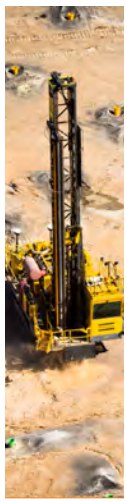

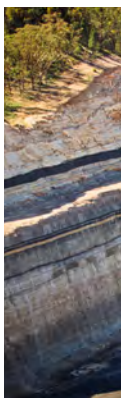
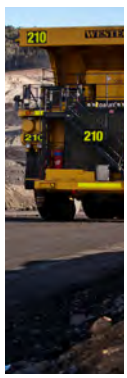

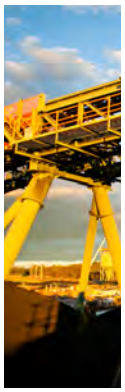

MOOLARBENCOAL

Moolarben Coal Complex
UG4 Ancillary Works Modification

Modification Report

APPENDIX B

BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

YANCOAL
兖煤澳大利亚有限公司

Moolarben Coal Complex UG4 Ancillary Works Modification
Biodiversity Development Assessment Report

Moolarben Coal Operations Pty Ltd

ecological AUSTRALIA
A TETRA TECH COMPANY

1300 646 131
www.ecoaus.com.au

DOCUMENT TRACKING

Project Name	Moolarben Coal Complex UG4 Ancillary Works Modification
Project Number	13676
Date	26 September 2019
Project Manager	Kalya Abbey
Prepared by	Cheryl O'Dwyer, Emily Bathgate
Reviewed by	Kalya Abbey, Meredith Henderson
Approved by	Daniel Magdi
Status	Draft
Version Number	V3
Last saved on	1 October 2019

This report should be cited as **'Eco Logical Australia 2019 Moolarben Coal Complex UG4 Ancillary Works Modification. Prepared for Moolarben Coal Operations Pty Ltd.'**

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from **Moolarben Coal Operations Pty Ltd**

Template 29/9/2015

Executive Summary

Eco Logical Australia Pty Ltd (ELA) was engaged by Moolarben Coal Operations Pty Ltd (MCO) to prepare a Biodiversity Development Assessment Report (BDAR) for the Modification to the Project Approval to account for changes to the Underground 4 (UG4) operations ancillary infrastructure. This BDAR assesses the impacts of the proposed development according to the NSW Biodiversity Assessment Method (BAM) established under Section 6.7 of the NSW *Biodiversity Conservation Act 2016* (BC Act).

The proposed Modification will involve the construction of a ventilation shaft and associated infrastructure compound, a Remote Services Infrastructure Area (RSIA), relocating/expanding four dewatering sites and associated access tracks/services corridors, comprising a total development footprint of approximately 12.5 ha. A study area of approximately 70 ha encompassing the development footprint was used for this assessment.

Assessment has been undertaken in accordance with the BAM and included database review, vegetation mapping and field survey including vegetation integrity plots and targeted threatened species surveys.

Key features of the study area include woodlands and shrubby heathlands with hollow bearing trees, patches of woodland and grassland vegetation, and rocky outcrops.

Three Plant Community Types (PCT) were mapped within the development footprint:

- PCT 281 - *Rough-Barked Apple-Red Gum-Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion,* which is present in four condition states (vegetation zone 1 – cleared; vegetation zone 2 - low condition; vegetation zone 3 – moderate condition; and vegetation zone 4 –good).
- PCT 479 - *Narrow-leaved Ironbark- Black Cypress Pine - Stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion*, which is also present in three condition states (vegetation zone 5 – low condition; vegetation zone 6 – moderate and vegetation zone 7 - good condition).
- PCT 1711 *Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin* is present in one condition state (vegetation zone 8 - good).

Five species of threatened woodland birds were recorded in the study area from the targeted surveys within PCT 479, Glossy Black Cockatoo, Dusky Woodswallow, Varied Sittella, Painted Honeyeater and Speckled Warbler, all listed as vulnerable under the BC Act and all considered ecosystem credit species. The Glossy Black Cockatoo, however, is a dual credit species if breeding habitat is identified within the development footprint. Although this species is not associated with PCT 479 in the Threatened Biodiversity Database Collection, confirmed presence within the development footprint and confirmation of suitable habitat (hollow bearing trees) have necessitated its inclusion in this assessment.

Ultrasonic microbat call analysis from acoustic recordings undertaken in 2018 identified a number of microbat species within the study area, within PCT 479. The Eastern Cave Bat (potentially recorded) and the Large-eared Pied Bat (confirmed) are both considered species credit species for this assessment. As for the Glossy Black Cockatoo, the species is not associated with PCT 479 in the Threatened Biodiversity Database Collection, however, confirmed and potential identification of these species within the development footprint and confirmation of suitable habitat in the adjacent locality (caves, scarps, cliffs, rock overhangs) have necessitated its inclusion in this assessment.

Additionally, Gang-gang Cockatoo and *Tylophora linearis* have been assumed to be present, due to survey timing constraints.

Biodiversity impacts that are considered unavoidable for the Modification will include the removal of approximately 10 ha of native vegetation:

- 4 ha of PCT 479 *Narrow-leaved Ironbark- Black Cypress Pine - Stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion*;
- 0.5 ha of PCT 1711 *Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin*;
- 5.5 ha of PCT 281 *Rough-Barked Apple-Red Gum-Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion* (2.5 ha of which conforms to Endangered Ecological Community (EEC) under the BC Act and approximately 0.3 ha corresponds with Critically Endangered Ecological Community (CEEC) under the EBPC Act).

A total of 42 ecosystem credits are required to offset PCT 281, 59 credits are required to offset PCT 479, and ten (10) credits are required to offset PCT 1711. In addition, 135 species credits each are required to offset impacts on the Large-eared Pied Bat and the Eastern Cave Bat; nine (9) credits each are required to offset the impacts on Gang-gang Cockatoos and Glossy Black Cockatoos, and 26 credits are required to offset impacts to *Tylophora linearis*. The retirement of the final credits will be carried out in accordance with the NSW Biodiversity Offset Scheme (BOS).

Serious and Irreversible Impacts (SAII) values have been considered as part of this assessment. PCT 281 conforms to 'White Box Yellow Box Blakely's Red Gum Woodland' which is a listed candidate entity potentially subject to SAII. The SAII threshold for this EEC is yet to be published by NSW Office of Environment and Heritage.

The Large-eared Pied Bat and Eastern Cave Bat are also listed as potential candidate SAII entities. SAII threshold for these two species is habitat within 100 m of rocky areas containing caves, overhangs, crevices, cliffs, escarpments or old mine tunnels (breeding habitat for the species). The northern end of the proposed southern dewatering sites access track is adjacent to and within 100 m of rocky outcrops. As acoustic detectors are the only survey method used to date for the Modification, and these species were detected, potential breeding habitat has been assumed to be present. However, existing disturbance including an existing vehicle access track is present, and further disturbance from the Modification would be minimal in this area. Therefore, it is considered unlikely that an SAII will occur.

This BDAR considered potential Matters of National Environmental Significance (MNES), and a likelihood of occurrence assessment (**Appendix E**) was conducted for MNES based on the Protected Matters Search Tool Report for the study area. Following a detailed habitat assessment for each MNES and previous records within the locality, impact assessments were completed for Superb Parrot, Large-eared Pied Bat, Corben's Long-eared Bat, Painted Honeyeater, White-throated Needletail, White Box Yellow Box Blakely's Red Gum Grassy Woodland, and Koala (**Appendix F**). With the exception of the minimal disturbance (0.3 ha) to White Box Yellow Box Blakely's Red Gum Grassy Woodland, impacts to MNES are considered unlikely.

A BAM credit summary report is attached in **Appendix G.**

Contents

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Abbreviations

Abbreviation	Description
BAM	Biodiversity Assessment Method
BAMC	Biodiversity Assessment Method Credit Calculator
BC Act	NSW Biodiversity Conservation Act 2016
BCD	Biodiversity and Conservation Division
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
CEEC	Critically Endangered Ecological Community
DNG	Derived Native Grassland
DPIE	NSW Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FM Act	NSW Fisheries Management Act 1994
GIS	Geographic Information System
IBRA	Interim Biogeographic Regionalisation for Australia
LEP	Local Environmental Plan
LGA	Local Government Area
MCO	Moolarben Coal Operations
MNES	Matters of National Environmental Significance
MWRC	Mid-Western Regional Councilbmp
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
RSIA	Remote Services Infrastructure Area
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community
UG4	Underground 4

1. Stage 1: Biodiversity Assessment

1.1 Introduction

Moolarben Coal Operations Pty Ltd (MCO) is seeking a modification to the Project Approval for Stage 1 of the Moolarben Coal Complex under Section 4.55 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act).

The modification is required to allow for the construction of ancillary infrastructure for the operation of UG4, (herein referred to as the underground 4 (UG4) Ancillary Works Modification [the Modification]).

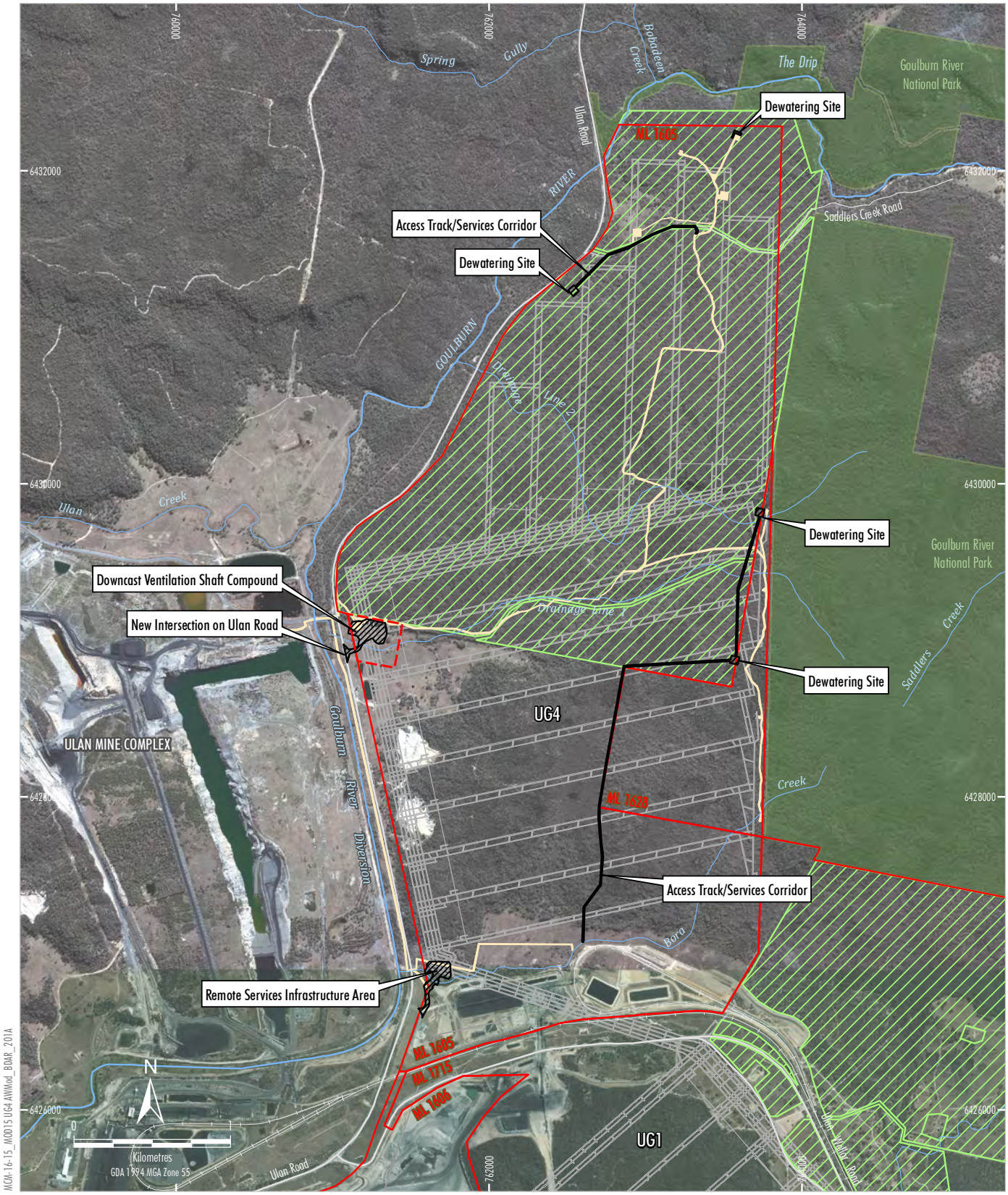
Key elements of the Modification include (**Figure 1**):

- Development of four additional bore sites and pads and extension of the associated access and infrastructure corridor for the UG4 underground workings and associated infrastructure;
- Development of a downcast ventilation shaft for UG4 and associated infrastructure (collectively referred to as the ventilation shaft compound); and
- Development of Remote Services Infrastructure Area.

This Biodiversity Development Assessment Report (BDAR) assesses the impacts of the Modification in accordance with the NSW Biodiversity Assessment Method (BAM). This BDAR has been prepared by Cheryl O'Dwyer (Senior Ecologist BAAS18153), who is an Accredited Person under the NSW *Biodiversity Conservation Act 2016* (BC Act). The contents of this BDAR comply with the requirements outlined in Table 25 of the BAM (NSW Office of Environment and Heritage [OEH], 2017).

The following terms have been used in this document, as required for a BDAR. Further definitions are included in **Appendix A**.

- **Development footprint** – the area of land that will be directly impacted by the Modification (approximately 12.5 ha)
- **Study area** – the area of land which encompasses the development footprint and has been surveyed for this BDAR (70 ha)
- **Buffer area** – the area of land extending 1,500 m from the development footprint, required to assess native vegetation extent and other landscape features in accordance with the BAM.



MCM-16-15_MOD15 UG4 AWMod_BDAR_201A

LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Existing Biodiversity Offset Area
- Existing/Approved Development
- Underground Longwall Layout
- Pipeline and Borefield Infrastructure
- UG4 Ancillary Works Modification
- Indicative Surface Infrastructure Area

Source: MCO (2019); NSW Department of Planning, Industry and Environment (2019)
Orthophoto Mosaic: MCO (April 2016 - May 2012)

MOOLARBEN COAL COMPLEX

Ancillary Works Modification

Figure 1

1.1.1 General description of the study area

The development footprint and associated study area is located within the Mid-Western Regional Council (MWRC) Local Government Area (LGA) along the western boundary of the Goulburn River National Park, approximately 43 km north-east of Mudgee, NSW. The study area is zoned RU1 (Primary Production) and E3 (Environmental Management). The following lots occur within the study area:

- Lot 2 DP 1246858
- Lot 20 DP 755439
- Lot 2 DP 722882
- Lot 5 DP 1240416
- Lot 1 and Lot 3 DP 1214133.

Three Plant Community Types (PCT) have been mapped within the study area, divided into eight distinct vegetation zones:

- PCT 281 - *Rough-Barked Apple-Red Gum-Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion*, which is present in four condition states (vegetation zone 1 – cleared condition; vegetation zone 2 – low condition; and vegetation zone 3 – moderate condition; and vegetation zone 4 – good condition)
- PCT 479 - *Narrow-leaved Ironbark- Black Cypress Pine - Stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion* is present in three condition states (vegetation zone 5 – low condition, vegetation zone 6 - moderate condition; and vegetation zone 7 - good condition)
- PCT 1711 T*antoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin* is present in one condition state (vegetation zone 8 – good condition).

Patches of PCT 281 conform to the Endangered Ecological Community (EEC) 'White Box Yellow Box Blakely's Red Gum Woodland', listed under the NSW BC Act and also the Critically Endangered Ecological Community (CEEC) 'White Box Yellow Box Blakely's Red Gum Woodland', listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Vegetation zones 2, 3 and 4 were considered to meet the listing criteria for the EEC under the BC Act (approximately 2.5 ha), while only vegetation zone 4 also conformed to the listing criteria of the CEEC under the EPBC Act (approximately 0.3 ha).

This report includes five base Site Maps (**Figures 2** to **5**) and the Location Map (**Figure 6**).

1.1.2 Development site footprint and study area

The development footprint covers an area of approximately 12.5 ha, although a larger study area of 70 ha was investigated.

Of the total footprint, approximately 10 ha is native vegetation and approximately 3 ha is cleared (existing track or road) or exotic vegetation. The majority of the cleared area occurs in the proposed RSIA and ventilation shaft compound. Targeted fauna surveys were completed in 2018 in close proximity to the current proposed development footprint.

Given that much of the current study area is within 800 m of the surveys undertaken in 2018, results of the targeted fauna surveys undertaken in 2018 have been included in this assessment. Additional targeted fauna surveys were undertaken in the current study area in August 2019 and are included in this BDAR.

Key features of the study area include woodlands and shrubby heathlands with hollow bearing trees, patches of woodland and grassland vegetation, and rocky outcrops.

The indicative locations of the relocated/expanded dewatering sites and associated access and infrastructure corridors are shown on **Figure 1**.

1.1.3 Sources of information used

The following data sources were reviewed as part of this BDAR:

- OEH (2017) BAM
- OEH Biodiversity Assessment Method Calculator (BAMC)
- NSW Biodiversity Values Map
- BioNet Vegetation Classification Database (OEH 2019a)
- Bionet Atlas of NSW Wildlife (OEH, 2018a and 2019a) covering an area from 10 km buffer around coordinates North: -32.20 West: 149.75 East: 149.85 South: -32.30
- EPBC Act Protected Matters Search Tool (DotEE, 2018 and 2019) using a 10 km buffer around coordinates:32.25031 149.78669
- NSW OEH Threatened Species Profile Database (OEH 2019b and 2019c)
- BioNet Threatened Biodiversity Data Collection (TBDC)
- Australia's IBRA Bioregions and sub-regions
- Department of Environment and Climate Change NSW (DECC, 2002). Descriptions of NSW (Mitchell) Landscapes, Version 2.

It is noted that there are inconsistencies between the information provided in the BioNet TBDC and the BAMC. These inconsistencies have been discussed with the Biodiversity and Conservation Division (BCD) of the NSW Department of Planning, Industry and Environment (DPIE) (formally OEH) during a pre-lodgement meeting on 27 August 2019 and the BCD advised that the information in the TBDC should be considered to be correct for the extent of the inconsistency. The BCD advised that the TBDC is updated more regularly than the BAMC.

This is further supported in an update from the BCD that was provided to all BC Act accredited assessors on Friday 6 September 2019, which indicated that the BAMC was scheduled to be updated at the end of September to reflect the latest information in the TBDC. In addition, these inconsistencies are discussed in *BAM Assessor Update Number 9* available online as follows:

> *When reviewing a species in BioNet assessors may notice that the data differs slightly from the BAM-C. This occurs when data is updated in BioNet (based on new information), but is not automatically updated in the BAM-C. The BAM-C data is updated periodically throughout the year, and assessors will be notified when this occurs.*

Given the above, the discussion and results in this BDAR relies on the information in the TBDC where the BAMC is not consistent.

