flown from the closest practical position, over the inaccessible area, to capture high resolution imagery and allow assignment of PCTs.

2.2.3. Vegetation mapping

Vegetation mapping was undertaken in ArcGIS 10.7.1. Existing vegetation mapping by FloraSearch (2017) and ELA (2020) was used as baseline datasets, as well as existing RPDs and vegetation plots which were used as an initial guide to identify vegetation types.

Following site surveys, additional RPDs and vegetation plot data collected as part of this study was used to refine PCT selection and community boundaries.

The drone imagery taken above the inaccessible portion of the Approved Underground Mining Area No Longer Required was assessed to determine the likely canopy and mid-storey species and was then used to validate vegetation mapping.

Supplementary datasets such as elevation contours, drainage and soil landscape mapping were used to help to delineate boundaries between vegetation communities.

2.2.4. Habitat assessment

Fauna habitat searches (concurrent with vegetation surveys) were conducted for potential foraging, roosting, breeding or nesting habitat of nocturnal and diurnal species. This includes inspection for the presence of tree hollows, stags, bird nests, food trees (*Banksia* spp., *Allocasuarina* spp., and winter-flowering eucalypts) and riparian areas.

2.3. Survey limitations

This assessment provides an overall assessment of the ecological values of the subject area with emphasis on PCTs, TECs, GDEs, threatened flora and fauna habitat, and fauna habitat features and was not intended to provide an inventory of all species across the study area. Habitat assessment by experienced ecologists has been used in lieu of targeted surveys for other threatened species.

No detailed threatened species surveys were carried out, however the results of previous threatened species targeted surveys were considered.

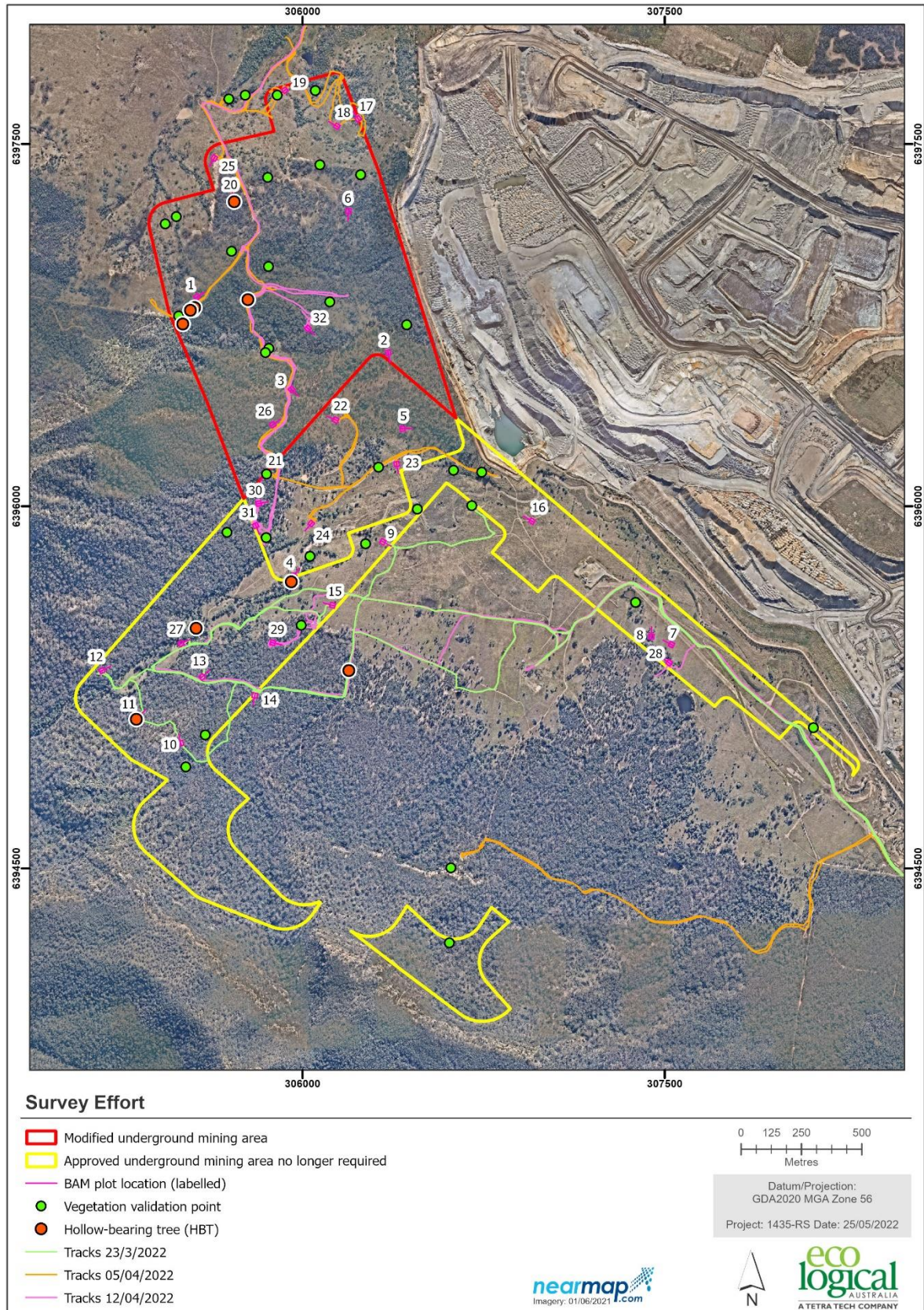


Figure 4: Survey effort

3. Results

3.1. Desktop assessment

3.1.1. Database searches

A search of the BioNet Atlas of NSW Wildlife (DPE 2022a) for species listed as threatened or migratory under the BC Act and EPBC Act identified 27 threatened fauna species and three threatened flora species that have been previously recorded in the search area (5 km radius of the study area). Threatened species records in proximity to the study area are shown on Figure 5 and Figure 6. The EPBC Act PMST retrieved 38 listed threatened species, 13 migratory species and four TECs that are known, likely or potential habitat may occur in the area based on habitat modelling.

Five threatened fauna species and four threatened flora species were identified in the EPBC Act PMST that were not previously assessed by ELA (2017) or FloraSearch (2017) (Table 1).

As these species were not previously assessed, a likelihood of occurrence analysis was undertaken for to determine their potential for occurrence in the study area and likelihood of being impacted by the Modification (Appendix C). None of these species were considered likely to occur in the study area or be impacted by the proposed Modification.

Table 1: Threatened fauna and flora species not previously assessed by ELA (2017) or FloraSearch (2017)

Scientific name	Common name	BC Act	EPBC Act
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V
<i>Delma impar</i>	Striped Legless Lizard, Striped Snake-lizard	V	V
<i>Falco hypoleucos</i>	Grey Falcon	E	V
<i>Hirundapus caudacutus</i>	White-throated Needletail	-	V
<i>Potorous tridactylus</i>	Long-nosed Potoroo (SE Mainland)	V	V
<i>Androcalva procumbens</i> (syn. <i>Commersonia procumbens</i>)	-	V	V
<i>Prostanthera cineolifera</i>	Singleton Mintbush	V	V
<i>Rhizanthella slateri</i>	Eastern Underground Orchid	V	E
<i>Rutidosis heterogama</i>	Heath Wrinkewort	V	V

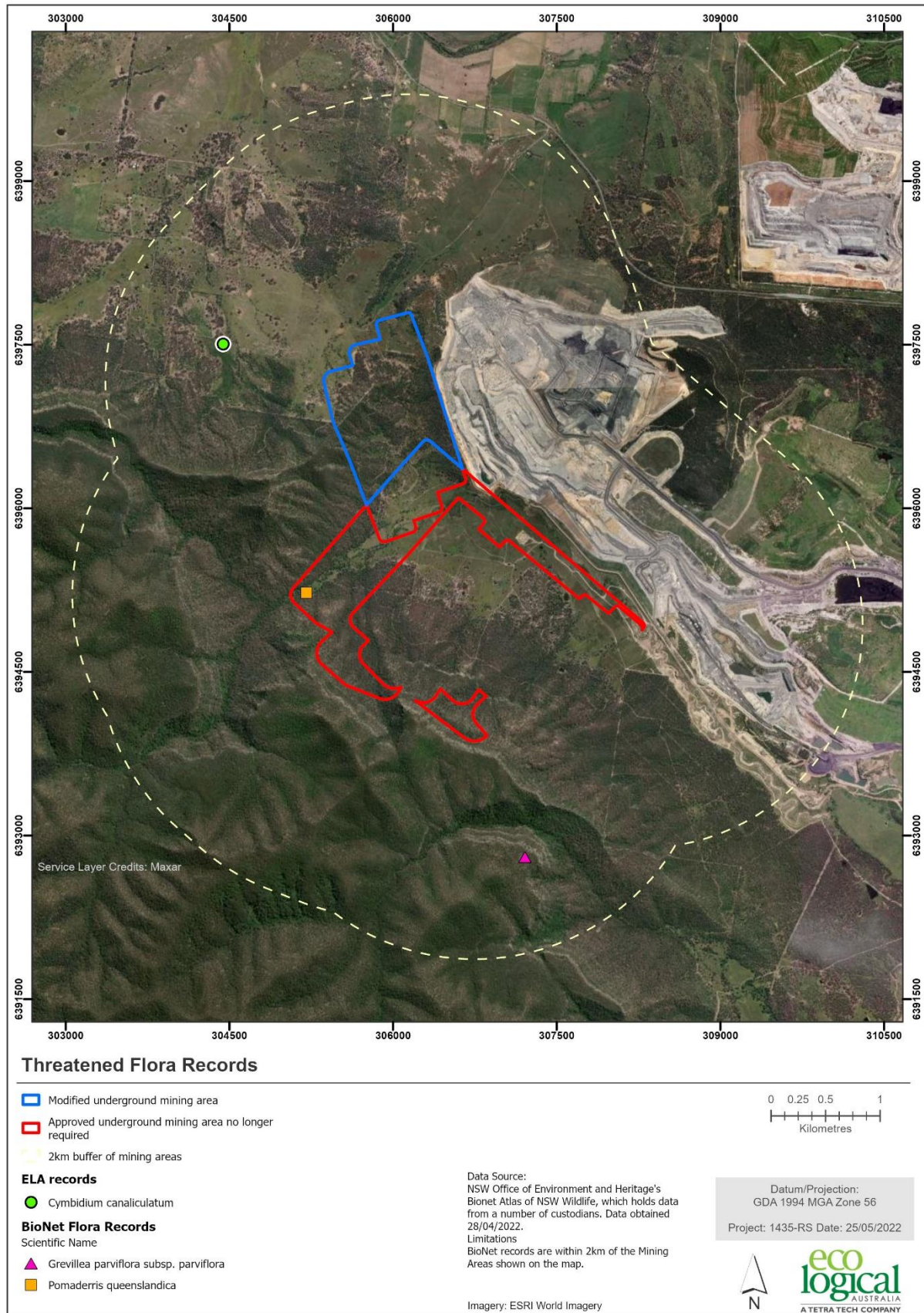


Figure 5: Threatened flora records

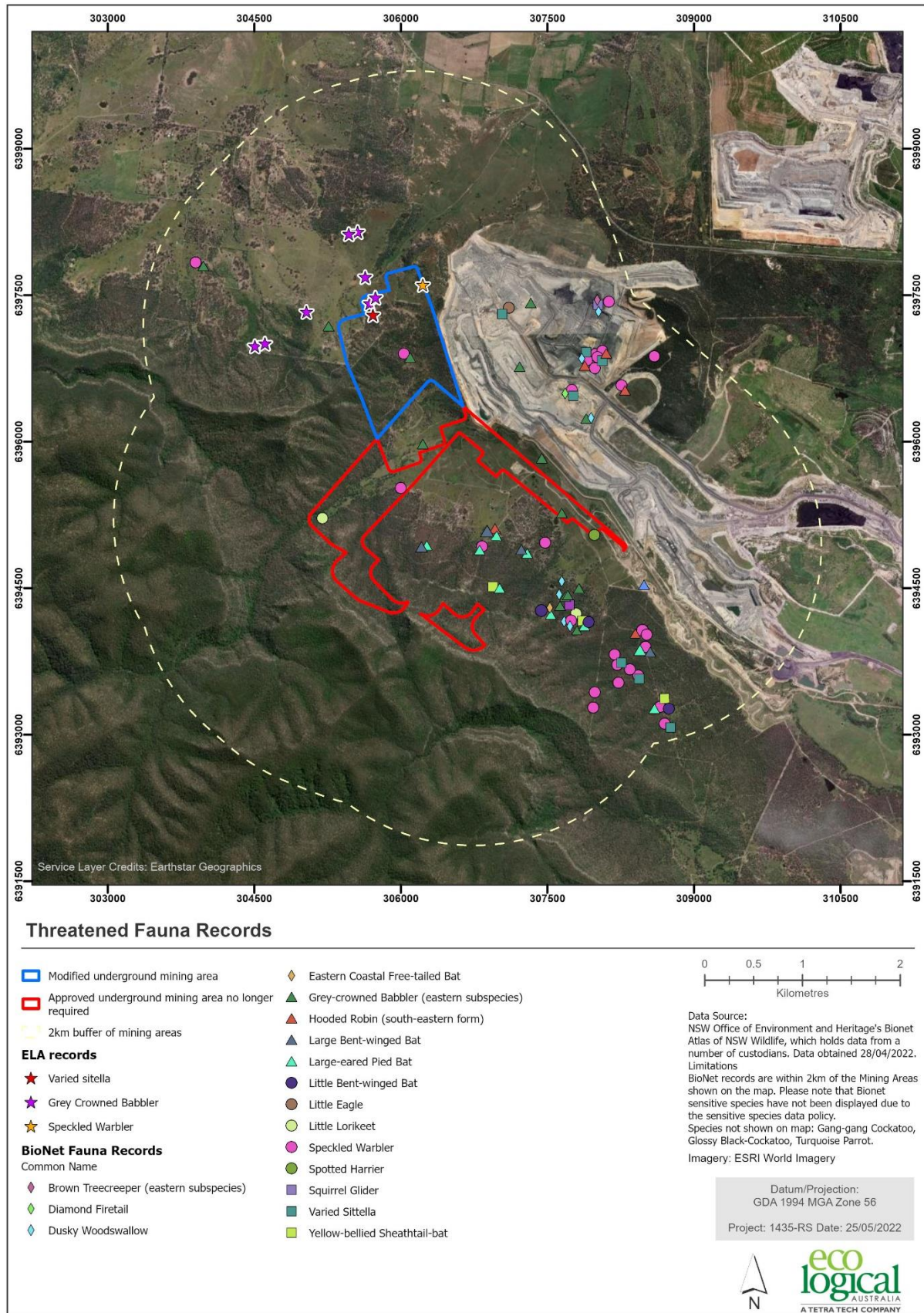


Figure 6: Threatened fauna records

3.1.2. Previous studies

The study area was predominantly mapped by FloraSearch (2017), although approximately 20 ha in the north was not covered by this mapping. ELA (2020) prepared ecological assessments for seismic surveys and drilling works in parts of the study area which covered the majority of these unmapped areas. Four separate vegetation communities were identified, with three communities corresponding with BC Act listed TECs and three with EPBC Act listed TECs (Table 2).

Table 2: Vegetation communities in the study area previously mapped by FloraSearch (2017) and ELA (2020)

Community (FloraSearch 2017)	Plant Community Type	BC Act Listing	EPBC Act Listing
Narrow-leaved Ironbark - Grey Box Woodland	PCT1603 – Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	Central Hunter Grey Box - Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions Endangered Ecological Community (EEC)	Central Hunter Valley Eucalypt Forest and Woodland Critically Endangered Ecological Community (CEEC)
Grey Box - Slaty Box Woodland	PCT 1176 – Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion Vulnerable Ecological Species (VEC)	Central Hunter Valley Eucalypt Forest and Woodland CEEC
Forest Red Gum - Rough-barked Apple - River She-oak Forest (Disturbed)	PCT 1106 – River Oak riparian woodland of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions EEC	Not listed
Derived Native Grassland	Predominantly a derived form of PCT1603 – Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	Not listed	In part - Central Hunter Valley Eucalypt Forest and Woodland CEEC, where part of adjacent “patch”, i.e. within 30m of forest/woodland areas.

3.2. Plant Community Types

3.2.1. Plant Community Types present

A total of five PCTs identified were identified within the study area during the field surveys:

- PCT 116: Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley
- PCT 922: Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion
- PCT 1176: Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion
- PCT 1598: Forest Red Gum grassy open forest on floodplains of the lower Hunter
- PCT 1603: Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter.

These PCTs and their extent within the study area are presented in Table 3 and Figure 7. All PCTs were recorded as being in good condition, with one PCT (PCT 1603) also present as a derived native grassland zone. Detailed descriptions of each PCT and vegetation condition zone within the study area are provided in the Table 4 to Table 9.

The study area also contained 2.88 ha of cleared areas or exotic vegetation which does not conform to a native PCT.