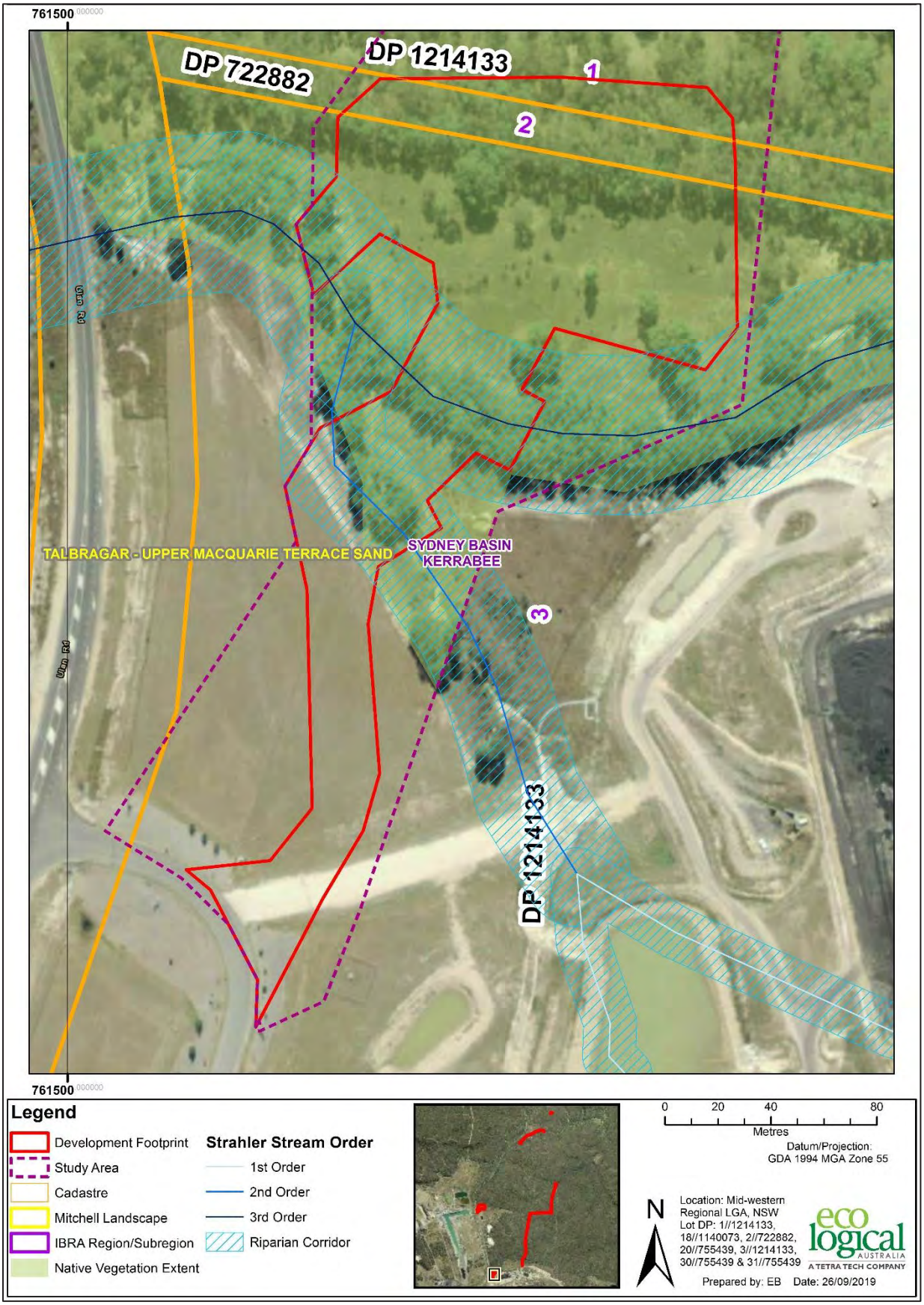


Figure 2: Site Map of RSIA

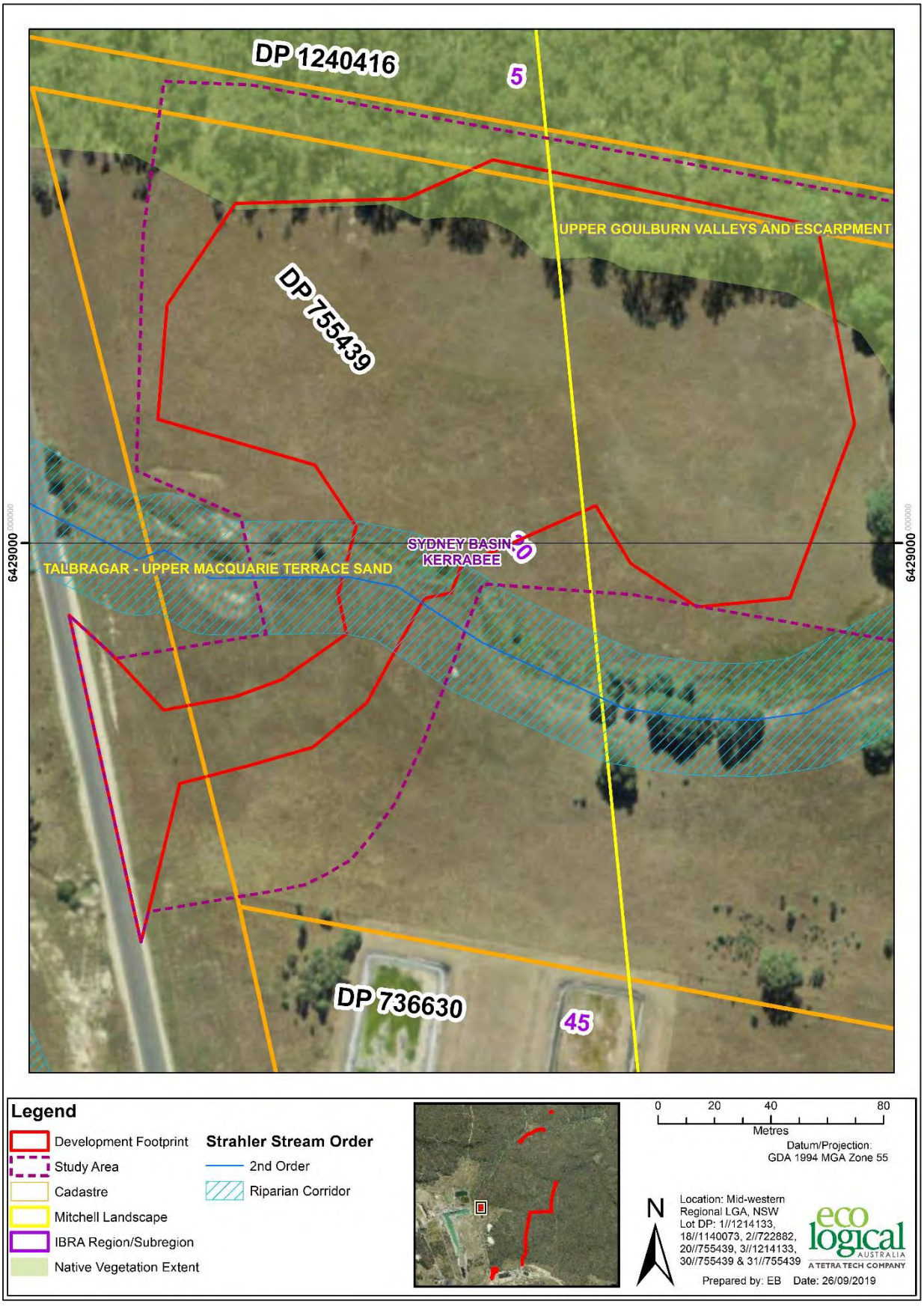


Figure 3: Site Map of ventilation shaft compound

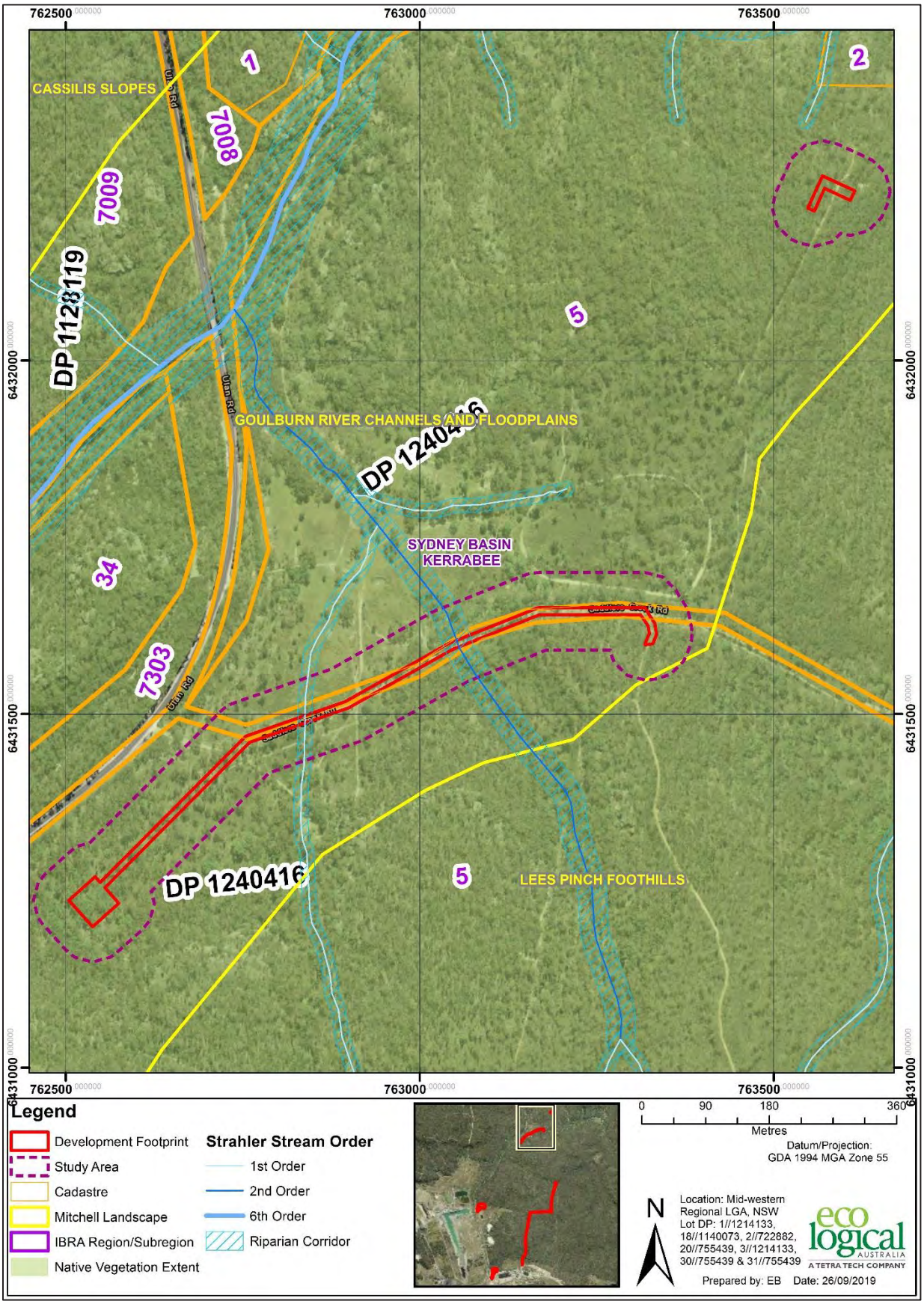


Figure 4: Site map of proposed northern dewatering sites and access track

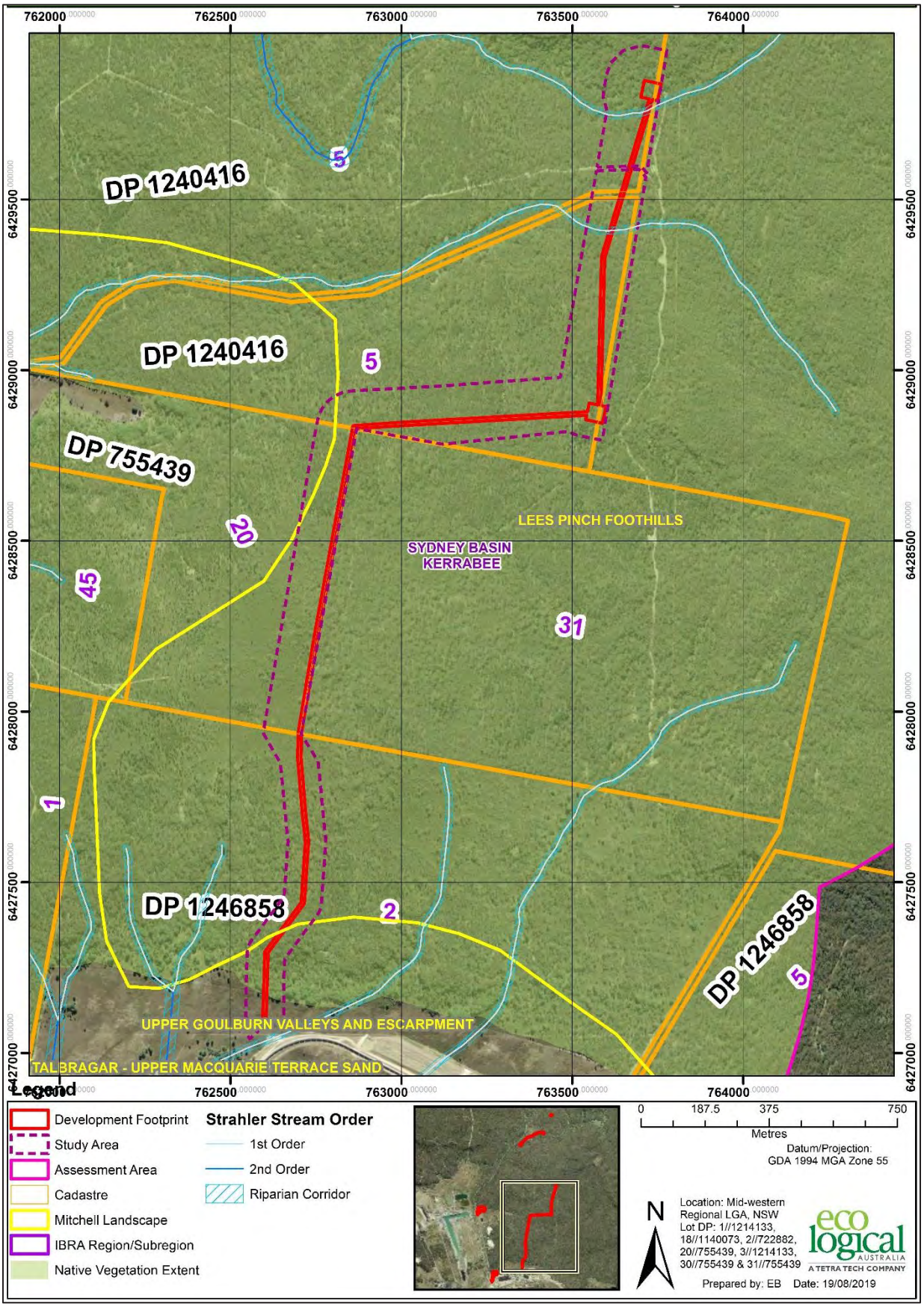
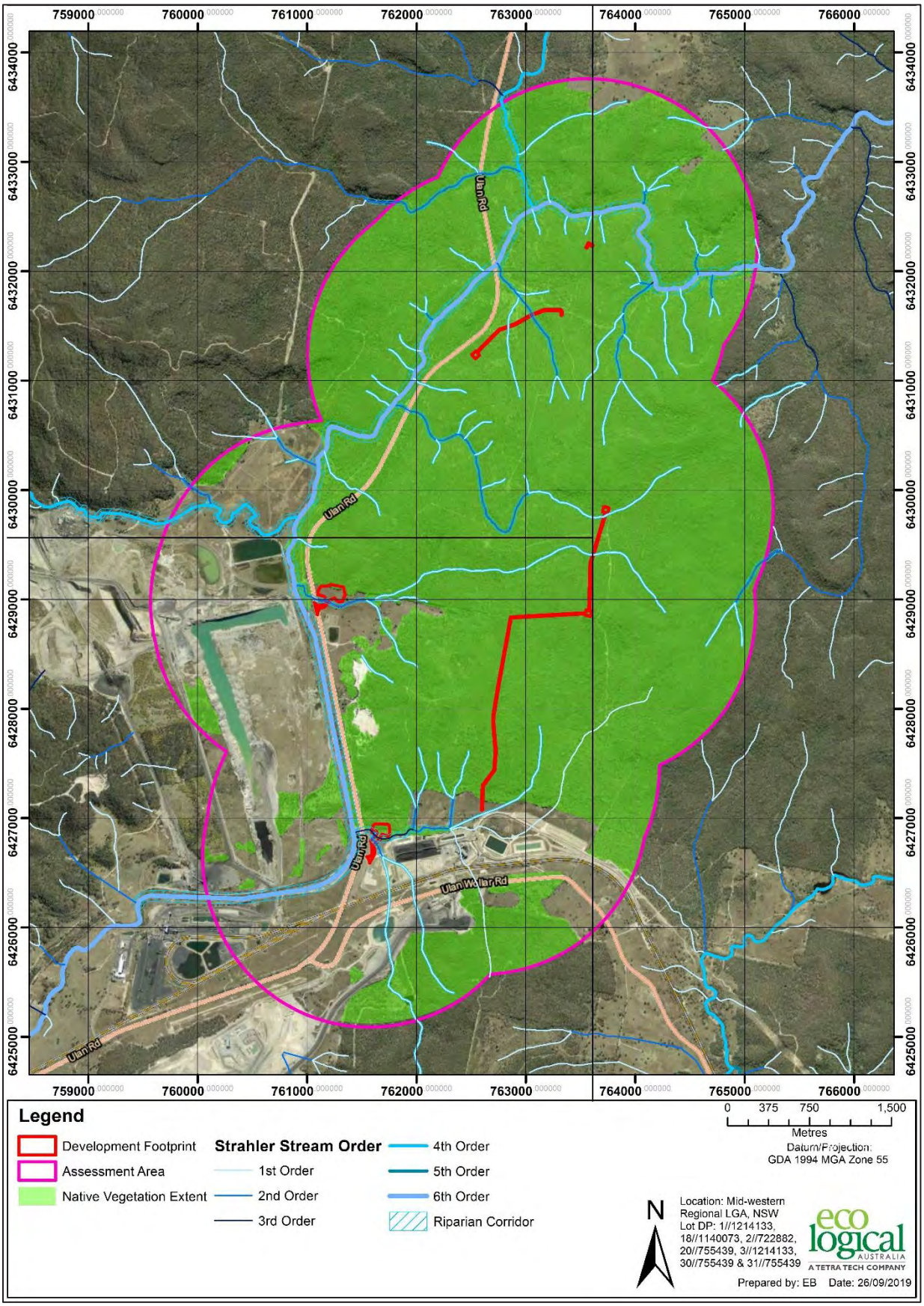


Figure 5: Site map of proposed southern dewatering sites and assess track



NB: Stahler stream order displayed as per Appendix 3 of the BAM. Not representative of on ground hydrology.

Figure 6: Location Map

1.2 Legislative context

Table 1: Legislative context

Name	Relevance to the project	Report Section
Commonwealth		
Environment Protection and Biodiversity Conservation Act 1999	Matters of National Environmental Significance (MNES) have been identified on or near the development footprint. This report assesses impacts to MNES and concludes that the Modification is unlikely to have a significant impact on MNES.	2.5.1
State		
***Environmental Planning and Assessment Act 1979* (EP&A Act)**	The Modification is State Significant Development (SSD) to be assessed under Part 4 of the EP&A Act.	2.1
Biodiversity Conservation Act 2016	The Modification exceeds the BAM threshold and requires submission of a BDAR.	1.1.2
***Fisheries Management Act 1994* (FM Act)**	The Modification does not involve impacts to Key Fish Habitat, does not involve harm to marine vegetation, dredging, reclamation or obstruction of fish passage. A permit or consultation under the FM Act is not required.	NA
Local Land Services Amendment Act 2016	The *Local Land Services Act 2013* does not apply to development consent issued under Part 4 of the EP&A Act.	NA
Water Management Act 2000	The Modification does not involve works on waterfront land. A Controlled Activity Approval under s91 of the *Water Management Act 2000* is not required.	NA
Planning Instruments		
SEPP 14 – Coastal Management	SEPP Coastal Management 2018 consolidated SEPP 14 Coastal Wetlands, SEPP 26 Littoral Rainforests and SEPP 71 Coastal Protection. The development footprint is not located on land subject to SEPP Coastal Management 2018.	NA
SEPP 44 – Koala Habitat Protection	The proposed development footprint is located within the MWRC LGA which is listed as one of the Council's to which SEPP 44 applies. The Modification will not impact on core koala habitat as defined by SEPP 44.	2.5.2
MWRC Local Environment Plan (LEP)	The Modification would occur on Land Zones RU1 (Primary Production) and E3 (Environmental Management). The Modification is classified as being 'permitted with consent' as outlined in the land-use objectives of the MWR LEP.	1.1.1

1.3 Landscape features

The following section details the base information entered into the BAMC for the development footprint.

1.3.1 IBRA regions and subregions

The development footprint is located within the Sydney Basin IBRA Bioregion and Kerrabee subregion.

1.3.2 Mitchell Landscapes

The development footprint falls within the Mitchell Landscapes as outlined in **Table 2**. The dominant landscape in the development footprint is the Talbragar – Upper Macquarie Terrace Sands and Gravels (40%).

Table 2: Mitchell Landscapes

Mitchell Landscape	Description
Lees Pinch Foothills **33%**	Stony plateau, rugged hills and ridges with narrow valleys on Triassic and Jurassic quartz sandstones, shale and conglomerate. General elevation 250-750 m. Extensive rock outcrops with low cliffs and benches, course sandy soils with rubbly debris on steep slopes, accumulation of alluvial sand in the valleys and yellow textured-contrast soils on some benches. Woodland of *Eucalyptus sideroxylon* (Red Ironbark), *E. punctata* (Grey Gum), *E. agglomerata* (Blue-leaved Stringybark), *E. sparsifolia* (Narrow-leaved Stringybark), *Callitris endlicheri* (Black Cypress Pine) and *Allocasuarina torulosa* (Forest Oak) on the slopes and ridges. *E. punctata*, *Corymbia trachyphloia* (Brown Bloodwood), and stringybarks (*Eucalyptus* sp.) with sparse ground cover in creeks and at the base of cliffs. Scattered forest *E. tereticornis* (Forest Red Gum) and ironbark along streams.
Talbragar-Upper Macquarie Terrance Sands and Gravel Slopes **40%**	Sandy Quaternary alluvial sediments on the floodplains and terraces of the Talbragar River, general elevation 350 to 500 m, local relief 30 to 40 m. Red- brown and red-yellow earthy sands with some yellow texture-contrast soils on the valley margins. *Eucalyptus camaldulensis* (River Red Gum) along the channels, *E. melliodora* (Yellow Box) and *Angophora floribunda* (Rough-barked Apple) with *Callitris glaucophylla* (White Cypress Pine) on the plain.
Upper Goulburn Valley and escarpments **14%**	Steep hills and sandstone escarpments with cliffs, rock outcrop and long debris slopes on Permian and Triassic quartz sandstone, lithic sandstone, conglomerate and shale, general elevation 250 to 700 m, local relief to 250 m. Stony coarse textured rubbly earths and harsh texture-contrast soils. Woodland of *Eucalyptus moluccana* (Grey Box), *E. tereticornis, E. albens* (White Box), *E. melliodora* and grasses. Rainforest elements in protected sites.
Goulburn River Channels and Floodplains **12%**	Channel, floodplain terraces and valley foothills on Quaternary alluvium and colluvium, general elevations 150 to 250 m, local relief 30 m. Deep gravelly coarse textured red and brown earths on upper slopes, harsh yellow-brown texture-contrast soils on terraces, gradational and uniform sands and loamy sands on the floodplain. Grassy woodland of *Eucalyptus albens*, *E. melliodora*, *E. tereticornis* and *Angophora floribunda*.

1.3.3 Rivers and streams

The development footprint traverses seven drainage features. There are four Strahler first order streams, two second order and one third order stream (**Figure 6**). The third order stream is located adjacent to the proposed RSIA.

1.3.4 Wetlands

The development footprint does not contain any wetlands.

1.3.5 Connectivity features

The development footprint is located above the approved UG4 mining domain adjacent to the Goulburn River National Park. The Park covers over 70,000 ha and including an approximately 90 km length of the Goulburn River. Connectivity features need to be considered under Section 9.2.1.6 of the BAM to assess potential impacts on the movement of threatened species.

1.3.6 Areas of geological significance and soil hazard features

There are a number of small caves, crevices and cliffs and bands of sandstone outcropping within the study area. These features do not occur within the development footprint and would be avoided by the Modification.

1.3.7 Site context

1.3.7.1 Method applied

The Modification layout meets the definition of a site-based development under the BAM, as a development other than a linear shaped development, or a multiple fragmentation impact development.

1.3.7.2 Percent native vegetation cover in the landscape

Geographic Information System (GIS) mapping using aerial imagery sourced from SIX Maps determined approximately 2,478 ha of native vegetation occurring within the 1,500 m buffer area (72%), using increments of 5%.

The native vegetation in the landscape surrounding the development footprint is considered to be predominantly grassy woodland on the flats comprising of *Eucalyptus blakelyi* (Blakely's Red Gum), *Angophora floribunda*, *E. moluccana* and *E. melliodora*. *Callitris endlicheri* and *E. macrorhyncha* (Red Stringybark) dominate the foot slopes with *E. crebra* (Narrow-leaved Ironbark), *C. endlicheri, E. agglomerata* and *E. rossii* (Scribbly Gum) dominating the steeper hilly terrain.

1.3.7.3 Patch size

Patch size was calculated using available vegetation mapping for all patches of intact native vegetation on and adjoining the development footprint. The patch size for all vegetation zones is greater than the 100 ha patch size class. Therefore, the patch size of 101 ha was entered into the BAMC.

1.4 Native vegetation

1.4.1 Survey effort

Vegetation surveys were undertaken within, and adjacent portions of the study area in August 2018. Following revision of the development footprint in 2019, further vegetation surveys were undertaken over a five day period in July 2019.

An initial vegetation mapping survey was undertaken to determine the extent of vegetation in the study area, to assign the vegetation to PCTs and determine the presence of any EEC (BC Act) and/or CEEC (EPBC Act). The number of vegetation integrity plots required in accordance with the BAM was determined and a total of 22 full-floristic vegetation integrity plots were completed within the study area.

Data collected from the vegetation integrity plots was used to assess the composition, condition and integrity of the PCTs. Targeted flora surveys were undertaken during the above survey period for *Acacia ausfeldii* (Ausfeld's Wattle)*, Commersonia procumbens*, and *Monotaxis macrophylla* (Large-leafed Monotaxis) as part of the BAM requirements. All floristic and vegetation integrity plot data is included in **Appendices B and C**.

Following the vegetation survey, the development footprint was revised to reduce the area of native vegetation to be cleared for the Modification to approximately 10 ha. The vegetation mapping and location of vegetation integrity plots is shown in **Figure 7, 8, 9 and 10**.

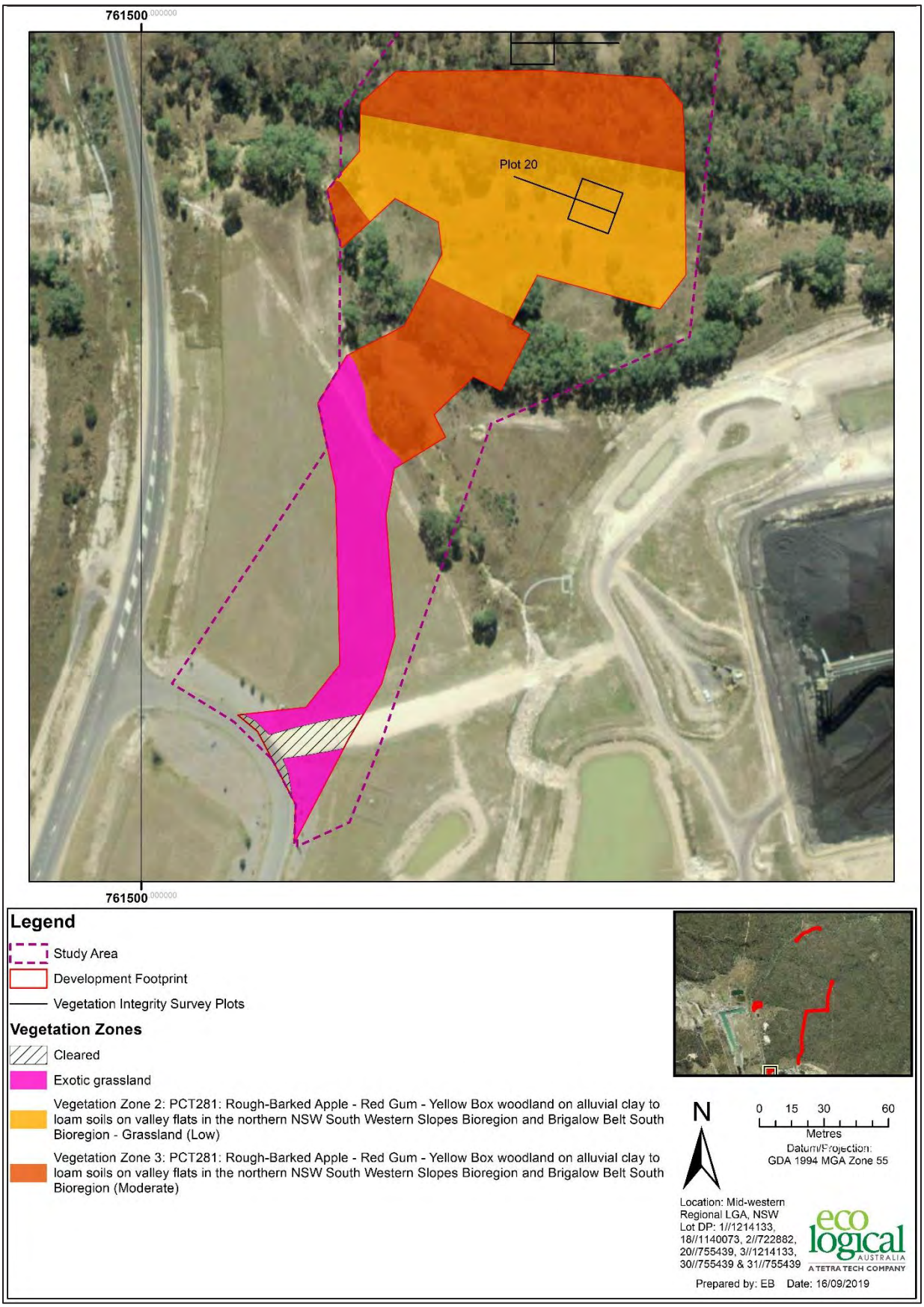


Figure 7: PCTs, native vegetation extent and vegetation plots within the proposed RSIA

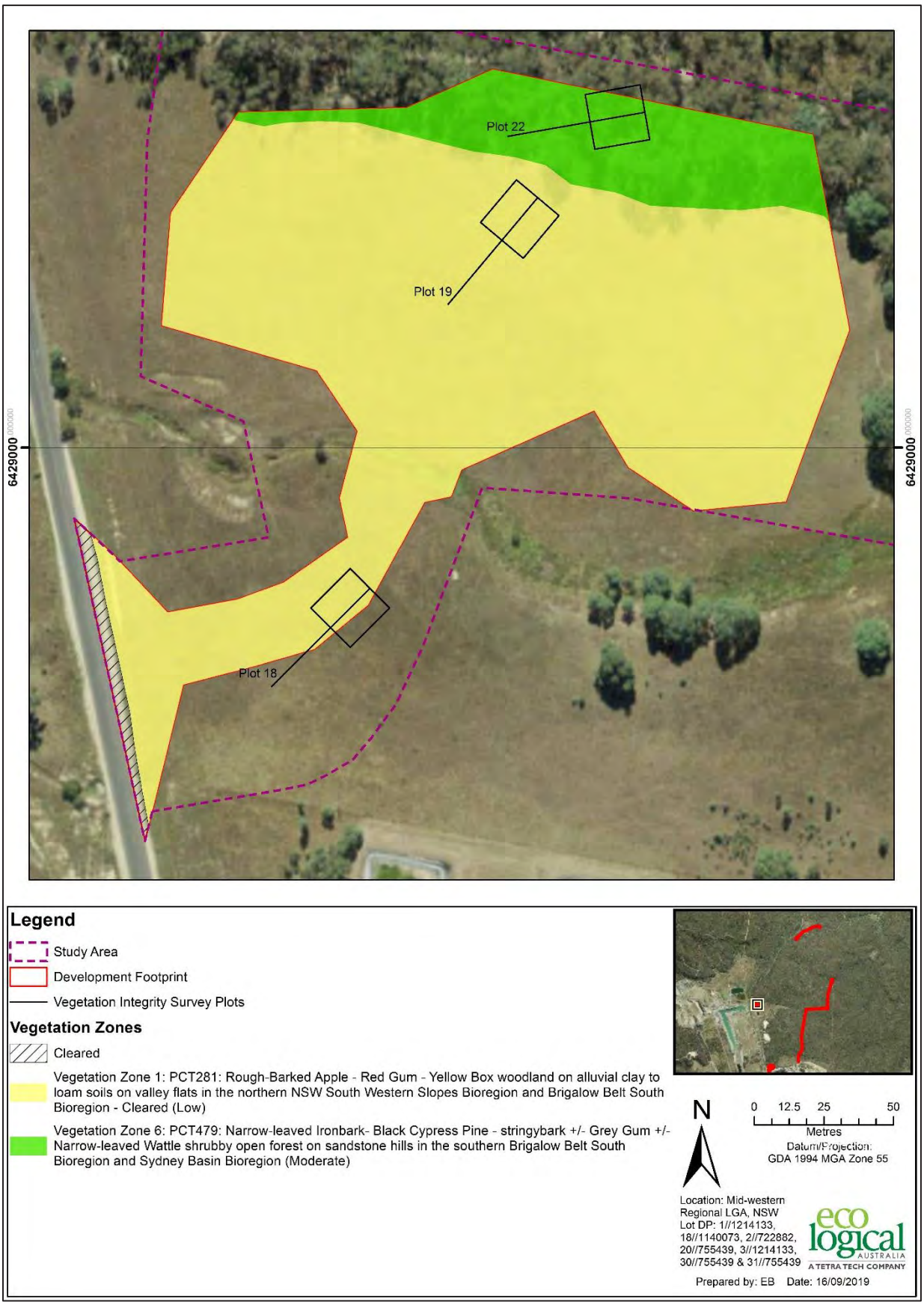


Figure 8: PCTs, native vegetation extent and vegetation plots within the proposed ventilation shaft compound

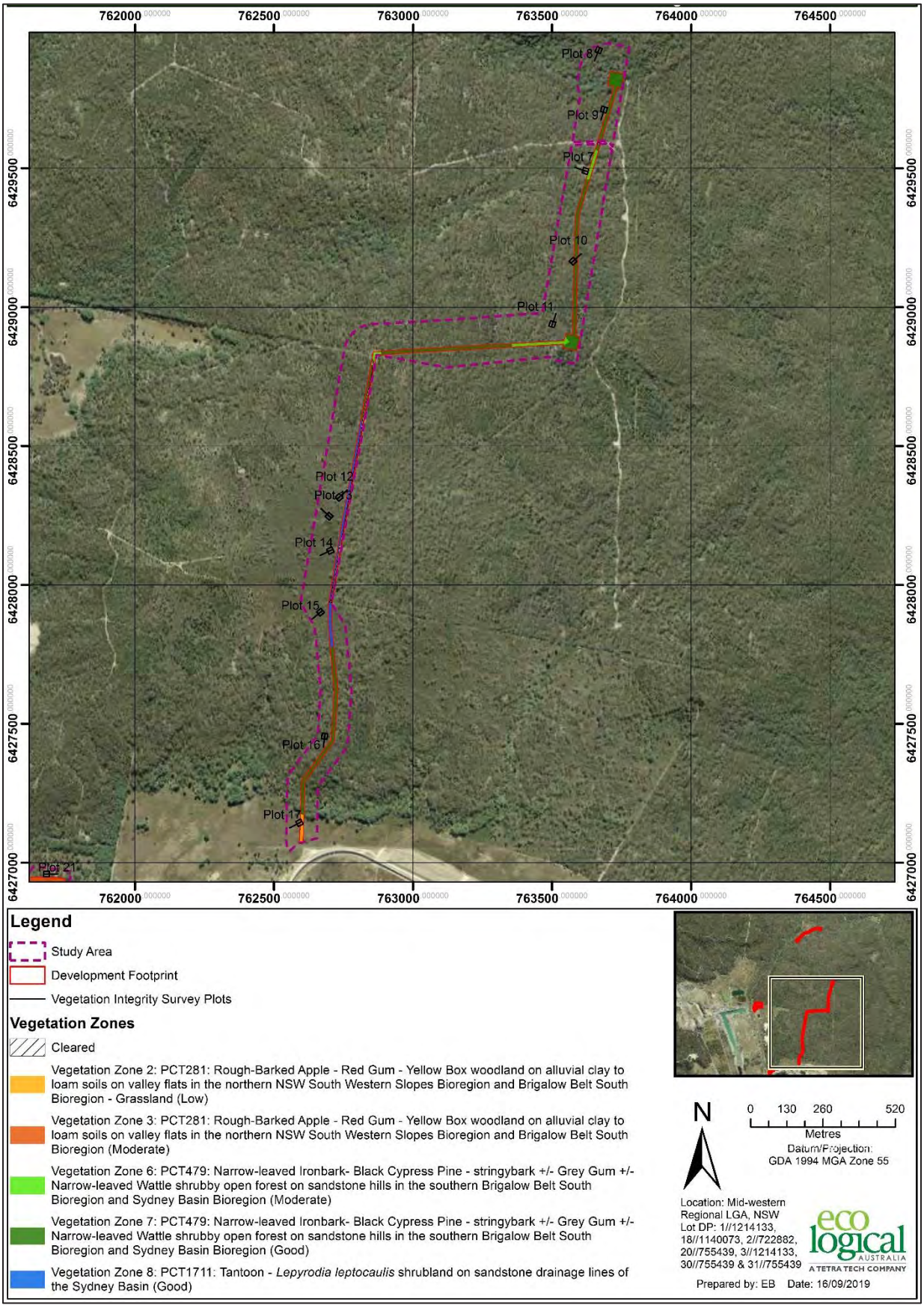


Figure 9: PCTs, native vegetation extent and vegetation plots within the proposed southern dewatering sites and access track

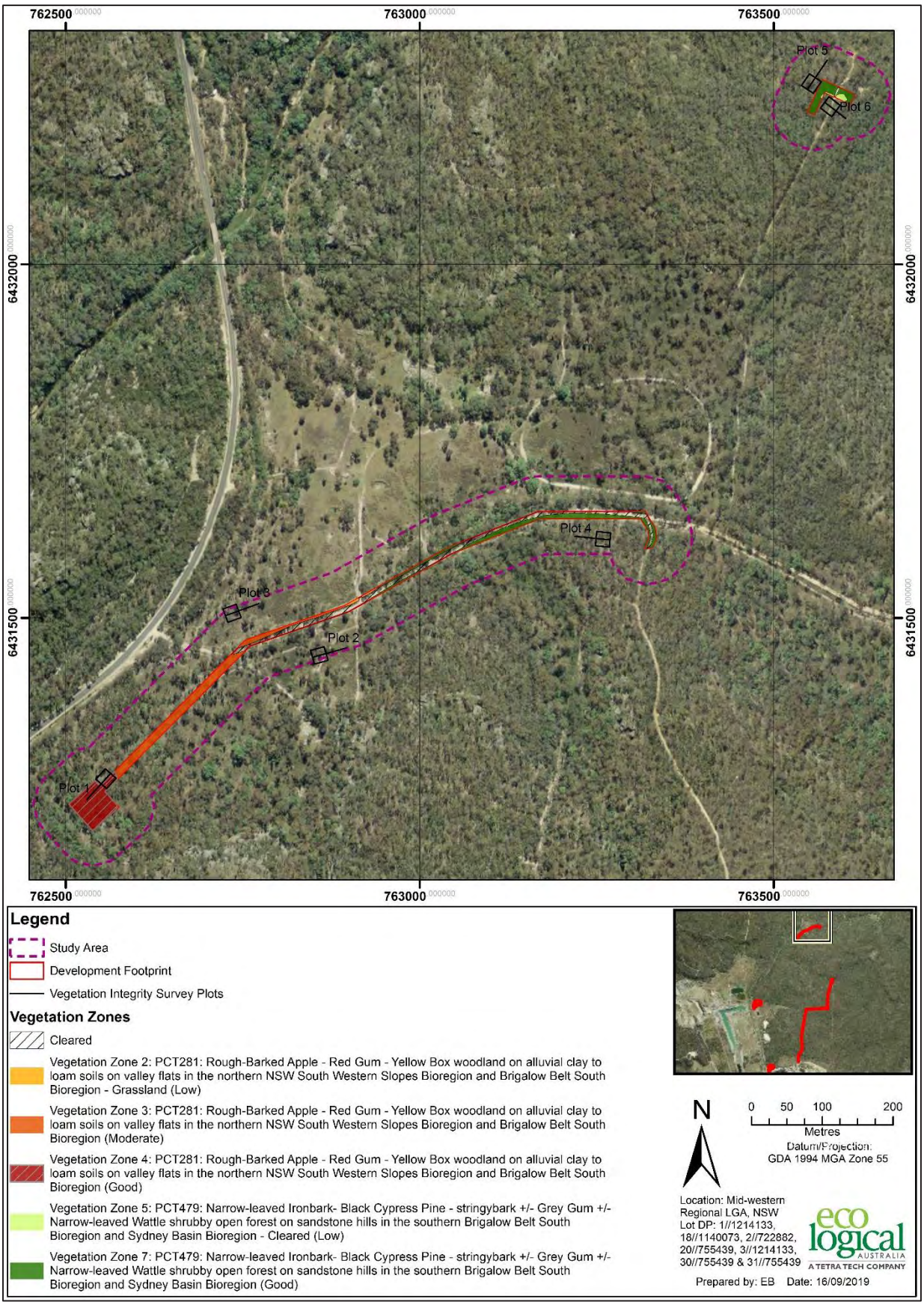


Figure 10: PCTs, native vegetation extent and vegetation plots within proposed northern dewatering sites and access track

1.4.1.1 Plant Community Types present

Three PCTs were identified within the development footprint as shown below in **Table 3**.

Table 3: Plant Community Types within the development footprint

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Approximate Area^	Percent cleared*
281	Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	Grassy Woodlands	5.5	67%
479	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	Western Slopes Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	4	40%
1711	Tantoon - *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin	Western Slopes Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	0.5	0%
Exotic	Areas cleared or consists of exotic vegetation			2.5	

***** Percentage cleared is an estimate value of the PCT that has been cleared in NSW using data contained within the BAMC.

^ numbers have been rounded.

1.4.1.2 PCT selection justification

Justification for the selection of PCTs is based primarily on a qualitative analysis of broad-scale mapping, landscape elements, soil characteristics and surrounding vegetation (**Table 4**). The various attributes were considered in combination to assign vegetation to the best fit PCT.

Table 4: PCT selection justification

PCT ID	PCT Name	Selection criteria	Species relied upon for identification of vegetation type and relative abundance
281	Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	IBRA region, landform, soils, vegetation formation and vegetation class	*Eucalyptus blakelyi* and *Angophora floribunda* were the dominant species observed within the footprint. Landform characteristics present with alluvial soils on valley flats. Surrounding vegetation included the above species and grassland species typical of Box-Gum Woodlands.
479	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	IBRA region, landform, soils, vegetation formation and vegetation class	Dominant canopy species included *Eucalyptus crebra* with scattered *E. macrorhyncha* and *Acacia linearifolia* (Narrow-leaved Wattle). The mid-storey contained *Acrotriche rigida*, *Cassinia sifton* (Sifton Bush) and *Leucopogon muticus* (Blunt Beard-heath).

PCT ID	PCT Name	Selection criteria	Species relied upon for identification of vegetation type and relative abundance
1711	Tantoon - *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin	IBRA region, landform, soils, vegetation formation and vegetation class	An upper stratum dominated by *Eucalyptus blakelyi, Angophora floribunda* and *Callitris endlicheri*. This PCT is a tall shrubland occurring on sandstone geologies within the neighbouring Goulburn River National Park. *Leptospermum polygalifolium* (Tantoon) was a dominant shrub with *Melaleuca thymifolia* (Thyme Honey-myrtle) scattered throughout. *Lepyrodia leptocaulis* was also present in the understory.

PCTs were stratified into eight vegetation zones (**Table 5**).

Table 5: Vegetation integrity zones within the development footprint

Veg Zone	PCT	PCT Name	Condition	Impact Area (ha)^	Plots required	Plots surveyed
1	281	Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Cleared	2.8	2	2
2	281	Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Low	1.0	1	2
3	281	Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Mod	1.2	1	3
4	281	Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Good	0.3	1	1
5	479	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	Low	0.1	1	1
6	479	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	Moderate	1	1	3
7	479	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	Good	3	2	6
8	1711	Tantoon - *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin	Good	0.5	1	4
		Exotic or Cleared areas		2.5		

Veg Zone	PCT	PCT Name	Condition	Impact Area (ha)^	Plots required	Plots surveyed
Total				**12.5**	**10**	**22**

^ numbers have been rounded.

1.4.1.3 Justification for Threatened Ecological Communities

Vegetation zones 2, 3 and 4 were determined to conform to the *White Box Yellow Box Blakely's Red Gum Woodland* EEC under the BC Act, and vegetation zone 4 was also found to conform to the *White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland* CEEC under EPBC Act (**Table 6**, **Figures 11, 12** and **13**). The EEC and CEEC are referred to in-text as Box Gum Woodland.

PCT 281 is listed under the BioNet Vegetation Classification as comprising Box Gum Woodland listed under the BC Act and the EPBC Act.

Justification of PCT 281 within the development footprint as Box Gum Woodland is based on the dominance of diagnostic species in the upper layer (*Eucalyptus blakelyi*) and lower stratum consisting of grasses and characteristic herbs as per the NSW Scientific Committee final determination. Approximately 2.5 ha is considered to be Box Gum Woodland EEC under the BC Act (vegetation zones 2, 3 and 4). Zones 2 and 3 are highly modified by grazing and disturbance resulting in *Aristida ramosa* dominance and containing few herbs. Vegetation zone 4 (approximately 0.3 ha) is considered to conform to the Commonwealth (EPBC Act) CEEC listing criteria due to the presence of 12 non-grass characteristic species (forbs, shrubs, ferns and sedges), the predominantly native understory and the potential of natural regeneration, which was not observed in vegetation zones 2 and 3.

Table 6: Threatened Ecological Communities within the development footprint

Veg Zone	PCT	BC Act			EPBC Act		
		Listing status	Name	Area (ha)	Listing status	Name	Area (ha)
2	281	E	White Box Yellow Box Blakely's Red Gum Woodland	1.0			
3	281	E	White Box Yellow Box Blakely's Red Gum Woodland	1.2			
4	281	E	White Box Yellow Box Blakely's Red Gum Woodland	0.3	CE	White Box Yellow Box Blakely's Red Gum Woodland and Derived native grassland	0.3 ha
			Total	2.5			0.3

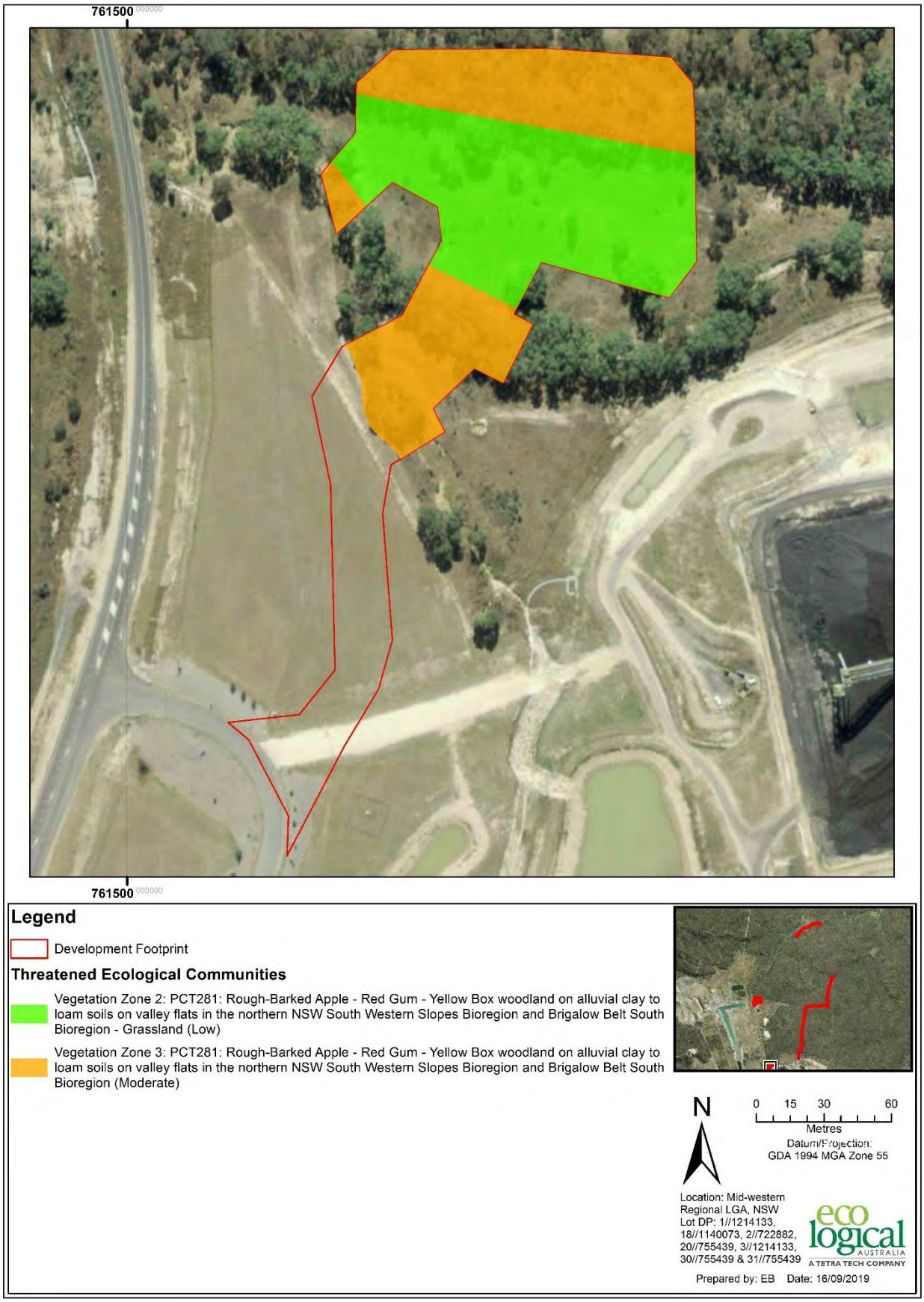


Figure 11: Threatened Ecological Communities within proposed RSIA

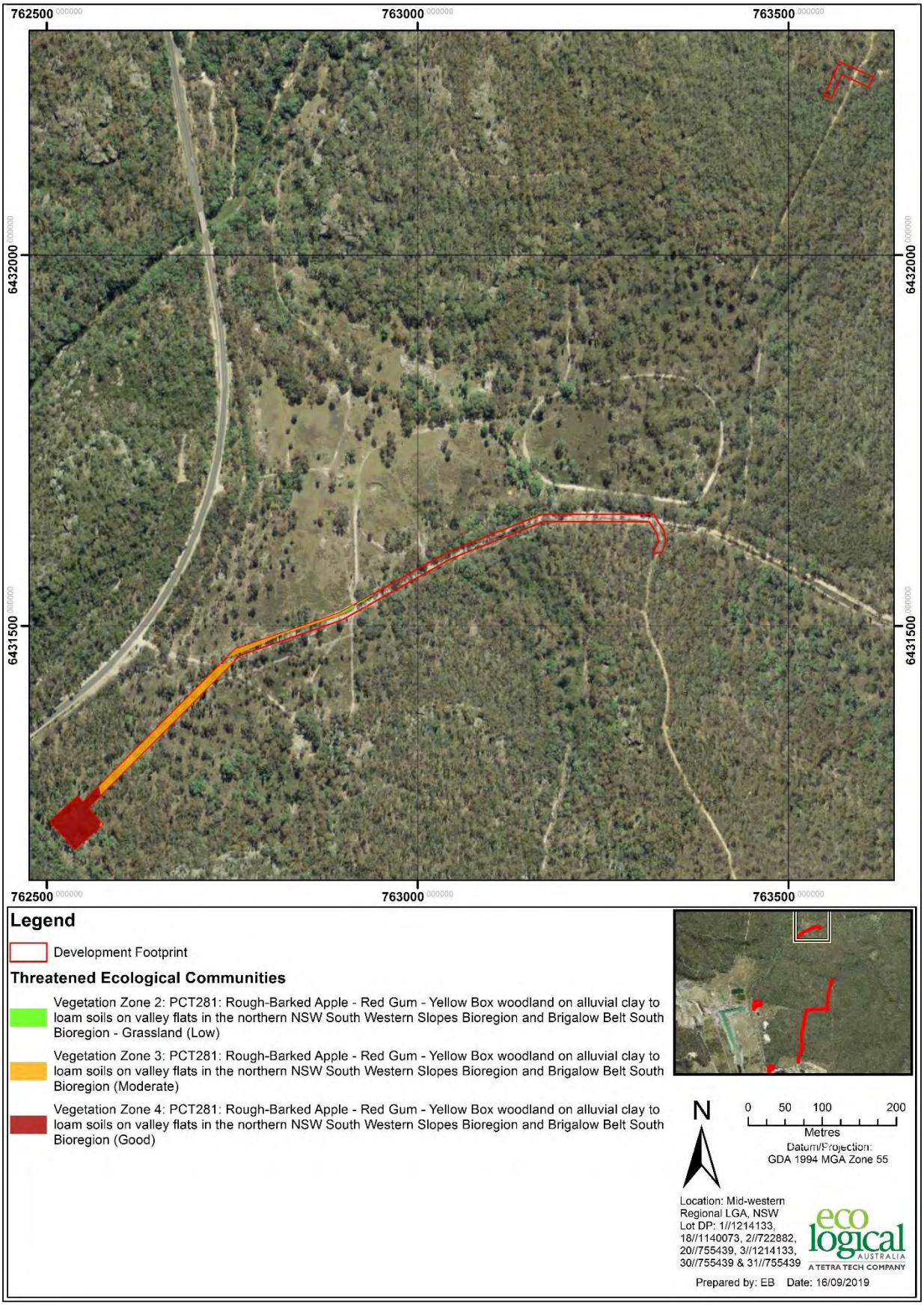


Figure 12: Threatened Ecological Communities within proposed northern dewatering sites and access track. Only Zone 4 confirms to CEEC

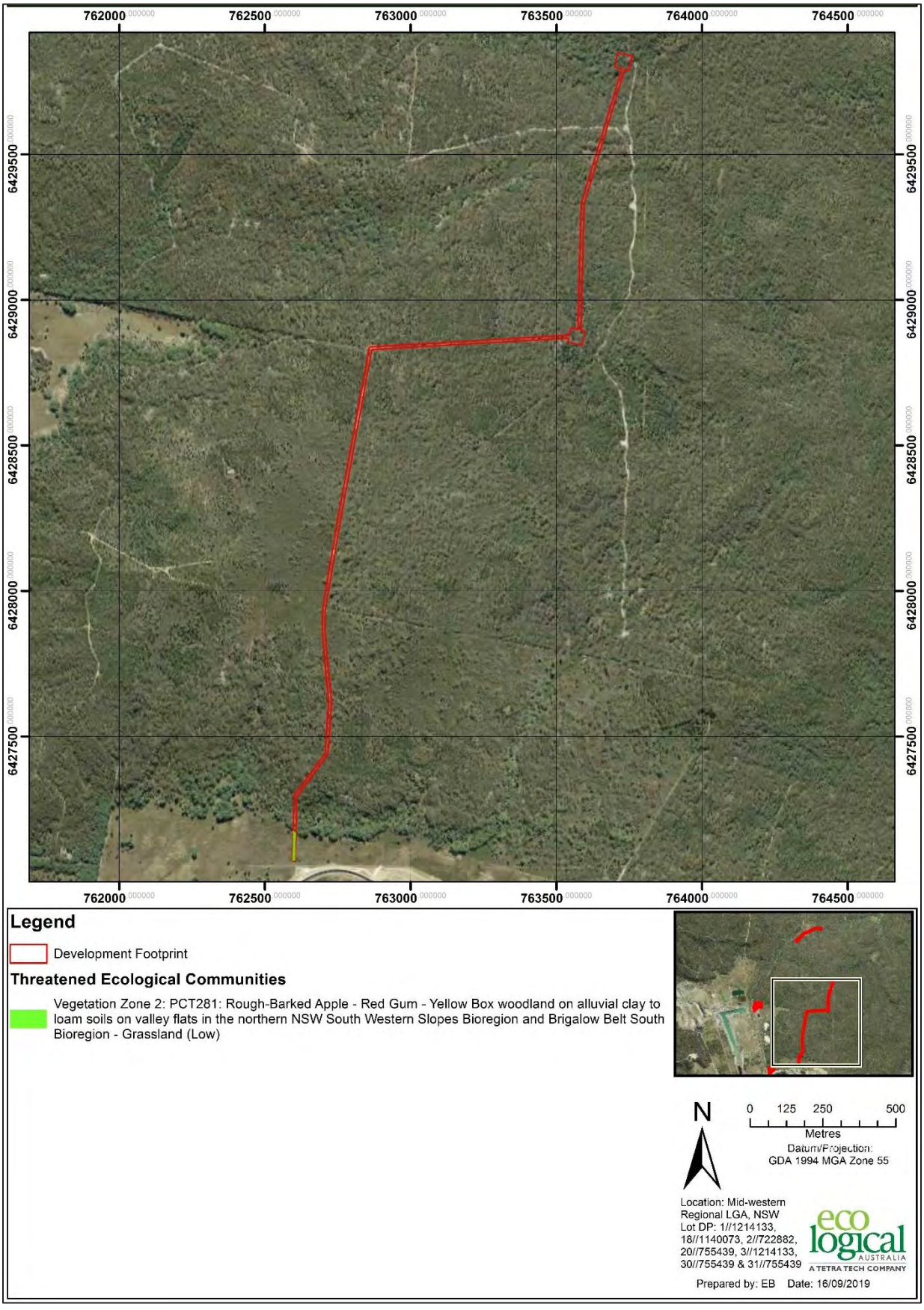


Figure 13: Threatened Ecological Communities within proposed southern dewatering sites and access track

1.4.2 Vegetation Zone Descriptions

1.4.2.1 PCT 281

Classification of PCT 281 - Rough-Barked Apple - Red Gum - Yellow Box Woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion, was based on various attributes which were considered in combination to assign vegetation to the best fit PCT. Attributes included dominant species in each stratum, community composition, soils and landscape position. Plot data collected in the field was input into the BioNet Vegetation Information System (VIS). The canopy comprised of *Eucalyptus blakelyi* together with *E. moluccana* and *Angophora floribunda*. Within the ground stratum, several of the species characteristic of Box Gum Woodland were present: *Aristida ramosa* (Purple Wiregrass), *Bothriochloa macra* (Red-leg Grass), *Rytidosperma* spp. (Wallaby Grass) and *Digitaria brownii* (Love Grass).

Four condition states of this community were identified including:

- PCT 281 Cleared (vegetation zone 1; 2.8 ha)
- PCT 281 Low (vegetation zone 2; 1.0 ha)
- PCT 281 Moderate (vegetation zone 3; 1.2 ha)
- PCT 281 Good (vegetation zone 4; 0.3 ha).

PCT 281 – Low (vegetation zone 2) (**Plate 1**) occurs as a small patch (1.0 ha) within the development footprint at the southern end of the access track adjacent to the Coal Handling and Preparation Plant, and a section in the middle of the area proposed as the RSIA. *Eucalyptus blakelyi* are scattered trees with an understory of native grasses such as *A. ramosa, B. macra, Cymbopogon refractus* (Barbed Wire Grass) and *Digitaria brownii*. Exotic herbs were present.

The northern section of the proposed RSIA has been classified as PCT 281 moderate (vegetation zone 3) (**Plate 2**). This vegetation zone contains a variety of canopy species include *Acacia linearifolia*, *E. blakelyi, E. moluccana* and *Angophora floribunda* with a few shrubs and native grasses. Vegetation zone 3 (PCT 281 Good; **Plate 3**) comprises a variety of trees such as *E. blakelyi* and *A. floribunda* with a variety of shrubs were present such as *Acacia buxifolia* (Box-leaf Wattle), *Exocarpos strictus* (Dwarf Cherry), *Cassinia sifton*, *Melichrus erubescens* (Ruby Urn Heath) and *Styphelia triflora* (Pink Five-corners). The ground layer was dominated by grasses including, *Rytidosperma* spp. (Wallaby Grass) and *Bothriochloa macra*. Other species include *Cheilanthes sieberi* (Rock Fern), *Goodenia hederacea* (Ivy Goodenia) and *Lomandra filiformis* (Wattle Matt-rush).

PCT 281- cleared (vegetation zone 1) occurs in the southern section of the proposed ventilation shaft compound and has been cleared of all overstorey and shrubs (2.8 ha; **Plate 4**).

Plate 1: PCT 281 Low (vegetation zone 2)

Plate 2: PCT 281 – Moderate (vegetation zone 3)

Plate 3: PCT 281 – Good (vegetation zone 4)

Plate 4: PCT 281 Cleared (vegetation zone 1)

1.4.2.2 PCT 479

For the areas classified as PCT 479, a qualitative analysis of the plot data and nearby canopy species were used to aid in the analysis. *Eucalyptus crebra* was identified as a dominant canopy species. *E. blakelyi, E. dwyeri* (Dwyer's Red Gum), *E. macrorhyncha*, *Acacia linearifolia* and *Angophora floribunda* were also present. Within the mid stratum *Allocasuarina gymnanthera, Acrotriche rigida, Cassinia sifton*, and *Leucopogon muticus* were present. Within the ground stratum, species typical of PCT 479 were present: *Aristida ramosa, Dianella revoluta* (Blue Flax Lily), and *Gahnia aspera* (Rough Saw-sedge). Three condition states of this community were identified including:

- PCT 479 Low (vegetation zone 5; 0.1 ha)
- PCT 479 Moderate (vegetation zone 6; 1 ha)
- PCT 479 Good (vegetation zone 7; 3 ha).

An area of PCT 479 Low (vegetation zone 5) (0.1 ha) occurs within the northern dewatering bore in an area which has been subject to previous disturbance. There is an abundance of woody debris and *E. crebra* was found to be regenerating (**Plate 5**).

Plate 5: PCT 479 – Low (vegetation zone 5)

Areas of PCT 479 - Moderate (vegetation zone 6) (**Plate 6**) were located on the north section of the proposed ventilation shaft compound and along sections of the proposed assess track. This condition has a reduced overstorey and mid-storey, and there are fewer individuals of the species listed above.

PCT 479 - Good (vegetation zone 7) (**Plate 7**) occurs along sections of the access track.

Plate 6: PCT 479 – Moderate (vegetation zone 6)

Plate 7: PCT 479 - Good (vegetation zone 7)

1.4.2.3 PCT 1711

PCT 1711 occurs along sections of the proposed access track with an upper stratum dominated by *Eucalyptus blakelyi, Angophora floribunda* and *Callitris endlicheri*. One vegetation zone was assigned to this community; good (**Plate 8**; vegetation zone 8).

PCT 1711 is a tall shrubland occurring on sandstone geologies, known to occur within the neighbouring Goulburn River National Park. *Melaleuca thymifolia* is scattered throughout. Another PCT considered for this site was PCT 472 *'Thyme Honey-myrtle-Red Gum - Mugga Ironbark shrubland / woodland in impeded drainage flats or depressions in the southern Brigalow Belt South Bioregion'*. However, this PCT was ruled out due to the lack of characteristic canopy species and variation within the middle and ground stratums.

Plate 8: PCT 1711 Good (vegetation zone 8)

1.4.3 Vegetation integrity assessment

Random meanders, overview inspection detailed floristic plots and aerial mapping have been used to assist in the delineation of vegetation zones. Vegetation integrity assessment using the BAMC was undertaken for each of the vegetation zones to be impacted by the development. The results are outlined in **Table 7**. The use of *local data* is not proposed to conduct this integrity assessment.

Table 7: Vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)^	Composition Condition Score	Structure Condition Score	Function Condition Score	Current vegetation integrity score
1	281	Cleared	2.8	26.5	3.2	15	10.9
2	281	Low	1.0	48.5	16.2	39.3	31.6
3	281	Moderate	1.2	55	8.5	64.4	31
4	281	Good	0.3	65.4	34.3	91.8	59
5	479	Low	0.1	56	10.3	49	30.5
6	479	Moderate	1	79.4	9.4	63.2	36.1
7	479	Good	3	72.8	11.7	98	43.7
8	1711	Good	0.5	74.1	29.3	51.8	48.3

^ numbers have been rounded.

1.5 Threatened species

1.5.1 Ecosystem credit species

Ecosystem credit species were returned by the BAMC as being associated with the PCTs present within the development footprint. Ecosystem credit species, their associated habitat constraints, geographic limitations and sensitivity to gain class are listed in **Table 8**. For dual listed species, only foraging habitat is included.

Table 8: Predicted ecosystem credit species

Species	Common Name	Habitat Constraints	Geographic constraints	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification for inclusion / exclusion
Anthochaera phrygia	Regent Honeyeater (Foraging)	-	-	High	CE	CE	Excluded from areas where there is no foraging habitat such as PCT 281 Low.
Callocephalon fimbriatum	Gang-gang Cockatoo (Foraging)	-	-	Moderate	V	Not Listed	Excluded from areas where there is no foraging habitat such as PCT 281 Low. It feeds on seeds mostly from Eucalypts and acacias which are present in all other vegetation zones.
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	-	-	High	V	Not Listed	Excluded from areas where there is no foraging habitat such as PCT 281 and PCT 479 low – areas where there are no *Allocasuarina* sp.
Chthonicola sagittata	Speckled Warbler	-	-	High	V	Not Listed	Included for all vegetation zones.
Circus assimilis	Spotted Harrier	-	-	Moderate	V	Not Listed	Included for all vegetation zones.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	-	-	High	V	Not Listed	Excluded from areas where there is no foraging habitat such as PCT 281 Low and PCT 1711.
Daphoenositta chrysoptera	Varied Sittella	-	-	Moderate	V	Not Listed	Excluded from areas where there is no foraging habitat such as PCT 281 Low.
Dasyurus maculatus	Spotted-tailed Quoll	-	-	High	V	E	Excluded from areas where there is no foraging or breeding habitat such as PCT 281.
Glossopsitta pusilla	Little Lorikeet	-	-	High	V	Not Listed	Excluded from areas where there is no foraging habitat such as PCT 281 Low.
Grantiella picta	Painted Honeyeater	Mistletoes present at a density of greater than five mistletoes per hectare	-	Moderate	V	V	Excluded from areas where there is no foraging habitat such as PCT 281 Low and where mistletoe is absent such as PCT 1711.

Species	Common Name	Habitat Constraints	Geographic constraints	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification for inclusion / exclusion
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	-	High	V	Not Listed	Included for all vegetation zones.
Hieraaetus morphnoides	Little Eagle (foraging)	-	-	Moderate	V	Not Listed	Included for all vegetation zones.
Hoplocephalus bungaroides	Broad-headed Snake (foraging)	-	-	High	E	V	Included in PCT 1711.
Lathamus discolor	Swift Parrot (foraging)	-	-	Moderate	E	CE	Excluded from areas where there is no foraging habitat such as PCT 281 Low and PCT 1711.
Lophoictinia isura	Square-tailed Kite (foraging)	-	-	Moderate	V	Not Listed	Included for all vegetation zones.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	-	-	Moderate	V	Not Listed	Excluded from areas where there is no foraging habitat such as PCT 281 Low.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	-	-	Moderate	V	Not Listed	Excluded from areas where there is no foraging habitat such as PCT 281 Low.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (foraging)	-	-	High	V	Not Listed	Included for all vegetation zones.
Neophema pulchella	Turquoise Parrot	-	-	High	V	Not Listed	Included for all vegetation zones.
Ninox connivens	Barking Owl (foraging)	-	-	High	V	Not Listed	Included for all vegetation zones.
Ninox strenua	Powerful Owl (foraging)	-	-	High	V	Not Listed	Included for all vegetation zones.
Petroica boodang	Scarlet Robin	-	-	Moderate	V	Not Listed	Included for all vegetation zones.
Petroica phoenicea	Flame Robin	-	-	Moderate	V	Not Listed	Included for all vegetation zones.
Phascolarctos cinereus	Koala (foraging)	-	-	High	V	V	Excluded from areas where there is no foraging habitat such as PCT 281 Low and PCT 479.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	-	-	Moderate	V	Not Listed	Included for all vegetation zones.

Species	Common Name	Habitat Constraints	Geographic constraints	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification for inclusion / exclusion
Pteropus poliocephalus	Grey-headed Flying-fox (foraging)	-	-	High	V	V	Excluded from areas where there is no foraging habitat such as PCT 281 Low.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	-	-	High	V	Not Listed	Included for all vegetation zones.
Stagonopleura guttata	Diamond Firetail	-	-	Moderate	V	Not Listed	Included for all vegetation zones.
Tyto novaehollandiae	Masked Owl (foraging)	-	-	High	V	Not Listed	Included for all vegetation zones.
Varanus rosenbergi	Rosenberg's Goanna	-	-	High	V	Not Listed	Included for all vegetation zones.

1.6 Species credit species

Predicted species credit species identified by the BAMC in association with the PCTs identified within the development footprint are listed below in **Table 9**. The associated habitat constraints, geographic limitations, sensitivity to gain class are detailed for each species credit species. Additional species that are known to occur within the area are included and have been entered into the BAMC. Where species are listed as both species and ecosystem credit species, the species credits only relate to breeding habitat.

Under Sections 6.4.1.10 and 6.4.1.17 of the BAM, a species credit species can be considered unlikely to occur if following field assessment it is determined that necessary habitat components or habitat constraints are absent or it is deemed that the habitat is substantially degraded such that the species is unlikely to utilise the area. An assessment of potential habitat was undertaken during the vegetation field surveys within the study area; some species credit species have excluded from the assessment based on habitat constraints and the justification is provided in **Table 9**.

Table 9: Candidate species credit species

Species	Common Name	Habitat Constraints[1]	Foraging Habitat Constraints	Breeding Habitat Constraints	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification for exclusion of species
Acacia ausfeldii	Ausfeld's Wattle	Requires Foot slopes and low rises on sandstone			High	V	NL	Included – habitat occurs throughout the development footprint. Not identified during targeted survey.
Anthochaera phrygia	Regent Honeyeater (breeding)				High	CE	CE	Excluded - Confined to two main breeding areas within NSW; Capertee Valley and Bundarra-Barraba region. Important breeding habitat is not within the development footprint (OEH March 2019).
Aprasia parapulchella	Pink-tailed Legless Lizard	Rocky areas or within 50 m of rocky areas			High	V	V	Included in PCT 281 with rocky areas. Not identified during targeted survey.
Burhinus grallarius	Bush Stone-curlew	Fallen/standing dead timber including logs			High	E	NL	Included – habitat occurs throughout the development footprint. Not identified during targeted survey.
Callocephalon fimbriatum	Gang-gang Cockatoo (Breeding)			Eucalypt tree species with hollows greater than 9 cm diameter	High	V	NL	Included – potential breeding habitat occurs throughout the development footprint.
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)		Presence of Allocasuarina and casuarina species	Hollow bearing trees; Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground.	High	V	NL	Included – potential breeding habitat occurs throughout the development footprint.
Chalinolobus dwyeri	Large-eared Pied Bat	Cliffs or within 2 km of rocky areas containing caves, overhangs or outcrops			High	V	V	Included due to the presence of caves in PCT 479.

Species	Common Name	Habitat Constraints[1]	Foraging Habitat Constraints	Breeding Habitat Constraints	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification for exclusion of species
Commersonia procumbens		Pilliga sandstone			High	V	V	Included – identified adjacent to the development footprint area. Not identified during targeted survey.
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)		Waterbodies; Within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	Nest trees - live (occasionally dead) large old trees in tall open forests located near large open water bodies.	High	V	NL	Excluded - No suitable breeding habitat exists within the development footprint. Not identified during targeted survey.
Hieraaetus morphnoides	Little Eagle (Breeding)		Waterbodies; Within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	Moderate	V	NL	Included. Not identified during targeted survey.
Hoplocephalus bungaroides	Broad-headed snake (Breeding)			Rocky areas; Including escarpments, outcrops and pogodas within the Sydney Sandstone geologies	Very High	E	V	Included due to the presence of caves in PCT 479 and rocky areas within PCT 1711. Not identified during targeted survey.
Lathamus discolor	Swift Parrot (Breeding)				Moderate	E	CE	Excluded - Only known to breed in Tasmania. No breeding habitat occurs within the development footprint (OEH March 2019).
Lophoictinia isura	Square-tailed Kite (Breeding)			Nest trees. Nests are generally located near watercourses.	Moderate	V	NL	Excluded - No suitable breeding habitat.

Species	Common Name	Habitat Constraints[1]	Foraging Habitat Constraints	Breeding Habitat Constraints	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification for exclusion of species
Miniopterus orianae oceanensis	Eastern Bentwing-bat (Breeding)			Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding	Very High	V	NL	Excluded – no breeding areas are located within the development footprint.
Monotaxis macrophylla	Large-leafed Monotaxis				High	E	NL	Included. Not identified during targeted survey.
Ninox connivens	Barking Owl (Breeding)			Hollow bearing trees; Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	High	V	NL	Included – potential breeding habitat occurs throughout the development footprint. Not identified during targeted survey.
Ninox strenua	Powerful Owl (Breeding)			Hollow bearing trees; Living or dead trees with hollow greater than 20cm diameter	High	V	NL	Included – potential breeding habitat occurs throughout the development footprint. Not identified during targeted survey.
Petaurus norfolcensis	Squirrel Glider				High	V	NL	Included – potential habitat occurs throughout the development footprint. Not identified during targeted survey.
Petrogale penicillata	Brush-tailed Rock Wallaby	Land within 1 km of rocky escarpments, gorges and steep slopes, boulder piles, rock outcrops or clifflines			Very high	E	V	Included due to the presence of rocky areas within PCT 479 and PCT 1711. Not identified during targeted survey.
Phascogale tapoatafa	Brush-tailed Phascogale	Hollow bearing trees			High	V	NL	Included – potential habitat occurs throughout the development footprint.
Phascolarctos cinereus	Koala (Breeding)				High	V	V	Included – potential habitat occurs throughout the northern areas of the

Species	Common Name	Habitat Constraints[1]	Foraging Habitat Constraints	Breeding Habitat Constraints	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification for exclusion of species
								development footprint. Not identified during targeted survey.
Pseudophryne australis	Red-crowned Toadlet				Moderate	V	NL	Excluded – distribution is outside its known area. No suitable breeding habitat such as ephemeral creeks and gutters.
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)			Breeding camps	High	V	V	Excluded - No suitable breeding habitat occurs within the development footprint. No breeding camps were identified.
Tylophora linearis					High	V	E	Included.
Tyto novaehollandiae	Masked Owl (Breeding)			Hollow bearing trees; Living or dead trees with hollows greater than 20cm diameter.	High	V	NL	Included – potential breeding habitat occurs throughout the development footprint. Not identified during targeted survey.
Vespadelus troughtoni	Eastern Cave Bat	Caves or within 2 km of rocky areas containing caves, overhangs, escarpments, crevices old mines, tunnels or old buildings			Very High	V	NL	Included. Caves and rocky escarpments occur within 2 km of development footprint.