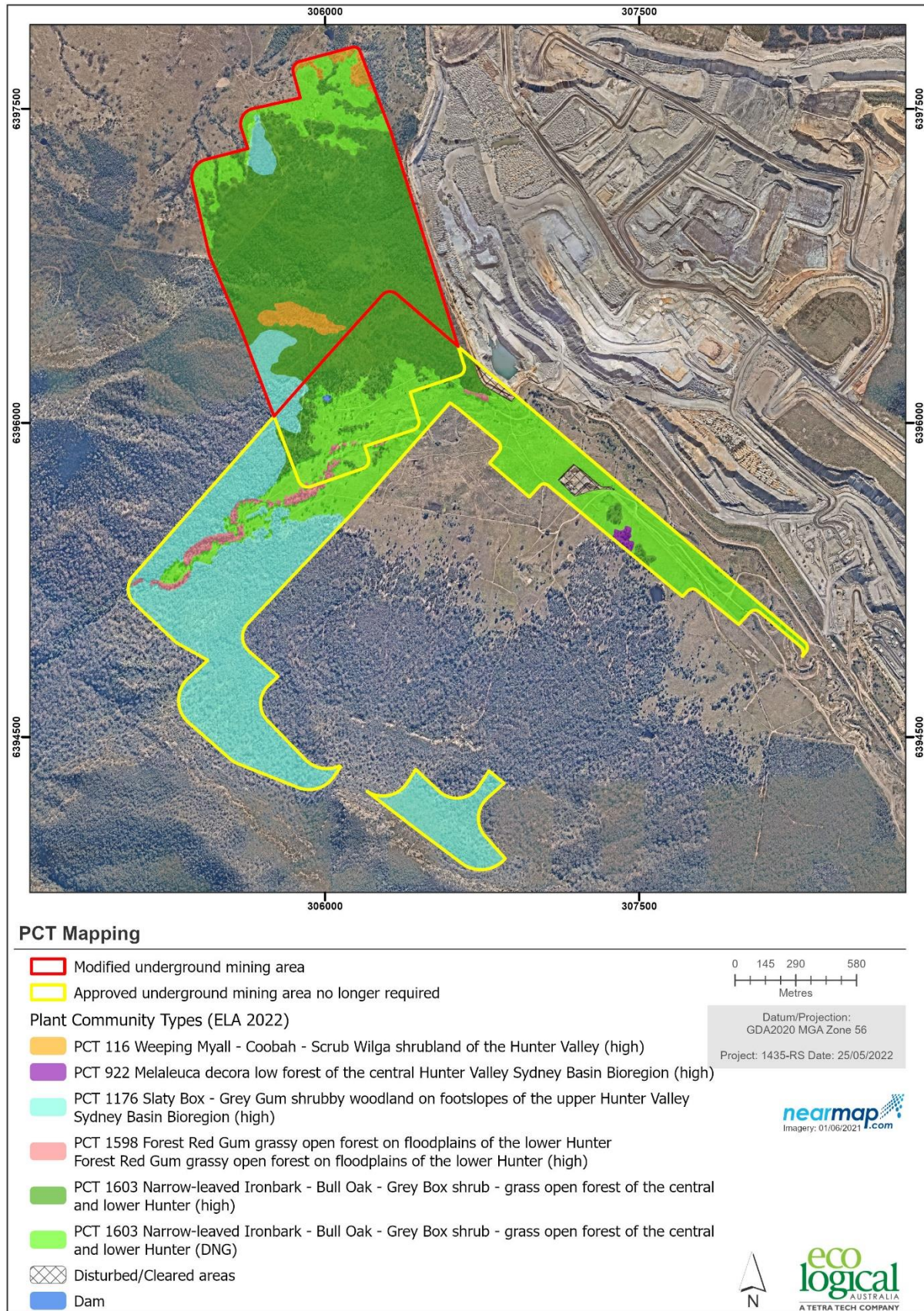


Figure 7: Plant Community Types

Table 3: PCTs and GDE potential

PCT ID	PCT Name	Area (ha)			GDE potential
		Approved underground mining area no longer required	Modified underground mining area	Change	
116	Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley	0	5.5	+ 5.5	Low Potential
922	Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion	0.8	0	- 0.8	High Potential
1176	Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	81.2	7.5	- 73.7	Low Potential
1598	Forest Red Gum grassy open forest on floodplains of the lower Hunter	4.1	0	- 4.1	High Potential
1603	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	3.8	89.2	+ 85.4	Low Potential
1603	Derived native grassland	51.2	15.6	- 35.6	Low Potential
Total		141.1	117.8	- 23.3	

Table 4: Zone 1 PCT 116 High Condition

116 - Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley			
Vegetation formation/class	Grassy Woodland/ Coastal Valley Grassy Woodlands		
Conservation status	NSW BC Act CEEC: Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion		
	EPBC Act CEEC: Not commensurate		
Description	This PCT occurs on steep to gently sloping areas south of Waterfall Creek on colluvial clay soils with surface rock evident in some locations. Floristically it consists of a combination of grassy woodland species and dry rainforest species.		
Characteristic canopy trees	<i>Brachychiton populneus</i> (Kurrajong) and <i>Eucalyptus crebra</i> (Narrow-leaved Ironbark) (occasional)		
Characteristic mid-storey	<i>Geijera salicifolia</i> (Wilga), <i>Notelaea microcarpa</i> (Native Olive), <i>Brachychiton populneus</i> , <i>Acacia salicina</i> (Cooba), <i>Bursaria spinosum</i> (Sweet Bursaria), <i>Psyrax odoratum</i> (Shiny-leaved Canthium), <i>Solanum jucundum</i> and <i>Melicytus dentatus</i> (Tree Violet)		
Characteristic groundcovers	<i>Eragrostis leptostachya</i> (Paddock Lovegrass), <i>Cymbopogon refractus</i> (Barbed-wire Grass), <i>Microlaena stipoides</i> (Weeping Grass), <i>Panicum effusum</i> (Hairy Panic), <i>Entolasia stricta</i> (Wiry Panic) and <i>Sporobolus creber</i> (Western Rat-tail Grass)		
Mean native richness	40		
Exotic species / HTW cover	<i>Galenia pubescens</i> (Galenia), <i>Bidens subalternans</i> (Greater Beggar's Ticks), <i>Senecio madagascariensis</i> (Fireweed) / 11%		
Condition	High		
Variation and disturbance	Generally consistent in condition across the study area with variation in the understorey associated with historic grazing.		
No. sites sampled	3 (Plot 3, 17 and 19)		
Fauna habitats	Dense vegetation for ground mammals and rainforest birds. Amphibian habitat in streams. Potential for small HBTs.		
Composition	Structure	Function	Vegetation Integrity Score
87.6	93.2	61.9	79.6



Table 5: Zone 1 PCT 922 High Condition

922 - <i>Melaleuca decora</i> low forest of the central Hunter Valley, Sydney Basin Bioregion			
Vegetation formation/class	Dry Sclerophyll Forest/ Hunter-Macleay Dry Sclerophyll Forest		
Conservation status	NSW BC Act EEC: -		
	EPBC Act CEEC: -		
Description	A patch of this PCT occurs in the centre east of the study area largely within an area of Narrow-leaved Ironbark – Grey Box Woodland. This PCT occurs on flat terrain and broad low gullies with impeded drainage. This PCT is characterised by the prominent presence of <i>Melaleuca decora</i> (Honey Myrtle) within areas otherwise dominated by <i>E. crebra</i> .		
Characteristic canopy trees	<i>Melaleuca decora</i> and <i>Eucalyptus crebra</i> (occasional)		
Characteristic mid-storey	<i>Melaleuca decora</i> , <i>Notelaea microcarpa</i> and <i>Solanum jucundum</i>		
Characteristic groundcovers	<i>Sporobolus creber</i> , <i>Cymbopogon refractus</i> , <i>Bothriochloa macra</i> (Red-legged Grass), <i>Calotis lappulacea</i> (Yellow Burr-daisy)		
Mean native richness	27		
Exotic species / HTW cover	<i>Galenia pubescens</i> , <i>Axonopus fissifolius</i> (Narrow-leaved Carpet Grass), <i>Bidens subalternans</i> , <i>Senecio madagascarensis</i> / 8.5%		
Condition	High		
Variation and disturbance	This PCT is confined to a relatively small area with little variation. Understorey disturbance is likely related to historic grazing.		
No. sites sampled	1 (Plot 8)		
Fauna habitats	Amphibian habitat in wet areas. Foraging resources for nectivorous birds and bats.		
Composition	Structure	Function	Vegetation Integrity Score
55.9	62.5	44.8	53.9



Table 6: Zone 1 PCT 1176 High Condition

1176 - Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion			
Vegetation formation/class	Dry Sclerophyll Forests (Shrubby sub-formation)/ Western Slopes Dry Sclerophyll Forests		
Conservation status	NSW BC Act VEC: Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion		
	EPBC Act CEEC: Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion		
Description	This PCT occurs along undulating to steep ridges and slopes on colluvium derived from Narrabeen and Permian sediments. Soils are usually dry, stony and relatively infertile and giving rise to a sparse and depauperate understorey. Most occurrences have a northerly aspect and as such this PCT is the second most prevalent over the study area, dominating the ridge lines and steep slopes to the west and adjacent to Wollemi National Park plateau.		
Characteristic canopy trees	<i>Eucalypts dawsonii</i> (Slaty Gum) and <i>Eucalyptus crebra</i>		
Characteristic mid-storey	<i>Acacia binervia</i> (Coast Myall), <i>Olearia elliptica</i> subsp. <i>elliptica</i> (Sticky Daisy Bush), <i>Bursaria spinosa</i> subsp. <i>spinosa</i> , <i>Dodonaea viscosa</i> subsp. <i>cuneate</i> (Wedge-leaf Hop-bush), <i>Allocasuarina verticillata</i> (Drooping Sheoak), <i>Notelaea microcarpa</i> , <i>Grevillea montana</i> (Mountain Grevillea) and <i>Bertya oleifolia</i>		
Characteristic groundcovers	<i>Panicum simile</i> (Two-colour Panic), <i>Entolasia marginata</i> (Bordered Panic), <i>Cymbopogon refractus</i> , <i>Panicum effusum</i> , <i>Lepidosperma laterale</i> (Variable Swordsedge) and <i>Entolasia stricta</i>		
Mean native richness	27		
Exotic species / HTW cover	<i>Senecio madagascariensis</i> , <i>Bidens pilosa</i> var. <i>pilosa</i> , <i>Cyclospermum leptophyllum</i> (Slender Celery), <i>Cestrum parqui</i> (Green Cestrum), <i>Cirsium vulgare</i> (Spear Thistle), <i>Sida rhombifolia</i> (Paddy's Lucerne), <i>Opuntia aurantiaca</i> (Tiger Pear), <i>Galenia pubescens</i> and <i>Eragrostis curvula</i> (African Lovegrass) / 2.1%		
Condition	High		
Variation and disturbance	This PCT is generally consistent in condition across the study area, however areas dominated by monocultures of <i>Acacia binervia</i> (see below) occur sporadically and likely in relation to a combination of past fire and disturbance events favouring this species. An additional form of this PCT was noted by Flora Search (2017) to occur along the shelf like escarpment areas far southwest of the study area. This PCT was not accessed on ground due to time and access issues. Aerial photographs (see photographs below) were utilised to determine the dominate canopy species to be <i>E. dawsonii</i> and <i>E. crebra</i> and PCT1176 still the 'best fit' community.		
No. sites sampled	8 (Plot 10, 11, 12, 13, 20, 21, 29 and 30)		
Fauna habitats	Low density of small tree hollows. Shelter, nesting and foraging habitat for birds, reptiles, bats and both terrestrial and arboreal mammals. Moderate occurrence of <i>Allocasuarina torulosa</i> (Forest Oak) for <i>Calyptorhynchus lathami</i> (Glossy Black-cockatoo).		
Composition	Structure	Function	Vegetation Integrity Score
65.6	69.6	56	63.5



1176 - Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion

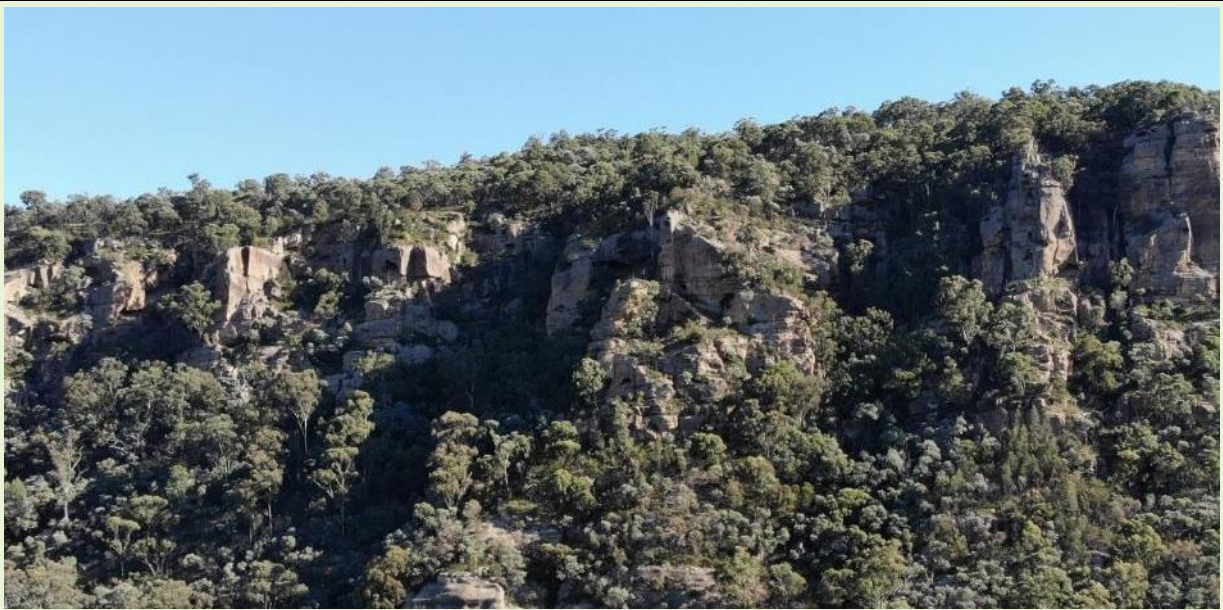


Table 7: Zone 1 PCT 1598 High Condition

1598 - Forest Red Gum grassy open forest on floodplains of the lower Hunter			
Vegetation formation/class	Forested Wetland/Coastal Floodplain Wetlands		
Conservation status	NSW BC Act EEC: Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions		
	EPBC Act CEEC: Not Listed		
Description	This PCT would formerly have covered the entire floodplain which is now largely cleared. The remnants are highly fragmented and occurring on the floodplain of North Wambo Creek in the west of the study area.		
Characteristic canopy trees	<i>Eucalyptus tereticornis</i> (Forest Red Gum), <i>Angophora floribunda</i> (Rough-barked Apple), <i>Eucalyptus crebra</i> and <i>Casuarina cunninghamiana</i> (River Oak)		
Characteristic mid-storey	<i>Acacia implexa</i> (Hickory Wattle), <i>Melia azedarach</i> (White Cedar), <i>Notelaea microcarpa</i> var. <i>microcarpa</i> and <i>Geijera salicifolia</i> var. <i>salicifolia</i>		
Characteristic groundcovers	<i>Cynodon dactylon</i> (Couch), <i>Microlaena stipoides</i> , <i>Oplismenus aemulus</i> (Australian Basket Grass) and <i>Panicum effusum</i>		
Mean native richness	38		
Exotic species / HTW cover	<i>Galenia pubescens</i> , <i>Axonopus fissifolius</i> , <i>Cestrum parqui</i> , <i>Heliotropium amplexicaule</i> (Blue Heliotrope), <i>Senecio madagascarensis</i> / 10.3%		
Condition	High		
Variation and disturbance	Occurs as small patchy remnants or isolated trees along North Wambo Creek and associated floodplain.		
No. sites sampled	2 (Plot 4 and 27)		
Fauna habitats	Amphibian habitat in streams. Potential for small HBTs. Shelter, nesting and foraging habitat for birds, reptiles, bats and both terrestrial and arboreal mammals.		
Composition	Structure	Function	Vegetation Integrity Score
93.3	94.5	81.8	89.7



Table 8: Zone 1 PCT 1603 High Condition

1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter			
Vegetation formation/class	Grassy Woodland/ Coastal Valley Grassy Woodland		
Conservation status	NSW BC Act EEC: Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions		
	EPBC Act CEEC: Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions		
Description	This PCT dominates the flat non-floodplain areas of the valley floor and the adjoining gently undulating lower slopes and ridges. This PCT is the second most extensive woodland vegetation type on the study area. On low flat areas it forms an open forest with sparse low shrubs and groundcover. Shrub size and density tend to increase on sloping sites and in upper gullies. Broad low drainage lines within the PCT support more or less dense stands of <i>Melaleuca decora</i> , where drainage is impeded.		
Characteristic canopy trees	<i>Eucalyptus crebra</i> and <i>Eucalyptus moluccana</i> (Grey Box)		
Characteristic mid-storey	<i>Allocasuarina luehmannii</i> (Bulloak), <i>Acacia salicina</i> , <i>Acacia binervia</i> , <i>Acacia implexa</i> , <i>Melaleuca decora</i> , <i>Psyrax odorata</i> , <i>Notelaea microcarpa</i> and <i>Geijera salicifolia</i>		
Characteristic groundcovers	<i>Calotis lappulacea</i> , <i>Eragrostis brownii</i> (Brown's Lovegrass), <i>Aristida personata</i> (Purple Wire-grass), <i>Cymbopogon refractus</i> and <i>Panicum effusum</i>		
Mean native richness	35		
Exotic species / HTW cover	<i>Senecio madagascariensis</i> , <i>Galenia pubescens</i> , <i>Eragrostis curvula</i> , <i>Cestrum parqui</i> , <i>Bidens subalternans</i> and <i>Axonopus fissifolius</i> / 9.5%		
Condition	High		
Variation and disturbance	This PCT is generally consistent in condition across the study area, with more disturbed patches adjoining the previously cleared areas of the valley floor.		
No. sites sampled	9 (Plot 1, 2, 5, 6, 22, 26, 28, 31 and 32)		
Fauna habitats	Shelter, nesting and foraging habitat for birds, reptiles, bats and both terrestrial and arboreal mammals. Moderate occurrence of <i>Allocasuarina torulosa</i> (Forest Oak) for Glossy Black-cockatoo.		
Composition	Structure	Function	Vegetation Integrity Score
68.6	90.9	45.5	65.7



Table 9: PCT 1603 Derived Native Grassland

1603 - Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin			
Vegetation formation/class	Dry Sclerophyll Forests (Shrubby sub-formation)/ Western Slopes Dry Sclerophyll Forests		
Conservation status	NSW BC Act VEC: Hunter Valley Foothills Slaty Gum Woodland in the Sydney Basin Bioregion.		
	EPBC Act CEEC: Hunter Valley Foothills Slaty Gum Woodland in the Sydney Basin Bioregion.		
Description	This PCT occurs as a result of past clearing and human disturbance valley floor and flatter terrain associated with the valley floor woodlands and now occurs as derived native grasslands. It dominates the majority of the valley to the north and south of north Wambo creek.		
Characteristic canopy trees	Isolated regenerating canopy species included <i>Eucalyptus crebra</i>		
Characteristic mid-storey	Occasional <i>Allocasuarina luehmannii</i> and <i>Acacia salicina</i>		
Characteristic groundcovers	<i>Sporobolus creber</i> , <i>Bothriochloa decipiens</i> (Red Grass), <i>Aristida personata</i> , <i>Cymbopogon refractus</i> and <i>Panicum effusum</i>		
Mean native richness	19		
Exotic species / HTW cover	<i>Axonopus fissifolius</i> , <i>Bidens subalternans</i> , <i>Cenchrus clandestinus</i> (Kikuyu Grass), <i>Galenia pubescens</i> and <i>Senecio madagascariensis</i> / 8.3%		
Condition	Low		
Variation and disturbance	This PCT is generally consistent in condition across the study area, with more disturbed patches adjoining tracks and areas of anthropogenic disturbance.		
No. sites sampled	8 (Plot 7, 9, 15, 16, 18, 23, 24 and 25)		
Fauna habitats	Low occurrence of foraging habitat for birds, reptiles, bats and terrestrial mammals.		
Composition	Structure	Function	Vegetation Integrity Score
32.2	48.3	15	28.7



3.2.2. Plant Community Type selection justification

In determining the PCT within the study area, various attributes were considered in combination to assign vegetation to the best fit PCT. Attributes included dominant species in each stratum and relative abundance, community composition, soils and landscape position. Reference was made to the PCT descriptions in the BioNet Vegetation Classification and the final scientific determinations for TECs (Table 10).