[1] As per the TBDC.

1.6.1 Targeted surveys

Targeted surveys for species credit species to be included in the assessment (**Table 9**) were undertaken in 2018 in areas adjacent the development footprint consistent with the survey timing prescribed by the BAMC for the individual species. Due to revision of the development footprint (proposed southern access track) in 2019, further targeted species surveys were undertaken in July and August 2019. Much of the 2018 targeted fauna survey effort was undertaken within 800 m of the current development footprint, and therefore the results of the 2018 surveys are considered relevant to this BDAR (for example, 800 m is deemed an appropriate call distance for forest owls (DEC 2004)).

Between the 2018 and 2019 survey periods, updates were made to the BAMC and TBDC which has resulted some differences in the list of species credit species relevant to the Modification, therefore, the 2018 survey targeted some species which are no longer considered relevant to the development footprint.

The dates and target species for targeted surveys undertaken for the Modification are listed in **Table 10.**

Where the survey timing constraints couldn't be met, species credit species have been conservatively assumed to occur within this BDAR to allow for progression of the Modification application.

Table 10: Targeted surveys undertaken for the Modification

Date	Surveyors	Target species
14- 17 August 2018 **2-3 July 2019**	Tom Kelly, David Allworth and Cheryl O'Dwyer, Angelina Siegrist	*Acacia ausfeldii, A. pendula*, *Commersonia procumbens*, *Cymbidium canaliculatum*, *Cynanchum elegans,* and *Monotaxis macrophylla*
27 - 31 August 2018	Angelina Siegrist and Cassandra Holt	Brush-tailed Phascogale, Brush-Tailed Rock Wallaby, Squirrel Glider, Koala, Owls (Barking, Masked and Powerful), Bush Stone-curlew. Red-crowned Toadlet, and Glossy Black Cockatoo.
4 September 2018	Angelina Siegrist and Cassandra Holt	Pink-tailed Legless Lizard, Cockatoos (Gang-gang and Glossy Black), Brush-Tailed Rock Wallaby, Superb Parrot. *Diuris tricolor**, *Tylophora linearis,* Eagles (White-bellied Sea-eagle and Little Eagle), and Pale-headed Snake.
12 October 2018 **27-31 October 2018**	Angelina Siegrist and Cassandra Holt	Gang-gang Cockatoo, Eastern Pygmy Possum, *Diuris tricolor*, Superb Parrot, *Prasophyllum petilum*, and Grey-headed Flying-fox.
1-2 November 2018	Angelina Siegrist and Cassandra Holt	Large-eared Pied Bat, Eastern Cave Bat, Eastern Bent-wing Bat, and Pale headed Snake.
2-3, 10 July 2019	Angelina Siegrist and Cheryl O'Dwyer	*Acacia ausfeldii, Commersonia procumbens*, and *Monotaxis macrophylla*
26-29th August 2019	Angelina Siegrist and Rebecca Croake	Brush-tailed Phascogale, Brush-Tailed Rock Wallaby, Squirrel Glider, Koala, Owls (Barking, Masked and Powerful), Bush Stone-curlew. Red-crowned Toadlet, and Glossy Black Cockatoo. Broad-headed snake.

Weather conditions during the targeted surveys are detailed in **Table 11**.

Table 11: Weather conditions

Date	Rainfall (mm)	Minimum temperature 0C	Maximum temperature 0C
14 August 2018	0	2.3	18.4
15 August 2018	0	0.8	20
16 August 2018	0	8.3	18.5
17 August 2018	0	-0.7	16.0
27 August 2018	7.2	5.9	17.9
28 August 2018	0.4	3	15.5
29 August 2018	0	-1	15.5
30 August 2018	0	-1.6	19.5
31 August 2018	0	7	16.6
4 September 2018	0.8	9.2	17.0
12 October 2018	0.2	9.8	20.0
27 October 2018	0	13	27.6
28 October 2018	0	13	23.2
29 October 2018	0	10.7	27.5
30 October 2018	0	10.4	30.4
31 October 2018	0	13.2	32.8
1 November 2018	0	16.3	34
2 November 2018	0	20.8	33.5
4 January 2019	0.2	19.3	39.0
2 July 2019	0	1.3	19.2
3 July 2019	0	0.2	19.3
10 July 2019	0	-2.5	13.4
23 July 2019	0	1.0	19.2
24 July 2019	0	7.2	16.9
26 August 2019	0	-1.1	22.1
27 August 2019	0	6	21.2
28 August 2019	0	3.7	18.9
29 August 2019	0	2.4	18.9

Source: Ulan Weather station (62036) and Gulgong Post Office (62013) BOM (2019).

1.6.1.1 Justification for methods

Targeted threatened flora surveys involved surveying on foot transects of suitable habitat in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016). Targeted threatened fauna surveys were undertaken consistent with the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (NSW DEC 2004), *'Species Credit' Threatened Bats and Their Habitats* (OEH 2018) and requirements within the BAM and TBDC. The targeted species survey effort is detailed in **Table 12**, with survey locations shown in **Figures 14** to **17.**

Table 12: Survey effort

Method	Total effort	Target species
Terrestrial Elliot A	120 trap nights	Native rodents
Arboreal Elliot B	24 nights	Brush-tailed Phascogale and Squirrel Glider
Area search	14 x 20-minute surveys	Koala, Bush Stone-curlew, Red-crowned Toadlet, Cockatoos (Gang-gang and Glossy Black), Little Eagle, Pink-tailed Legless Lizard and reptiles
Call playback	4hrs before dawn, 4hrs after dusk, across 4 days	Barking Owl, Powerful Owl and Masked Owl
Ultrasonic microbat call recording (Anabat)*	2 devices recording for 2 nights	Large-eared Pied Bat, Eastern Cave Bat and Eastern Bent-wing Bat
Habitat search (day)	20 min per site over 14 sites, hollow bearing trees and evidence of stick nests	Pink-tailed Legless Lizard, Cockatoos (Gang-gang and Glossy Black), Little Eagle Bush-stone curlew and Koalas
Habitat search (night)	20 min per site over 14 sites, hollow bearing trees	Bush-stone curlew, Koala, Brush-tailed Phascogale, Squirrel Glider, Pale-headed Snake and Broad-headed Snake
Parallel transects	4-person hours (2018)	Flora. *Acacia ausfeldii, A. pendula, Commersonia procumbens, Cymbidium canaliculatum, Cynanchum elegans, Monotaxis macrophylla, Cymbidium canaliculatum, Diuris tricolor, Prasophyllum petilum* and *Tylophora linearis*
Random meander	4-person hours 60-person hours (2019)	Flora. *A. ausfeldii, A. pendula, Commersonia procumbens, Cymbidium canaliculatum, Cynanchum elegans, Monotaxis macrophylla, Cymbidium canaliculatum, Diuris tricolor, Prasophyllum petilum* and *Tylophora linearis*
Remote camera traps (terrestrial)	24 nights (2018)	Koala, Brush-tailed Phascogale, Brush-tailed Rock Wallaby and Squirrel Glider.
Remote camera traps (arboreal)	24 nights (2018) 28 nights (2018	Arboreal mammals such as Brush-tailed Phascogale and Squirrel Glider.
Search for scats and signs	Opportunistic	Koala, Brush-tailed Phascogale, Brush-tailed Rock Wallaby and Squirrel Glider
Spotlighting on foot	4 hours before dawn, 4 hours after dusk, across 4 days	Owls (Masked, Barking, Powerful), Bush-stone curlew, arboreal mammals including Brush-tailed Phascogale, Squirrel Glider and Koala, Pale-headed Snake and Broad-headed Snake.
Transect	60 person hours	Threatened flora *A. ausfeldii, A. pendula, Commersonia procumbens, Cymbidium canaliculatum, Cynanchum elegans, Monotaxis macrophylla, Cymbidium canaliculatum, Diuris tricolor, Prasophyllum petilum* and *Tylophora linearis*

Although a total of three PCTs were identified by the vegetation mapping, the study area was deemed to constitute only one stratification unit for the targeted fauna surveys, consistent with Section 5.1 of the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004). No live trapping was conducted in the north-west section of the study area (ventilation shaft compound), as the area is mostly cleared (PCT 281 - Cleared) with a low vegetation integrity score of 10.9 and therefore was considered to not require further assessment. One trapping site and nocturnal surveys were conducted in the south-west section of the study area (within the RSIA) and within land adjacent the study area (in 2018) along the eastern boundary of Lot 5 DP 1240416 (previous development footprint).

The use of local data is not proposed, and expert reports have not been used as part of this BDAR.

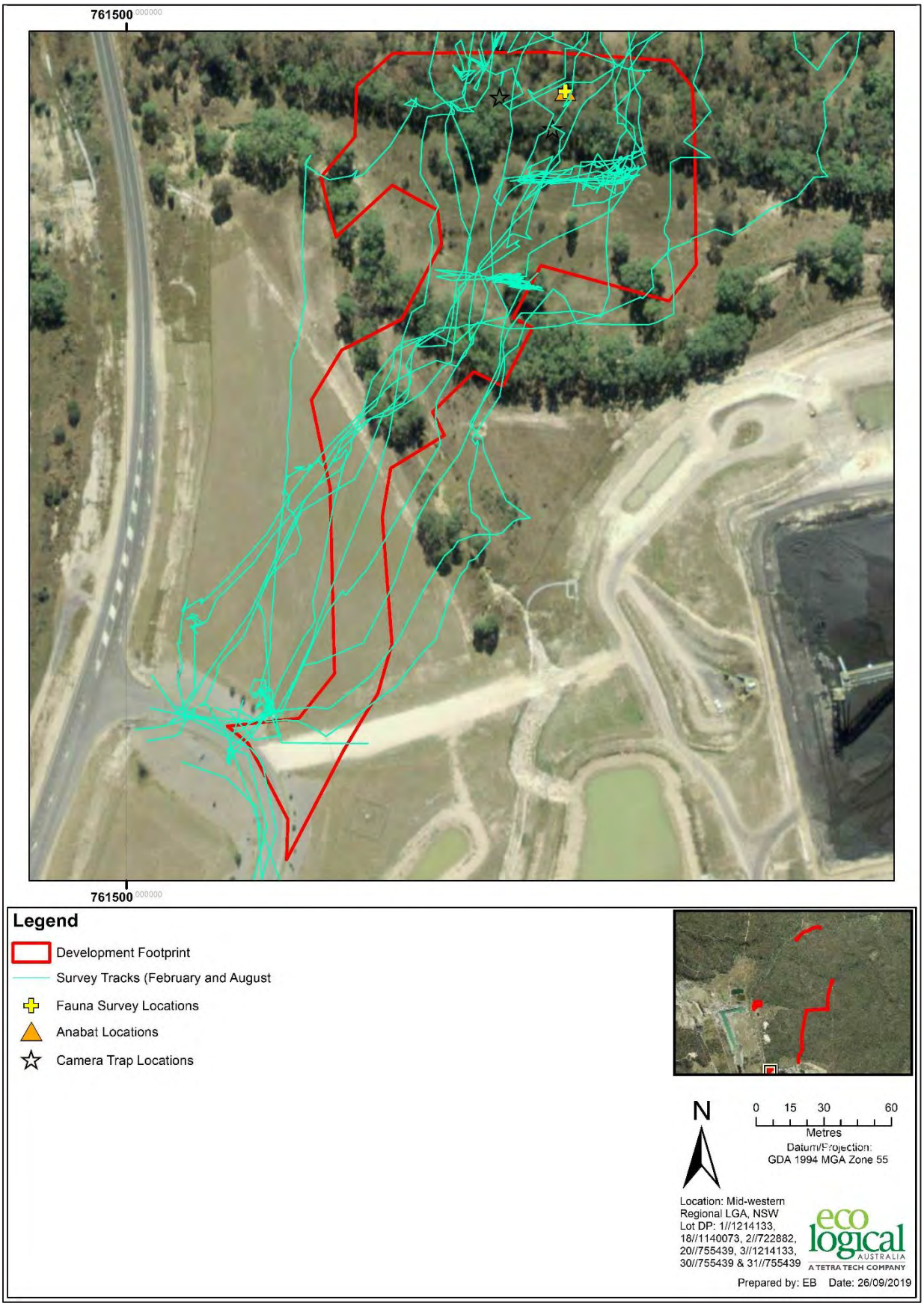


Figure 14: Targeted fauna survey effort - RSIA

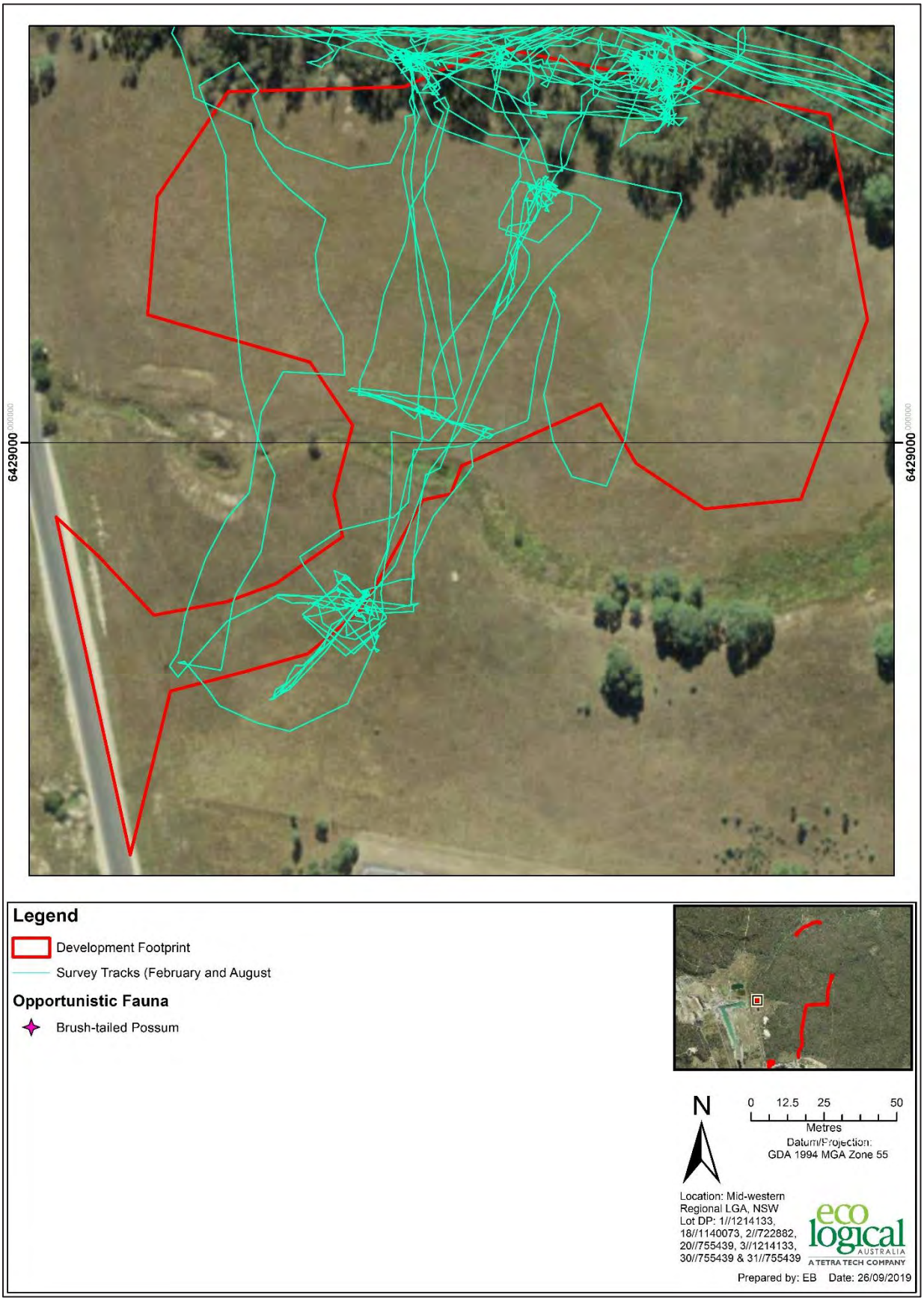


Figure 15: Targeted fauna survey effort – ventilation shaft compound

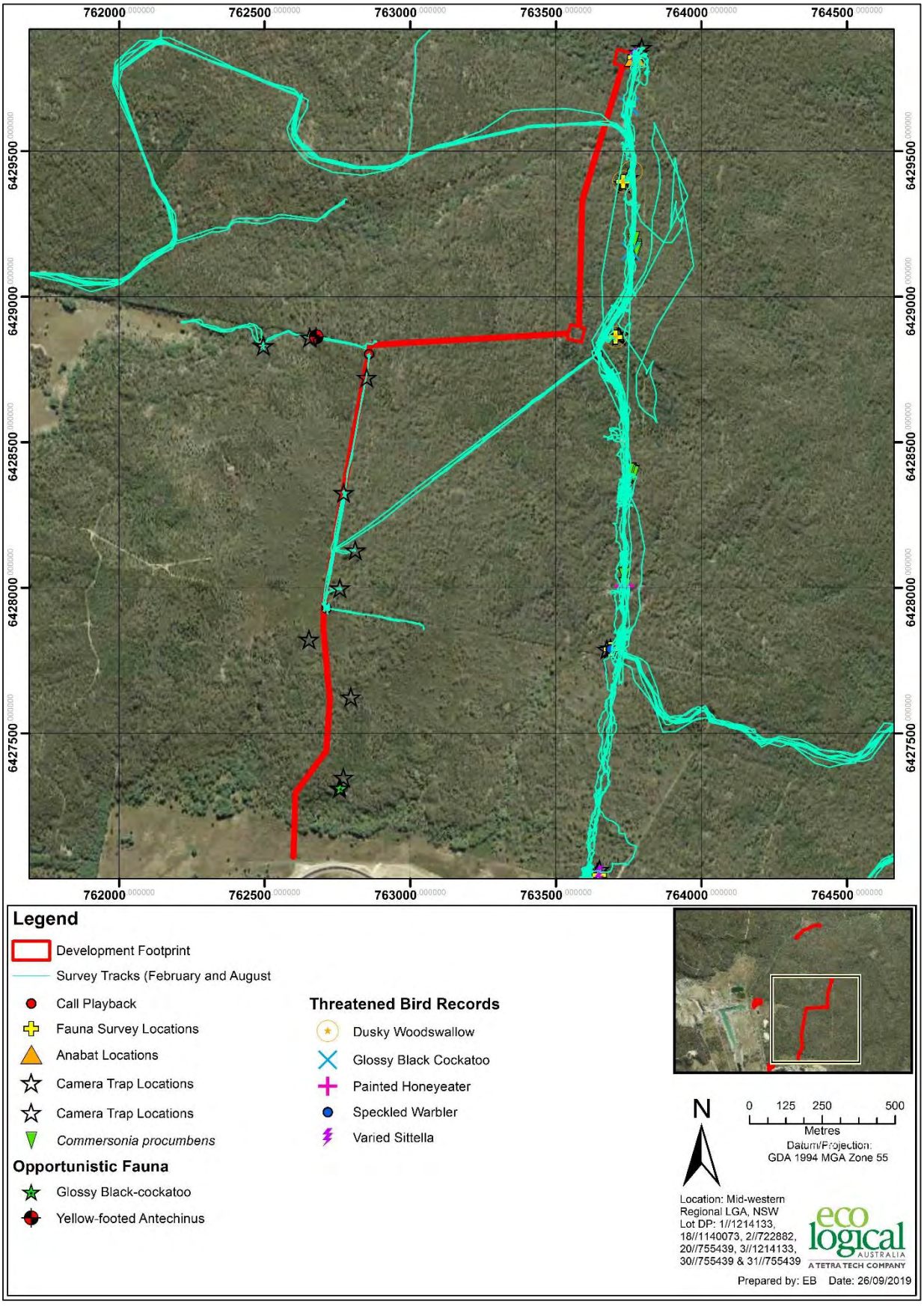


Figure 16: Targeted fauna survey effort – southern dewatering sites and access track

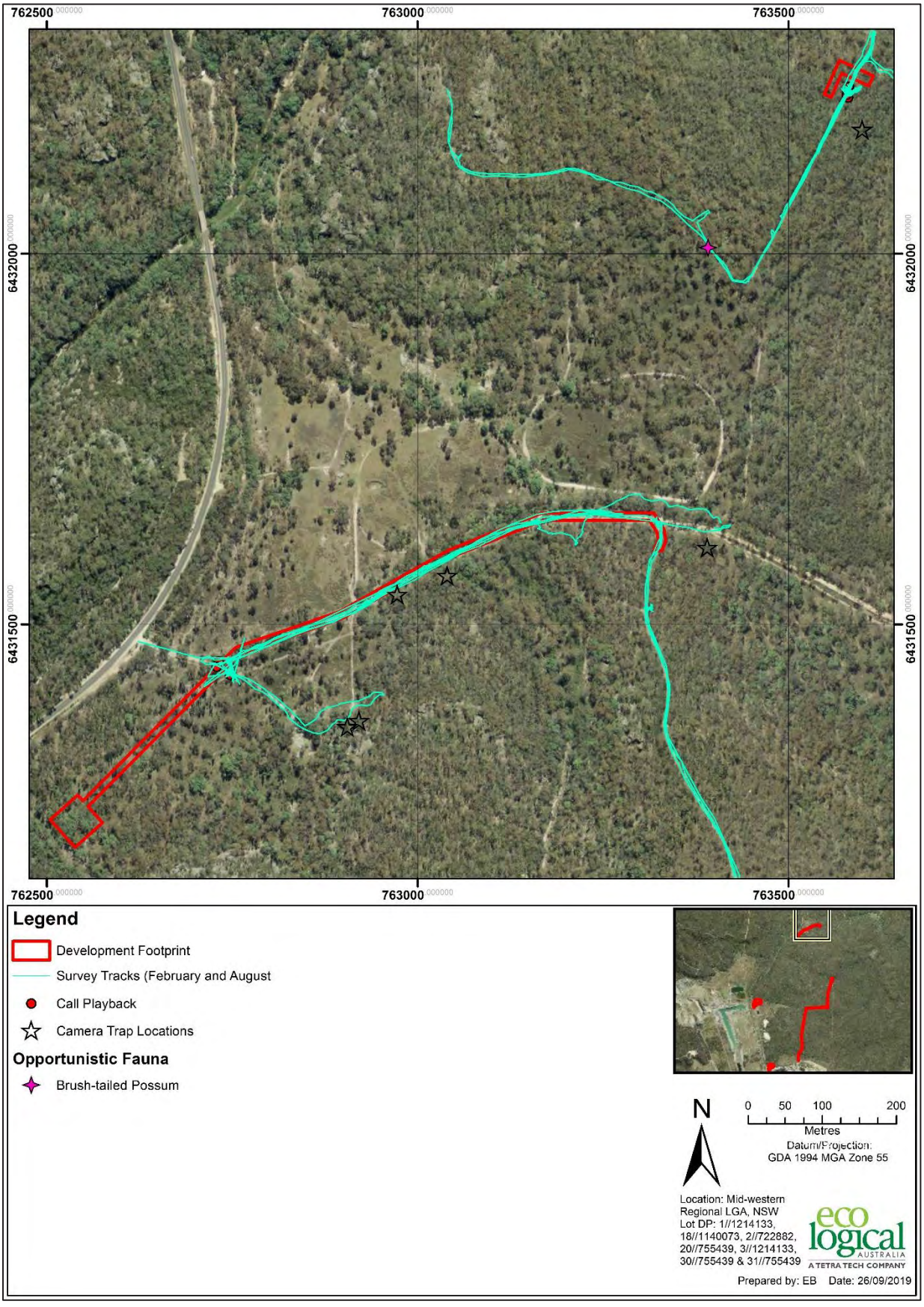


Figure 17: Targeted fauna survey effort – northern dewatering sites and access track

1.6.1.2 Survey results

Threatened species identified from the targeted surveys are detailed in **Table 13**.

Table 13: Threatened species identified within the study area

Species	Common Name	Credit type	Biodiversity risk weighting
Calyptorhynchus lathami	Glossy Black Cockatoo	**Dual**	**2**
Artamus cyanopterus cyanopterus	Dusky Woodswallow	**Ecosystem**	
Daphoenositta chrysoptera	Varied Sittella	**Ecosystem**	
Grantiella picta	Painted Honeyeater	**Ecosystem**	
Chthonicola sagittata	Speckled Warbler	**Ecosystem**	
Chjalinolobus dwyeri	Large-eared Pied Bat	**Species**	**3**
Saccolaimus flaviventris	Yellow Bellied Sheath-tailed Bat	**Ecosystem**	
Nyctophilus corbeni*	Corbens Long-eared Bat	**Ecosystem**	
Vespadelus troughtoni*	Eastern Cave Bat	**Species**	**3**
Miniopterus orianae oceanensis	Eastern Bent-wing Bat	**Dual**	**3**

**Potentially identified – see Microbat analysis section below*

Further species credit species assumed to be present in the study area due to the presence of suitable habitat are listed in **Table 14**.

Table 14: Threatened species assumed to be present

Species	Common Name	Credit Type	Biodiversity Risk Weighting	Survey timing
Callocephalon fibriatum	Gang-gang Cockatoo	Species	2	Oct - Jan
Tylophora linearis		Species	2	Sept - May

Targeted flora surveys in 2018 detected the presence of *Commersonia procumbens*. Approximately 14 individuals were found along the edge of the northern boundary of Lot 31 DP 755439 and on the eastern boundary of Lot 5 DP 1240416 within PCT 479 (Good condition) and PCT 1711 (Good condition). Due to revision of the development footprint in 2019, these individuals occur outside the current development footprint and will not be impacted by the Modification. No further *Commersonia procumbens* or other threatened flora species were identified from surveys of the current development footprint.

GLOSSY BLACK COCKATOO

Glossy Black Cockatoo is a dual credit species for breeding habitat, which includes hollow bearing trees - living or dead trees with hollows greater than 15cm diameter and greater than 5m above ground. Whilst the TBDC does not recognise Glossy Black Cockatoos being associated with PCT 479, the species were observed flying over the area and there were signs of foraging within *Allocasuarina* sp. Glossy Black Cockatoos were identified within the study area from the targeted surveys, as well as from previous records, and therefore cannot be excluded as potentially breeding in the study area.

Potentially suitable hollow bearing trees were recorded within the development footprint, and species polygons have been created around these trees consisting of a 30 m buffer to determine the area likely to be impacted by the proposed development. Whilst the precise size and location of hollows have not been assessed as part of this BDAR, a conservative approach has been undertaken and all hollow bearing trees within the development footprint are therefore considered to be suitable.

THREATENED MICROBATS

Ultrasonic microbat call analysis of recordings taken at anabat sites during the November 2018 targeted surveys identified a large number of microbat species within the study area, especially in PCT 479 vegetation zone 7 (the detailed analysis report is included in **Appendix D**). There were 3,276 call sequences recorded during the survey period, and 71% of the calls were able to be used to positively identify a bat to genus or species. Three threatened microbat species were confidently identified from the analysis:

- Large-eared Pied Bat
- Eastern Bent-winged Bat
- Yellow-bellied Sheath-tailed Bat.

Two further threatened microbat species were potentially identified from the analysis:

- Corben's Long-eared Bat
- Eastern Cave Bat.

The defining features of the call profiles assigned to these two threatened species overlap with other more common species, and therefore, positive identification from ultrasonic call recordings is not possible. However, both species have previously been recorded within 10 km of the study area, and therefore are potentially present at the development site.

Yellow-bellied Sheath-tailed Bat and Corben's Long-eared Bat are both ecosystem credit species, and therefore, no further assessment is required for this BDAR.

The Eastern Bent-wing Bat is only a species-credit-species if breeding habitat is directly impacted. Whilst potentially suitable breeding habitat for this species including caves and crevices are present within the study area (northern end of southern dewatering sites and access track), it will not be directly impacted by the Modification and therefore, the Eastern Bent-wing Bat has not been further included in this BDAR.

The Eastern Cave Bat was potentially identified from five calls, and the Large-eared Pied Bat was confidently identified from one call and potentially identified from one call, within PCT 479. Neither species is associated with PCT 479 in the TBDC. However, the identification of these species in the study area and ELA's local knowledge of these species indicates they are foraging within PCT 479 and are therefore associated with this PCT. It is also noted in the TBDC that both species "*cannot be reliably predicted to occur on site based on vegetation and other landscape features (either foraging or breeding) and therefore a precautionary approach has been taken to assign categories*" (Ecological data, TBDC).

As such, in accordance with Table 1 of the BAM survey guideline *'Species Credit' Threatened Bats and Their Habitats* (OEH 2018), all habitat on the subject land where the subject land is within 2 km of caves, scarps, cliffs and rock overhangs has been mapped as species polygons for these species credit species.

Further, the BAM survey guideline *'Species Credit' Threatened Bats and Their Habitats* (OEH 2018) states that for both the Eastern Cave Bat and the Large-eared Pied Bat, if acoustic detectors are the only survey method used and the target species is detected, breeding must be assumed and mapped in accordance with Table 2 of the guideline. Breeding habitat is determined as habitat within 100 m of the subject land and the area immediately surrounding the feature (caves, scarps, cliffs and rock overhangs).

Survey effort should include harp trapping and is further discussed **Appendix D**.

1.6.1.3 Species polygons

Inconsistencies between the BAMC and the TBDC were identified during the preparation of this BDAR. As outlined in **Section 1.1.3**, the BCD has confirmed that the information in the TBDC should considered to be correct for the extent of the inconsistency. As such, the habitat mapping and subsequent assessments are based on the vegetation associations in the TBDC, with the exception of species identified in the study area during the targeted surveys.

Table 15 lists the species credit species which have been mapped for the Modification, and highlights inconsistencies between the BAMC and the TBDC. Species polygons are shown in **Figure 18** to **Figure 24**.

Table 15: Species habitat polygons

Species	Common Name	BAMC	TBDC	Survey results	Outcome
Calyptorhynchus lathami	Glossy Black Cockatoo	PCT 479	None	Observed within PCT 479. Hollows found within the development footprint but not all were measured so all HBT's were assumed suitable.	Polygons based on 30 m buffer around HBT's within PCT 479.
Chjalinolobus dwyeri	Large-eared Pied Bat	PCT 479 PCT 281 PCT 1711	PCT 281	Anabat recordings of this species found in PCT 479.	Polygon based on area within 100 m (SAII) and 2 km from the rocky escarpment. Polygon based on PCT 281 within 2 km of rocky escarpments.
Vespadelus troughtoni	Eastern Cave Bat	PCT 479 PCT 281 PCT 1711	PCT 281	Potential Anabat recordings to this species found in PCT 479.	Polygon based on PCT 281 within 2 km of rocky escarpments Polygon based on area within 100 m (SAII) and 2 km from the rocky escarpment.
Callocephalon fimbriatum	Gang-gang cockatoo	PCT 479 PCT 281 PCT 1711	PCT 479 PCT 281	Hollows found within the development footprint but not all were measured	Polygons based on 30 m buffer around HBT's within PCT 479.

Species	Common Name	BAMC	TBDC	Survey results	Outcome
				so all HBT's were assumed suitable	
Tylophora linearis		PCT 479	PCT 479	Assumed present as unable to survey due to timing being outside recommended survey period	Polygon based on PCT 479-Moderate and Good.

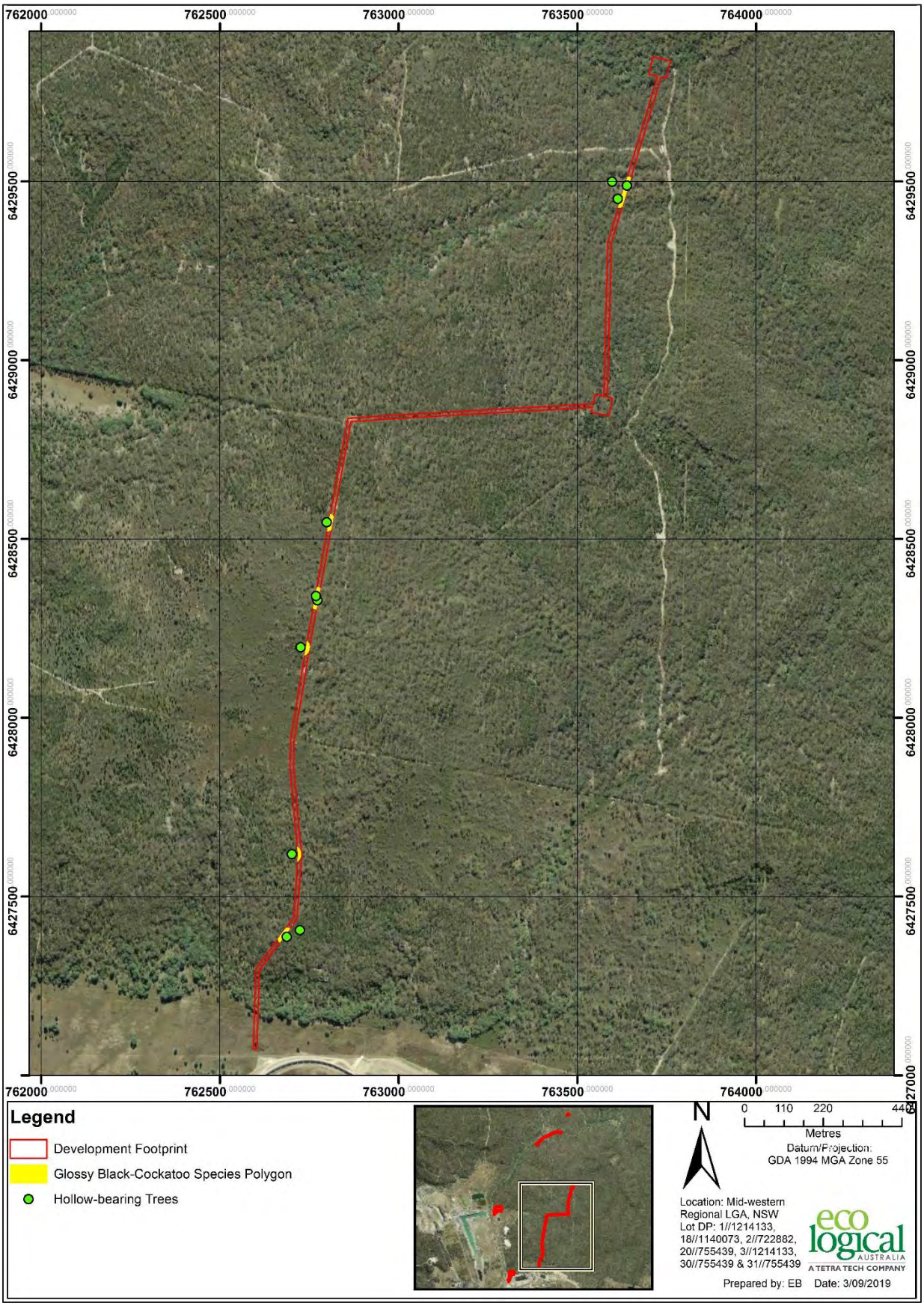


Figure 18: Species polygon for Glossy Black Cockatoo (based on presence of suitable hollow-bearing trees)

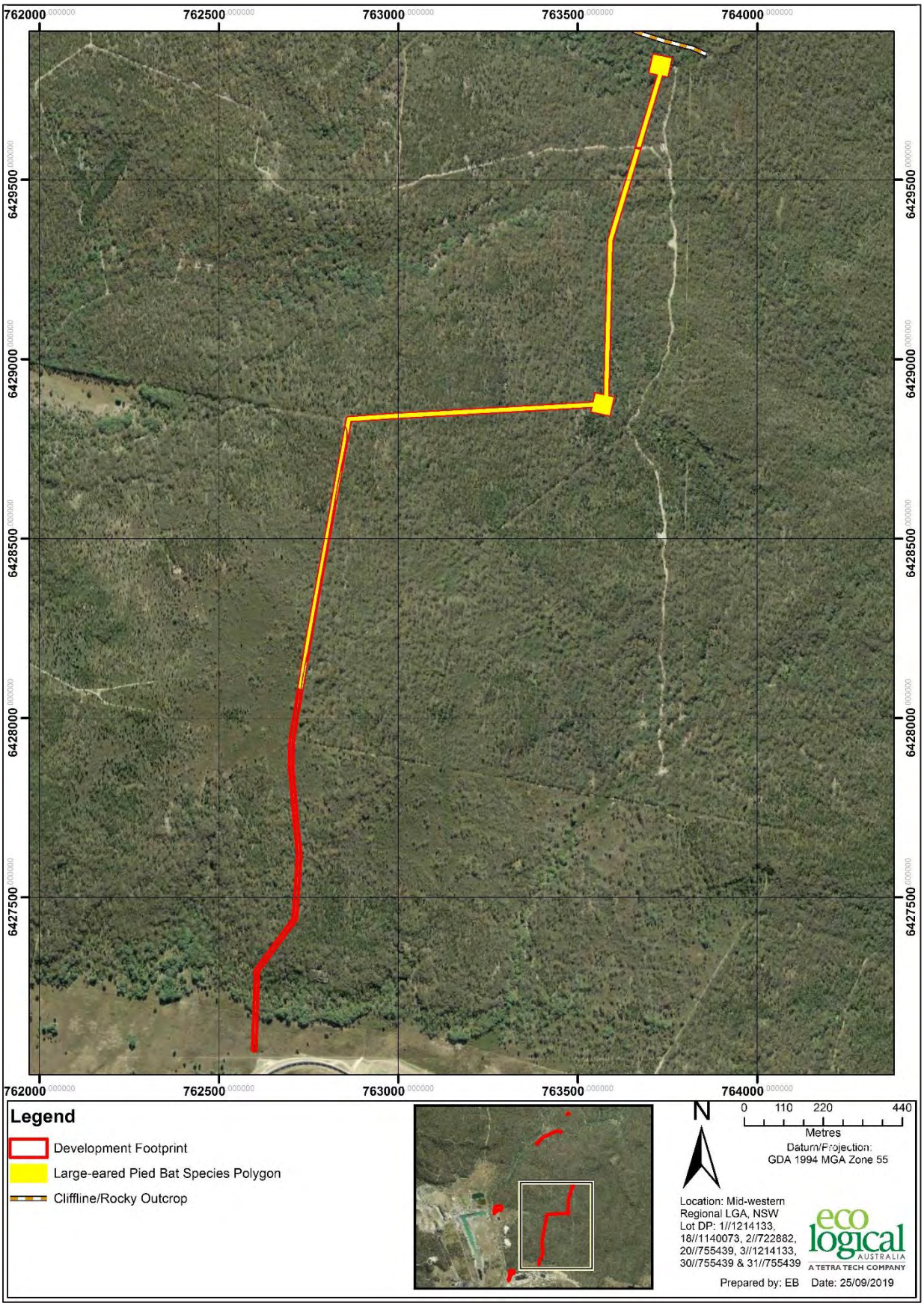


Figure 19: Species polygon for Large-eared Pied Bat (within 2 km of rocky outcrops)

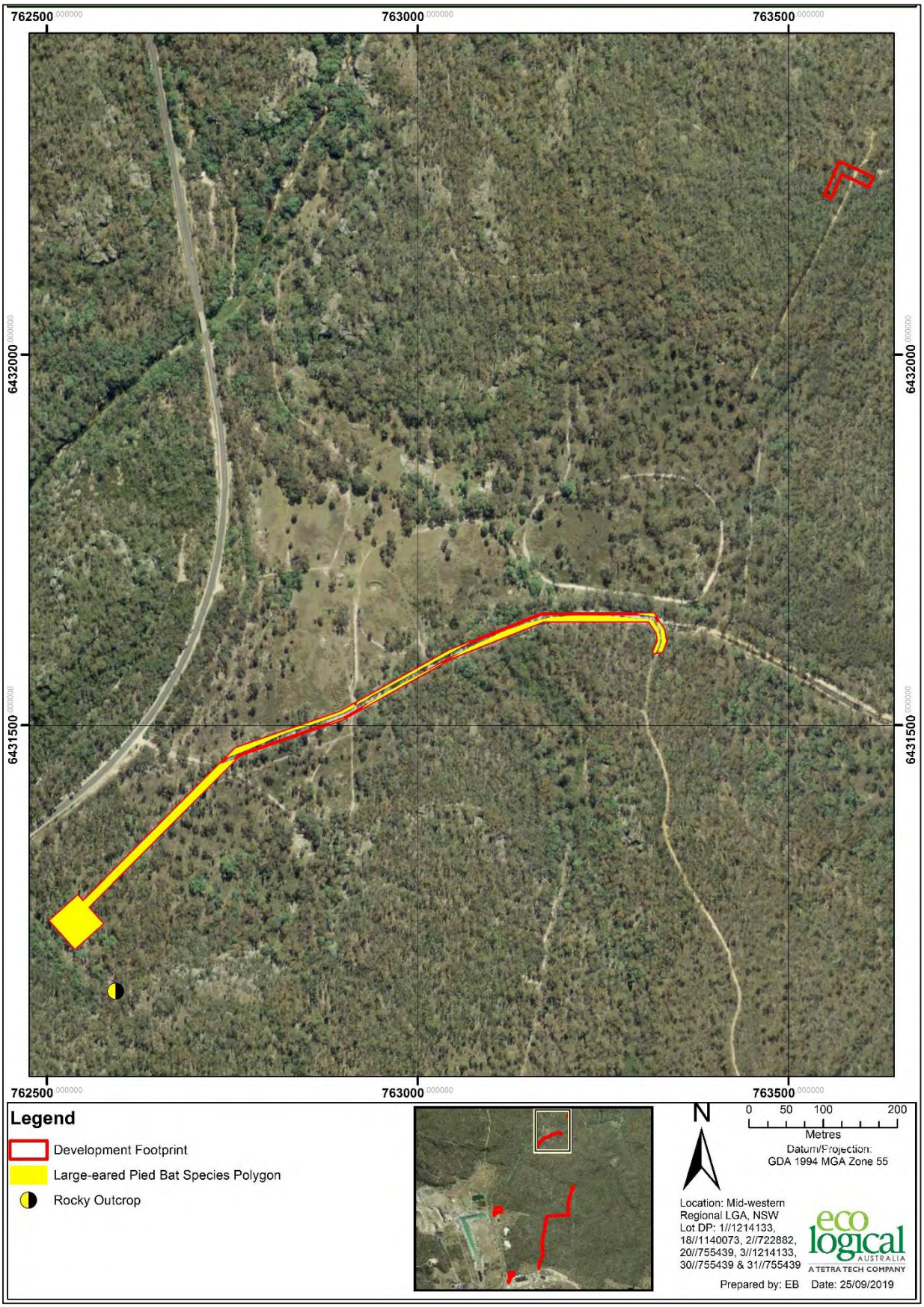


Figure 20: Species polygon for Large-eared Pied Bat (within 2 km of rocky outcrops).

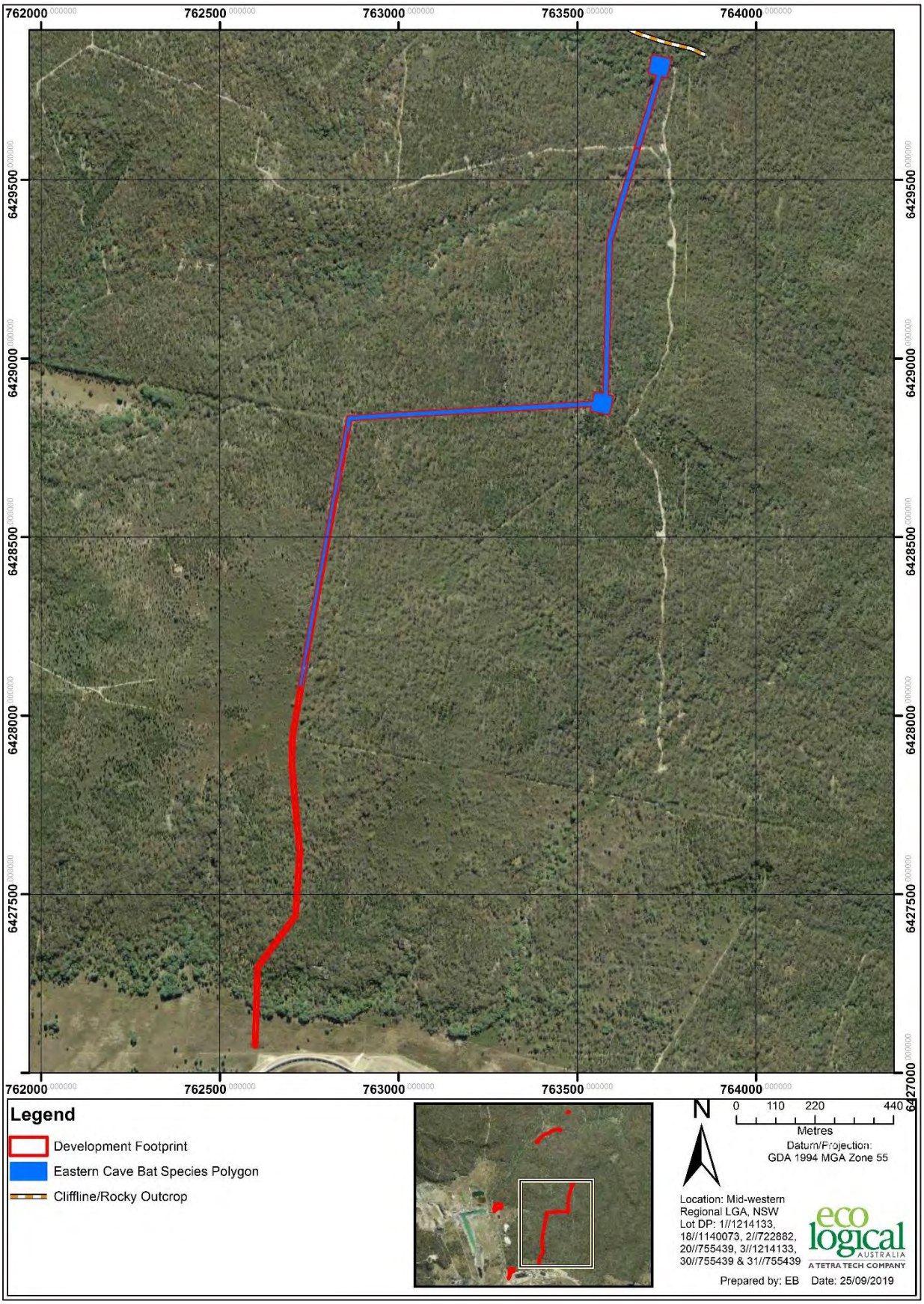


Figure 21: Species polygon for Eastern Cave Bat (areas within 2 km of rocky outcrops).

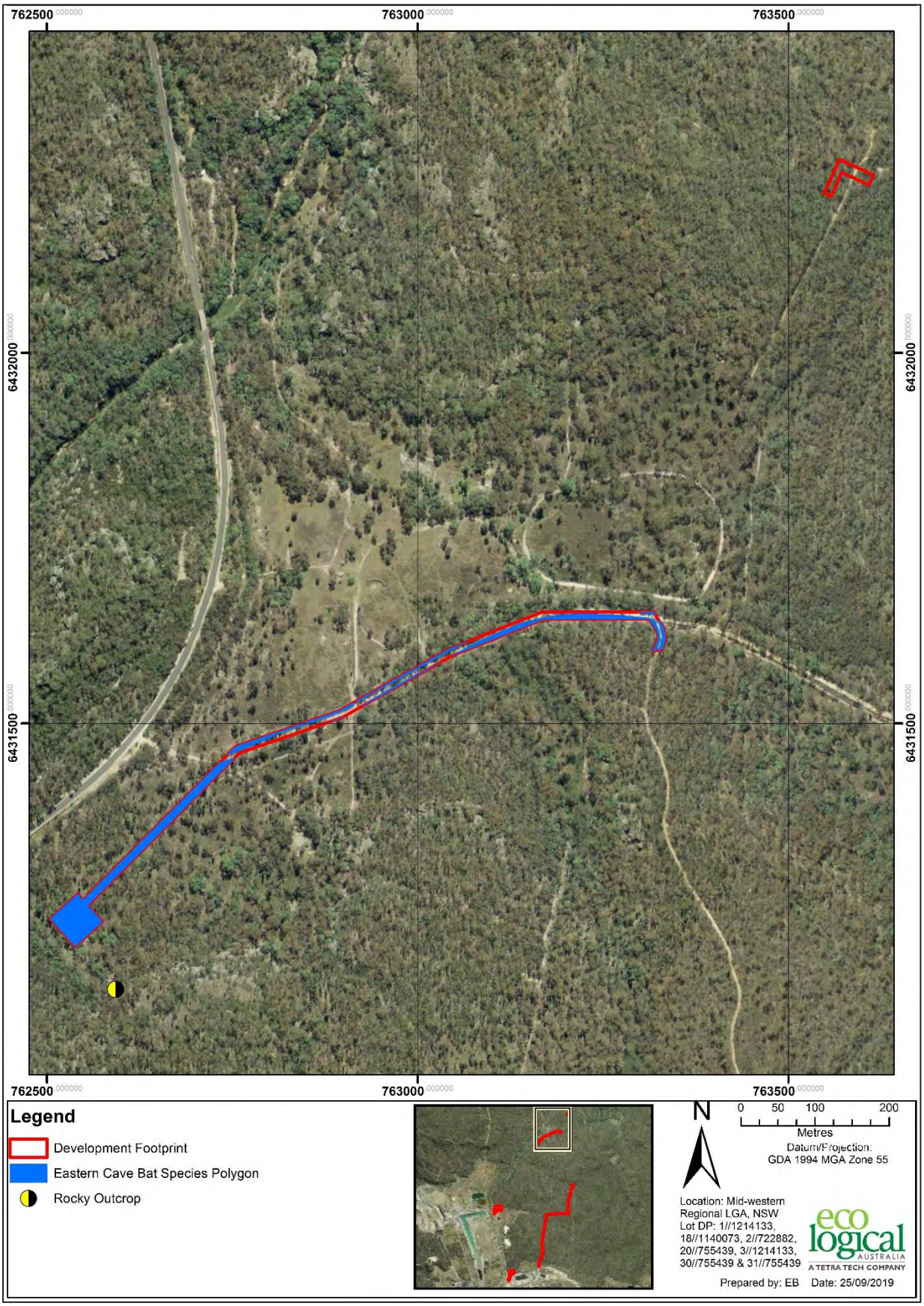


Figure 22: Species polygon for Eastern Cave Bat (areas within 2 km of rocky outcrops).

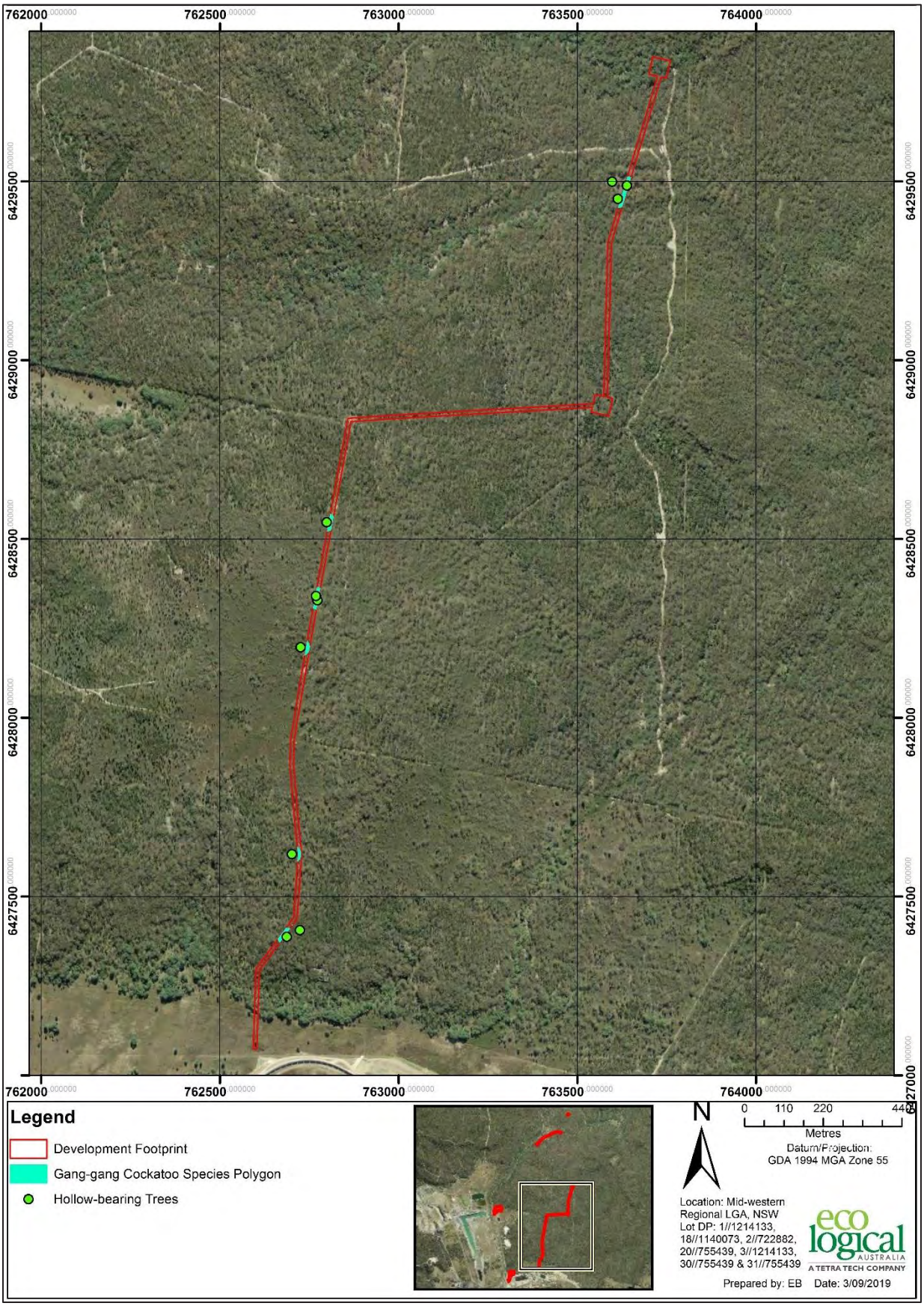


Figure 23: Species polygon for Gang-Gang Cockatoo (area based on presence of suitable hollow bearing trees).

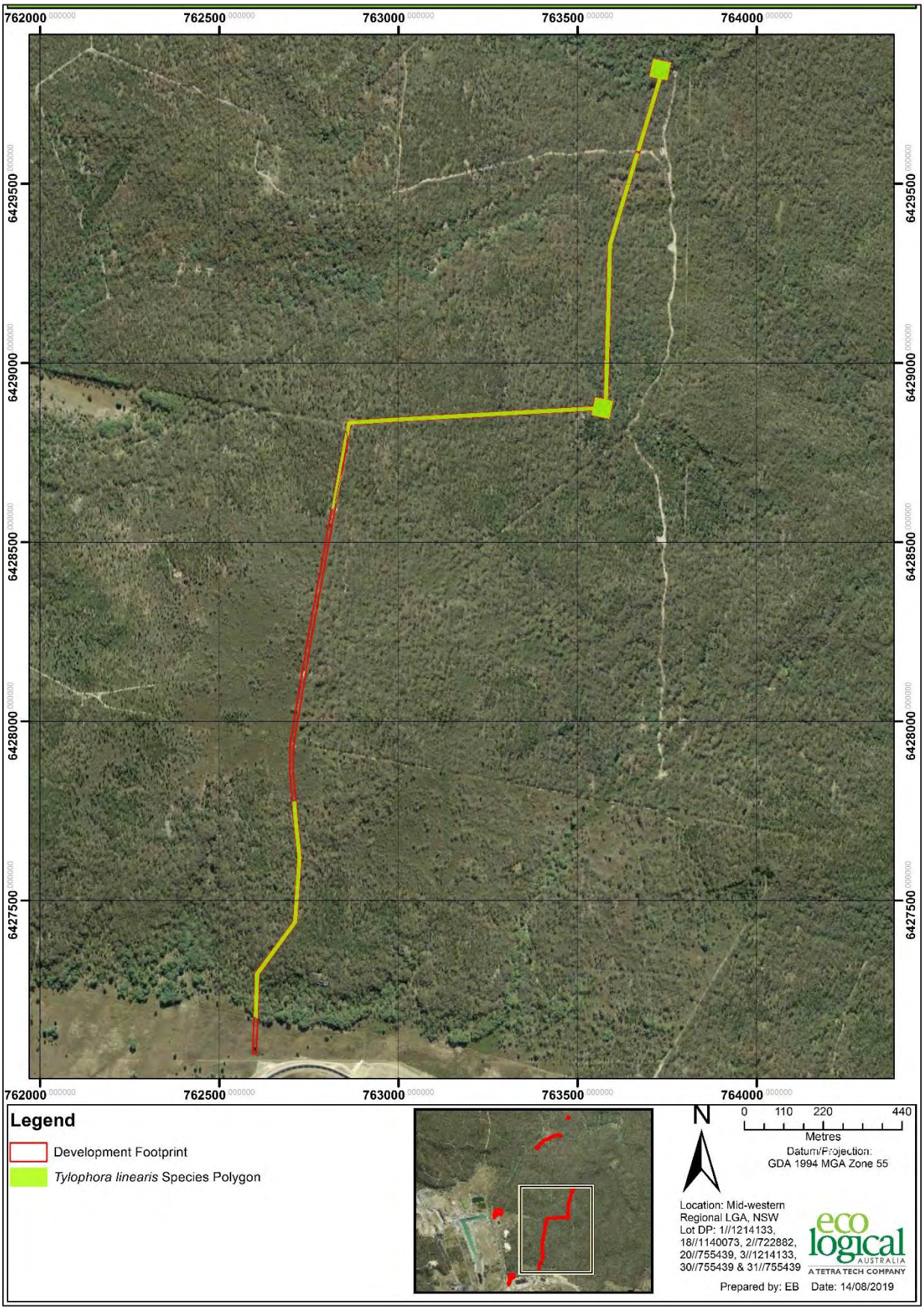


Figure 24: Species polygon for *Tylophora linearis* (area based on PCT 479 Good).

2. Stage 2: Impact assessment (biodiversity values)

2.1 Avoiding impacts

2.1.1 Locating a project to avoid and minimise impacts on vegetation and habitat

The development footprint has been modified and located in areas that avoids and minimises impacts as required by Section 8.1.1.3 of the BAM (**Table 16**).

Table 16: Locating a project to avoid and minimise impacts on vegetation and habitat

Approach*	Addressed through the design of the Modification
locating the project in areas where there are no biodiversity values	Areas of cleared land containing low biodiversity values have been used to the greatest extent practicable. The proposed ventilation shaft compound and the RSIA occur within predominantly cleared land. Access tracks to the bores will use existing tracks and roads where possible. Most of the development footprint occurs within areas that are of low biodiversity values and utilises access tracks that already exists.
locating the project in areas where the native vegetation or threatened species habitat is in the poorest condition	The placement of the development footprint has centred in the area of lowest biodiversity value (cleared, grazed). The development footprint for the ventilation shaft compound and the RSIA are placed in an area of previous disturbance from historical clearing and the proposed access tracks are predominantly along existing tracks, where practicable. Nearby areas of remnant native vegetation outside the footprint to the north and east will not be impacted by the Modification.
locating the project in areas that avoid habitat for species and vegetation in high threat categories (e.g. an EEC or CEEC), indicated by the biodiversity risk weighting for a species	The location of the development footprint has been designed to avoid areas of high-quality vegetation and species habitat. The placement of the development footprint primarily utilises an area of low biodiversity value (cleared, grazed) and the footprint has been designed to avoid areas or higher biodiversity value and avoid impacts by utilising areas low in biodiversity and along areas of tracks.
locating the project such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained	The development footprint of the ventilation shaft compound and RSIA contain limited habitat connectivity and are located within an already heavily fragmented landscape. Lands directly adjoining (not impacted by project) are either heavily modified and minimal habitat connectivity exists or contain remnant vegetation and contribute to the connectivity function. The development footprint has been able to avoid any impediments to connectivity due to the small nature of the disturbances associated with the Modification.

* refer to Section 8.1.1.3 of the BAM.

2.1.2 Designing a project to avoid and minimise impacts on vegetation and habitat

The development has been designed in a way which avoids and minimises impacts as required by Section 8.1.2.1 of the BAM (**Table 17**).

Table 17: Designing a project to avoid and minimise impacts on vegetation and habitat

Approach*	Addressed through the design of the Modification
reducing the clearing footprint of the project	The Modification has minimised vegetation clearing through strategic placement to avoid native vegetation wherever possible. The development footprint of the Ventilation Shaft Compound and RSIA have been placed primarily in a previously cleared area with low biodiversity values. The proposed access tracks will use areas of existing track where possible which will be widened or elongated to facilitate the installation of services.

Approach*	Addressed through the design of the Modification
locating ancillary facilities in areas where there are no biodiversity values	Placement of the development footprint has resulted in the use of land with low biodiversity values (ventilation shaft compound and RSIA) are within areas of cleared and exotic grasslands with a vegetation integrity score of 10.9 of with only a small section (0.3 ha) within PCT 281-good. The proposed access track would use the existing track as much as possible with most clearing of native vegetation occurring within the southern section.
locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)	The proposed location of the RSIA and the ventilation shaft compound are in areas of vegetation in poor condition, with low vegetation integrity scores. The proposed access tracks would use areas of existing track where possible.
locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC)	It has not been possible to completely avoid impacts to areas providing species habitat. The placement of the development footprint has minimised impacts as far as practicable to species habitat whilst maintaining the extent necessary for development.
providing structures to enable species and genetic material to move across barriers or hostile gaps	No regional or local corridors or remnant vegetation is affected.
making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development footprint.	The placement of the development footprint has been located to include the poorest condition native vegetation and species habitat where possible.
Ensuring vehicles remain on designated roads and tracks whenever possible	Use of signposting and driver education during the induction process and in ongoing project discussions
Establishment and regular maintenance of erosion and sediment controls during construction -until disturbed areas are revegetated.	Management of sediment and erosion controls are undertaken in accordance with the MCC Water Management Plan.