Table 10: Potential PCTs

Selected PCT ID	PCT Name	Other PCT options	Justification
116	Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley	PCT1543, 616 and 1526	All occurrences of this PCT consist of a sparse canopy of diagnostic species; <i>Brachychiton populneus subsp. populneus</i> and <i>Eucalyptus crebra</i> , a dense midstorey dominated by; <i>Acacia salicina</i> and dry rainforest species <i>Psydrax odorata</i> , <i>Notelaea microcarpa</i> var. <i>microcarpa</i> , and a rich understory of grasses; <i>Aristida</i> spp., <i>Bothriochloa macra</i> and <i>Chloris truncata</i> (Windmill Grass). The above assemblage of key species, formation characteristics in combination with its occurrence on colluvial heavy, brown clay soil on lower slopes of the South Hunter Valley within Hunter Interim Biogeographic Regionalisation for Australia (IBRA) subregion make PCT 116 the best fit community.
922	Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion	PCT 1696	All occurrences of this PCT consist of a dense canopy of diagnostic species; <i>Melaleuca decora</i> and <i>Eucalyptus crebra</i> (occasional), a sparse midstorey dominated by; <i>Notelaea microcarpa</i> var. <i>microcarpa</i> , and understory of grasses and sedges; <i>Bothriochloa macra</i> , <i>Cymbopogon refractus</i> and <i>Fimbristylis dichotoma</i> (Common Fringe-sedge). The above assemblage of key species, formation characteristics in combination with its occurrence in areas of impeded drainage within the Hunter Valley within Hunter IBRA-subregion make PCT 922 the best fit community.
1176	Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	PCT 1629 and 1657	All occurrences of this PCT consist of a dense canopy of diagnostic species; <i>Eucalyptus dawsonii</i> , a sparse midstorey dominated by; <i>Olearia elliptica</i> , <i>Notelaea microcarpa</i> var. <i>microcarpa</i> and <i>Acacia salicina</i> , and an understory of grasses and sedges; <i>Aristida personata</i> (Purple Wiregrass) and <i>Cymbopogon refractus</i> . The above assemblage of key species, formation characteristics in combination with its prominent occurrence on footslopes of Permian and Narrabeen sandstone lithology within the Hunter Valley within Hunter IBRA-subregion make PCT 1176 the best fit community.
1598	Forest Red Gum grassy open forest on floodplains of the lower Hunter	PCT42	All occurrences of this PCT consist of a dense canopy of diagnostic species; <i>Eucalyptus tereticornis</i> and <i>Angophora floribunda</i> , a sparse midstorey dominated by; <i>Casuarina cunninghamiana</i> , and an understory of grasses, graminoids and forbs; <i>Microlaena stipoides</i> , <i>Cymbopogon refractus</i> , <i>Lobelia purpurascens</i> (Whiteroot) and <i>Cyperus</i> spp. The above assemblage of key species, formation characteristics in combination with its occurrence along drainage lines and creeks of the floodplain within the Hunter Valley within Hunter IBRA-subregion make PCT 1598 the best fit community.

Selected PCT ID	PCT Name	Other PCT options	Justification
1603	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	PCT 623, 1612 and 1691	All occurrences of this PCT consist of a dense canopy of diagnostic species; <i>Eucalyptus crebra</i> , a sparse midstorey dominated by; <i>Allocasuarina luehmannii</i> , <i>Bursaria spinosa</i> and <i>Notelaea microcarpa</i> var. <i>microcarpa</i> , and understory of grasses; <i>Aristida ramosa</i> and <i>Cymbopogon refractus</i> . The above assemblage of key species, formation characteristics in combination with its occurrence flat non-floodplain areas of the valley floor and the adjoining gently undulating lower slopes within the Hunter Valley within Hunter IBRA-subregion make PCT 1603 the best fit community.
1603	Derived native grassland	PCT 623, 1612 and 1691	All occurrences of this PCT consist of a absent canopy and sparse midstorey of <i>Acacia salicina</i> and understory dominated by native grasses; <i>Sporobolus creber</i> , <i>Bothriochloa decipiens</i> , <i>Aristida personata</i> , <i>Cymbopogon refractus</i> and <i>Panicum effusum</i> . The above assemblage of key species, formation characteristics in combination with its adjacent occurrence to intact patches of PCT 1603 on the flat non-floodplain areas of the valley floor and the adjoining gently undulating lower slopes within the Hunter Valley within Hunter IBRA-subregion make PCT 1603 the best fit community.

3.2.3. Vegetation integrity assessment

3.2.3.1. Vegetation zones

A total of six vegetation zones were identified across both the Approved Underground Mining Area No Longer Required and Modified Underground Mining Area. The condition of each PCT is largely consistent across the study area; therefore, vegetation zones are according to PCT, and have not been split by condition with the exception of PCT 1603 which is present as both high condition woodland and derived native grassland. A total of 32 vegetation integrity survey plots were collected across both areas consistent with the BAM (Table 11).

Table 11: Vegetation zones and vegetation integrity survey plots collected on the development site

Vegetation Zone	PCT ID	PCT Name	Area (ha)		Vegetation Integrity Survey Plots required		Vegetation Integrity Survey Plots collected	
			Approved underground mining area no longer required	Modified underground mining area	Approved underground mining area no longer required	Modified underground mining area	Approved underground mining area no longer required	Modified underground mining area
1	116	116 - Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley	0	5.5	0	3	0	3
2	922	922 - Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion	0.8	0	1	0	1	0
3	1176	1176 - Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	81.2	7.5	5	3	7	3
4	1598	1598 - Forest Red Gum grassy open forest on floodplains of the lower Hunter	4.1	0	1	1	2	1
5	1603	1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	3.8	89.2	2	5	4	7
6	1603	Derived native grassland	51.2	15.6	5	3	6	4
Total			141.1	117.8	14	15	20	18

3.2.3.2. Vegetation integrity scores

All vegetation attribute scores of the Modified Underground Mining Area are within 25% of the Approved Underground Mining Area No Longer Required, with the exception of PCT 1603 composition which was 29% higher within the Modified Underground Mining Area (Table 7, Table 8, Table 9). Excluding PCTs 116 and 922, the Modified Underground Mining Area had a higher average composition score by 5.15 (108% of approved area average composition score), a lower average structure score by 3.75 (95% of approved area average structure score), a slightly higher average function score by 3.1 (106% of approved area average function score) and a slightly higher average vegetation integrity score by 1.52 (102% of approved area average vegetation integrity score) (Table 9).

Table 12: Average vegetation scores for each PCT in the Approved Underground Mining Area No Longer Required

PCT	Composition	Structure	Function	Vegetation integrity
116	--	--	--	--
922	55.9	62.5	44.8	53.9
1176	65.6	69.6	56	63.5
1598	93.3	94.5	81.8	89.7
1603	68.6	90.9	45.5	65.7
1603 – DNG	32.6	48.3	15	28.7
Average	65.03	75.83	49.58	61.90

DNG = Derived Native Grassland.

Table 13: Average vegetation scores for each PCT the Modified Underground Mining Area

PCT	Composition	Structure	Function	Vegetation integrity
116	87.6	93.2	61.9	79.6
922	--	--	--	--
1176	69	55	53	58.6
1598	82.5	91.1	88.9	87.4
1603	88.3	93.9	51.6	75.3
1603 – DNG	40.9	48.3	17.2	32.4
Average	70.18	72.08	52.68	63.43

DNG = Derived Native Grassland.

Table 14: Difference in vegetation attribute scores for the Modified Underground Mining Area compared to the Approved Underground Mining Area No Longer Required

PCT	Composition	Structure	Function	Vegetation integrity
116	--	--	--	--
922	--	--	--	--
1176	+3.4	-14.6	-3	-4.9
1598	-10.8	-3.4	+7.1	-2.3
1603	+19.7	+3	+6.1	+9.6
1603 – DNG	+8.3	0	+2.2	+3.7
Average	+5.15	-3.75	+3.1	+1.52

DNG = Derived Native Grassland.

3.2.4. Threatened Ecological Communities

Four TECs listed under the BC Act and one TEC listed under the EPBC Act occur within the study area (Figure 8 and Figure 9):

- Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion (CEEC – BC Act)
- Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions (EEC – BC Act)
- Hunter Valley Foothills Slaty Gum Woodland in the Sydney Basin Bioregion (VEC – BC Act)
- Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions (EEC – BC Act)
- Central Hunter Valley Eucalypt Forest and Woodland (CEEC – EPBC Act).

A summary of areas for each BC Act and EPBC Act listed TECs within the study area is provided in Table 15 and Table 16, respectively.

Note that under section 7.1 of the BC Act, VECs (e.g. Hunter Valley Foothills Slaty Gum Woodland in the Sydney Basin Bioregion) are not included in the definition of TECs for the purposes of biodiversity assessment and approvals under the EP&A Act.

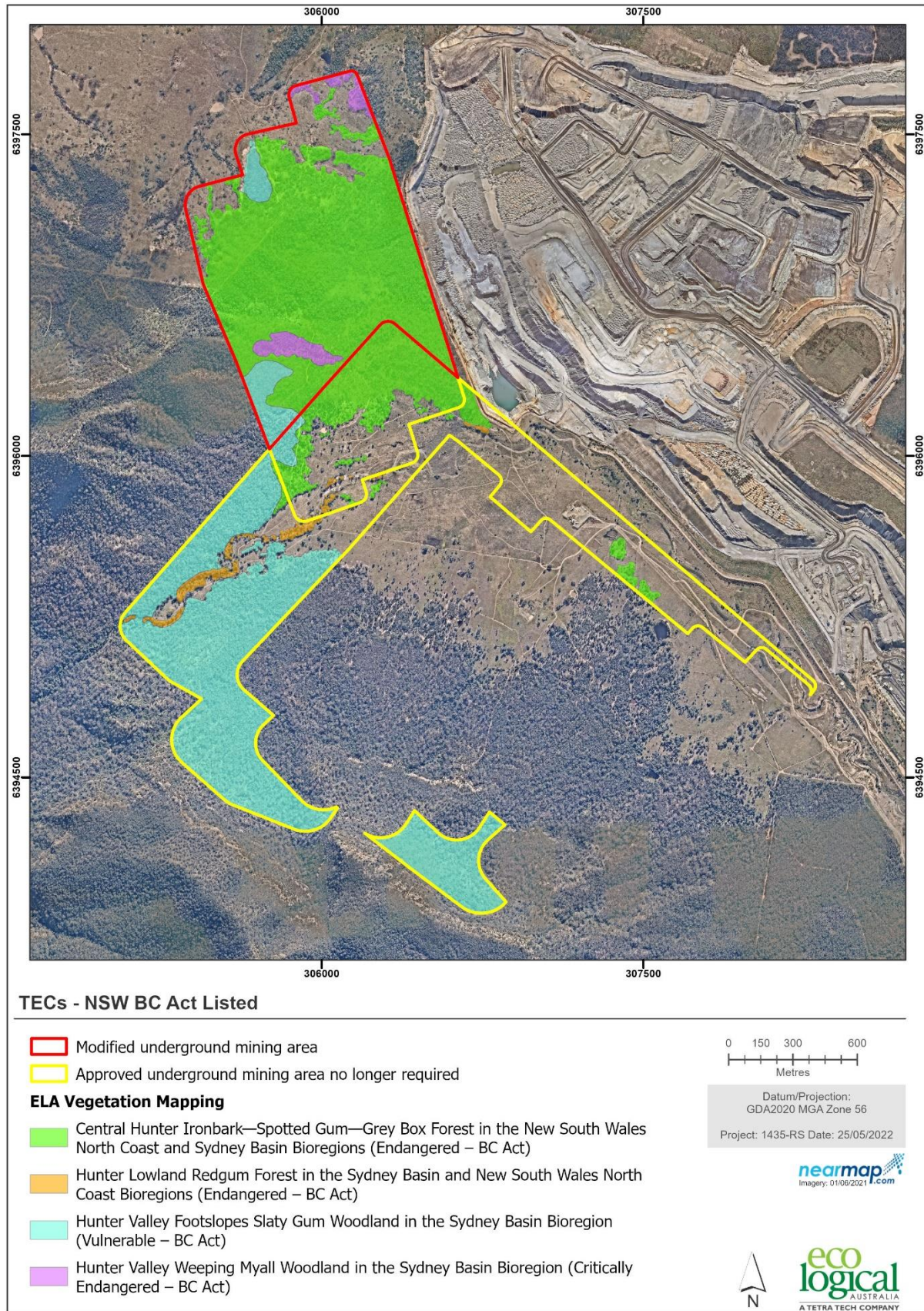


Figure 8: TECs (BC Act)

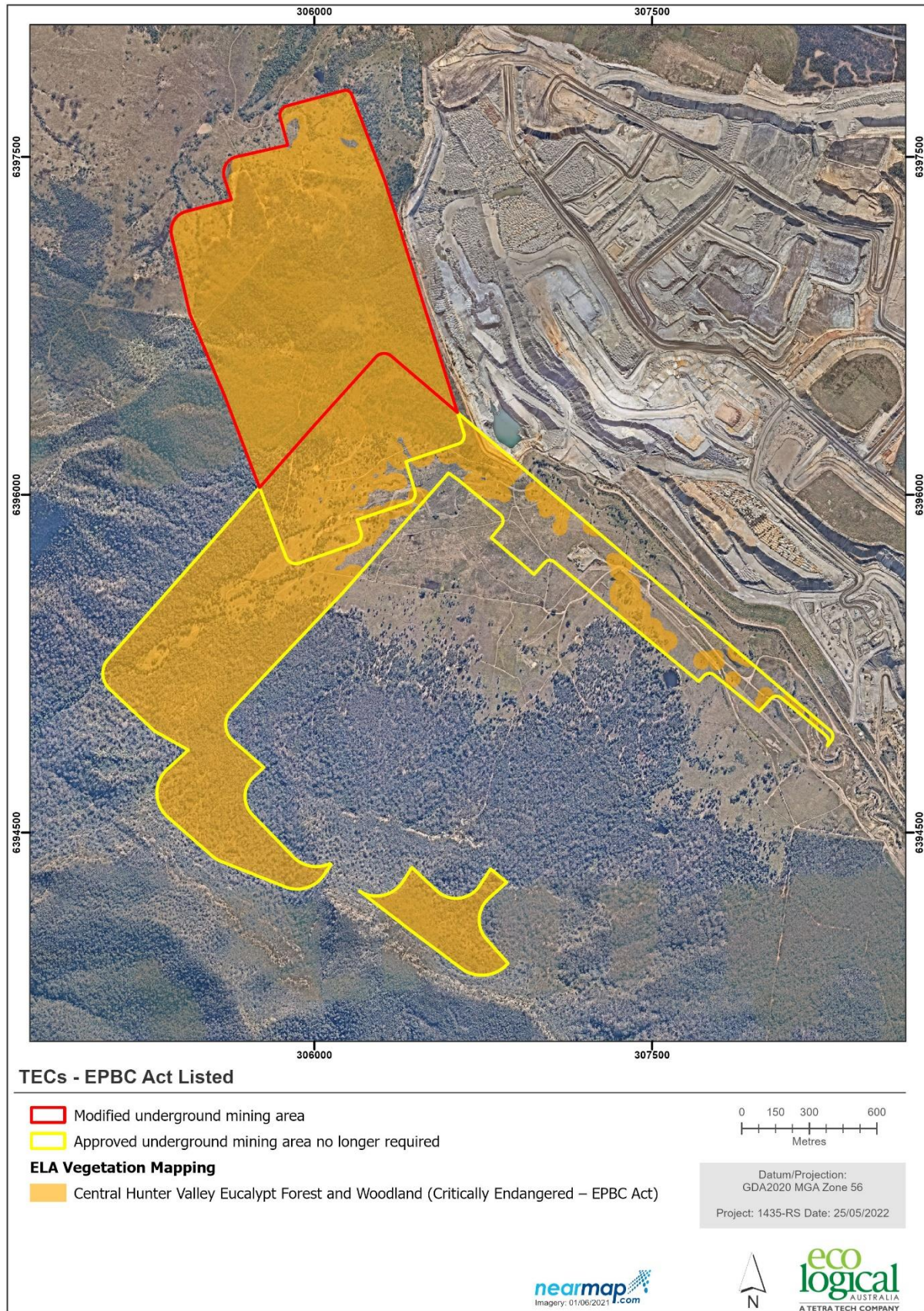


Figure 9: TECs (EPBC Act)

Table 15: TECs (BC Act)

PCT ID	BC Act	BC Act Name	Approved underground mining area no longer required (ha)	Modified underground mining area (ha)	Change (ha)
116 - Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley	CEEC	Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion	0	5.5	+ 5.5
922 - Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion	EEC	Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	0.8	0	-0.8
1598 - Forest Red Gum grassy open forest on floodplains of the lower Hunter	EEC	Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	4.1	0	-4.1
1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	EEC	Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	4.6	89.2	+84.6
Total			9.5	94.7	+85.2

*Hunter Valley Footslopes VEC was excluded from BC Act TEC area calculations as VECs are not included in the definition of TECs under Section 7.1 of the BC Act.