* refer to Section 8.1.2.1 of the BAM.

Plate 9: Existing access tracks which will be located within the proposed development footprint

2.2 Assessment of Impacts

2.2.1 Direct impacts

The Modification includes direct impacts on native vegetation, including impacts on EEC/CEEC and threatened species through the removal of potential habitat. Direct impacts of the development on:

- native vegetation are outlined in **Table 18.**
- EEC/CEEC are outlined in **Table 19** and **Table 20.**
- threatened species and threatened species habitat is outlined in **Table 21.**

Direct impacts including the development footprint (construction and operation) are shown on **Figure 25**.

Table 18: Direct impacts on native vegetation

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)^
281	Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	Grassy Woodlands	5.5
479	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	Western Slopes Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	4
1711	Tantoon - *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin	Western Slopes Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	0.5

^ numbers have been rounded.

Table 19: Direct impacts on BC ACT threatened ecological communities

PCT ID	PCT Name	NSW BC Act Name	Listing Status	Veg Zone	Direct impact (ha)
281	Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	Endangered Ecological Community	2	1
				3	1.2
				4	0.3

Table 20: Direct impacts on EPBC ACT threatened ecological communities

Veg Zone	PCT ID	PCT Name	Commonwealth EPBC Act Name	Listing Status	Direct Impact (ha)
4	**281**	Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered Ecological Community	0.3

Table 21: Direct impacts on threatened species and threatened species habitat

Species	Common Name	Direct impact of habitat (ha)	NSW listing status	EPBC Listing status
Callocephalon fimbriatum	Gang-gang cockatoo	0.43 ha	Vulnerable	Not Listed
Calyptorhynchus lathami	Glossy Black Cockatoo	0.43 ha	Vulnerable	Not Listed
Chalinolobus dwyeri	Large-eared Pied Bat	4.21 ha	Vulnerable	Vulnerable
Tylophora linearis		1.43 ha	Vulnerable	Endangered
Vespadelus troughtoni	Eastern Cave Bat	4.21 ha	Vulnerable	Not Listed

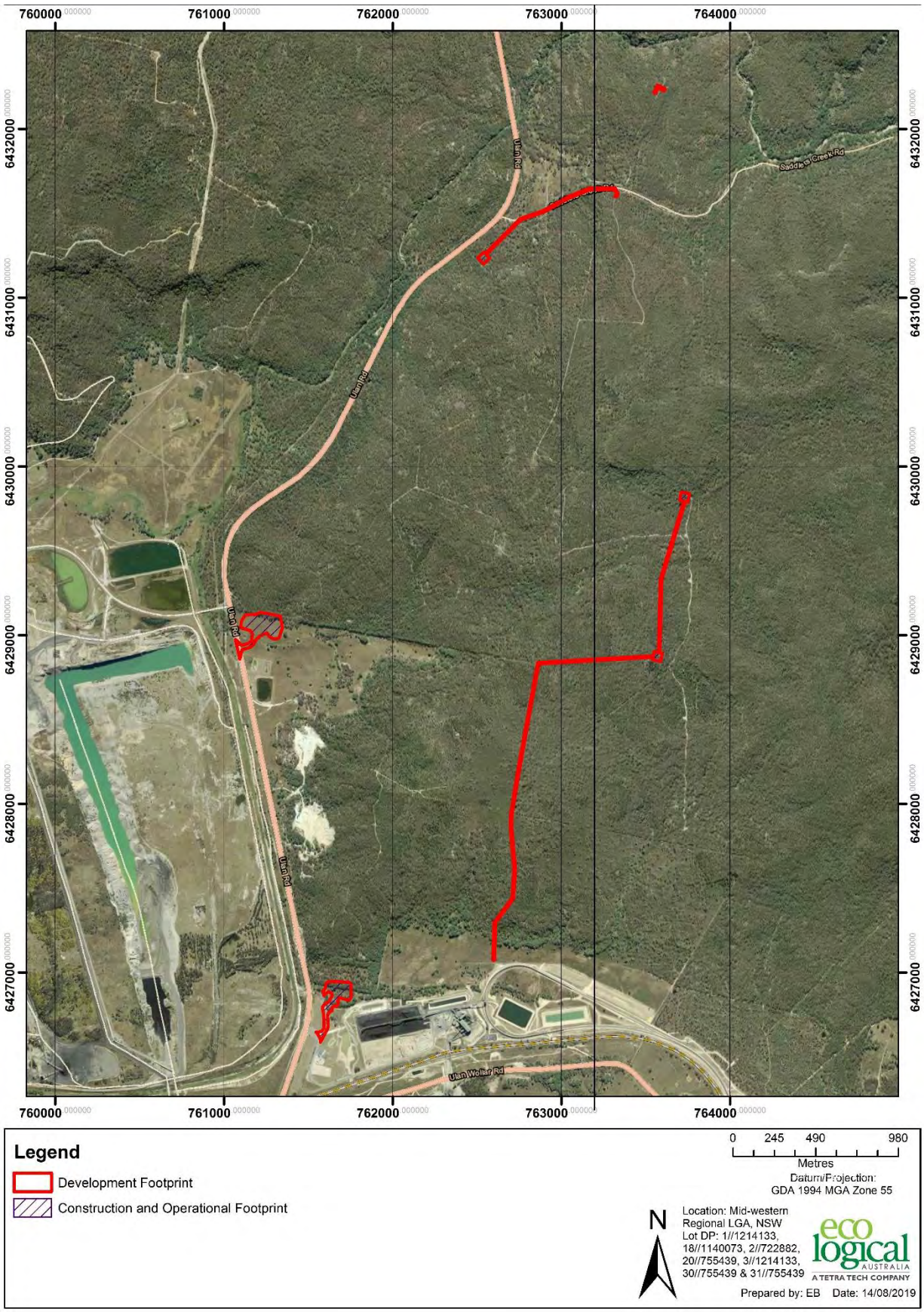


Figure 25: Proposed development footprint including construction and operation

2.2.2 Change in vegetation integrity

The change in vegetation integrity as a result of the development is outlined in **Table 22**.

Table 22: Change in vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)^	Current vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity
1	281	Cleared	2.8	10.9	0	-10.9
2	281	Low	1.0	31.6	0	-31.6
3	281	Moderate	1.2	31	0	-31
4	281	Good	0.3	59	0	-59
5	479	Low	0.1	30.5	0	-30.5
6	479	Moderate	1	36.1	0	-36.1
7	479	Good	3	43.7	0	-43.7
8	1711	Good	0.5	48.3	0	-48.3

^ numbers have been rounded.

2.2.3 Prescribed biodiversity impacts

The NSW *Biodiversity Conservation Regulation 2017* (BC Reg; clause 6.1) identifies actions that are prescribed as impacts to be assessed under the biodiversity offset scheme. The prescribed impacts relevant to this proposal in the impacts of development on karsts, caves, crevices, cliffs and other geological features of significance and rocks. The development footprint is within 100 m of rocky outcrops (**Plate 10** and **Plate 11**). However, these features are outside the development footprint and will not be directly impacted.

There are several distinct bands of sandstone outcropping along the proposed access track (southern section; PCT 479) which may provide suitable habitat for threatened reptiles (**Plate 12**). Within the development footprint, rocks are largely embedded rock with shallow crevices unlikely to be utilised regularly. No observations or evidence of their use was observed during the field survey.

Plate 10: Rocky outcrops within 100 m of the end of proposed access track.

Plate 11: Rocky outcrops outside the development footprint.

Plate 12: Rocky areas

2.2.4 Risk Assessment for Potential Indirect impacts

The indirect impacts of the development have been identified and are outlined in **Table 26.** A risk assessment has been undertaken for any residual impacts likely to remain after the mitigation measures have been applied. Likelihood criteria, consequence criteria and the risk matrix are provided in **Table 23**, **Table 24** and **Table 25** respectively. Measures proposed to mitigate and manage impacts are given in **Table 27**.

Table 23: Likelihood criteria

Likelihood criteria	Description
Almost certain (Common)	Will occur, or is of a continuous nature, or the likelihood is unknown. There is likely to be an event at least once a year or greater (up to ten times per year). It often occurs in similar environments. The event is expected to occur in most circumstances.
Likely (Has occurred in recent history)	There is likely to be an event on average every one to five years. Likely to have been a similar incident occurring in similar environments. The event will probably occur in most circumstances.
Possible (Could happen, has occurred in the past, but not common)	The event could occur. There is likely to be an event on average every five to twenty years.
Unlikely (Not likely or uncommon)	The event could occur but is not expected. A rare occurrence (once per one hundred years).
Remote (Rare or practically impossible)	The event may occur only in exceptional circumstances. Very rare occurrence (once per one thousand years). Unlikely that it has occurred elsewhere; and, if it has occurred, it is regarded as unique.

Table 24: Consequence criteria

Consequence category	Description
Critical **(Severe, widespread long-term effect)**	Destruction of sensitive environmental features. Severe impact on ecosystem. Impacts are irreversible and/or widespread. Regulatory and high-level government intervention/action. Community outrage expected. Prosecution likely.
Major **(Wider spread, moderate to long term effect)**	Long-term impact of regional significance on sensitive environmental features (e.g. wetlands). Likely to result in regulatory intervention/action. Environmental harm either temporary or permanent, requiring immediate attention. Community outrage possible. Prosecution possible.
Moderate **(Localised, short-term to moderate effect)**	Short term impact on sensitive environmental features. Triggers regulatory investigation. Significant changes that may be rehabilitated with difficulty. Repeated public concern.
Minor **(Localised short-term effect)**	Impact on fauna, flora and/or habitat but no negative effects on ecosystem. Easily rehabilitated. Requires immediate regulator notification.
Negligible **(Minimal impact or no lasting effect)**	Negligible impact on fauna/flora, habitat, aquatic ecosystem or water resources. Impacts are local, temporary and reversible. Incident reporting according to routine protocols.

Table 25: Risk matrix

Consequence	Likelihood				
	Almost certain	Likely	Possible	Unlikely	Remote
Critical	Very High	Very High	High	High	Medium
Major	Very High	High	High	Medium	Medium
Moderate	High	Medium	Medium	Medium	Low
Minor	Medium	Medium	Low	Low	Very Low
Negligible	Medium	Low	Low	Very Low	Very Low

Table 26: Risk Assessment for all identified potential Indirect impacts

Indirect impact	Modification phase	Risk (pre-mitigation)	Risk (post-mitigation)	Nature	Extent	Frequency	Duration	Timing
Inadvertent impacts on adjacent habitat or vegetation	Construction	Medium	Low	Potential damage to adjacent habitat or vegetation	Adjacent vegetation	Daily, during construction and operational phases	During construction	Potentially long-term impacts
Sedimentation and contaminated and/or nutrient rich run-off	Construction	Medium	Low	Potential runoff during construction works	Unlikely due to flat landscape and implementation of MCO Water Management Plan.	During heavy rainfall or storm events	During rainfall events	Short-term impacts
Noise, dust or light spill	Construction	Low	Low	Noise and dust created from machinery Night works limited to ventilation shaft drilling. No other night works , so no light spill	Adjacent vegetation unlikely due to the implementation of the Vegetation Clearing Protocol and MCO Biodiversity Management Plan	During construction works	Sporadic throughout construction period; throughout operation period	Short-term impacts
Transport of weeds and pathogens from the site to adjacent vegetation	Construction	Medium	Very Low	Potential spread of weed seed and pathogens from incoming machinery and equipment	Potential for spread into nearby habitat	During construction and operational phases	Life of mine	Potentially long-term impacts
Increase in pest animal populations	Construction / operation	Low	Low	Construction / operation	Potential to increase if food scraps/rubbish is	Throughout adjacent vegetation	Likely to occur gradually after disturbance to	During construction

Indirect impact	Modification phase	Risk (pre-mitigation)	Risk (post-mitigation)	Nature	Extent	Frequency	Duration	Timing
					left on site. Potential to increase -/+ decrease due to disturbance to existing vegetation.		habitat and vegetation takes place	
Vehicle strike	Construction / operation	Low	Very Low	Potential for native fauna to be struck by working machinery and moving vehicles	Within access roads and within development footprint	Daily, during construction and operational phases	Life of mine	Potentially long-term impacts
Rubbish dumping	Construction / operation	Low	Low	Construction / operation	Potential rubbish dumping by workers	Potential for rubbish to spread into areas outside development footprint	Any time	Life of mine
Wood collection	Construction / operation	Low	Low	Construction / operation	Removal of wood in vegetation adjacent to the development footprint	Throughout adjacent vegetation	Potential to occur at any time during construction or operational phases	Life of mine
Bush rock removal and disturbance	Construction / operation	Low	Low	Construction / operation	Removal of rocks in vegetation adjacent to development footprint	Potential for disturbance in adjacent vegetation and area surrounding the development footprint	Potential to occur at any time during construction or operational phases	Life of mine

Indirect impact	Modification phase	Risk (pre-mitigation)	Risk (post-mitigation)	Nature	Extent	Frequency	Duration	Timing
Increased risk of fire	Construction / operation	Medium	Low	Construction / operation	Potential for fire to spark during construction and operation from any machinery or electrical works	Throughout adjacent vegetation	Potential to occur at any time throughout the operational or construction phases	During operating/ construction hours
Disturbance to specialist breeding and foraging habitat.	Construction / operation	Medium	Low	Construction / operation	Rocks occur within adjacent development footprint so potential to reduce habitat	Potential for disturbance in adjacent vegetation and area surrounding the development footprint	Potential to occur at any time throughout the operational or construction phases	During operating/ construction hours

Table 27: Measures proposed to mitigate and manage potential impacts

Measure	Action	Outcome	Timing	Responsibility
Instigating clearing protocols including pre-clearing surveys, staged clearing, and the presence of a trained ecological or licensed wildlife handler during clearing events	Pre-clearing surveys to be completed and clearing undertaken in accordance with Section 4.2 and 4.3 of the BMP (MCO 2019).	Any fauna utilising habitat within the development footprint area will be identified and managed to ensure clearing works minimise the likelihood of injuring resident fauna	During clearing works	Project Manager
Erosion and sediment control measures to control the quality of water released from the site into the receiving environment	Manage exposed soil surfaces Sediment and erosion control on works	Control of erosion and sedimentation	Life of mine	Project Manager
Construction works during daylight hours, except ventilation shaft drilling	Construction will only occur during daylight hours with the exception of ventilation shaft drilling	Light impacts associated with construction and operation will mostly be avoided as majority of works will occur during daylight hours	Life of mine	Project Manager
Management of dust generation	Dust suppression measures implemented in accordance with the Air Quality Management Plan.	Mitigate dust created during construction/operation	Life of mine	Project Manager
Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	All machinery/equipment cleaned prior to entering the property. There are currently no weeds listed under the NSW *Biosecurity Act 2015* in the development footprint.	Prevent the spread of weeds or pathogens	Life of mine	Project manager
Implementation of pest control measures.	Pest control to be implemented as prescribed in the BMP.	Minimise spread of pest fauna species	Life of mine	Environment Officer/ Ecologist

Measure	Action	Outcome	Timing	Responsibility
Staff training to communicate environmental aspects and responsibilities	Prior to commencement of works on site, all site personnel will be required to undertake a site induction identifying their responsibilities under the BMP and Environmental Management Systems.	All staff are trained in environmental aspects and responsibilities.	To occur for all staff entering / working at the Development Footprint and when environmental issues become apparent	Project Manager, all staff
Timing works to avoid critical life cycle events such as breeding or nursing	Impacts to fauna will be minimised in accordance with avoidance and pre-clearing procedures identified in Section 4 of the BMP (MCO 2019).	Minimise impacts to fauna	During native vegetation clearing in accordance with the BMP	Project Manager

2.2.5 Serious and Irreversible Impacts (SAII)

The proposed development footprint has three potential Serious and Irreversible Impact (SAII) candidate entities identified (**Table 28**, **Figures 26-27**). Information on impacts to potential SAII candidate species and communities have been considered and are given in **Table 9**, **Table 30** and **Table 31**. As the proposed Modification is a Major Project, the below listed impacts need only be considered by the consent authority.

It should be noted that the Modification would not result in the removal of any potential breeding habitat (as defined in the *'Species Credit' Threatened Bats and their Habitats*) for the Large-eared Pied Bat or Eastern Cave Bat. However, there is the potential to impact on 0.26 ha of habitat within 100 m of breeding habitat. Whilst the surrounding PCT 479 is not identified as being associated with either species in the TBDC, the Large-eared Pied Bat was positively recorded as occurring and the Eastern Cave Bat was potentially identified within the study area near the rocky outcrops. Given that a track already exists, and no rocky areas will be disturbed, no SAII is predicted for these species.

Based on the results of the below assessments, it is considered unlikely that the Modification would result in a SAII to any threatened species or community.

Table 28: Candidate species SAII

Species / Community	Common Name	Principle	Direct impact individuals / area (ha)	Threshold
PCT 281 Rough-Barked Apple - Red Gum - Yellow Box Woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion.	White Box Yellow Box Blakely's Red Gum Woodland	1 and 2	Removal of approximately 2.5 ha	Not yet published
Chalinolobus dwyeri	Large-eared Pied Bat	4	Removal of 0.26 ha of habitat.	100 m from rocky outcrops, caves disused mines
Vespadelus troughtoni	Eastern Cave Bat	4	Removal of 0.26 ha of habitat.	100 m from rocky outcrops, caves disused mines

Table 29: Determining whether impacts are serious and irreversible

Determining whether impacts are serious and irreversible	Assessment
Principle 1	
Does the proposal impact on a species, population or ecological community that is a candidate entity because it is in a rapid rate of decline?	Yes. The development footprint will result in a loss of 2.5 ha of White Box Yellow Box Blakely's Red Gum Woodland listed under the BC Act.
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible	The BCD has not yet published a threshold for this community. The Modification would remove approximately 0.003% of the White Box Yellow Box Blakely's Red Gum Woodlands within the IBRA Subregion (OEH 2015). Considering the characteristics of the surrounding lands are very similar to that of the development footprint, there is the potential that the occurrence of this EEC could be extensive in its derived form. Given the poor quality and the extent of this PCT within the surrounding landscape, the removal of 2.5 ha is considered to be relatively small.
Principle 2	
Does the proposal impact on a species that is a candidate entity because it has been identified as having a very small population size?	No
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible	
Principle 3	
Does the proposal impact on the habitat of a species or an area of an ecological community that is a candidate entity because it has a very limited geographic distribution?	No
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible.	
Principle 4	
Does the proposal impact on a species, a component of species habitat or an ecological community that is a candidate entity because it is irreplaceable?	Yes
b. If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible.	Both species of bats (Large-eared Pied Bat and Eastern Cave Bat) have thresholds listed as being within 100 m of potential breeding habitat. Breeding habitat is identified as PCTs associated with species within 100 m of rocky areas, caves or overhangs. Whilst PCT 479 is not listed as being associated with the species in the TDBC, both species have been recorded during the survey and therefore are included. Further, as acoustic detectors were the only survey method used and these species were detected, breeding must be assumed. At the end of the proposed access track (Plot 9) there are caves and rocky outcrops within 100 m of the development footprint.

Table 30: Evaluation of an impact on a candidate species

Impact Assessment Provision	Assessment
1. the size of the local population directly and indirectly impacted by the development and the likely impact (including direct and indirect impacts) that the development will have on the habitat of the local population, including but not limited to:	
a. an estimate of the change in habitat available to the local population as a result of the proposed development	The Large-eared Pied Bat and Eastern Cave Bat have been recorded within the development footprint and potential breeding areas are within 100 m of the development footprint. Within the 100 m buffer there will be a net loss of 0.26 ha of PCT 479 as a result of the Modification.
b. the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and	Due to the Modification there will be a loss of 0.26 ha within the 100 m radius from rocky outcrops for the Eastern Cave Bat and the Large Eared Pied Bat.
c. modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development	The proposed access track occurs within 100 m of potential breeding habitat for the Eastern Cave Bat and the Large-eared Pied Bat
2. the likely impact on the ecology of the local population.	
At a minimum, address the following for fauna: a. breeding **b. foraging** **c. roosting, and** **d. dispersal or movement pathways, or** **a. pollination cycle** **b. seedbanks** **c. recruitment, and** **d. interactions with other species (e.g. pollinators, host species, mycorrhizal associations)**	SAII for the Large-eared Pied Bat and the Eastern Cave Bat are potential breeding and roosting habitat and presence of breeding individuals, ie areas within 100 m of rocky areas containing caves or overhangs, crevices, cliffs, escarpments or old mines / tunnels (OEH 2019). At the end of the proposed access track there is potential breeding or roosting habitat within 100 m of the development footprint of which 0.26 ha of habitat will be affected.
3. a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development	The Modification is unlikely to result in the fragmentation or isolation of populations of the Eastern Cave Bat or the Large-eared Pied Bat. The majority of the proposed access track is within an existing vehicle track and the surrounding vegetation is connected to areas of the Goulburn River National Park.
4. the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	At the end of the proposed access track, outside of the development footprint, there are rocky outcrops which could be potential breeding areas for the two species of bats (Eastern Cave Bat and Large-eared Pied Bat). Much of this area follows an existing vehicle access track. Given the mitigation measures that will be in place it is unlikely that there will be impacts to breeding, dispersal and genetic diversity.
5. the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	The proponent has a weed management plan in place and will ensure that vehicles and machinery are free of weeds and soil pathogens. It is unlikely that the Modificationwill result in an increase in feral animal activity within the local area.

Impact Assessment Provision	Assessment
6. the measure/s proposed to contribute to the recovery of the species in the Interim Biogeographic Regionalisation for Australia (IBRA) subregion.	The presence of the Large-eared Pied Bat and the Eastern Cave Bat were detected using Anabat in PCT 479 near the top of the proposed southern access track. These observations will be added to BioNet which will be used to inform the location of bats and to clarify distribution as part of the National Recovery Plan.

Table 31: Evaluation of an impact on a TEC

Impact Assessment Provisions	Assessment
1. the area and condition of the TEC to be affected directly and indirectly by the proposed development	PCT 281 – Low, PCT 281 – Moderate and PCT 281 – good are considered to be TEC 'White Box Yellow Box Blakey's Red Gum Woodland' under the BC Act and PCT 281 – Good (0.3 ha) is considered to be CEEC under the EPBC Act. The total loss of TEC will be 2.5 ha directly affected by the Modification.
2. the extent and overall condition of the TEC within an area of 1000 ha, and then 10000 ha, surrounding the proposed development footprint. In the case of strategic biodiversity certification projects, the extent and overall condition of the TEC may be assessed across the IBRA sub region	Detailed mapping of the local occurrence of the EEC is not available. Much of the landscape consists of lands similar to that of the development footprint. These areas have been highly disturbed/grazed and have not been mapped by any vegetation mapping programs as a native vegetation community. Within 1,000 ha of the development footprint, White Box Yellow Box Blakely's Red Gum Woodlands is estimated to cover approximately 1% of the area. The removal of 2.5 ha represents less than 17% of these mapped lands. Within 10,000 ha of the development footprint, the White Box Yellow Box Blakely's Red Gum Woodlands cover approximately 13% of the area. The removal of 2.5 ha represents 0.14 % of the lands within 10,000 ha (OEH 2017).
3. an estimate of the extant area and overall condition of the TEC remaining before and after the impact of the proposed development has been taken into consideration	The Modification will reduce the extant area of the EEC by 2.5 ha of which approximately 0.3 ha is CEEC. Considering the very small area and reduced quality of the vegetation to be removed, it is considered that the development will have a negligible impact on the extant area and overall condition of the EEC and CEEC on a broad scale.
4. the development proposal's impact on:	
a. abiotic factors critical to the long-term survival of the TEC; for example, will the impact lead to a reduction of groundwater levels or substantial alteration of surface water patterns; will it alter natural disturbance regimes that the TEC depends upon, e.g. fire, flooding etc.?	The Modification will not impact abiotic factors critical to the long-term survival of the EEC.
b. characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of under-storey species or harvesting of plants	The Modification will not impact characteristic and functionally important species outside of the proposed impact area.
c. the quality and integrity of an occurrence of the TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the TEC	The Modification is unlikely to result in the spread of invasive weed species into vegetation adjacent to the development footprint. This potential indirect impact will be managed during pre-construction works and throughout construction. The Modification will not have additional impacts to the quality and integrity of the occurrence of Box

Impact Assessment Provisions	Assessment
	Gum Woodland outside of the proposed development footprint.
5. direct or indirect fragmentation and isolation of an area of the TEC	The Modification will not cause direct or indirect fragmentation or isolation of any area of Box Gum Woodland as the access track is already present except for a small patch in PCT 281 – good.
6. the measures proposed to contribute to the recovery of the TEC in the IBRA subregion.	One of the measures proposed to be implemented by MCO is the control of weeds to prevent their spread, as prescribed in the current BMP. MCO will limit the spread of weeds into adjoining similar vegetation and will not directly, or otherwise indirectly impact areas outside of the development footprint.

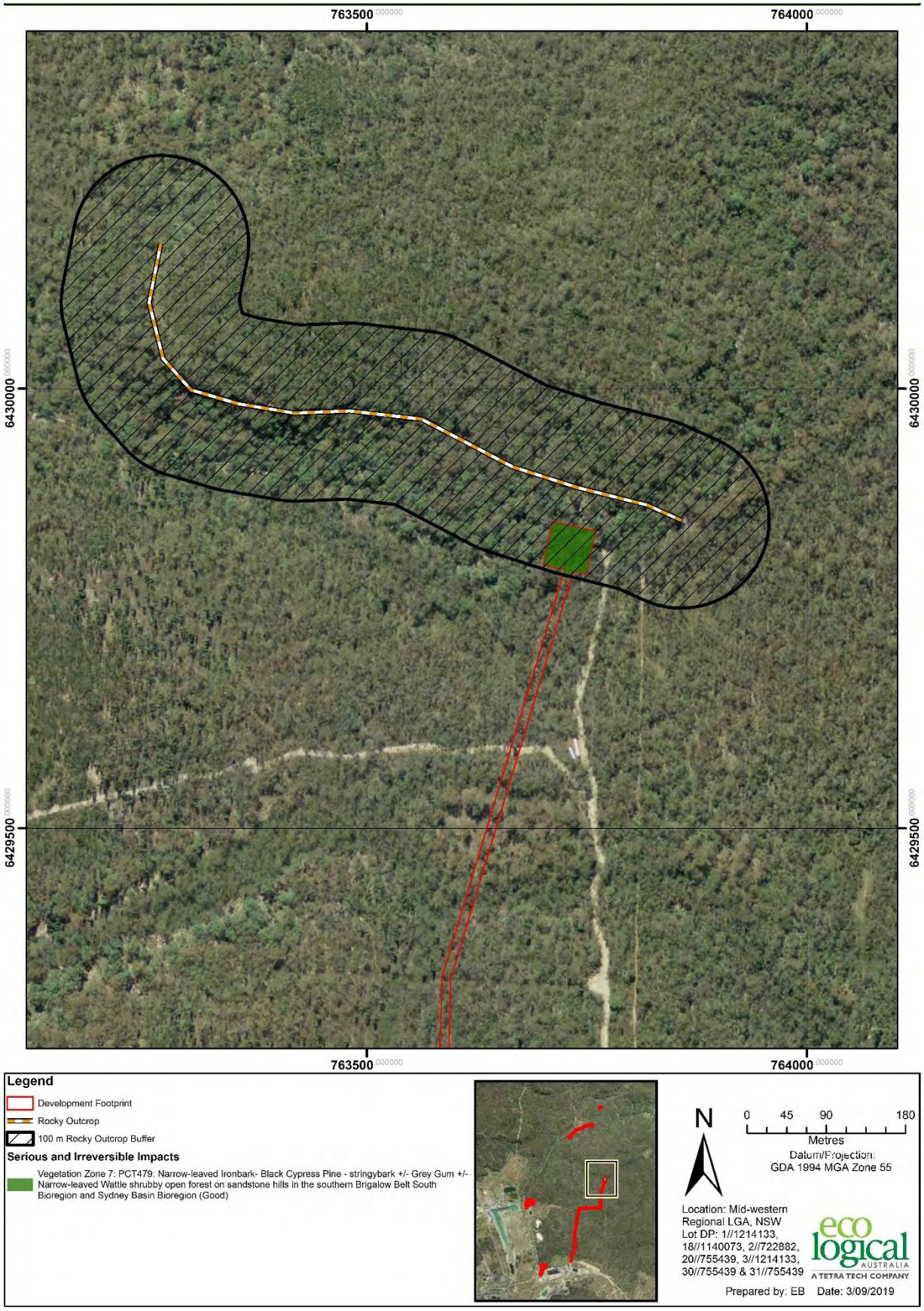


Figure 26: SAII Location of rocky outcrops as potential breeding habitat for the Eastern Cave Bat and the Large-eared Pied Bat.

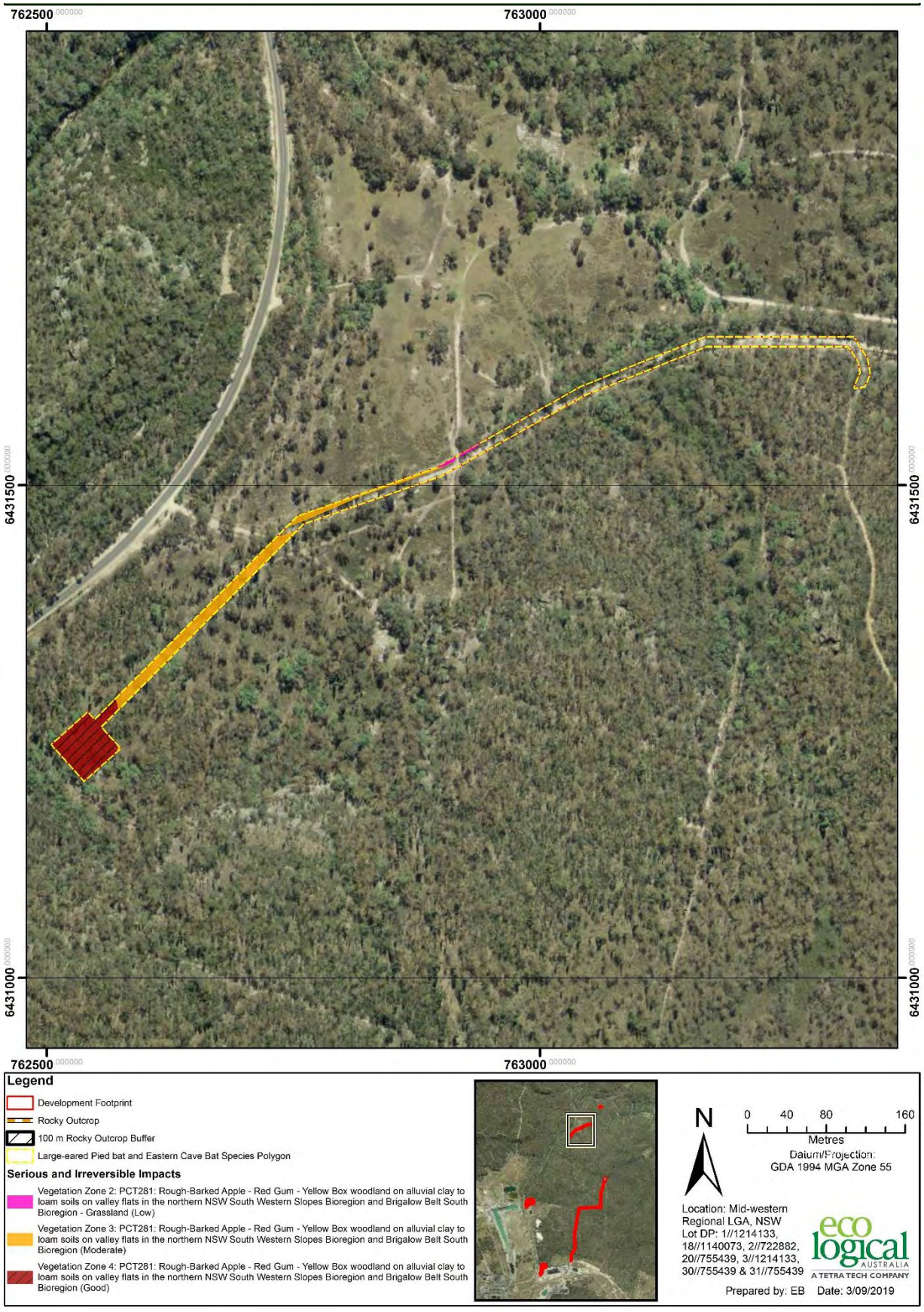


Figure 27: SAII Location of PCT 281 Good and PCT 281 Moderate

2.3 Impact summary

Following implementation of the BAM and the BAMC, the following impacts have been determined.

2.3.1 Serious and Irreversible Impacts (SAII)

As discussed in **Section 2.2.5**, three candidate entities occur within the development footprint (**Table 28** and **Figure 26 and 27**). No published thresholds exist for SAII to White Box Yellow Box Blakely's Red Gum Woodlands, so all impacts are potentially SAII.

SAII thresholds for the Eastern Cave Bat and the Large-Eared Pied Bat are impacts that occur within 100 m of potential breeding sites, that is, rocky outcrops, cliff-lines or caves. The end of the proposed southern access track and bore is within the 100 m buffer zone of rocky outcrops (**Plate 10** and **Plate 11**). Approximately 0.26 ha of native vegetation occurs within the 100 m buffer zone.

Detailed consideration of whether impacts on candidate species / community are serious and irreversible is included in **Table 32**. It is unlikely that the modification would result in a serious and irreversible impact to the three candidate entities.

Table 32: Serious and Irreversible Impacts Summary

Species / Community	Common Name	Principle	Direct impact area (ha)	Summary
PCT 281 Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion.	White Box Yellow Box Blakely's Red Gum Woodland	1 and 2	2.5 ha	The amount of this PCT to be affected is small and the majority is low quality.
Chalinolobus dwyeri	Large-eared Pied Bat	4	0.26 ha	The end the proposed access track occurs within 100 m of rocky outcrops which are potential breeding habitat and therefore has the potential to be a SAII. However, given that an access track already exists and no rocky outcrops will be impacted an SAII is unlikely.
Vespadelus troughtoni	Eastern Cave Bat	4	0.26 ha	The end the proposed access track occurs within 100 m of rocky outcrops which are potential breeding habitat, and therefore, has the potential to be a SAII. However, given that an access track already exists and no rocky outcrops will be impacted an SAII is unlikely.

2.3.2 Impacts requiring offsets

The impacts of the development requiring offset for native vegetation are outlined in **Table 33** and shown in **Figures 28 to 31**. The impacts of the development requiring offset for threatened species and threatened species habitat are outlined in **Table 34**.

Table 33: Impacts to native vegetation that require offsets

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)^
PCT 281	Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	Grassy Woodlands	2.5 ha
PCT 479	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	Western Slopes Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	4 ha
PCT 1711	Tantoon - *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin	Western Slopes Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	0.5 ha

^ numbers have been rounded.

Table 34: Impacts on threatened species and threatened species habitat that require offsets

Species	Common Name	Direct impact of habitat (ha)	NSW listing status	EPBC Listing status
Callocephalon fimbriatum	Gang-gang cockatoo	0.43 ha	Vulnerable	Not Listed
Calyptorhynchus lathami	Glossy Black Cockatoo	0.43 ha	Vulnerable	Not Listed
Chalinolobus dwyeri	Large-eared Pied Bat	4.21 ha	Vulnerable	Vulnerable
Tylophora linearis		1.43 ha	Vulnerable	Endangered
Vespadelus troughtoni	Eastern Cave Bat	4.21 ha	Vulnerable	Not Listed

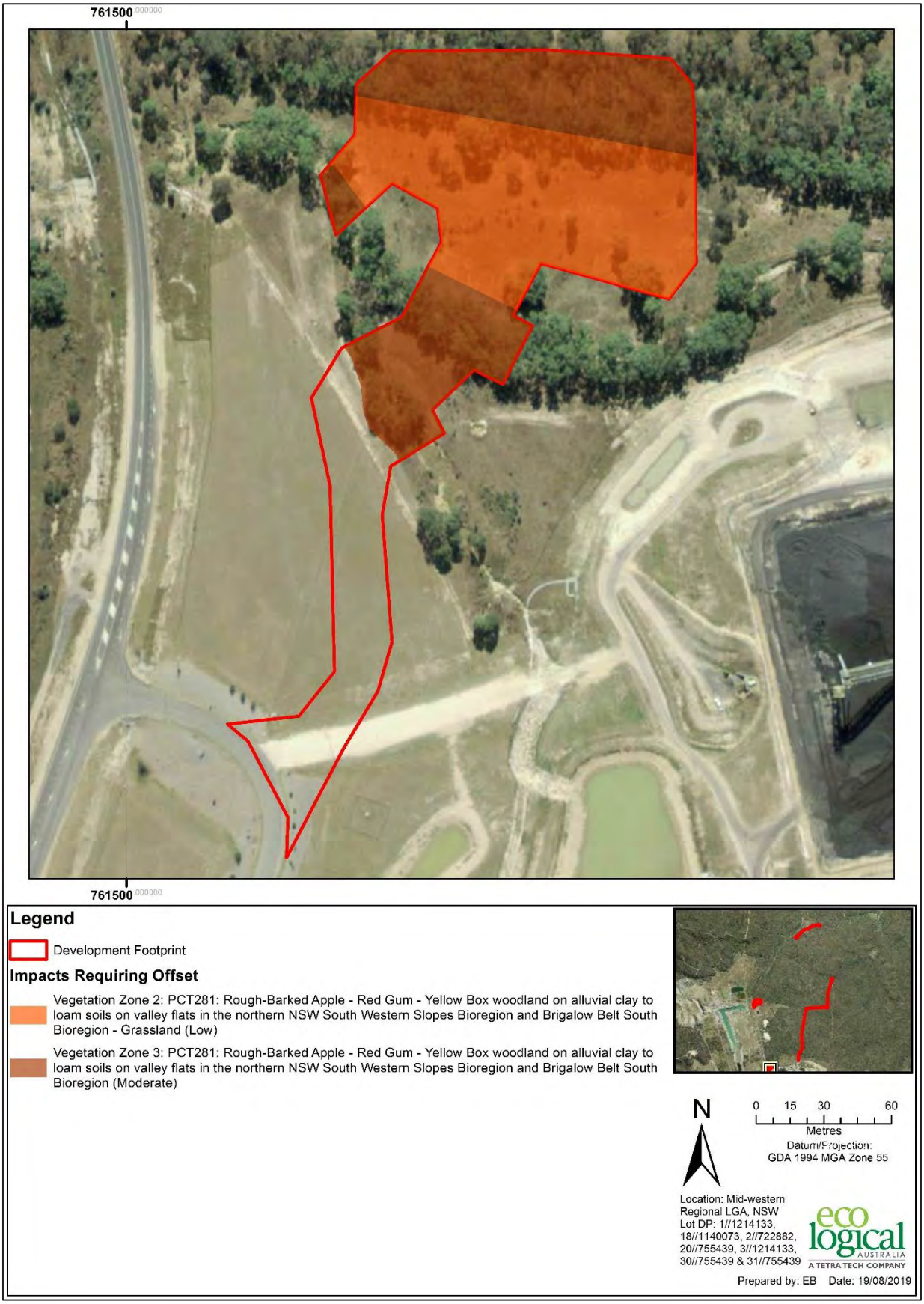


Figure 28: Areas requiring offsets - RSIA

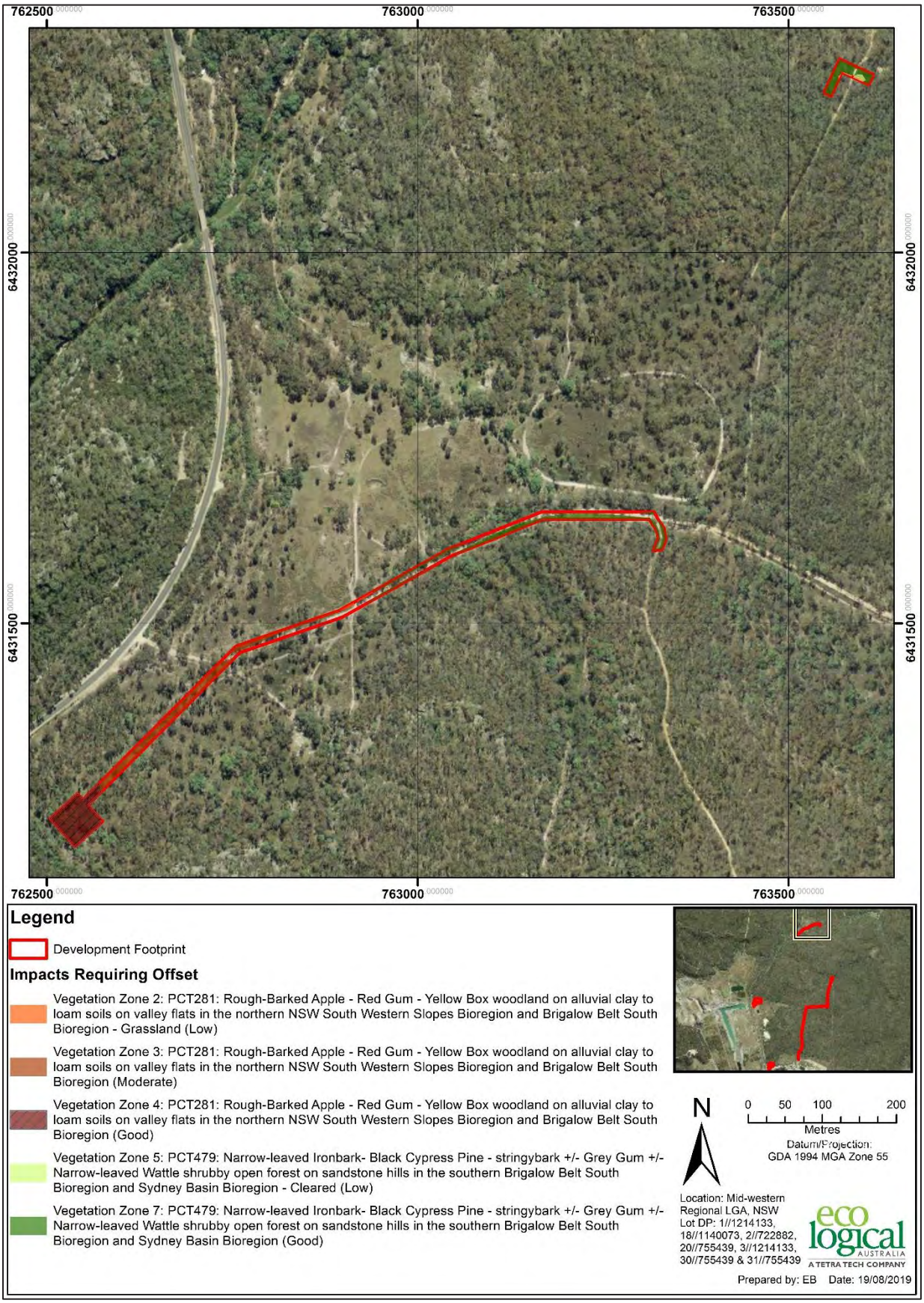


Figure 29: Areas requiring offsets - northern dewatering site and access track

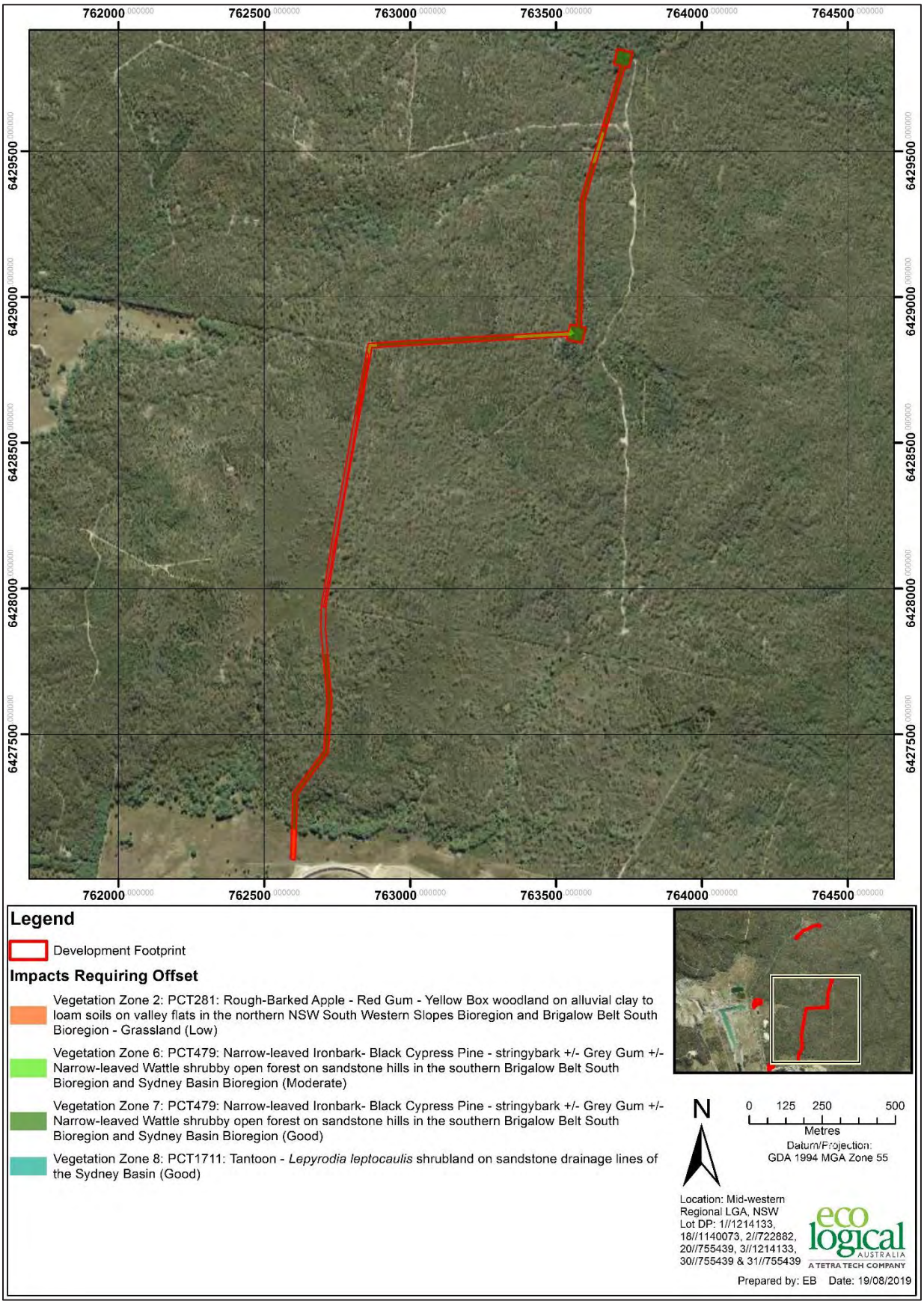


Figure 30: Areas requiring offsets - southern dewatering site and access track

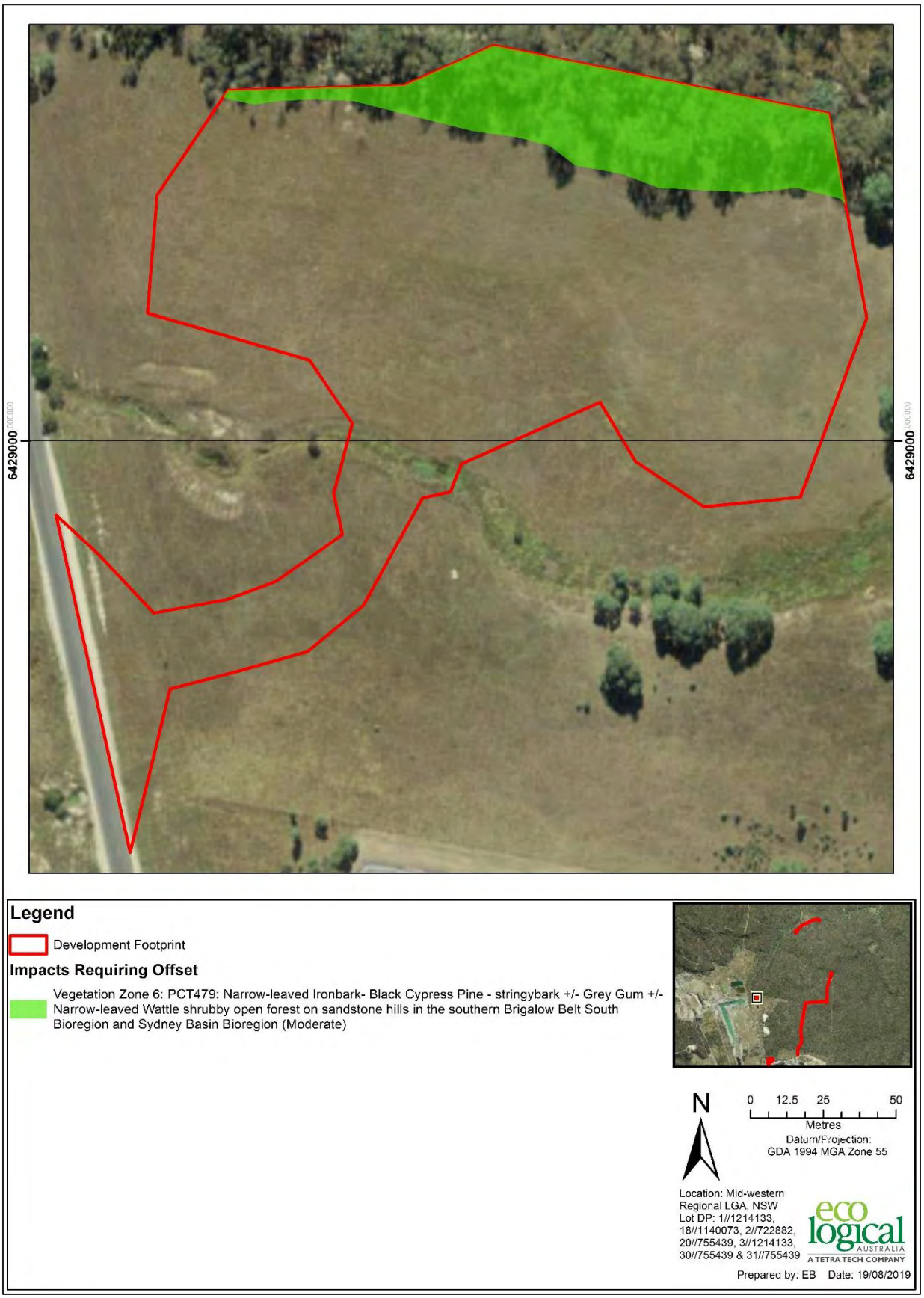


Figure 31: Areas requiring offsets – ventilation shaft compound

2.3.3 Impacts not requiring offsets

The impacts of the development not requiring offset for native vegetation are outlined in **Table 35** and shown in **Figure 32**. PCT 281- Cleared (vegetation zone 1) has a vegetation integrity score of 10.9 which is below the threshold required for offsetting native vegetation. Whilst this PCT has the potential to be associated with TECs, the score was still below the threshold (<15) as per Section 3.1.1.3 of the BAM.

Table 35: Impacts to native vegetation not requiring offsets

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)	Rationale
PCT 281	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	Grassy Woodlands	2.8 ha	The quality of the vegetation was poor with a VI score of 10.9

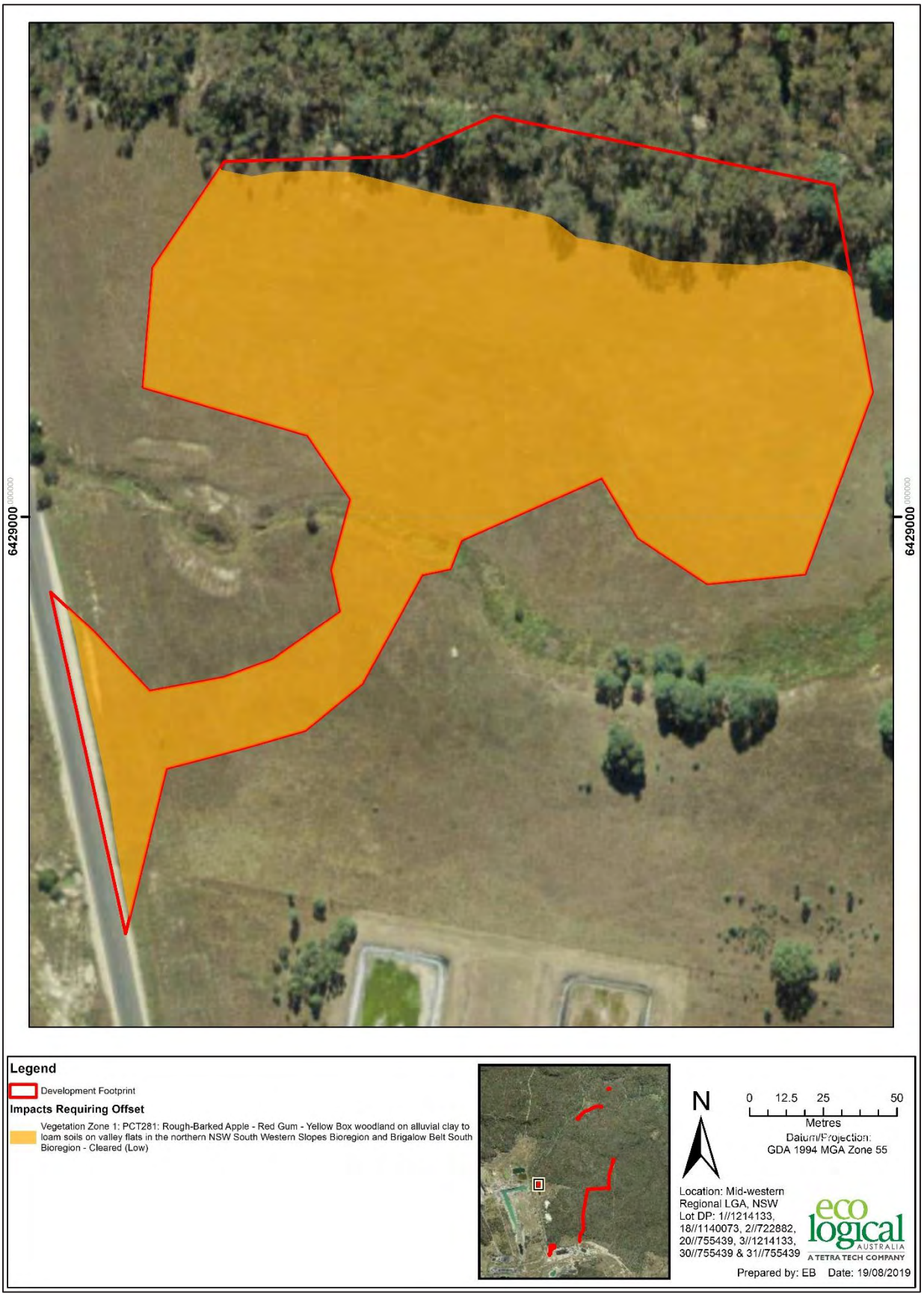


Figure 32: Areas not requiring offsets ventilation shaft compound

2.3.4 Areas not requiring assessment

Areas not requiring assessment are those considered cleared or dominated by exotic vegetation. These are shown in **Figure 33 - 36**. Within the development footprint there is approximately 2.5 ha of cleared and/or exotic vegetation.

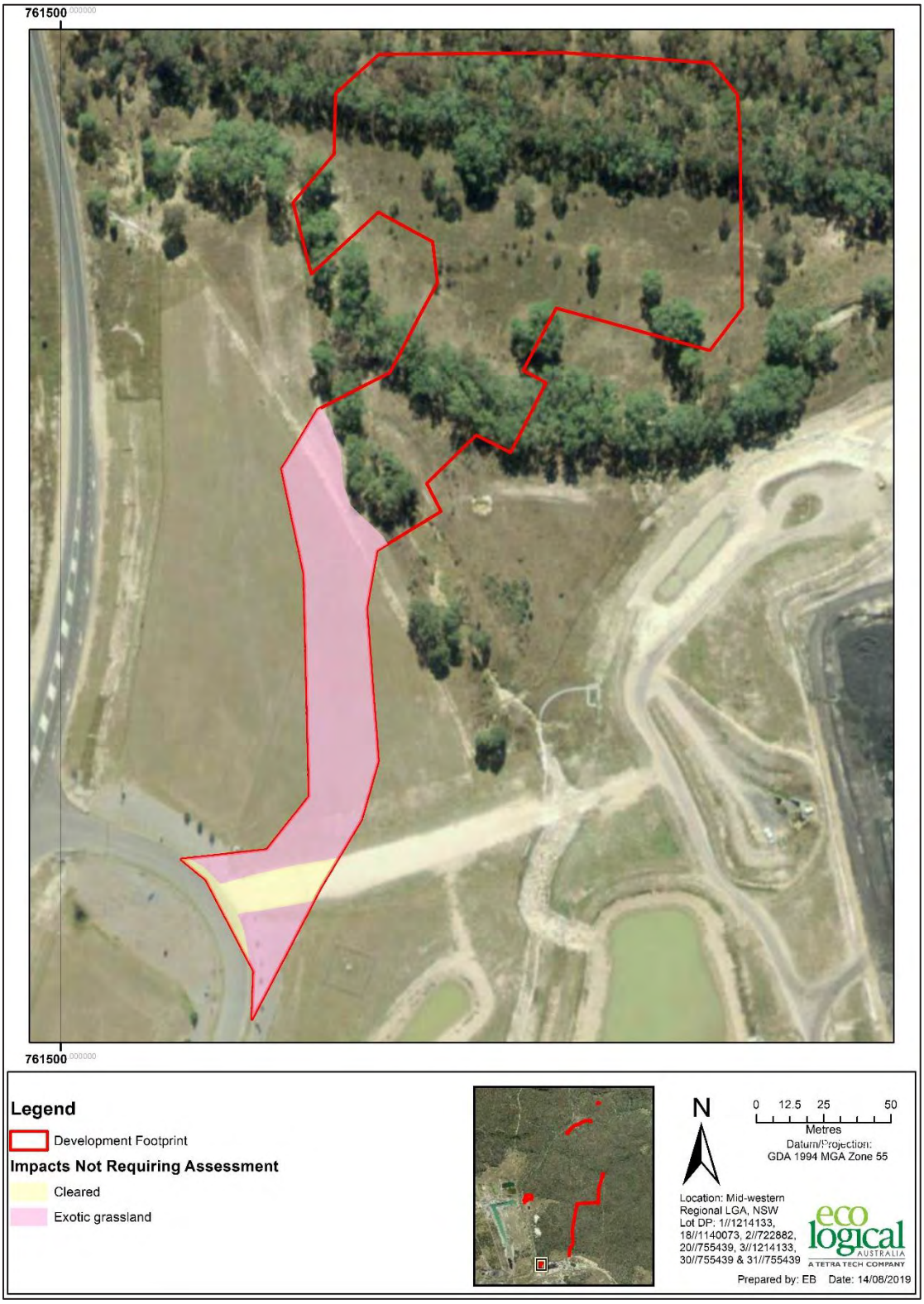


Figure 33: Areas not requiring offsets – RSIA

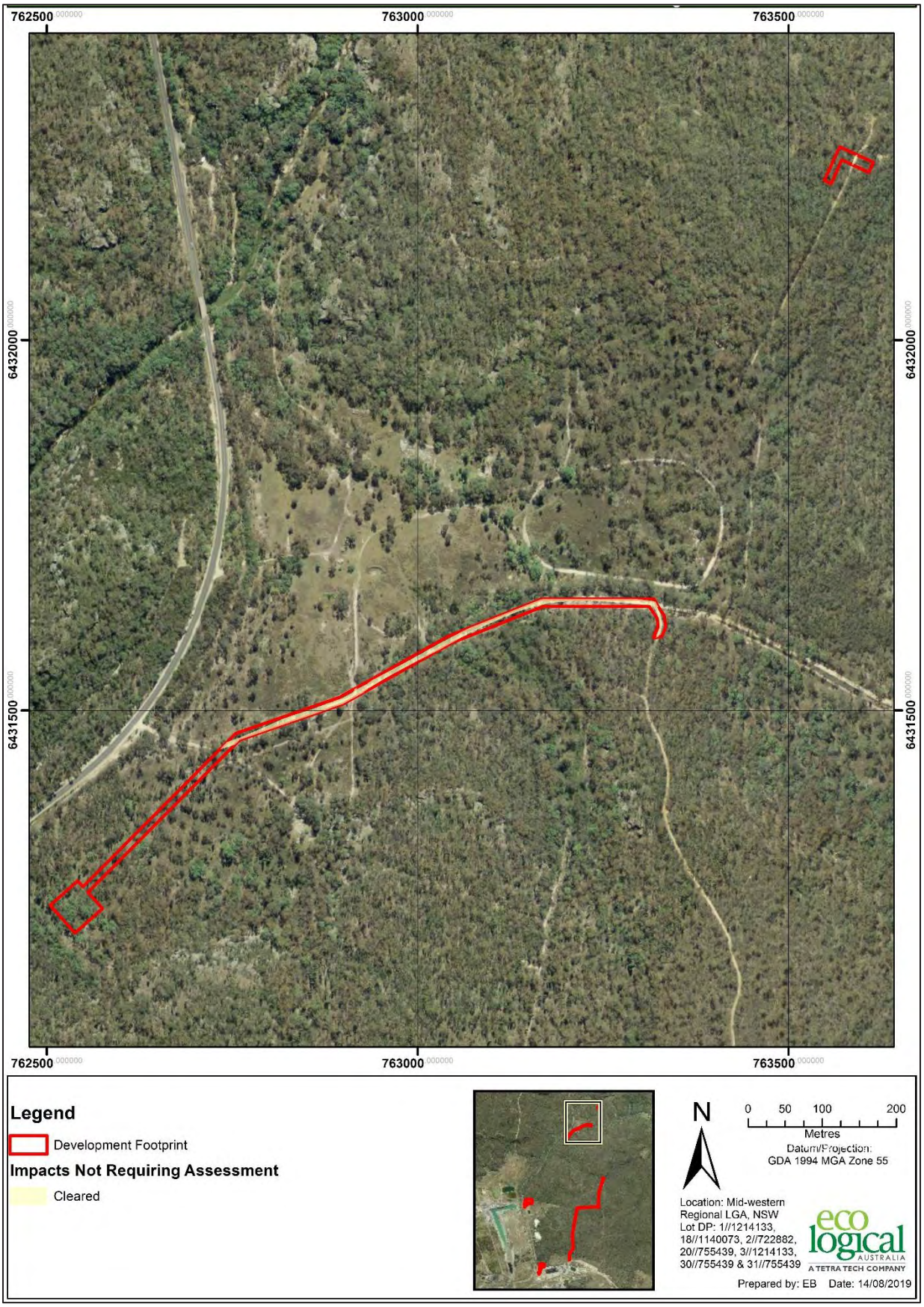


Figure 34: Areas not requiring offsets – northern dewatering site and access track

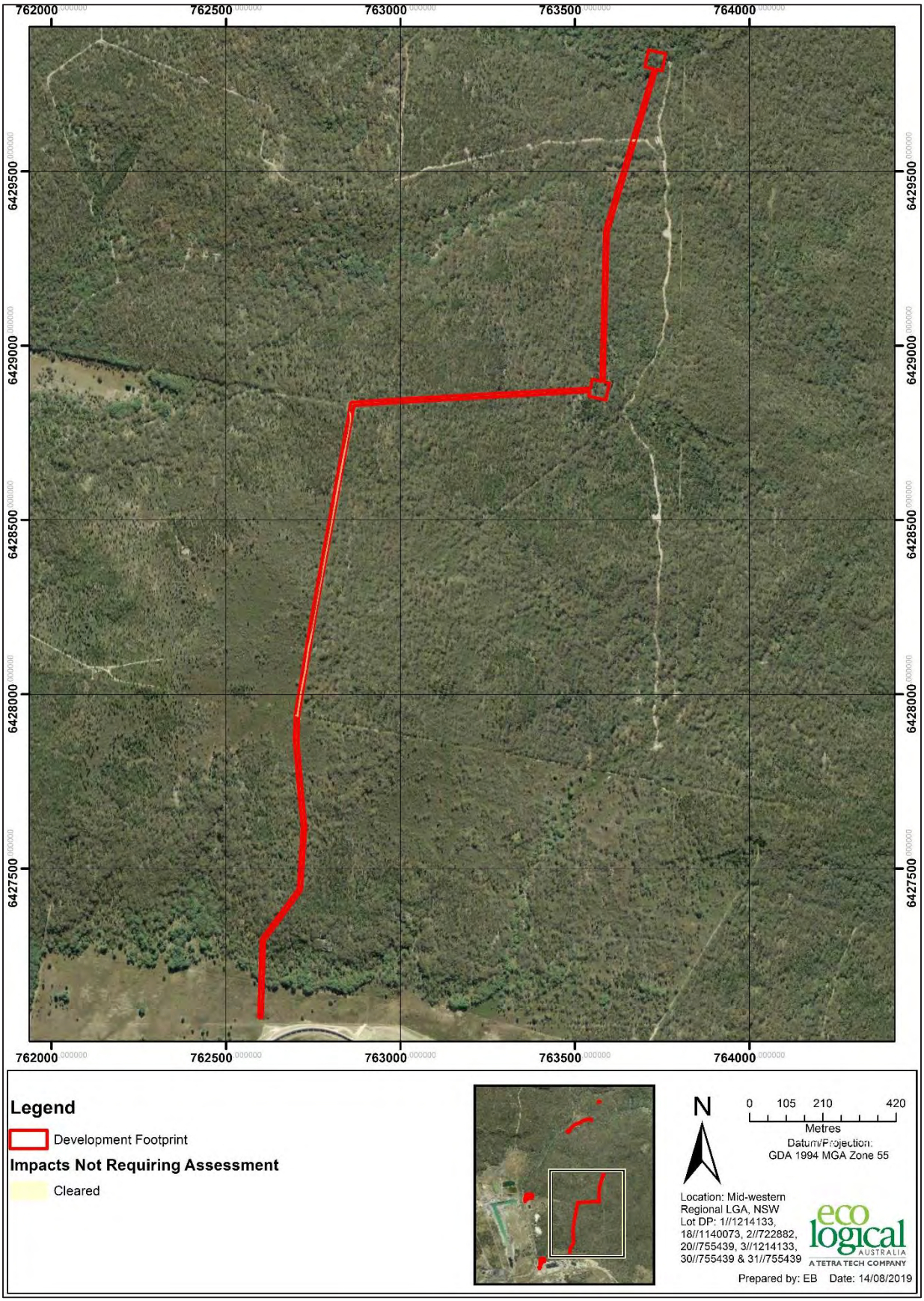


Figure 35: Areas not requiring offsets – southern dewatering site and access track

Figure 36: Areas not requiring assessment

2.3.5 Credit summary

The number of ecosystem credits required for the development are outlined in **Table 36**. The number of species credits required for the development are outlined in **Table 37**. A biodiversity credit report is included in **Appendix G**.