Table 16: TECs (EPBC Act)

EPBC Act	EPBC Act Name	Approved underground mining area no longer required (ha)	Modified underground mining area (ha)	Change (ha)
CEEC	Central Hunter Valley Eucalypt Forest and Woodland	117.1	116.4	-0.7

3.3. Ground Water Dependent Vegetation

HunterEco (2019) assessed potential GDEs within the Approved Underground Mining Area No Longer Required and identified two high potential GDEs. Based on vegetation mapping undertaken for this assessment and consideration of the GDE assessment (HunterEco 2019), a total of 4.9 ha of high potential GDE has been identified within the Approved Underground Mining Area No Longer Required. This includes PCT 922 (*Melaleuca decora* low forest), occurring in an isolated patch with impeded drainage, and PCT 1598 (Forest Red Gum grassy open forest) which occurs along North Wambo Creek (5th order stream) (Figure 10).

The Approved Underground Mining Area Required contains 0.65 ha of high potential GDE which is associated with PCT 1598 along the lower reach of North Wambo Creek. The Modified Underground Mining Area does not contain any areas identified as high potential GDE. In total, the Modification would result in a 4.9 ha reduction in the area of high potential GDE within mining areas, and no new areas of high potential GDE would be directly undermined (Table 17).

It is noted that high potential GDE associated with PCT 1598 also occurs north of the Modified Underground Mining Area at the headwaters of the ephemeral Waterfall Creek (3rd order stream) (Figure 10). This occurs outside of the Modified Underground Mining Area and the potential GDE would not be directly undermined as a result of the proposed Modification. 1st and 2nd order ephemeral drainage lines that flow into Waterfall Creek occur within the Modified Underground Mining Area, however these areas do not contain any likely associated GDE.

Table 17: Area of potential GDE in the Approved Underground Mining Area No Longer Required and Modified Underground Mining Area

GDE Potential	Approved Underground Mining Area No Longer Required (ha)	Modified Underground Mining Area (ha)	Difference (ha)
High Potential	4.9	0	-4.9

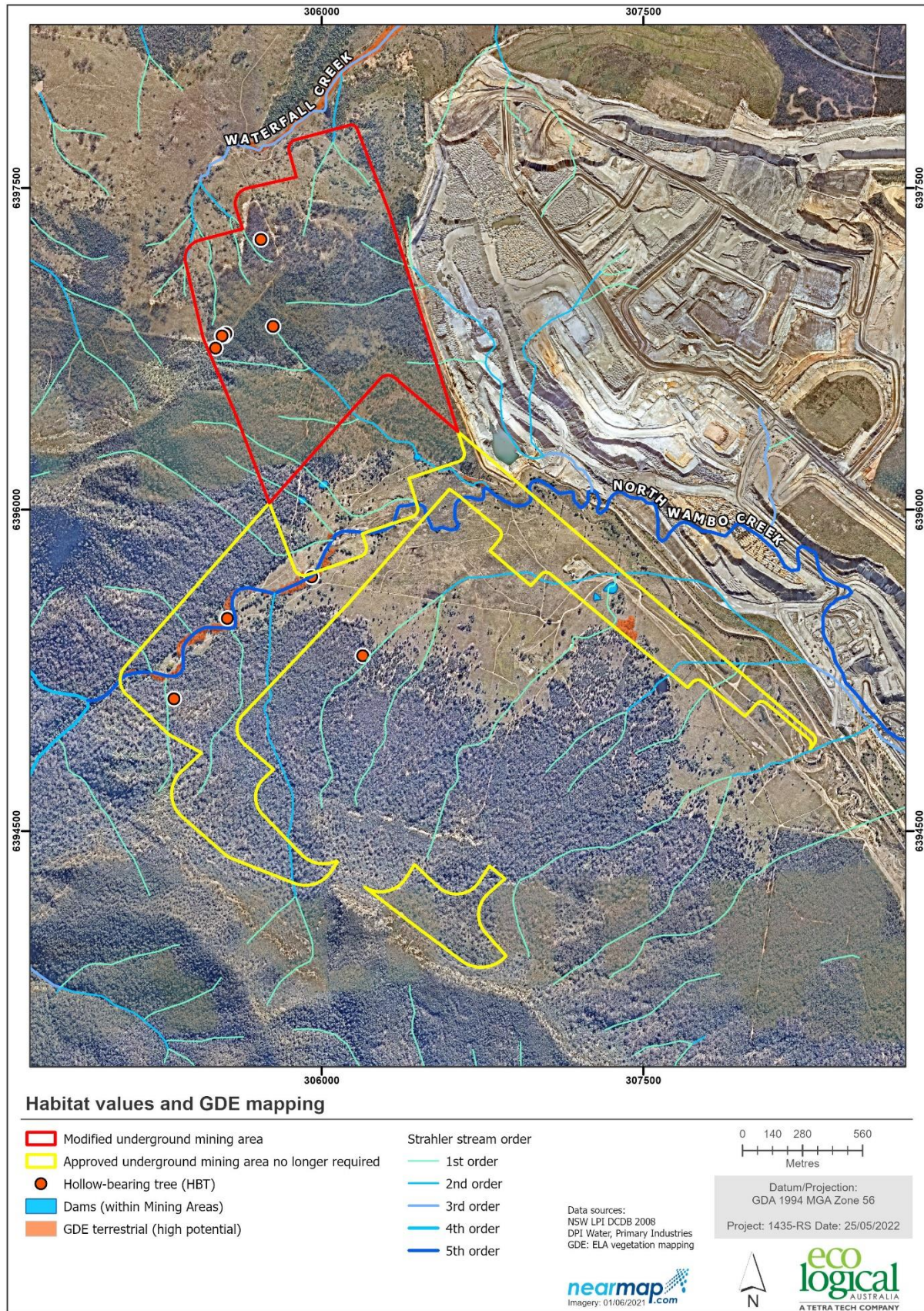


Figure 10: GDEs and habitat features

3.4. Threatened flora and threatened flora populations

A 2013 record for *Pomaderris queenslandica* (Scant Pomaderris) has appeared on BioNet in 2022. The record has a stated location accuracy of 10 m and is located along North Wambo Creek within the Modified Underground Mining Area No Longer Required. This species was not assessed as part of the initial FloraSearch (2017) assessment.

Pomaderris queenslandica is listed as associated with PCT 1176 (Slaty Box – Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion) and PCT 1603 (Narrow-leaved Ironbark – Bull Oak – Grey Box shrub – grass open forest of the central and lower Hunter). However, the 2013 BioNet record is not backed by a vouchered herbarium specimen and is likely to be a misidentification of similar non-threatened species *Pomaderris vellea* (Woolly Pomaderris), considering that it has not been recorded during previously flora assessments since 2013, and annual vegetation monitoring that occurs close to the record. *Pomaderris queenslandica* is widely scattered in north-east NSW and Queensland with specimens known from Mount Dangar and the Gloucester district, with the nearest records approximately 35 km west of the study area. *Pomaderris vellea* occurs in open forest on the coast and escarpment north from the Hunter Valley to Boonoo Boonoo and inland to Denman, also at Leumeah, with the nearest records for this species are 45 km to the east and 45 km to the northwest.

PCT 1176 and PCT 1603 (intact) represent potential habitat for this species, however it is considered unlikely that this species occurs within the Modified Underground Mining Area.

Two threatened flora populations have been identified as likely to occur (FloraSearch 2017, ELA 2017, ELA 2020). FloraSearch (2017) assessed *Cymbidium canaliculatum* (Black Orchid) population in the Hunter Catchment and *Acacia pendula* (Weeping Myall) population in the Hunter catchment as likely to occur in the approved area. This remains true for the Modified Underground Mining Area.

PCT 1176, 1603 and 1598 present potential habitat for the threatened population *Cymbidium canaliculatum* population in the Hunter Catchment. No *Cymbidium canaliculatum* individuals were observed during field assessments. The proposed Modification area contains a large amount of suitable host species including *Eucalyptus crebra*, *Eucalyptus dawsonii*, *Angophora floribunda* and *Eucalyptus moluccana*. These host species are unlikely to be impacted by the proposed modification and potential habitat would be retained.

One additional PCT in the Modified Underground Mining Area, PCT 116 (Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley), represents low potential habitat for the threatened *Acacia pendula* population in the Hunter catchment and the threatened plant species *Cynanchum elegans* (White-flowered Wax Plant).

Opportunistic threatened flora searches were conducted concurrently with vegetation surveys and no threatened flora species were identified. No additional threatened flora habitat was identified during field assessments.

3.5. Threatened fauna

3.5.1. Threatened fauna habitat

Habitat features relevant to each fauna group with potential to use the study area are presented in Table 18 and described in the following sections.

Table 18: Key fauna habitat features present across the study area

Habitat features	Fauna species
HBTs, stags and nests	Arboreal mammals, birds, microchiropteran bats, reptiles and frogs
Cliffs, overhangs, escarpments and crevices	Microchiropteran bats, small birds, small mammals and reptiles
Man-made structures (including old mines or tunnels)	Microchiropteran bats, small birds and small mammals
Riparian and water bodies	Birds, microchiropteran bats, reptiles and frogs
Forested Wetlands	Birds, arboreal and terrestrial mammals, microchiropteran bats, reptiles and frogs
Grassy Woodlands	Birds, arboreal and terrestrial mammals, microchiropteran bats, reptiles and frogs
Dry Sclerophyll Forests	Birds, arboreal and terrestrial mammals, microchiropteran bats, reptiles and frogs
Grasslands	Birds, small mammals, reptiles

3.5.1.1. Hollow bearing trees, stags and nests

Within the Modified Underground Mining Area, PCT 1176 (Slaty Box - Grey Gum shrubby woodland), PCT 1598 (Forest Red Gum grassy open forest on floodplains of the lower Hunter) and PCT 1603 (Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest) have a relatively low abundance of HBTs and stags. The vegetation condition in these communities is consistent between the Approved Underground Mining Area No Longer Required and the Modified Underground Mining Area, as demonstrated by similar the vegetation integrity scores, and the number of HBTs and stags is highly likely to be very similar.

A total of ten HBTs were recorded incidentally during the field assessment (Table 19), although no detailed HBT survey was conducted. Six HBTs were recorded within the Modified Underground Mining Area, three HBTs were recorded in the Approved Underground Mining Area No Longer Required, and one HBT was recorded in adjacent habitat, outside of the mining areas but within the same vegetation type (PCT 1176). All hollows recorded had an entrance diameter of less than 30 cm.

PCT 116 is only recorded within the Modified Underground Mining Area (5.5 ha). Large Eucalypts are uncommon in this community, however, may be present as scattered emergent trees with potential to contain hollows. *Brachychiton populneus* is a common component of the canopy and midstorey of this PCT which may contain small hollows.

Table 19: HBTs recorded during site surveys

ID	Area	PCT	Tree Species	DBH	<50 mm	50 - 100 mm	200 - 300 mm	300 - 400 mm	>400 mm	Total
1	Proposed modification	1603	<i>Eucalyptus moluccana</i>	25	0	3	0	0	0	3
2	Proposed modification	1603	<i>Eucalyptus moluccana</i>	80	2	0	0	0	0	2
3	Proposed modification	1603	<i>Eucalyptus moluccana</i>	45	1	1	0	0	0	2
4	Proposed modification	1603	<i>Eucalyptus moluccana</i>	30	0	3	0	0	0	3
5	Proposed modification	1603	<i>Eucalyptus moluccana</i>	50	0	0	2	0	0	2
6	Previously approved area	1598	<i>Angophora floribunda</i>	90	0	0	1	0	0	1
7	Previously approved area	1176	<i>Eucalyptus dawsonii</i>	90	0	0	1	0	0	1
8	Previously approved area	1176	<i>Eucalyptus dawsonii</i>	60	0	0	1	0	0	1
9	Previously approved area	1603 - DNG	<i>Angophora floribunda</i>	90	0	2	0	0	0	2
10	Proposed modification	1176	<i>Eucalyptus moluccana</i>	50	0	0	3	0	0	3
Total					3	9	8	0	0	20

DNG = Derived Native Grassland.

3.5.1.2. Cliffs, overhangs, escarpments or crevices

The Approved Underground Mining Area No Longer Required contains or is in very close proximity to several areas of cliff and escarpment habitat. Larger amounts of these habitat features also occur further south and southwest in Wollemi State Conservation Area.

No substantial cliffs, overhangs or escarpments were observed during the field assessment in the Modified Underground Mining Area, and no habitat features suitable for cave-roosting microbats or Brush-tailed Rock-wallaby (*Petrogale penicillata*) were recorded. There is some potential for small rocky outcrops (e.g. <5 m²) to occur and crevices may form between rocks suitable for reptiles.

3.5.1.3. Man-made structures (including old mines or tunnels)

No man-made structures including old mines, tunnels or houses were recorded in the proposed Modification area.

3.5.1.4. Riparian and water bodies

Several small ephemeral streams (1st and 2nd order) occur within the Modified Underground Mining Area. The 1st and 2nd order streams flow into either Waterfall Creek in the north, or North Wambo Creek in the south.

Following rainfall, these streams would likely contain pools, suitable as amphibian habitat, and bird, mammal and reptile foraging resources.

A small dam was also recorded with a small amount of fringing aquatic vegetation, providing suitable amphibian habitat, and bird, mammal and reptile foraging resources.

The Modified Underground Mining Area completely avoids North Wambo Creek (5th order stream) which is within the Approved Underground Mining Area No Longer Required.

3.5.1.5. Forested Wetlands

Within the Approved Underground Mining Area No Longer Required, scattered remnant *Eucalyptus tereticornis*, *Angophora floribunda* and *Casuarina cunninghamiana* along North Wambo Creek contain hollows and provide roosting sites and breeding structures for hollow-dependant bats, birds and arboreal mammals. The Modified Underground Mining Area avoids these potential habitat features.

3.5.1.6. Dry Sclerophyll Forests and Grassy Woodlands

These communities occur with variable understorey cover ranging from open and grassy to densely shrubby with thorny shrub species *Bursaria spinosa*. These areas are likely to provide sheltering, breeding and foraging habitat for a range of fauna groups, particularly for small woodland birds. Flowering *Eucalyptus* trees would be a significant foraging resource in this habitat. Groundcover is generally either grassy or high litter cover, providing habitat for small reptiles and invertebrates.

3.5.1.7. Grasslands

Grassland communities in the proposed modification area are largely homogenous in terms of fauna habitat. Low densities of small trees and shrubs provided some habitat availability, as do a low number of scattered logs and rocks. Scattered paddock trees occur within the derived grassland, consisting of predominantly Narrow-leaved Ironbark, and Bulloak. Generally, these trees are relatively young and have not developed hollows, or contain small hollows.

3.5.2. Threatened fauna species

Grey-crowned Babbler (*Pomatostomus temporalis*), listed as vulnerable under the BC Act, was observed several times during the field surveys in both the Approved Underground Mining Area No Longer Required and the Modified Underground Mining Area.

Twenty threatened fauna species have been previously assessed as likely to occur within the Approved Underground Mining Area No Longer Required. Given the adjacent locations and similarities in habitats present, these species are also likely to occur in the Modified Underground Mining Area (Appendix D), with the exception of Brush-tailed Rock-wallaby which is unlikely to occur in the Modified Underground Mining Area due to the absence of suitable rocky escarpments, outcrops and cliff habitat.

Escarpment and cliffline habitat representing potential roosting and breeding habitat for Large-eared Pied Bat (*Chalinolobus dwyeri*) and Eastern Cave Bat (*Vespadelus troughtoni*) is also present within the Approved Underground Mining Area No Longer Required area but absent from the Modified Underground Mining Area. Both areas contain suitable foraging habitat (woodland/forest within 2km of caves/cliffs) for the species.

No additional threatened fauna species are likely to occur in the Modified Underground Mining Area (Appendix C).

4. Assessment of the impact on biodiversity values

The key potential biodiversity impacts of the Modification would be related to the the reorientation of the approved Longwall 24 and Longwall 25, and the addition of Longwall 26 and the associated subsidence impacts and consequences. The Modification would not include any additional surface development areas.

A Subsidence Assessment has been prepared by Mine Subsidence Engineering Consultants (MSEC) (2022) for the Modification. A comparison of the maximum predicted total subsidence effects for the approved and modified South Bates Extension Underground Mine layout is provided in Table 20. The values represent the maximum predicted accumulated movements due to the extraction of all longwalls for the respective layouts.

Table 20: Comparison of maximum predicted total subsidence effects

Layout	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km ⁻¹)	Maximum predicted total sagging curvature (km ⁻¹)
Existing/Approved Longwalls 17 to 23	1,950	80	> 3.0	> 3.0
Modified Longwalls 24 to 26	1,950	75	> 3.0	> 3.0

Notes: mm = millimetre; mm/m = millimetres per metre; km⁻¹ = 1/kilometre

The predicted vertical subsidence, maximum predicted tilt and curvatures above the modified Longwalls 24 to 26 are similar to those predicted for the existing/approved Longwalls 17 to 23 and therefore the potential impacts to natural vegetation in the modified Longwalls 24 to 26 would be similar to the existing/approved Longwalls 17 to 23 (MSEC, 2022).

Biodiversity values and assessment requirements are summarized in Table 21.

Based on Table 21, it is concluded that the Modification would not result in an increase impacts on biodiversity values as defined in the BC Act and BC Regulation.

Table 21: Summary of biodiversity values in Approved Underground Mining Area No Longer Required and Modified Underground Mining Area

Biodiversity value	Description	Will the Modification increase impacts on the biodiversity value?
Vegetation abundance - 1.4(b) BC Regulation	Occurrence and abundance of vegetation at a particular site.	The Approved Underground Mining Area No Longer Required contains 141.1 ha of native vegetation. The Modified Underground Mining Area contains 117.8 ha of native vegetation. Therefore, the Modification would result in a 23.3 ha reduction undermining of native vegetation. The additional PCT (116) that is not present in the Approved Underground Mining Area No Longer Required makes up 3% of the Modified Underground Mining Area. The Subsidence Assessment (MSEC, 2022) predicts similar or less subsidence would occur in the Modification area compared to the Approved Underground Mining Area No Longer Required and the already mined longwalls of the South Bates Underground Mine. In already undermined areas the occurrence of native vegetation has not reduced (ELA, 2014-21). No above-ground clearing is proposed and no significant impacts to the extent of native vegetation communities are expected, and therefore the occurrences and abundance of these communities is considered unlikely to be reduced. Furthermore, the area of native vegetation to be undermined would be reduced as a result of the Modification. Based on the prediction of similar or less subsidence (MSEC, 2022) and monitoring results which have not recorded impacts to vegetation occurrence or abundance in previously undermined areas (ELA, 2014-21), the Modification would not increase the impact on vegetation abundance
Vegetation integrity - 1.5(2)(a) BC Act	Degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state.	A comparison of vegetation integrity scores between the Approved Underground Mining Area No Longer Required and the Modified Underground Mining Area demonstrates that vegetation condition is largely equivalent or similar between the two areas. The average vegetation integrity of PCTs shared by Approved Underground Mining Area No Longer Required and Modified Underground Mining Area (i.e. excluding PCT 116 and 992) is 61.90 within the Approved Underground Mining Area No Longer Required, and an average of 63.43 in the Modified Underground Mining Area. The similarity of these values suggests there is no difference in vegetation integrity between the two areas. The Subsidence Assessment (MSEC, 2022) predicts similar or less subsidence would occur in the Modification area compared to the Approved Underground Mining Area No Longer Required and the already mined longwalls of the South Bates Underground Mine. In already undermined areas the native vegetation integrity has varied (predominantly in terms of composition) due to seasonal variation in conditions (i.e. rainfall) and no significant impacts to vegetation condition as a result of subsidence have been recorded (ELA, 2014-21). The Modification does not include any additional above-ground clearing, the total area of native vegetation to be undermined is lower, and no significant impacts to overall vegetation integrity are expected. Based on the prediction of similar or less subsidence (MSEC, 2022) and monitoring results which have not recorded impacts to vegetation integrity in previously undermined areas (ELA, 2014-21), the Modification would not increase the impact on vegetation integrity

Biodiversity value	Description	Will the Modification increase impacts on the biodiversity value?
Water Sustainability - 1.4(f) BC Regulation	Degree to which water quality, water bodies and hydrological processes sustain threatened species and threatened ecological communities at a particular site	North Wambo Creek is the most notable hydrological feature in the study area and is associated with high potential GDEs (HunterEco, 2019). The Modification would reduce the length of North Wambo Creek to be undermined by 2.1 km and the predicted subsidence effects would be similar or less than associated with the Approved Mining Area No Longer Required (MSEC 2022). The upper reaches of Waterfall Creek (i.e. first and second order sections) are located above the Modified Underground Mining Area with the third order section located at least 180 m from the modified layout. The Modification would result in subsidence impacts on this area (MSEC, 2022). However, the total length of first and second order unnamed drainage lines which form tributaries of North Wambo Creek and Waterfall Creek that would be undermined would be reduced as a result of the Modification (MSEC 2022). The Modified Underground Mining Area contains no high potential GDEs while the Approved Underground Mining Area No Longer Required contains 4.9 ha. The proposed Modification would avoid mining under 4.9 ha of the area of high potential GDE, and no new areas of high potential GDE would be directly undermined within Modified Underground Mining Area. Therefore, the potential impacts to GDEs as a result of the Modification are expected to be reduced. The Modification is unlikely to result in an overall increased impact on water sustainability.
Habitat suitability - 1.5(2)(b) BC Act	Degree to which the habitat needs of threatened species are present at a particular site	Fauna species Detailed threatened fauna surveys were not undertaken as part of this review, however, Grey-crowned Babbler, listed as vulnerable under the BC Act, was incidentally observed at both the Approved Underground Mining Area No Longer Required and the Modified Underground Mining Area. Both areas contain suitable habitat for this species, as well as other threatened woodland birds known to occur in the locality. Both areas (particularly in PCTs dominated by a high canopy of <i>Eucalyptus</i>) contain suitable foraging resources that are likely utilised by threatened woodland birds, as well as low-moderate quantity of suitable HBTs for hollow dependent woodland birds. No clearing of vegetation is proposed as part of the Modification, and any impacts to <i>Eucalyptus</i> species associated with subsidence is expected to be negligible, and most likely restricted to individual plants, if at all. Twenty threatened fauna species have been previously assessed as likely to occur within the Approved Underground Mining Area No Longer Required. These species are also likely to occur in the Modified Underground Mining Area (Appendix D) with the exception of Brush-tailed Rock-wallaby which is unlikely to occur in the Modified Underground Mining Area due to the absence of suitable rocky escarpments, outcrops and cliffs. Roosting and breeding habitat for Large-eared Pied Bat is also present within the Approved Underground Mining Area No Longer Required but absent from the Modified Underground Mining Area. Both areas contain suitable foraging habitat that is unlikely to be significantly affected. The previous assessments undertaken for the Approved Underground Mining Area No Longer Required remain valid for the Modified Underground Mining Area due to the similarity in habitat and foraging resources.

Biodiversity value	Description	Will the Modification increase impacts on the biodiversity value?
		Overall, no additional threatened fauna species were considered likely to occur in the Modified Underground Mining Area, and cliffline habitat which represents important potential habitat for three threatened species, Brush-tailed Rock-wallaby, Large-eared Pied Bat and Eastern Cave Bat, is absent from the Modified Underground Mining Area. Based on the prediction of similar or less subsidence (MSEC, 2022) and monitoring results which have not recorded a loss of threatened fauna populations or their habitat in previously undermined areas (ELA, 2014-21), the Modification would not increase the impact on habitat suitability for threatened fauna. Flora species Detailed threatened flora surveys were not undertaken as part of this review, and there were no incidental observations of threatened flora in the Modification area. Several species have been identified as having low potential to occur in the study area but no species are considered likely to occur (FloraSearch, 2017; ELA, 2017; ELA, 2020). FloraSearch (2017) noted that out of the species considered to have low potential to occur, <i>Pterostylis gibbosa</i> is the most likely species to occur in the Approved Underground Mining Area No Longer Required area, which remains true in the sclerophyll forest habitat in the Modified Underground Mining Area. FloraSearch (2017) identified the threatened flora populations <i>Cymbidium canaliculatum</i> population in the Hunter Catchment and <i>Acacia pendula</i> population in the Hunter catchment as likely to occur in the Approved Underground Mining Area No Longer Required. This remains true for the Modified Underground Mining Area. PCT 1176, 1603 and 1598 present potential habitat for the threatened population <i>Cymbidium canaliculatum</i> population in the Hunter Catchment. No <i>Cymbidium canaliculatum</i> individuals were observed during field assessments. The proposed Modification area contains a large amount of suitable host species including <i>Eucalyptus crebra</i>, <i>Eucalyptus dawsonii</i>, <i>Angophora floribunda</i> and <i>Eucalyptus moluccana</i>. These host species are unlikely to be impacted by the proposed modification and potential habitat would be retained. One additional PCT occurs in the Modified Underground Mining Area, PCT 116 (Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley), representing potential habitat for the threatened <i>Acacia pendula</i> population in the Hunter catchment and the threatened plant species <i>Cynanchum elegans</i>. No direct impacts to this habitat are proposed and subsidence impacts are considered unlikely to result in this area becoming unsuitable habitat for either species if present. Based on the assessment of additional species not previously assessed (Appendix C), and results of field surveys, no additional threatened flora species or threatened flora populations are likely to occur in the Modified Underground Mining Area. The assessments undertaken by FloraSearch (2017) remain valid for the Modified Underground Mining Area. Based on the prediction of similar or less subsidence (MSEC, 2022) and low likelihood of occurrence threatened flora, the Modification would not increase the impact on habitat suitability for threatened flora.

Biodiversity value	Description	Will the Modification increase impacts on the biodiversity value?
Threatened species abundance - 1.4(a) BC Regulation	Occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site	Both the Approved Underground Mining Area No Longer Required and the Modified Underground Mining Area contain known and potential habitat for a similar suite of threatened species, with the exception of cliffline habitat, which represents important potential habitat for three threatened fauna species, Brush-tailed Rock-wallaby, Large-eared Pied Bat and Eastern Cave Bat, and is absent from the Modified Underground Mining Area. No systematic surveys have been undertaken to assess threatened species abundance. The Modification would result in similar subsidence impacts (MSEC 2022) to a reduced area of native vegetation/habitat compared to the Approved Underground Mining Area No Longer Required. The study area contains three TECs listed under the BC Act. The Modification would result in: • a 4.1 ha reduction in the area of Hunter Lowland Redgum Forest (EEC) to be undermined • a 5.5 ha increase in the area of Hunter Valley Weeping Myall Woodland (CEEC) to be undermined (this community is not present in the Approved Underground Mining Area No Longer Required) • an 84.6 ha increase in the area of Central Hunter Ironbark—Spotted Gum—Grey Box Forest (EEC) to be undermined. The Subsidence Assessment (MSEC, 2022) predicts similar or less subsidence would occur compared to the Approved Underground Mining Area No Longer Required and the already mined longwalls of the South Bates Underground Mining areas. In these already undermined areas the occurrence of TECs has not reduced (ELA 2014-21). Although there is an increase in the area of some TECs to be undermined within the Modified Underground Mining Area, no above-ground clearing is proposed and no significant impacts to these communities are expected, and therefore the occurrences and abundance of these communities is considered unlikely to be reduced. Based on the prediction of similar or less subsidence (MSEC, 2022), monitoring results which have not recorded impacts to threatened species or TEC abundance in previously undermined areas (ELA, 2014-21) and no above-ground clearing proposed, the Modification would not increase the impact on the occurrence and abundance of threatened species or TECs, or their habitat.
Habitat connectivity - 1.4(c) BC Regulation	Degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range	Both the Approved Underground Mining Area No Longer Required and the Modified Underground Mining Area have a high level of habitat connectivity due to dominance of forest and woodland habitats and surrounding areas of native vegetation. No clearing of vegetation is proposed as part of the Modification and therefore and no impacts to habitat connectivity for threatened ecological communities or species are considered likely to occur. The Modification would not increase the impact on habitat connectivity.
Threatened species movement - 1.4(d) BC Regulation	Degree to which a particular site contributes to the movement of	Both the Approved Underground Mining Area No Longer Required and the Modified Underground Mining Area provide forest, woodland and grassland habitat for movement of threatened species within the locality. Both areas contain similar habitats and connectivity, and the

Biodiversity value	Description	Will the Modification increase impacts on the biodiversity value?
	threatened species to maintain their lifecycle	Modification does not involve direct surface impacts. Any potential impacts associated with subsidence are expected to be minimal and are not likely to affect the movement of threatened species required to maintain their lifecycle. The Modification would not increase the impact on threatened species movement.
Flight path integrity - 1.4(e) BC Regulation	Degree to which the flight paths of protected animals over a particular site are free from interference	Both the Approved Underground Mining Area No Longer Required and the Modified Underground Mining Area are likely to be used as part of broader flight paths by threatened bird and bat species in the locality and region. The Modification will not the impact the flight path of protected species in the study area, as no above-ground work is proposed, outside of what has previously been approved. The Modification would not increase the impact on flight path integrity.

4.1. Commonwealth EPBC Act

The following MNES, known or considered likely to occur in the study area and with potential to be impacted by the Modified Underground Mining Area, were assessed in accordance with the Significant Impact Criteria (SIC) in the EPBC Act Significant Impact Guidelines (DotE 2013):

- Central Hunter Valley Eucalypt Forest and Woodland – Critically Endangered
- *Pteropus poliocephalus* (Grey-headed Flying-fox) –Vulnerable
- *Dasyurus maculatus* (Spotted-tailed Quoll) – Endangered
- *Petauroides volans* (Greater Glider) – Vulnerable
- *Hirundapus caudacutus* (White-throated Needletail) – Vulnerable
- Migratory species:
 - White-throated Needletail
 - *Motacilla flava* (Yellow Wagtail)
 - *Monarcha melanopsis* (Black-faced Monarch)
 - *Gallinago hardwickii* (Latham’s Snipe)
 - *Myiagra cyanoleuca* (Satin Flycatcher)
 - *Rhipidura rufifrons* (Rufous Fantail).

4.1.1. Threatened species, populations and communities

Based on the SIC assessments (Appendix E), it was concluded that it is unlikely that the proposal would have a significant impact on MNES for the following reasons:

- No direct impacts including surface clearing are proposed
- Potential indirect impacts associated with subsidence and surface cracking are considered negligible.

Accordingly, the proposed Modification is unlikely to result in any significant impact on MNES under the EPBC Act and the preparation of a referral under the EPBC Act is not recommended in relation to threatened species, populations or communities.

Detailed SIC for MNES are provided in Appendix E.

4.1.2. Migratory species

The assessment found that six migratory bird species listed under the EPBC Act may be impacted by the proposed activity, however no significant impacts were likely to these species (Appendix E).

In accordance with the EPBC Act significant impact criteria, it was concluded that the proposed activity:

- Will not substantially modify, destroy or isolate an area of important habitat for a migratory species
- Will not result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species
- Will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

Accordingly, the preparation of a referral under the EPBC Act is not recommended in relation to migratory species.

5. Conclusion

This assessment provides an assessment and comparison of biodiversity values between an Approved Underground Mining Area No Longer Required and a Modified Underground Mining Area at the South Bates Extension Underground Mine. As part of this assessment, vegetation integrity plot surveys have been undertaken to generate baseline data and accurately quantify the vegetation integrity across the entire study area. These sites may also be used as future monitoring sites to assess any impacts of potential subsidence on vegetation communities.

The Approved Underground Mining Area No Longer Required contains 141.1 ha of native vegetation and the Modified Underground Mining Area contains 117.8 ha of native vegetation. No clearing of vegetation is proposed within the Modified Underground Mining Area, and any impacts of vegetation abundance associated with subsidence are considered likely to be negligible. Vegetation integrity was generally high and found to be similar between both areas. Therefore, the proposed Modification is unlikely to result in any decrease in vegetation abundance or integrity beyond that already approved.

The study area contains three TECs listed under the BC Act. The Modification would result in undermining of 5.5 ha of Hunter Valley Weeping Myall Woodland (CEEC), this community is not present in the Approved Underground Mining Area No Longer Required. The Modification would result in a 4.1 ha reduction in the area of Hunter Lowland Redgum Forest (EEC) and an 84.6 ha increase in the area of Central Hunter Ironbark—Spotted Gum—Grey Box Forest to be undermined.

The study area contains one TEC listed under the EPBC Act. The Modification would result in a 0.7 ha reduction in the area of Central Hunter Valley Eucalypt Forest and Woodland CEEC to be undermined.

Both the Approved Underground Mining Area No Longer Required and the Modified Mining Area contain known and potential habitat for a range of threatened woodland species, in particular woodland birds. However, as no above-ground clearing is proposed, threatened species habitat would not be impacted by the Modified Underground Mining Area.

The total amount of high potential GDE that would be undermined as a result of the Modification would reduce by 4.9 ha.

The Modified Underground Mining Area represents a reduction in native vegetation communities, GDE and cliff line habitat. Therefore, risk of biodiversity impacts associated with subsidence is likely to be decreased in the Modified Underground Mining Area. It is therefore concluded that the Modification would not result in an increase in impacts on biodiversity values as defined in the BC Act and BC Regulation.

It is also concluded that the Modification would be unlikely to result in any significant impact on relevant MNES listed under the EPBC Act.

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Appendix A Vegetation Floristic Plot Data

Species	Exotic	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	Plot 26	Plot 27	Plot 28	Plot 29	Plot 30	Plot 31	Plot 32	
<i>Abutilon oxycarpum</i>		0.1	0.1	0	0	0	0.2	0	0	0	0	0	0.1	0.1	0	0	0	0.2	0.2	0.2	0	0	0	0.1	0.1	0	0	0	0	0	0	0	0	
<i>Abutilon</i> spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	
<i>Acacia amblygona</i>		0	0	0	0	0	0	0	0	0	1	0.2	0	0	0	0	0	0	0	0	0.2	0	0.1	0	0	0	0	0	0	0	2	1	0	0.3
<i>Acacia binervata</i>		0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Acacia binervia</i>		0	0	0	0	0	0	0	0	0	20	0	75	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	
<i>Acacia doratoxylon</i>		0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	
<i>Acacia implexa</i>		0	0	3	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Acacia irrorata</i> subsp. <i>irrorata</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	
<i>Acacia myrtifolia</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	
<i>Acacia piligera</i>		0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
<i>Acacia prominens</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	
<i>Acacia salicina</i>		0	0	25	0	5	0	0	0	0	0	2	0	0	0	0	0	8	0	0	0	0	3	0	0	0	0	0	0	0	0.2	0	0.1	
<i>Acacia verniciflua</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	1	0	0	0.8	0	0	
<i>Allocauarina luehmannii</i>		5	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	2	0.1	0.2	
<i>Allocauarina verticillata</i>		0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0.2	3	0	0	0	0	0	5	0	0	0	0	0	
<i>Alternanthera denticulata</i>		0	0	0	0	0	0	0	0.5	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Ambrosia psilostachya</i>	*	0	0	0	0	0.1	0	0	0	2	0	0	0	0	0	0.1	1	0.3	3	5	0.1	0	0	0.1	0.5	0	0	0	0	0	0	0.1	0	
<i>Amyema gaudichaudii</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	
<i>Anagallis</i> spp.	*	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	
<i>Ancistrachne uncinulata</i>		0.5	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Angophora floribunda</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	
<i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	*	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Aristida personata</i>		0	0	0	0	0	0	0	0.5	0	0.5	0	0	0	0	0	0	0	8	0	1	0	0	15	25	0	0	0	0.2	1	0	5	10	
<i>Aristida ramosa</i>		0	5	0	0	0	0	0	0	25	0	0	0	0	0	1	40	2	20	3	0	0.2	2	5	15	10	0	20	0	0	0.5	0	0	
<i>Arthropodium</i> spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0.1	0	0	0	
<i>Asperula conferta</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0.1	
<i>Asteraceae</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Asteraceae</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	
<i>Atriplex semibaccata</i>		0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Austrostipa ramosissima</i>		0	0	15	0.5	5	0	0	0	0	0	0	0	0	0	0	0	2	20	0	0	0	0	0	0	0	10	0	0	0	0	0	0	
<i>Austrostipa scabra</i> subsp. <i>scabra</i>		0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	5	5	45	25	0	0	1	0	0	0	0	0	0	0	0	0	0	
<i>Austrostipa verticillata</i>		0	0	0	0.1	0	0	1	0	20	0	0	0	0	0	0	1	0	25	40	2	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Axonopus fissifolius</i>	*	0	0	0	2	0	0	10	0.5	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	5	0	0	2	0	0	0	0	
<i>Axonopus</i> spp.	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Bertya oleifolia</i>		0	0	0	0.8	0	0	0	0	0	50	1	0.2	20	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	2	0	0	0	
<i>Bidens pilosa</i> var. <i>pilosa</i>	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	10	0.5	0	0	0	0	0	0	0	15	0	0	0.1	0.1	
<i>Bidens subalternans</i>	*	0	0	0.2	0	2	0.1	0	2	1	0	0	0	0	0	0	0	0.2	5	0	0	0	0	0.2	0	1	0	0	30	0	0	0	0.1	
<i>Bothriochloa biloba</i>		10	5	0	0	0	0	0	0	0	0	0	0	0	0	30	5	0.2	0.2	0	0	0	10	1	10	1	0	0	0	0	0	0	0	
<i>Bothriochloa decipiens</i> var. <i>decipiens</i>		5	10	5	0	10	15	0	0	0	0	0	0	0	0	20	0	0.5	0.5	2	0	0	5	8	20	45	0	0	0	0	0	0	10	
<i>Bothriochloa macra</i>		10	10	2	0	0.1	10	0	10	0	0	0	0	0	0	10	2	0.5	0.5	0	0	0	20	10	15	15	0	0	0	0	0.2	1	0.2	
<i>Brachychiton populneus</i> subsp. <i>populneus</i>		0.2	1	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0.2	0	10	0.5	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Breynia oblongifolia</i>		0.2	1	1	0	0.2	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0												

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Species	Exotic	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	Plot 26	Plot 27	Plot 28	Plot 29	Plot 30	Plot 31	Plot 32
Melicytus dentatus		0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Callitris glaucophylla		0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0.5	0	0	0	0	0.1
Calotis cuneifolia		3	5	4	0	15	5	0	0	0	0	0	0	0	0	0	0	2	0.2	0.5	5	1	1	0.1	0	0	0	1	0	0.5	1	0.5	0.1
Calotis lappulacea		5	10	0.1	0	5	1	0	10	0	0	0	0	0	0	2	0	0.1	0.1	0.1	0	0	0	0	0	0.1	0	0	0	1	0.3	0.3	0
Calystegia marginata		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
Psydrax spp.		0	2	0	0	0	8	0	0	0	0	0	0	0	0	0	0	4	0	10	8	0	0	0	0	0	0	0	0	0	0.1	0	0
Cassytha glabella f. glabella		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0
Casuarina cunninghamiana		0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
Cenchrus clandestinus	*	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Centaurium erythraea	*	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0
Cestrum parqui	*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cheilanthes sieberi subsp. sieberi		0.2	0.2	0	0	0	0.1	0	0.1	0	0	0	0.1	0.1	0	0.1	0.1	1	0.1	1	0	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0	0.5	1	0.1	0
Chenopodium spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloris ventricosa		25	10	40	0	15	30	0	0	0	0	0	0	0	0	0	0	1	1	2	1	0	10	4	2	0.2	0.1	0	1	0	0	10	10
Choretrum candollei		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Cirsium vulgare	*	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0.2	0	0	0	0	0	0
Commelina cyanea		0	0	0	0	0.5	0.2	0	0.1	0.5	0.1	0	0	0	0	0	0	0	1	0.1	0.1	0	0	0	0.1	0	0	0	0.1	0.2	0	0	0
Convolvulus erubescens		0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conyza spp.	*	0	0	0	5	0	0	0.2	0.1	5	0	0	0	0	0	0	0	0.5	10	5	0.5	0	0	0	0	0.2	0.8	0	0.1	0	0	0	0
Cyclospermum leptophyllum	*	0	0	0	0.1	0	0.1	0	0	2	0	0	0	0	0	0.2	2	0	0	0	0.1	0	0.1	0.4	1	2	0.1	0	0	0	0	0	0.1
Cymbopogon refractus		5	10	25	0	1	0	30	10	0	0	10	0	0	0	2	0	10	2	10	2	0	15	2	5	2	0	10	0	20	10	10	10
Cynodon dactylon		0	0	0	20	0	0	15	1	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	20	0	0.5	0	0	0	0
Cynoglossum australe		0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
Cyperaceae	0	0	0	0	0	0	0	0	0	0	0.5	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0
Cyperus brevifolius	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0
Cyperus fulvus		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyperus gracilis		0	0	0	0.2	0	0	0	0.2	2	0	0	0	0	0	0	0	1	0.2	0.1	0.3	0.2	0	0	0	0	0.8	0	0	0.2	0.1	0	0
Cyperus spp.		0.2	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0.1	0	0	0.1	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0
Cyperus polystachyos		0	0	0	0	0	0	0	0.2	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Desmodium spp.		2	2	0.2	0	0.2	0.2	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0.1	0.1	0	0	0	0	0
Desmodium varians		2	0.2	0.1	0	0.2	0.2	0	0	0	0.1	0.1	0	0	0	0	0	0.1	0.1	0.1	0.1	0.1	0.1	0	0.1	0	0.1	0	0	1	0.2	2	0.5
Dianella caerulea var. caerulea		0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0.1	0	0	0	0
Dianella tasmanica		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Dichanthium sericeum subsp. sericeum		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	20
Dichelachne spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
Dichondra repens		5	0.1	0	0	0	0.5	0	0.2	0	0	0	0	0	0	0	0	0.8	10	0.5	1	0.1	0.2	0	0.1	0	0	0.2	0	0.1	0.1	0.2	0
Digitaria brownii		0	0	0	0	0	0	0	0																								

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<i>Enneapogon</i> spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	
<i>Entolasia marginata</i>		0	0	0	0	0	0	0	0	0	0	1	0	10	0	0	0	5	0	0.5	2	0.2	0	0	0	0	1	0	0	0.2	0.5	5	2	
<i>Entolasia stricta</i>		0	0	0	0	0	0	0	0	0	1	0	0.1	0	0	0	0	8	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Eragrostis brownii</i>		5	10	0.5	0	1	2	2	2	0	0	0.5	0	0	0	5	10	2	0.2	1	0	4	10	2	0	0	0	0	0	20	2	5	10	5
<i>Eragrostis cilianensis</i>	*	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	
<i>Eragrostis curvula</i>	*	5	0	0	0	0.5	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	
<i>Eragrostis leptostachya</i>		10	0.2	0	0	0	0.2	0.2	3	0	0	0	0	0	0	0	0	15	15	5	0	0	1	0	0	0	0	0	1	0	1	5	0	
<i>Eremophila debilis</i>		0	0.2	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0.1	0	0	0	0	0	0.2	0	0	0	0	0	
<i>Eriochloa pseudoacrotricha</i>		0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Erodium</i> spp.		0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Eucalyptus crebra</i>		25	45	0	0	20	30	0	1	0	0	15	0	0	0	0	0	15	0	0	0	0.8	40	0	0	0	0	0	30	30	8	15	1	
<i>Eucalyptus dawsonii</i>		0	0	0	0	0	0	0	0	0	45	40	2	2	0	0	0	0	0	0	45	50	0	0	0	0	0	0	0	0	30	0	0	
<i>Eucalyptus moluccana</i>		15	0	0	0	15	30	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	35	0	0	0	15	40	
<i>Euchiton involucratus</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	
<i>Euchiton sphaericus</i>		0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	
<i>Evolvulus alsinoides</i> var. <i>decumbens</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.2	0.1	0	
<i>Exocarpos strictus</i>		0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Facelis retusa</i>	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	
<i>Ficus</i> spp.		0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Fimbristylis dichotoma</i>		0.5	0.1	0	0	0.1	0	0.2	1	0.2	0	0	0	0	0	0.2	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0.1	0.2	0.2	0.2	0.2
<i>Gahnia aspera</i>		0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Gahnia</i> spp.		0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Galenia pubescens</i>	*	0	0	0	15	0	0	0	5	0	0	0	0	0	0	0	0	0.8	5	0	0.5	0	0	0	0	0	0.2	0.1	2	0	0	0	0	
<i>Galium leiocarpum</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Galium</i> spp.		0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	
<i>Gamochaeta</i> spp.	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Geijera salicifolia</i>		0.1	1	25	0	2	5	0	0	0	0	0	0	0	0	0	0	10	0	25	1	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Geranium potentilloides</i> var. <i>potentilloides</i>		0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	
<i>Geranium solanderi</i> var. <i>solanderi</i>		0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Glycine clandestina</i>		0.1	0.2	0.2	0	0.2	0.5	0	0.2	0	0.1	0.1	0	0	0	0.1	0	0.2	0.2	0.1	0.2	0	0.2	0	0	0.1	0	0	0	0.2	0.2	5	0.5	
<i>Glycine microphylla</i>		0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	1	0	
<i>Gomphocarpus fruticosus</i>	*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	
<i>Gonocarpus longifolius</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.1	0	0	
<i>Grevillea montana</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.8	2	0	
<i>Guizotia abyssinica</i>	*	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Hardenbergia violacea</i>		0	0																															

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Species	Exotic	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	Plot 26	Plot 27	Plot 28	Plot 29	Plot 30	Plot 31	Plot 32	
<i>Lepidium africanum</i>	*	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Lepidium bonariense</i>	*	0	0.1	0	0.1	0	0	0	0.1	0	0	0	0	0	0	0	0	0.1	0.1	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
<i>Lepidium</i> spp.		0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Lepidosperma laterale</i>		0	0	0	0	0	0	0	0	0	0.5	0.1	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0.1	0	0	0	0	0
<i>Leptomeria acida</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0.8	0
<i>Lomandra longifolia</i>		0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0
<i>Lomandra multiflora</i> subsp. <i>multiflora</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0
<i>Maireana microphylla</i>		0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0.1	
<i>Melaleuca decora</i>		0	0	0	0	0	0	0	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0
<i>Melia azedarach</i>		0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
<i>Microlaena stipoides</i> var. <i>stipoides</i>		1	1	10	25	10	20	0	1	15	0	0	0	0.5	0	2	0	15	10	15	5	2	3	2	5	0	45	0	0	10	5	15	5	
<i>Modiola caroliniana</i>	*	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0
<i>Myoporum</i> spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
<i>Nicotiana megalosiphon</i> subsp. <i>megalosiphon</i>		0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Notelaea microcarpa</i> var. <i>microcarpa</i>		35	20	40	0	5	15	0	0.1	0	5	0.1	0	0	0	0	0	40	0	65	0.2	0.1	0.2	0	0	0	0	0.3	0.1	4	0.2	0.1	0.2	
<i>Olearia elliptica</i> subsp. <i>elliptica</i>		5	0.2	0.3	0	0	0.2	0	0	0	25	25	0	0	0	0	0	0	0	0	15	0.1	0.1	0	0	0	0	10	0	4	0.3	0.2	0	0
<i>Opercularia diphylla</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0
<i>Oplismenus aemulus</i>		0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0
<i>Opuntia aurantiaca</i>	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0
<i>Opuntia stricta</i> var. <i>stricta</i>	*	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Oxalis perennans</i>		0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Oxalis</i> spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
<i>Ozothamnus</i> spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0.1	
<i>Panicum effusum</i>		10	2	20	4	20	10	10	5	0	0	5	0	0	0	5	5	10	25	10	0	0.5	5	20	15	2	0	0	10	10	10	15	25	
<i>Panicum simile</i>		0	0	0	0	0	0	0	0	25	1	5	0.2	0.5	0	20	0	5	10	5	15	0.1	1	15	10	1	0	0	0	0	5	10	10	
<i>Panicum</i> spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	15	0	0	0	0	0	0
<i>Paronychia brasiliana</i>	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
<i>Paspalidium distans</i>		0	0	0	0	0	0	0	0.2	2	0	0	0	0	0	0.5	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Paspalum</i> spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0
<i>Passiflora herbertiana</i> subsp. <i>herbertiana</i>		0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0
<i>Pellaea paradoxa</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Philothea difformis</i> subsp. <i>smithiana</i>		0	0	0	0	0	0	0	0	0	0	0	5	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Phyllanthus</i> spp.		0.1	0	0	0.4	0	0	0	0	0	0	0	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0.1	0	0	0	0
<i>Phytolacca octandra</i>	*	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Pimelea curviflora</i> var. <i>sericea</i>		0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Pimelea latifolia</i> subsp. <i>elliptifolia</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0					

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Species	Exotic	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	Plot 26	Plot 27	Plot 28	Plot 29	Plot 30	Plot 31	Plot 32		
<i>Schinus areira</i>	*	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0		
<i>Schkuhria pinnata</i> var. <i>abrotanoides</i>	*	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
<i>Scleria mackaviensis</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0.1	0	0	1		
<i>Scutellaria humilis</i>		0.2	0	0.1	0	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0.2	0		
<i>Scutellaria mollis</i>		0	0.2	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0.1	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0.2	
<i>Senecio hispidulus</i>		0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	
<i>Senecio madagascariensis</i>	*	0.5	0.3	0.2	2	0.5	0.2	0.1	1	0.5	0.1	0	0	0	0	0.5	0.5	10	4	5	0.2	0	1	0.2	2	4	0.1	0.1	1	0.5	0.1	1	1	1	
<i>Setaria parviflora</i>	*	0	0	0	0	2	0	20	10	10	0	0	0	0	0	15	10	0	0.2	0	0	0	0	10	25	3	0	0	0	0	0	0	0	0	
<i>Setaria pumila</i>	*	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Setaria sphacelata</i>	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	
<i>Sida corrugata</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.2	0.1	0.1	0	0	
<i>Sida hackettiana</i>		0.1	0.1	0.1	0	2	0.2	0	1	2	0	0	0	0	0	0	0	0.1	3	0.1	0	0	0.2	0.4	0.3	0.3	0	0	0.1	0.1	0	0.2	0	0	0
<i>Sida rhombifolia</i>	*	0.1	0.2	0	0.1	0.2	0.1	0	55	5	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	10	0.1	0	0	0	0
<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>		0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0.5	2	0.3	0.2	0	0	0	0	0	0.1	0	0	0.2	0	0	0	0	0
<i>Sigesbeckia</i> spp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	
<i>Silene gallica</i> var. <i>gallica</i>	*	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0
<i>Sisyrinchium</i> spp.	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	
<i>Solanum aviculare</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	
<i>Solanum brownii</i>		0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Solanum chenopodioides</i>	*	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Solanum jucundum</i>		1	0.1	0.2	0	0	0.1	0	0.2	0	0	0	0	0	0	0	0	0.3	0	0.2	5	0	0.2	0	0	0	0	0	0	0.1	0	0.2	1	0	1
<i>Solanum nigrum</i>	*	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.2	0	0	0	0	0	0	0
<i>Solanum prinophyllum</i>		0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
<i>Solanum</i> spp.		0.2	0.1	0.5	0	1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
<i>Sonchus oleraceus</i>	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0
<i>Sporobolus creber</i>		10	10	10	0	15	15	20	25	10	0	0	0	0	0	25	10	15	15	10	3	0	5	5	10	5	0	0	10	0.2	0	10	10	0	0
<i>Stackhousia viminea</i>		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
<i>Stellaria media</i>	*	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0
<i>Stephania japonica</i> var. <i>discolor</i>		0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0
<i>Taraxacum officinale</i>	*	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Teucrium junceum</i>		0.1	0	0.1	0	0	0.2	0	0	0	0	0.5	0.2	0	0	0	0	0.2	0	0	1	0.1	0.1	0	0	0	0	0	0	1	0.2	0.8	0.8	0	0
<i>Trachymene incisa</i> subsp. <i>incisa</i>		0	0.1	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
<i>Trema tomentosa</i> var. <i>aspera</i>		0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Trifolium subterraneum</i>	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.2	0	0
<i>Tripogon loliiformis</i>		0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Urochloa</i> spp.		0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
<i>Verbena</i> spp.		0	0.1	0	0.5	1	0.2	0.2	0	10	0	0	0	0	0	1	30	0.1																	

Appendix B BAM calculator input data

Plot	PCT	easting	northing	bearing	Composition						Structure						Function											
					Tree	Shrub	Grass	Forbs	Ferns	Other	Tree	Shrub	Grass	Forbs	Ferns	Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	TreeStem5to9	TreeStem10to19	TreeStem20to29	TreeStem30to49	TreeStem50to79	Tree Regen	High Threat Exotic	
01	1603	305591	6396883	30	6	7	13	6	1	4	80.3	11.9	92.2	13.5	0.2	4.3	0	0	60	15	1	1	1	1	0	1	5.5	
02	1603	306360	6396601	155	6	10	13	8	1	4	75.0	4.9	83.3	15.7	0.2	2.5	0	0	51	12	1	1	1	1	0	1	0.3	
03	116	305979	6396457	110	6	6	11	7	0	3	96.0	5.7	127.7	5.0	0.0	0.5	0	0	48	11	1	1	1	0	0	1	0.4	
04	1598	305984	6395738	25	3	4	10	16	0	3	25.6	11.3	61.1	4.8	0.0	3.6	1	0	23	10	1	1	0	0	0	1	20.3	
05	1603	306448	6396320	89	6	3	13	7	0	3	47.3	10.4	99.2	24.6	0.0	0.6	1	0	74	5	1	1	1	1	1	1	3.0	
06	1603	306188	6397185	185	5	7	9	9	1	3	80.1	9.0	107.2	7.4	0.1	0.9	0	0	29	12	1	1	1	1	0	1	0.5	
07	1603	307536	6395422	100	0	0	8	1	0	0	0.0	0.0	78.4	0.2	0.0	0.0	0	0	57	0	0	0	0	0	0	0	10.3	
08	922	307446	6395494	81	2	2	13	7	1	2	1.1	65.2	59.1	16.8	0.1	0.3	0	0	63	0	1	1	1	1	0	1	8.5	
09	1603	306368	6395834	100	0	1	12	6	0	0	0.0	0.1	111.4	12.8	0.0	0.0	0	0	45	0	0	0	0	0	0	0	1.5	
10	1176	305489	6395053	350	4	5	5	2	0	2	71.0	76.4	3.2	0.6	0.0	0.2	0	0	83.2	35	1	1	1	1	0	1	0.1	
11	1176	305347	6395154	45	5	7	7	2	0	2	58.1	42.7	22.1	0.3	0.0	0.2	1	0	62	15	1	1	1	1	1	1	0.0	
12	1176	305196	6395333	63	2	8	2	2	1	1	77.0	6.3	0.3	0.2	0.1	0.1	1	0	79	10	1	1	1	1	1	1	0.0	
13	1176	305609	6395317	47	2	9	4	1	1	1	77.0	57.1	11.2	0.1	0.1	0.1	0	0	82.6	25	1	1	1	0	0	1	0.0	
15	1603	306087	6395599	280	0	0	14	4	1	1	0.0	0.0	121.8	5.1	0.1	0.1	0	0	72	0	0	0	0	0	0	0	0.5	
16	1603	306915	6395958	300	0	0	9	3	1	0	0.0	0.0	88.0	30.2	0.1	0.0	0	0	68	0	0	0	0	0	0	0	2.5	
17	116	306211	6397631	300	6	5	20	13	2	3	75.2	6.8	98.9	34.6	1.2	0.4	2	0	46	30	1	1	1	1	1	1	11.0	
18	1603	306108	6397593	300	0	1	21	8	1	2	0.0	0.2	202.8	16.6	0.1	0.3	0	0	36	1	0	0	0	0	0	0	14.0	
19	116	305894	6397700	220	3	6	15	10	1	2	100.0	18.9	130.6	9.9	1.0	0.2	1	0	33	5	1	1	1	1	1	1	5.1	
20	1176	305716	6397266	150	6	5	13	11	0	2	48.9	28.7	35.5	7.2	0.0	0.3	0	0	87	55	1	1	1	1	0	1	0.7	
21	1176	305828	6396107	200	4	7	8	2	1	1	53.9	4.4	7.3	1.1	0.1	0.1	0	0	90.2	10	1	1	1	1	0	1	0.0	
22	1603	306107	6396371	280	5	5	13	6	1	3	46.3	5.6	88.0	1.8	0.2	0.4	0	0	43	0	1	1	1	1	0	1	1.0	
23	1603	306388	6396184	160	0	1	14	5	1	0	0.0	0.1	99.5	20.8	0.2	0.0	0	0	62	0	0	0	0	0	0	0	0.4	
24	1603	306012	6395901	210	0	1	11	6	1	1	0.0	0.1	132.0	2.7	0.2	0.1	0	0	67	0	0	0	0	0	0	0	2.0	
25	1603	305616	6397413	210	0	0	10	4	1	1	0.0	0.0	86.2	0.6	0.1	0.1	0	0	56	0	0	0	0	0	0	1	10.0	
26	1603	305906	6396357	225	4	8	10	19	1	6	24.1	9.9	79.7	2.4	0.1	0.9	2	0	38	38	1	1	1	1	1	1	0.3	
27	1598	305536	6395449	68	4	9	6	16	1	3	40.8	32.2	49.4	4.4	0.1	0.3	0	0	57	10	1	1	1	0	0	1	0.2	
28	1603	307490	6395371	300	2	1	8	4	0	0	30.1	8.0	42.8	0.4	0.0	0.0	0	0	72	5	1	1	1	1	0	1	35.0	
29	1176	305868	6395437	130	4	10	11	15	1	4	68.0	19.3	58.9	3.3	0.5	1.5	0	0	57	19	1	1	1	1	1	1	0.7	
30	1176	305810	6396009	60	5	9	11	9	1	2	40.4	5.6	37.5	2.1	1.0	0.4	0	0	83	6	1	1	1	1	0	1	0.1	
31	1603	305802	6395928	150	4	8	14	10	1	3	30.2	19.5	118.2	2.4	0.1	8.0	0	0	23	0	1	1	1	1	0	1	1.0	
32	1603	306046	6396713	110	6	6	18	5	0	2	41.6	2.6	128.4	0.6	0.0	1.0	0	0	54	9	1	1	1	1	1	1	1.1	

Appendix C Likelihood of occurrence for species previously not assessed

Likelihood of occurrence for species not previously assessed

Scientific Name	Common Name	BC Act	EPBC Act	Distribution	Habitat	Ecology	Distribution overlaps	Habitat quality	Species known to occur in region	Species known to occur on site	Likelihood of occurrence	Habitat on site directly or indirectly impacted	Impact Assessment Required
<i>Delma impar</i>	Striped Legless Lizard	V	V	In NSW, occurs in the Southern Tablelands, the South West Slopes and possibly on the Riverina.	Natural Temperate Grassland, secondary and modified grassland, open Box-Gum Woodland.	Shelter in tussock-forming grasses or under surface rocks. Actively hunts for spiders, crickets, moth larvae and cockroaches. Two papery eggs are laid in early summer. Goes below ground or under rocks or logs over winter.	Yes	Marginal -Good	Yes (nearest record approximately 12 km away between Jerrys Plains and Muswellbrook)	No	Unlikely	Potential	No
<i>Falco hypoleucos</i>	Grey Falcon	E1	--	Arid and semi-arid zones. In NSW, found chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range.	Shrubland, grassland and wooded watercourses, occasionally in open woodlands near the coast, and near wetlands.	Preys primarily on birds, especially parrots and pigeons; reptiles and mammals are also taken. Utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring.	Yes	Good	Yes, only on rare occasions. Generally an arid zone species.	No	Unlikely	No	No
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	South eastern NSW and Victoria, in two distinct populations: a northern population in the sandstone geology of the Sydney Basin as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria.	Heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water. This species breeds mainly in autumn, but has been recorded calling throughout the year. Egg masses are foamy with an average of approximately 500-800 eggs and are laid in burrows or under vegetation in small pools. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter.	Yes	Marginal	No	No	Unlikely	Potential	No
<i>Hirundapus caudacutus</i>	White-throated Needletail	--	V, M	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide.	Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland.	Breeds in eastern Siberia, north-eastern China and Japan. The species arrives in Australia in September–October, and most depart by April. It almost always forages aerially. Recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows.	Yes	Good	Yes	No	Likely	No	No
<i>Potorous tridactylus</i>	Long-nosed Potoroo	V	V	In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm.	Coastal heaths and dry and wet sclerophyll forests.	Breeding occurs throughout the year, although there is a peak from late winter to early summer. The fruit-bodies of hypogeous (underground-fruited) fungi are a large component of the diet. They also eat roots, tubers, insects and their larvae. Individuals are thought to be non-territorial and have home ranges of about 2-5ha. Potoroos are nocturnal and crepuscular and rarely seen. They spend the day in "squats" in dense vegetation and their regular movement through the vegetation creates characteristic runways.	Yes	Marginal	No	No	Unlikely	No	No

Scientific Name	Common Name	BC Act	EPBC Act	Distribution	Habitat	Ecology	Distribution overlaps	Habitat quality	Species known to occur in region	Species known to occur on site	Likelihood of occurrence	Habitat on site directly or indirectly impacted	Impact Assessment Required
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations.	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.	Yes	Good	Yes	No	Likely	No	Yes
<i>Androcalva procumbens</i>	--	V	V	Endemic to NSW, found in the Dubbo-Mendooran-Gilgandra region, the Pilliga and Nymagee areas, the Upper Hunter region, and in Goonoo SCA.	Sandy sites, disturbed habitats such as roadsides, quarry edges and gravel stockpiles. Often found in Eucalyptus dealbata- E. sideroxylon woodland, Melaleuca uncinata scrub, and mallee with Calytrix tetragona understorey.	Fruiting period is summer to autumn. Flowers from August to December. Appears to produce seed which persists for some time in the seed bank. Large numbers of seedlings have been observed germinating after fire at sites where the species was not apparent above ground before the fires. Clusters of individuals may be clonal. The species is often found as a pioneer species of disturbed habitats.	No	Marginal	No	No	No	No	No
<i>Pomaderris queenslandica</i>	Scant Pomaderris	V	--	Scant Pomaderris is a medium-sized shrub 2 - 3m tall. The stems are whitish with tiny star-shaped hair clusters. The leaves are oval to narrow elliptical, 2.5 - 7 cm long and 10 - 25 mm wide. They are shiny on the top and woolly underneath. The small creamy yellow flowers appear during spring-summer.	Widely scattered but not common in north-east NSW and in Queensland. It is known from several locations on the NSW north coast and a few locations on the New England Tablelands and North West Slopes, including near Torrington and Coolata.	Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.	Yes	Marginal	No	Unverified record from 2013 in Approved Underground Mining Area No Longer Required	Unlikely	No	No
<i>Prostanthera cineolifera</i>	Singleton Mint Bush	V	V	Restricted to only a few localities near Walcha, Scone, Cessnock and St Albans.	Open woodlands on exposed sandstone ridges.	Fire response is unknown, but other <i>Prostanthera</i> species are fire sensitive, with recruitment occurring from the soil seed bank following a fire.	Yes	Marginal	Yes	No	Potential	No	No
<i>Rhizanthella slateri</i>	Eastern Australian Underground Orchid	V	E	In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area,	Sclerophyll forest in shallow to deep loams.	Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed. Flowers September to November.	Yes	Good	No	No	Unlikely	No	No

Scientific Name	Common Name	BC Act	EPBC Act	Distribution	Habitat	Ecology	Distribution overlaps	Habitat quality	Species known to occur in region	Species known to occur on site	Likelihood of occurrence	Habitat on site directly or indirectly impacted	Impact Assessment Required
				Agnes Banks and near Nowra.									
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	Between Cessnock and Kurri Kurri, in Howes Valley, and north from Wyong to Newcastle on the Central Coast.	Heath on sandy soils, moist areas in open forest, and along disturbed roadsides.	--	Yes	Good	No	No	Unlikely	No	No

Appendix D Details of species previously assessed as likely to occur

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of occurrence in Modified Underground Mining Area
<i>Artamus cyanopterus</i>	Dusky Woodswallow	Vulnerable	-	Occupies sclerophyll forest, woodland, coastal scrub and wooded farmland. This species was not recorded during the field surveys however has been recorded during assessments undertaken for other WCPL approvals and/or ongoing monitoring.	Likely
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	Vulnerable	-	Associated with a variety of forest types containing <i>Allocasuarina</i> species. Nests in large trees with large hollows. Has previously been recorded close proximity to the study area during ongoing monitoring works and also recorded within 5 km. Potential habitat exists in foraging habitat (<i>Allocasuarina</i> spp.) and potential nesting habitat (hollow-bearing trees).	Likely
<i>Chthonicola sagittata</i>	Speckled Warbler	Vulnerable	-	Occupies a wide range of eucalypt dominated communities with a grassy understorey, often on rocky ridges or in gullies. Typical habitat for this species would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. This species was recorded within the study area by ELA in 2016 and during previous assessments undertaken for other WCPL approvals and/or ongoing monitoring. Habitat for this species exists within the study area in the form of potential foraging and nesting habitat.	Yes
<i>Circus assimilis</i>	Spotted Harrier	Vulnerable	-	The Spotted Harrier occurs in grassy open woodland and grasslands. This species was not recorded during the field survey but was recorded during previous assessments undertaken for DA 305-7-2003 and ongoing monitoring. This species has been recorded within 5 km of the study area. Habitat for this species exists within the study area in the form of open woodland and grassland.	Likely
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	Vulnerable	-	The Brown Treecreeper occupies dry Eucalypt woodlands, particularly open grassy woodland lacking a dense understorey but containing abundant fallen woody debris. This species was not recorded during the field survey or for WCPL approvals and/or but was recorded during previous assessments undertaken for DA 305-7-2003 and ongoing monitoring works. Habitat for this species exists within the study area in the form of foraging habitat and potential nesting habitat.	Likely
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Vulnerable	-	The Varied Sittella occurs in eucalypt forests and woodlands with rough-barked species, or mature smooth-barked gums with dead branches. This species was recorded within the study area by ELA in 2016 and was recorded during previous assessments undertaken for DA 305-7-2003 and for WCPL approvals and/or ongoing monitoring. Habitat for this species exists within the study area in the form of foraging habitat and potential nesting habitat.	Yes
<i>Glossopsitta pusilla</i>	Little Lorikeet	Vulnerable	-	The Little Lorikeet mostly occurs in dry, open eucalypt forests and woodlands containing nectar-bearing eucalypts and mistletoes on which it feeds. This species has been recorded in the study area during WCPL ongoing monitoring and was recorded during previous assessments undertaken for DA 305-7-2003. Habitat for this species exists within the study area in the form of potential foraging and nesting habitat.	Likely
<i>Hieraaetus morphnoides</i>	Little Eagle	Vulnerable	-	The Little Eagle occupies open eucalypt forest, woodland or open woodland. It nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. This species was not recorded during the field survey or during previous assessments undertaken for DA 305-7-2003 and for WCPL approvals and/or ongoing monitoring. Habitat for this species (foraging and nesting) exists within the study area in the form of open woodlands.	Likely
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	Vulnerable	-	The Hooded Robin is associated with a wide range of eucalypt woodlands and open forests, usually open grassy temperate woodlands. The species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover. This species was not recorded during the field survey but has been recorded during flora and fauna monitoring works. Habitat for this species exists within the study area in the form of foraging habitat and potential nesting habitat.	Likely
<i>Neophema pulchella</i>	Turquoise Parrot	Vulnerable	-	The Turquoise Parrot is found in open forest and timbered grassland, especially low shrub ecotones between woodland and grasslands with high proportion of native grasses and forbs. This species was not recorded during the field survey or during previous assessments undertaken for DA 305-7-2003 and for WCPL approvals and/or ongoing monitoring. Habitat for this species exists within the study area in the form of foraging habitat and potential nesting habitat.	Likely
<i>Ninox strenua</i>	Powerful Owl	Vulnerable	-	The Powerful Owl is found in eastern forests, from the coast to the tablelands. This species is now uncommon and occurring at low densities. Powerful Owls can inhabit a wider range of vegetation types, preferring large tracts of woodland or forest habitat. This species was not recorded during the field survey or during previous assessments undertaken for DA 305-7-2003 and for WCPL approvals and/or ongoing monitoring. This species has been recorded within 5 km of the study area. Habitat for this species exists within the study area in the form of potential foraging and roosting habitat.	Likely
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler	Vulnerable	-	The Grey-crowned Babbler (eastern subspecies) is known from open woodlands dominated by mature eucalypts with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs (DPE 2022b). This species was recorded within the study area by ELA in 2016 and 2022, and during previous assessments undertaken for DA 305-7-2003 and for WCPL approvals and/or ongoing monitoring. Habitat for this species exists within the study area in the form of potential foraging and nesting habitat.	Yes
<i>Dasyurus maculatus maculatus</i>	Spotted-tailed Quoll (SE mainland population)	Vulnerable	Endangered	The Spotted-tailed Quoll has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the subalpine zone to the coastline (DPE 2022b). This species was not recorded during the field survey or during previous assessments undertaken for DA 305-7-2003 and for WCPL approvals and/or ongoing monitoring. This species has been recorded approximately 2 km to the north of the study area. Habitat for this species exists within the study area in the form of roosting (tree hollows), nesting and foraging (woodland) habitats.	Likely
<i>Petauroides volans</i>	Greater Glider	-	Vulnerable	The Greater Glider is associated with Eucalyptus forests and woodlands. This species was not recorded during the field survey or during previous assessments undertaken for DA 305-7-2003 and for WCPL approvals and/or ongoing monitoring. The nearest record for this species is approximately 5 km to the south of the study area. Potential habitat for this species exists within the study area in the form of foraging, nesting and shelter (woodlands containing <i>Eucalyptus</i> spp.).	Likely
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	Endangered	Vulnerable	The Brush-tailed Rock-wallaby is found in rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices and usually near fresh water. This species was not recorded during the field survey however has been recorded in the surrounds by monitoring conducted by WCPL. Potential habitat exists in the Approved Mining Area No longer Required in the form of rocky escarpment, however this habitat type is not present in the Modified Underground Mining Area.	Unlikely
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Vulnerable	Vulnerable	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves, rock overhangs and disused mine shafts. This species was recorded during previous assessments undertaken for DA 305-7-2003 and for WCPL approvals, and/or ongoing monitoring. Foraging habitat for this species exists within the study area in the form of open woodland. The Modified Underground Mining Area does not contain potential roosting habitat.	Likely

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of occurrence in Modified Underground Mining Area
<i>Miniopterus australis</i>	Little Bent-winged Bat	Vulnerable	-	The Little Bent-winged Bat inhabits moist eucalypt forest, wet and dry sclerophyll forest. This species is generally found in well-timbered areas. It roosts in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings. Males and juveniles disperse in summer. Only five nursery sites/maternity colonies are known within Australia. This species was recorded within the study area by ELA in 2016 and during previous WCPL approvals and/or ongoing monitoring. Habitat for this species exists within the study area in the form of potential foraging and roosting habitat (hollow-bearing trees and caves), although cave habitat is not present in the Modified Underground Mining Area.	Likely
<i>Miniopterus schreibersii oceanensis</i>	Large Bent-winged Bat	Vulnerable		The Large Bent-winged Bat is associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland. It forages above and below the tree canopy on small insects. This species will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter. This species was recorded within the study area by ELA in 2016 and during previous WCPL approvals and/or ongoing monitoring. Habitat for this species exists within the study area in the form of potential foraging and roosting habitat (hollow-bearing trees and caves), although cave habitat is not present in the Modified Underground Mining Area.	Likely
<i>Mormopterus norfolkensis</i>	Eastern Coastal Free-tailed Bat	Vulnerable		Most records of the Eastern Freetail-bat are from dry eucalypt forest and woodland east of the Great Dividing Range. Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges. The Eastern Coastal Free-tailed Bat primarily roosts in hollows or behind loose bark in mature eucalypts. This species was recorded within the study area by ELA in 2016 and during previous assessments undertaken for DA 305-7-2003 and for WCPL approvals, and/or ongoing monitoring. Habitat for this species exists within the study area in the form of potential foraging and roosting habitat (hollow-bearing trees).	Likely
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	Vulnerable		The Yellow-bellied Sheathtail-bat is found in almost all habitats, from wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests and heathland. This species roosts in tree hollows; may also use caves; has also been recorded in a tree hollows in paddock trees. This species was recorded within the study area by ELA in 2016 and during previous assessments undertaken for DA 305-7-2003. This species has been recorded within 5 km of the study area. Habitat for this species exists within the study area in the form of potential foraging and roosting habitat (hollow-bearing trees).	Likely

Appendix E Commonwealth EPBC Act Significant impact criteria assessments

The EPBC Act administrative guidelines on significance set out ‘Significant Impact Criteria’ (DotE 2013) that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance. Matters listed under the EPBC Act as being of national environmental significance include:

- Listed threatened species and ecological communities.
- Listed migratory species.
- Wetlands of International Importance.
- The Commonwealth marine environment.
- World Heritage properties.
- National Heritage places.
- Nuclear actions.
- A water resource, in relation to coal seam gas development and large coal mining development.

Specific ‘Significant Impact Criteria’ are provided for each matter of national environmental significance except for threatened species and ecological communities in which case separate criteria are provided for species listed as endangered and vulnerable under the EPBC Act.

The following section assesses impacts on threatened ecological communities and fauna species against the relevant significant impact criteria. These are:

- Central Hunter Valley Eucalypt Forest and Woodland – Critically Endangered
- Grey-headed Flying-fox –Vulnerable
- Spotted-tailed Quoll – Endangered
- Greater Glider – Vulnerable
- White-throated Needle-tail - Vulnerable
- Migratory species:
 - White-throated Needle-tail
 - Yellow Wagtail
 - Black-faced Monarch
 - Latham’s Snipe
 - Satin Flycatcher
 - Rufous Fantail.

E1 - Central Hunter Valley Eucalypt Forest and Woodland / White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Table 22: Community profile – Central Hunter Valley Eucalypt Forest and Woodland

Overview	Comment
EPBC Act status	Critically Endangered
BC Act status	Endangered Ecological Community
Threat abatement plan	No
Recovery plan	No
Habitat	The ecological community is mainly in the Central Hunter Valley—in the Muswellbrook, Singleton and Cessnock Local Government Areas. Typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from finer grained sedimentary rocks Across the range of the ecological community, one or more of a complex of four eucalypt tree species usually dominate the canopy; <i>Eucalyptus crebra</i> (Narrow-leaved Ironbark), <i>Corymbia maculata</i> (Spotted Gum), <i>Eucalyptus dawsonii</i> (Slaty Gum) and <i>Eucalyptus moluccana</i> (Grey box). Typically, the woodland has a sparse mid layer of native flowering shrubs and a ground layer of grasses, daisies, lilies, orchids and other flowers.
Extent of local occurrence	122.07 ha of vegetation in the Modified Underground Mining Area is consistent with this community.
Impacts	No surface clearing or other direct impacts proposed. Indirect impacts considered unlikely and negligible

Table 23: Significant impact assessment – Central Hunter Valley Eucalypt Forest and Woodland

Criterion	Response
Central Hunter Valley Eucalypt Forest and Woodland	
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	
1) reduce the extent of an ecological community	122.07 ha of vegetation in the Modified Underground Mining Area is consistent with this community. No surface clearing or other direct impacts proposed therefore the proposed action will not reduce the extent of the ecological community. Indirect impacts associated with subsidence would be negligible and would not reduce the extent of the community.
2) fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	No surface clearing or other direct impacts proposed. Indirect impacts associated with subsidence would be negligible and would not fragment or increase fragmentation of the community.

Criterion	Response
3) adversely affect habitat critical to the survival of an ecological community	No surface clearing or other direct impacts proposed. Indirect impacts associated with subsidence would be negligible and would not adversely affect habitat critical to the survival of the community
4) modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Mining activities below the surface of this community is likely to affect groundwater. As this community is considered low potential groundwater dependant, any below ground modifications to water are unlikely to affect the community's survival. Indirect impacts to alternation of surface water drainage patterns associated with subsidence are considered negligible and would not substantially affect the community.
5) cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	No surface clearing or other direct impacts proposed. Indirect impacts associated with subsidence would be negligible and likely restricted to individual plants, if at all. Negligible loss of individual plants would not cause the decline or loss of functionally important species across the community
6) i. cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: assisting invasive species, that are harmful to the listed ecological community, to become established, or	Indirect impacts associated with subsidence would be negligible and likely restricted to individual plants, if at all, and would not substantially reduce to quality or integrity of the community or assist invasive species to become established.
6) ii. cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or	No use of fertilisers, herbicides or other chemicals or pollutants are proposed to be used on the surface community. Relatively small amounts of herbicide may be used for weed treatment or track maintenance, but would not be used in quantities sufficient to reduce quality or integrity of the community.
7) interfere with the recovery of an ecological community.	The proposed activity is unlikely to interfere substantially with the recovery of the ecological community as there as no proposed direct impacts, and any indirect impacts associated with subsidence would be negligible.
Conclusion: Is there likely to be a significant impact?	No. The proposed activity is unlikely to have a significant impact on Central Hunter Eucalypt Forest and Woodland as there are no proposed direct impacts, and any indirect impacts associated with subsidence would be negligible.

E2 - Grey-headed Flying-fox (*Pteropus poliocephalus*)

Table 24: Species profile – Grey-headed Flying-fox

Overview	Comment
EPBC Act status	Vulnerable
BC Act status	Vulnerable
Threat abatement plan	No
Recovery plan	No
Habitat and ecology	Roosts and breeds in conspicuous camps, usually near water. Occurs in a variety of habitats including subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.
Extent of local occurrence	2 records within 10 km. All Eucalyptus Forest in study area is suitable foraging habitat. No bat colony on site.
Important population	There are no Nationally Important flying fox camps within 10 km of the study area.
Impacts	No direct impacts are proposed

Table 25: Assessment of significance – Grey-headed Flying-fox

Criterion	Question	Response
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
1)	Lead to long-term decrease in the size of an important population of a species	Undermining of foraging habitat with no surface impacts is unlikely to lead to a long-term decrease in the size of Grey-headed Flying-fox.
2)	Reduce the area of occupancy of an important population	Undermining of foraging habitat is unlikely to reduce the area of occupancy Grey-headed Flying-fox. No clearing is proposed and all habitat within the study area will be retained
3)	Fragment an existing important population into two or more populations	Fragmentation of the important population will not result from the proposed activity.
4)	Adversely affect habitat critical to the survival of the species	Habitat critical to the survival of the Grey-headed Flying-fox is likely to be camp sites and important foraging areas. The study area is not considered to constitute critical habitat.
5)	Disrupt the breeding cycle of an important population	No breeding habitat will be impacted.

Criterion	Question	Response
6)	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Undermining of foraging habitat with no surface impacts is unlikely to lead to a decrease the availability or quality of habitat to the extent that the species is likely to decline
7)	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Invasive species are unlikely to become established as a result of underground mining in the Modified Underground Mining Area.
8)	Introduce disease that may cause the species to decline	It is unlikely that diseases will be introduced as a result of underground mining in the Modified Underground Mining Area.
9)	Interfere substantially with the recovery of the species	Undermining of foraging habitat with no surface impacts is unlikely to interfere with the recovery of Grey-headed Flying-fox.
Conclusion	Is there likely to be a significant impact?	No. The proposed activity is unlikely to have a significant impact on Grey-headed Flying-fox as there are no direct impacts to the species or foraging habitat proposed, and potential indirect impacts are considered negligible.

E3 - Spotted-tail Quoll (*Dasyurus maculatus*)

Table 26: Species profile - Spotted-tail Quoll

Overview	Comment
EPBC Act status	Endangered
BC Act status	Vulnerable
Threat abatement plan	Yes (Feral Cats and Red Fox)
Recovery plan	Yes
Habitat and ecology	Open forest, woodland. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4,000 hectares. Are known to traverse their home ranges along densely vegetated creek lines.
Extent of local occurrence	No records within 10 km. All Eucalyptus Forest in study area is suitable foraging habitat. No potential dens recorded on site.
Impacts	No direct impacts are proposed

Table 27: Assessment of significance - Spotted-tail Quoll

Criterion	Question	Response
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
1)	Lead to a long-term decrease in the size of an important population	Undermining of potential seasonal foraging habitat will not lead to a long-term decrease in the size of the population of Spotted-tail Quoll.
2)	Reduce the area of occupancy of an important population	No surface clearing is proposed and undermining of potential seasonal foraging habitat is unlikely to reduce the area of occupancy for Spotted-tail Quoll. All habitat within the study area will be retained.
3)	Fragment an existing important population into two or more populations	Fragmentation of the population will not result from the proposed activity.
4)	Adversely affect habitat critical to the survival of a species	The study area does not contain habitat listed as critical to the survival of Spotted-tail Quoll.
5)	Disrupt the breeding cycle of a population	No
6)	Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No surface clearing is proposed and undermining of potential seasonal foraging habitat is affect habitat quality for Spotted-tail Quoll. All habitat within the study area will be retained.
7)	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Invasive species are unlikely to become established.

Criterion	Question	Response
8)	Introduce disease that may cause the species to decline	Disease is unlikely to be introduced.
9)	Interfere substantially with the recovery of the species	No surface clearing is proposed and undermining of potential seasonal foraging habitat is unlikely interfere with the recovery of Spotted-tail Quoll. All habitat within the study area will be retained.
Conclusion	Is there likely to be a significant impact?	No. The proposed activity is unlikely to have a significant impact on Spotted-tail Quoll as no direct impacts are proposed, and potential indirect impacts are considered negligible.

E4 – Greater Glider (*Petauroides volans*)

Table 28: Species profile – Greater Glider

Overview	Comment
EPBC Act status	Vulnerable
BC Act status	Not listed
Threat abatement plan	No
Recovery plan	No
Habitat and ecology	Arboreal nocturnal marsupial, largely restricted to eucalyptus forest and woodlands. Mostly folivorous, with diet comprising mostly of eucalypt foliage and flowers. Favors forests with a diversity of eucalypt species. Shelters during the day in large hollows in large old trees. Typically small home range (1-4 ha), but may be larger in lower productivity forests and open woodlands.
Extent of local occurrence	No records within 10 km. All Eucalyptus Forest in study area is suitable foraging habitat.
Impacts	No direct impacts are proposed

Table 29: Assessment of significance – Greater Glider

Criterion	Question	Response
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
1)	Lead to a long-term decrease in the size of an important population	Undermining of potential foraging habitat will not lead to a long-term decrease in the size of the population of Greater Glider.
2)	Reduce the area of occupancy of an important population	No surface clearing is proposed and undermining of potential foraging habitat is unlikely to reduce the area of occupancy for Greater Glider. All habitat within the study area will be retained.
3)	Fragment an existing important population into two or more populations	Fragmentation of the population will not result from the proposed activity.
4)	Adversely affect habitat critical to the survival of a species	The study area does not contain habitat listed as critical to the survival of Greater Glider.
5)	Disrupt the breeding cycle of a population	No
6)	Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No surface clearing is proposed and undermining of potential foraging habitat is affect habitat quality for Greater Glider. All habitat within the study area will be retained.
7)	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Invasive species are unlikely to become established.
8)	Introduce disease that may cause the species to decline	Disease is unlikely to be introduced.

Criterion	Question	Response
9)	Interfere substantially with the recovery of the species	No surface clearing is proposed and undermining of potential foraging habitat is unlikely interfere with the recovery of Greater Glider. All habitat within the study area will be retained.
Conclusion	Is there likely to be a significant impact?	No. The proposed activity is unlikely to have a significant impact on Greater Glider as no direct impacts are proposed, and potential indirect impacts are considered negligible.

E5 – White-throated Needletail (*Hirundapus caudacutus*)

Table 30: Species profile – White-throated Needletail

Overview	Comment
EPBC Act status	Vulnerable
BC Act status	Not listed
Threat abatement plan	No
Recovery plan	No
Habitat and ecology	White-throated Needletail is a trans-equatorial migrant, breeding in the Northern Hemisphere and flying south for the boreal winter. After breeding in eastern Siberia, north-eastern China and Japan, the species leaves the breeding grounds between late August and October, flying singly or in scattered flocks. In Australia, White-throated Needletails almost always forage aerially, at heights up to 'cloud level', above a wide variety of habitats ranging from heavily treed forests to open habitats, such as farmland, heathland or mudflats
Extent of local occurrence	Species likely to forage over the study area and locality.
Impacts	No direct impacts are proposed

Table 31: Assessment of significance – White-throated Needletail

Criterion	Question	Response
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
1)	Lead to a long-term decrease in the size of an important population	Undermining of potential seasonal foraging habitat will not lead to a long-term decrease in the size of the population of White-throated Needletail.
2)	Reduce the area of occupancy of an important population	No surface clearing is proposed and undermining of potential seasonal foraging habitat is unlikely to reduce the area of occupancy for White-throated Needletail. All habitat within the study area will be retained.
3)	Fragment an existing important population into two or more populations	Fragmentation of the population will not result from the proposed activity.

Criterion	Question	Response
4)	Adversely affect habitat critical to the survival of a species	The study area does not contain habitat listed as critical to the survival of White-throated Needle-tail.
5)	Disrupt the breeding cycle of a population	No, the species breeds in the northern hemisphere.
6)	Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No surface clearing is proposed and undermining of potential seasonal foraging habitat is affect habitat quality for White-throated Needle-tail. All habitat within the study area will be retained.
7)	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Invasive species are unlikely to become established.
8)	Introduce disease that may cause the species to decline	Disease is unlikely to be introduced.
9)	Interfere substantially with the recovery of the species	No surface clearing is proposed and undermining of potential seasonal foraging habitat is unlikely interfere with the recovery of White-throated Needle-tail. All habitat within the study area will be retained.
Conclusion	Is there likely to be a significant impact?	No. The proposed activity is unlikely to have a significant impact on White-throated Needle-tail as no direct impacts are proposed, and potential indirect impacts are considered negligible.

E6 – Migratory species

Table 32: Migratory species significant impact thresholds

Species	Significant impact thresholds (DotE 2015)		Important habitat (DotE 2015)
	Area of habitat	Ecologically significant proportion of the population	
White-throated Needletail (<i>Hirundapus caudacutus</i>)	--	100	Non-breeding habitat only: Found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial. Large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. Appears to have traditional roost sites.
Yellow Wagtail (<i>Motacilla flava</i>)	--	10,000	Non-breeding habitat only: mostly well-watered open grasslands and the fringes of wetlands. Roosts in mangroves and other dense vegetation
Black-faced Monarch (<i>Monarcha melanopsis</i>)	2,600 ha	465	Wet forests particularly rainforests and wet sclerophyll forests.
Latham's Snipe (<i>Gallinago hardwickii</i>)	--	--	Sites that support at least 18 individuals and are naturally occurring open freshwater wetland with vegetation cover nearby (for example, tussock grasslands, sedges, lignum or reeds within 100 m of the wetland).
Satin Flycatcher (<i>Myiagra cyanoleuca</i>)	4,400 ha	1,700	A variety of woodland and forest types.
Rufous Fantail (<i>Rhipidura rufifrons</i>)	2,600 ha	1,100	Important habitat for the Rufous Fantail includes moist, dense habitats.

Table 33: Significant impact assessment – Migratory species

Criterion	Question	Response
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:		
1)	substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	No direct impacts to important habitat for a migratory species are proposed. Potential indirect impacts associated with subsidence are considered to be negligible, and would not impact important habitat for a migratory species
2)	result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	The proposed activity is unlikely to result in invasive species establishing in an area of important habitat for any of the listed migratory species.
3)	seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	No direct impacts are proposed, and the proposed activity is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of the population for any of the listed migratory species.
Conclusion	Is there likely to be a significant impact?	No. The proposed activity is unlikely to have a significant impact on listed migratory species as it will not impact on important habitat, an ecologically significant proportion of the population or seriously disrupt the lifecycle for an ecologically significant proportion of the population for these species.