Table 36: Ecosystem credits required

PCT ID	PCT Name	Vegetation Formation	Direct impact (ha)^	Credits required
281	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Grassy Woodlands	2.5	42
479	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrubby sub-formation)	4	59
1711	Tantoon - *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin	Dry Sclerophyll Forests (Shrubby sub-formation)	0.5	10
Total				**111**

^ numbers have been rounded.

Table 37: Species credit summary

Species	Common Name	Direct impact	Credits required
Callocephalon fimbriatum	Gang-gang Cockatoo	0.43	9
Calyptorhynchus lathami	Glossy Black-Cockatoo	0.43	9
Chalinolobus dwyeri	Large-eared Pied Bat	4.21	135
Tylophora linearis		1.43	26
Vespadelus troughtoni	Eastern Cave Bat	4.21	135
TOTAL			**314**

3. Consistency with legislation and policy

Additional matters relating to impacts on flora and fauna which are not covered by the BC Act must also be addressed for the proposed development. Potential impacts on MNES in accordance with the EPBC Act and SEPP 44 Koala Habitat have been addressed below.

3.1.1 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where MNES may be affected. Under the Act, any action which 'has, will have, or is likely to have a significant impact on a matter of MNES' is defined as a 'controlled action', and requires approval from the Commonwealth Department of the Environment and Energy (DotEE), which is responsible for administering the EPBC Act (DotE 2013).

The process includes conducting an Assessment of Impact for listed threatened species and ecological communities that represent a MNES that will be impacted as a result of the proposed action. Significant impact guidelines (DotE 2013) that outline a number of criteria have been developed by the Commonwealth, to provide assistance in conducting the Assessment of Significance and help decide whether or not a referral to the Commonwealth is required.

Six MNES were assessed under the EPBC Act:

1. White Box Yellow Box Blakely's Red Gum Grassy Woodland DNG – listed as critically endangered under the EPBC Act
2. Painted Honeyeater - listed as vulnerable under the EPBC Act
3. Superb Parrot – listed as endangered under the EPBC Act
4. Corben's Long-eared Bat - listed as vulnerable under the EPBC Act
5. Large-eared Pied Bat- listed as vulnerable under the EPBC Act
6. White-throated Needletail – listed as vulnerable under the EPBC Act
7. Koala - listed as vulnerable under the EPBC Act.

No MNES was deemed to be significantly impacted by the proposed action. Details of the assessments are provided in **Appendix F**.

4. Conclusion

Eco Logical Australia has prepared this BDAR for MCO for the proposed Modification, required to allow for the construction of ancillary infrastructure for the operation of UG4. The purpose of this BDAR is to address the requirements of the BAM in assessing the impact of the Modification on biodiversity values.

Biodiversity impacts that are considered unavoidable for the Modification will include the removal of approximately 10 ha of native vegetation. Serious and Irreversible Impacts (SAII) values have been considered as part of this assessment.

Targeted surveys were initially undertaken to address candidate species credit species during August and November 2018. The development footprint was revised in 2019, and further targeted surveys and additional vegetation plots were undertaken in July and August 2019. Two threatened species credit species identified in the BAMC were outside the appropriate targeted survey period and have been assumed present due to the presence of suitable habitat.

Large-eared pied bat, Eastern Bent-wing Bat and Eastern Cave Bat were detected (or potentially detected) onsite using Anabat recordings and therefore, these species have been assumed to be present with breeding habitat occurring within 100 m of the proposed development footprint. Glossy Black Cockatoos were also identified in the development footprint and cannot be excluded from the assessment.

The credit requirements have therefore been defined as:

- 111 Ecosystem credits
- 314 Species credits

With the exception of the minimal disturbance (0.3 ha) to White Box Yellow Box Blakely's Red Gum Grassy Woodland CEEC, impacts to MNES are considered unlikely.

Mitigation measures have been outlined to reduce the impacts to biodiversity.

5. References

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Appendix A: Definitions

Terminology	Definition
Biodiversity credit report	The report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
BioNet Atlas	The BioNet Atlas (formerly known as the NSW Wildlife Atlas) is the OEH database of flora and fauna records. The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails) and some fish
Broad condition state:	Areas of the same PCT that are in relatively homogenous condition. Broad condition is used for stratifying areas of the same PCT into a vegetation zone for the purpose of determining the vegetation integrity score.
Connectivity	The measure of the degree to which an area(s) of native vegetation is linked with other areas of vegetation.
Credit Calculator	The computer program that provides decision support to assessors and proponents by applying the BAM, and which calculates the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Development	Has the same meaning as development at section 4 of the EP&A Act, or an activity in Part 5 of the EP&A Act. It also includes development as defined in section 115T of the EP&A Act.
Development footprint	The area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials.
Development site	An area of land that is subject to a proposed development that is under the EP&A Act.
Ecosystem credits	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.
High threat exotic plant cover	Plant cover composed of vascular plants not native to Australia that if not controlled will invade and outcompete native plant species.
Hollow bearing tree	A living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the minimum entrance width is at least 5 cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1 m above the ground. Trees must be examined from all angles.
Important wetland	A wetland that is listed in the Directory of Important Wetlands of Australia (DIWA) and SEPP 14 Coastal Wetlands
Linear shaped development	Development that is generally narrow in width and extends across the landscape for a distance greater than 3.5 kilometres in length
Local population	The population that occurs in the study area. In cases where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately.
Local wetland	Any wetland that is not identified as an important wetland (refer to definition of Important wetland).
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.

Terminology	Definition
Operational Manual	The Operational Manual published from time to time by OEH, which is a guide to assist assessors when using the BAM
Patch size	An area of intact native vegetation that: a) occurs on the development site or biodiversity stewardship site, and b) includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤30 m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the development site or stewardship site.
Proponent	A person who intends to apply for consent to carry out development or for approval for an activity.
Regeneration	The proportion of over-storey species characteristic of the PCT that are naturally regenerating and have a diameter at breast height <5 cm within a vegetation zone.
Riparian buffer	Riparian buffers applied to water bodies in accordance with the BAM
Sensitive biodiversity values land map	Development within an area identified on the map requires assessment using the BAM.
Site attributes	The matters assessed to determine vegetation integrity. They include: native plant species richness, native over-storey cover, native mid-storey cover, native ground cover (grasses), native ground cover (shrubs), native ground cover (other), exotic plant cover (as a percentage of total ground and mid-storey cover), number of trees with hollows, proportion of over-storey species occurring as regeneration, and total length of fallen logs.
Site-based development	a development other than a linear shaped development, or a multiple fragmentation impact development
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
Subject land	Is land to which the BAM is applied in Stage 1 to assess the biodiversity values of the land. It includes land that may be a development site, clearing site, proposed for biodiversity certification or land that is proposed for a biodiversity stewardship agreement.
Threatened Biodiversity Data Collection	Part of the BioNet database, published by OEH and accessible from the BioNet website.
Threatened species	Critically Endangered, Endangered or Vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as Critically Endangered, Endangered or Vulnerable.
Vegetation Benchmarks Database	A database of benchmarks for vegetation classes and some PCTs. The Vegetation Benchmarks Database is published by OEH and is part of the BioNet Vegetation Classification.
Vegetation zone	A relatively homogenous area of native vegetation on a development site, land to be biodiversity certified or a biodiversity stewardship site that is the same PCT and broad condition state.
Wetland	An area of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle. Wetlands may exhibit wet and dry phases and may be wet permanently, cyclically or intermittently with fresh, brackish or saline water
Woody native vegetation	Native vegetation that contains an over-storey and/or mid-storey that predominantly consists of trees and/or shrubs

Appendix B: Floristic Data

Species	E	HTW	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
Acacia buxifolia* subsp. *buxifolia			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0
Acacia gladiiformis			0.2	0.1	0	0.2	0.1	0.1	0	0	0.1	0	0.1	0	0.1	0.2	0.1	0	0	0	0	0	0	0
Acacia hakeoides			0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia leucolobia			0.2	0	0	0.2	2	0.1	0.1	0	0.1	0	0.2	0.2	0.5	0.5	0.1	0.1	0	0	0	0	0	0
Acacia linearifolia			0	0	0	0	0	0	0	0	0.3	1	0	0	0	0	0	0	0	0	0	0	0.1	1
Acacia spectabilis			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0
Acacia uncinata			0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0
Acetosella vulgaris	*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	0
Acrotriche rigida			0	0	0	0	0	0	0	0	0.5	0.2	0.2	0	1	0.1	0	0	0	0	0	0	0	3
Allocasuarina diminuta subsp. diminuta			0	0	0	0	0	0	0	0	0	4	0.5	0.2	0.2	10	30	0	0	0	0	0	0	0
Allocasuarina gymnanthera			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Allocasuarina luehmannii			0.1	0	0	0.2	1	0	0	0.5	0.3	0	0	0	0	0	0	0.5	0	0	0	0	0	0

Species	E	HTW	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
Amyema miquelii			0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0.1	0
Amyema pendula* subsp. *pendula			0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0.1	0	0	0	0	0	0	0.1
Amyema quandang* var. *quandang			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***Anagallis* spp.**	*		0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Angophora floribunda			5	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0.1	0	0	1	0.1	0.5
Aristida acuta			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	0	0	0	0
***Aristida* spp.**			2	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.2	0.5	0.5	0.5	0.1	0.1	20	2	2	4	0.1	0.1
Aristida vagans			0	0.1	0.5	0	0	0	0	0	0.1	0	0	0	0	0.1	0	0	0.5	0	0	0	0.1	0.1
Arundinella nepalensis			5	0.1	0	0	0	0.1	2	0	0.5	0	0.3	0	0	1	0.1	0	3	0	0	0	0	0
Asperula conferta			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
Astroloma humifusum			0	0	0	0	0	0	0	0	0.1	0	0	0	0	0.1	0.1	0.1	0	0	0	0.1	0	0
Austrostipa scabra* subsp. *scabra			0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bossiaea obcordata			0	0	0	0	5	0.1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bossiaea rhombifolia			0	0	0	10	0	0	0	0	0	0	0	0	0.1	0.2	0	0	0	0	0	0	0	0

Species	E	HTW	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
Bothriochloa macra			0	0	0.1	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	2	3	0	0.1	0.1
Brachyloma daphnoides* subsp. *daphnoides			0	0	0	0.1	0.1	0	10	0	0	0	0	0.3	0	0.1	0.1	0.1	0	0	0	0	0	0
Bursaria spinosa subsp. spinosa			0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Callitris endlicheri			0.5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	10	0	0	0	0	0	0
Calocephalus citreus			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0
Calotis cuneifolia			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0.1	0	0.1
***Calytrix* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calytrix tetragona			0.1	0	0	0	0	0.1	0.1	0.1	0	0.5	0.2	0.2	0.1	0.1	0.2	0.2	0	0	0	0	0	0
Capsella bursa-pastoris	*		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0
Cassinia sifton			20	10	30	0.1	0	0	0	0	0.1	0	0	0.1	0.1	0	0	0	1	0	0	0.1	1	0.3
Cassinia quinquefaria			0	0	0	0	0	0	0	15	0	0	0	0	0.2	0	0	0	0	0	0	0	0	2
Cassytha pubescens			0.1	0.1	0	0	0.1	0	0.1	0.1	0	0	0.1	0	0.1	0	0.1	0	0	0	0	0	0	0
Cheilanthes sieberi* subsp. *sieberi			0	0.1	0.1	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0.5	0.1	0	0.1	0.1	0

Species	E	HTW	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
Cheiranthera linearis			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
***Cleistochloa* spp.**			0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***Correa* spp.**			0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***Crassula* spp.**			0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cymbopogon refractus			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0
***Cyperaceae* spp.**			0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Desmodium varians			0	0	0	0	0	0	0	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0
Dianella revoluta* var. *revoluta			0.1	0	0	0.2	0.1	0	0	0	0	0	0.1	0	0.1	0.1	0	0.1	0	0	0	0	0	0.1
Dichelachne micrantha			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Digitaria brownii			0	0	0.1	0.1	0.1	0.1	0	0	0.1	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0
***Digitaria* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***Echinopogon* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0.1	0	0	0	0	0
Echium plantagineum	*		0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0.1	0.1	0	0	0
Einadia nutans* subsp. *nutans			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
***Epacris* spp.**			0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Species	E	HTW	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
Eragrostis brownii			0.2	0	0.1	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0	0	0	0	0	0	0
Eragrostis cilianensis	*		0	0.1	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eragrostis leptostachya			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***Eragrostis* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0.1	0	0	0	0
Eucalyptus agglomerata			0	0	0	0	0	0	0	7	1	0	0	0	0	0	0	5	0	0	0	0	0	0
Eucalyptus blakelyi			10	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0.7
Eucalyptus crebra			0	0.5	0	5	7	20	0	0.5	20	8	10	5	10	5	5	5	0	0	0	0	0	0
Eucalyptus dwyeri			0	0	0	0	0	0	0	5	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0
Eucalyptus fibrosa			0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0
Eucalyptus macrorhyncha			0	0	0	5	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	15
Eucalyptus melliodora			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Eucalyptus moluccana			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0
Eucalyptus parramattensis* subsp. *parramattensis			0	0	0	0	0	0	0	1	0	0	0	2	0	0	1	1	0	0	0	0	0	0
Eucalyptus rossii			0	0	0	5	7	0	5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

Species	E	HTW	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
***Euchiton* spp.**			0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exocarpos strictus			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0
Gahnia aspera			0	0	0	0	0.2	0.1	0.1	0	0.5	2	1	0	1	1	0	0	0	0	0.1	0	1	0.1
Glycine clandestina			0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
***Gnaphalium* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0
Gonocarpus elatus			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gonocarpus tetragynus			0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Goodenia hederacea* subsp. *hederacea			0	0	0	0	1	0.1	0	0	0	0	0	0.1	0.1	0.1	0.1	0	0	0	0	0.1	0.1	0
Grevillea ramosissima* subsp. *ramosissima			0	0	0	0.3	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0
Grevillea sericea* subsp. *sericea			0.3	0.1	0	0.2	0.1	0.1	0	0	0.1	0	0.2	0.1	0.1	0.2	0.1	0.1	0	0	0	0	0	0
Haloragis heterophylla			0.1	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harmogia densifolia			0	0	0	0	0.1	0	0	0	0	0	0	0.1	0	0.1	0.2	0	0	0	0	0	0	0
Heliotropium amplexicaule	*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0

Species	E	HTW	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
Hibbertia circumdans			0	0	0	0	0.2	0.1	0	0.2	0.2	0	0	0	0	0	0	0.1	0	0	0	0	0	0
Hibbertia obtusifolia			0	0	0	0.1	0.1	0.1	0.1	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0.1
Hibbertia riparia			0	0	0	0.2	0.1	0.1	0	0	0.1	0	0	0.1	0.1	0.2	0.1	0	0	0	0	0	0	0
***Hovea* spp.**			0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Hydrocotyle laxiflora			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0.1
Hypericum gramineum			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
Hypochaeris radicata	*		0	0	0	0	0	0	0	0.1	0	0	0	0	0	0.1	0	0	0.2	0.1	0.1	0.1	0	0.1
***Isopogon* spp.**			0	0	0	0	0.1	0	0.1	0	0	0	0	0	0	0.1	0.1	0	0	0	0	0	0	0
***Juncus* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	0
Laxmannia gracilis			0.1	0	0	0.1	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0.1	0.1	0
Leptospermum parvifolium			1	0.5	2	0	0	0	0	0.1	0	0.2	0	1	0.2	5	10	0.1	0	0	0	0	0	0
Leptospermum polygalifolium subsp. transmontanum			0	0	0	0	0	0	0	0	0.2	0	0.2	0	0	50	0.1	0	0	0	0	0	0	0
***Lepyrodia* spp.**			0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.2	0.2	0	0	0	0	0	0	0
Leucopogon attenuatus			0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0.2	0	0	0	0	0	0	0
Leucopogon muticus			0.1	0	0.1	0.2	1	0	0.5	10	0.3	5	0.5	5	10	2	7	15	0	0	0	0	0.1	0.1

Species	E	HTW	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
***Liliaceae* spp.**			0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lissanthe strigosa* subsp. *subulata			0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0	0	0	0.1	0	0	0	0	0.1	0
Lomandra confertifolia* subsp. *pallida			0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0
Lomandra filiformis* subsp. *filiformis			0.5	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0.1	0
Lomandra glauca			0.1	0	0	0.1	0.1	0	5	0	0.2	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0	0	0	0	0	0
Lomandra leucocephala* subsp. *leucocephala			0	0	0	0	0	0	0.1	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0
Lomandra multiflora* subsp. *multiflora			0.2	0.1	0	0.1	0.2	0.1	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0.1	3	1	0.1	0.1	0.1
Macrozamia secunda			0	0	0	0.1	0.1	0.1	0	0	0.1	0.2	0	0.1	0.1	0	0.2	0	0	0	0	0	0	0
***Melaleuca* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0
Melaleuca thymifolia			30	1	0.5	0	0	0	0	0	0.5	0	1	0	0	0.3	5	0	0	0	0	0	0	0
Melichrus erubescens			0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0.1	0.1
Melichrus urceolatus			0	0	0	0.1	0	0	0	0	0	0.1	0.1	0	0	0	0.1	0	0	0	0	0.1	0.1	0.1

Species	E	HTW	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
Microlaena stipoides* var. *stipoides			0	0	0	0	0	0.1	0	0.1	0.1	0.1	0.1	0	0	0	0.1	0	0.1	0	0	0	0.1	0
Monotoca scoparia			0	0	0	0	0	0	10	0	0	0	0	0.1	0.2	0	0	0.1	0	0	0	0	0	0
Monotoca scoparia			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Orchidaceae			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oxalis perennans			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0
***Oxalis* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0
Panicum effusum			0.1	0	0.1	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***Panicum* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0.1	0
Parentucellia latifolia	*		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0.1	0	0	0
Patersonia sericea			0	0	0	2	0	0	0.5	0	0	0	0	0	0.1	0.1	0	0.1	0	0	0	0	0	0.1
Persoonia curvifolia			0.1	0	0	0.1	0	0	0.2	0	0.1	0	0.1	0.2	0.1	0.1	0.1	0	0	0	0	0	0	0
Persoonia linearis			0.2	0	0	0.2	1	0	0	0.3	1	0	0.5	2	2	0.2	1	0.5	0.2	0	0	0	0.1	0.1
Phyllanthus hirtellus			0	0	0	0.1	0	0	0	0.1	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
Phyllanthus occidentalis			0	0	0	0.1	0	0	0	0	0	0	0	0.1	0.1	0.1	0	0.1	0	0	0	0	0	0.1
***Poaceae* spp.**			0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Species	E	HTW	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
Podolepis neglecta			0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***Podolepis* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Pomax umbellata			0	0	0	0.1	0	0.1	0	0.2	0.1	0.1	0	0.1	0.1	0	0.1	0	0	0	0	0	0	0.1
***Pultenaea* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0
Rytidosperma pallidum			0	0	0	2	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0
***Rytidosperma* spp A.**			0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0
***Rytidosperma* spp B.**			0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	1	0	1	0.1
Sannantha cunninghamii			1	0.5	0.2	0	0.5	0.1	0	0	0.1	0.2	10	0.1	0	0	0	0.1	0	0	0	0	0	0
Schoenus sIpp.			0	0	0	0	0.1	0	1	0	0	0	0	0.1	0.1	0.1	0.2	0.1	0	0	0	0	0	0
Setaria sIpp.			0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shrub (SG)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
Solanum spp.			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0
***Solenogyne* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
***Sonchus* spp.**			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0
Sporobolus creber			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***Stackhousia* spp.**			0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0
Stuartina muelleri			0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Species	E	HTW	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
Styphelia triflora			0.1	0	0	0.5	0.1	0	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0	0	0	0	0.1	0.1
Themeda triandra			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0
Vittadinia cervicularis* var. *cervicularis			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0
***Wahlenbergia* spp.**			0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
Xanthorrhoea johnsonii			0	0	0	0.5	2	0.1	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0

***E = exotic, HTW = high threat weeds**

Appendix C: Vegetation survey data

Plot Location Data						
Plot no.	**PCT**	**Vegetation Zone**	**Condition**	**Eastings**	**Northings**	**Bearing**
1	281	4	Good	762563.2	6431280	45.57
2	281	3	Moderate	762848.5	6431444	255.72
3	281	3	Moderate	762725.5	6431503	251.47
4	479	7	Good	763268.7	6431610	93.94
5	479	7	Good	763547.6	6432247	216.84
6	479	5	Low	763572.1	6432229	301.65
7	479	7	Good	763629.5	6429488	104.14
8	479	7	Good	763671.6	6429934	23.77
9	479	7	Good	763689.3	6429721	16.99
10	479	7	Good	763568.4	6429159	230.64
11	479	6	Moderate	763497.5	6428930	200.71
12	1711	8	Good	762726.6	6428308	230.64
13	1711	8	Good	762705.7	6428241	126.72
14	1711	8	Good	762711.8	6428128	66.41
15	1711	8	Good	762675.1	6427908	54.11
16	479	7	Good	762683.3	6427465	6.18
17	281	2	Low	762600.6	6427149	63.89
18	281	1	Cleared	761174.2	6428949	48.17
19	281	1	Cleared	761234.5	6429090	43.13
20	281	2	Low	761720.3	6426880	105.88
21	281	3	Moderate	761671.9	6426959	268.74
22	479	6	Moderate	761273	6429121	80.21

Composition (number of species)							Structure (Total cover)					
Plot no.	**Tree**	**Shrub**	**Grass**	**Forb**	**Fern**	**Other**	**Tree**	**Shrub**	**Grass**	**Forb**	**Fern**	**Other**
1	4	12	7	5	0	1	15.6	53.3	8.1	0.5	0.0	0.1
2	2	6	4	1	1	1	5.5	12.2	0.8	0.1	0.1	0.1
3	1	5	9	2	1	0	3.0	32.8	1.4	0.2	0.1	0.0
4	4	17	5	4	0	2	15.2	12.8	2.4	2.4	0.0	0.6
5	3	16	7	3	0	3	15.0	10.7	0.9	1.2	0.0	2.2
6	1	10	6	3	0	2	20.0	1.0	0.6	0.3	0.0	0.2

Composition (number of species)							Structure (Total cover)					
7	1	10	6	1	0	1	5.0	31.3	8.3	0.5	0.0	0.1
8	7	10	5	3	1	2	20.0	27.0	0.5	0.4	0.1	0.2
9	5	15	10	1	0	2	22.1	3.6	2.3	0.1	0.0	0.2
10	3	10	6	2	0	2	11.0	10.6	2.5	0.2	0.0	0.3
11	1	15	8	2	0	1	10.0	14.0	2.0	0.2	0.0	0.1
12	3	18	7	2	0	3	15.0	10.1	1.2	0.2	0.0	0.3
13	1	20	8	4	0	2	10.0	15.5	2.1	0.4	0.0	0.2
14	1	23	12	4	0	2	5.0	70.0	3.6	0.4	0.0	0.2
15	2	21	9	3	0	3	6.0	55.0	1.1	0.3	0.0	0.4
16	6	16	5	4	0	0	22.5	17.1	0.5	0.4	0.0	0.0
17	1	3	10	4	1	0	0.1	1.7	24.6	0.4	0.5	0.0
18	0	0	8	1	1	0	0.0	0.0	7.5	0.1	0.1	0.0
19	0	0	7	2	0	0	0.0	0.0	7.3	0.2	0.0	0.0
20	2	3	5	5	1	0	3.0	0.3	4.4	0.5	0.1	0.0
21	4	9	10	3	1	1	2.3	1.8	2.8	0.3	0.1	0.1
22	5	11	6	8	0	2	25.2	6.1	0.6	0.8	0.0	0.2

Function											
Plot no	**Large Trees**	**Hollow trees**	**Litter Cover**	**Length Fallen Logs**	**Tree Stem 5- 9 cm**	**Tree Stem 10-19 cm**	**Tree Stem 20-29 cm**	**Tree Stem 30-49 cm**	**Tree Stem 50-79 cm**	**Tree Regen**	**High Threat Weed Cover**
1	4	2	52	17	1	1	1	1	1	1	0.0
2	0	0	30	0	1	1	1	1	0	1	0.0
3	1	0	24	10	1	1	0	1	0	1	0.0
4	3	3	84	33	1	1	1	1	1	1	0.0
5	1	2	61	17	1	1	1	1	1	1	0.0
6	0	0	50	100	0	0	0	0	0	1	0.0
7	3	1	65	50	0	0	0	0	1	1	0.0
8	4	4	61	20	1	1	1	1	1	1	0.0
9	1	5	93	85	1	1	1	1	1	1	0.0
10	1	2	76	90	1	1	1	1	1	1	0.0
11	0	2	59	33	1	1	1	1	0	1	0.0
12	0	1	79	27	1	1	1	1	0	1	0.0
13	1	5	68	30	1	1	1	1	1	1	0.0

Function											
14	0	3	44	11	0	1	0	1	0	0	0.0
15	0	0	49	2	1	1	0	0	0	1	0.0
16	0	1	60	17	1	1	1	1	0	1	0.0
17	0	0	19	0	1	1	0	0	0	1	0.1
18	0	0	39	0	0	0	0	0	0	0	0.1
19	0	0	42	0	0	0	0	0	0	0	0.1
20	0	0	27.4	8	1	1	0	1	0	1	0.1
21	0	0	69.4	62	1	1	1	1	0	1	0.0
22	0	0	72.8	54	1	1	1	1	0	1	0.0

Appendix D: Microbat Ultrasonic Analysis Report

MCO UG4 Biodiversity Assessment Ultrasonic Analysis Report

Report completed 6 March 2019.

Eco Logical Australia Pty Ltd (ELA) was engaged by Moolarben Coal Operations (MCO) to analyse ultrasonic microchiropteran bat call data collected from two sites associated with UG4 of the Moolarben Coal Mine in central-western NSW for a pending biodiversity assessment.

This report outlines the methodology used and results of the data analysis.

Methods

Total survey was equivalent to three Anabat detector nights across two separate sites. The detectors were set to record data passively over a period of two consecutive nights at each site. Anabat 2 (SD2) recorded two nights of data between 31 October and 2 November 2018 and Anabat 4 (SD2) only recorded data on 4 January 2019. The UG4 study area is characterised by dry sclerophyll wood land and derived native grassland communities with the woodland areas tending to be on sloped to steeply sloped terrain. For a detailed description of the vegetation community and structure present at the survey sites refer to the main report.

Data Analysis

Bat calls were analysed by Alicia Scanlon from Eco Logical Australia using the program AnalookW (Version 4.2z 19 September 2017, written by Chris Corben, www.hoarybat.com). Call identifications were made using regional based guides to the echolocation calls of microbats in New South Wales (Pennay et al 2004); and south-east Queensland and north-east New South Wales (Reinhold et al 2001) and the accompanying reference library of over 200 calls from Sydney Basin, NSW (which is available at http://www.forest.nsw.gov.au/research/bats/default.asp). Alicia has over eleven years of experience in the identification of ultrasonic call recordings. This report and a sample of the calls was reviewed by Rodney Armistead, who has 5 years' experience in the identification of ultrasonic call recordings. The report was further reviewed by Greg Ford, Principal Ecologist and Director of Balance! Environmental.

Bat calls were analysed using species-specific call profile parameters including call shape, characteristic frequency, initial slope and time between pulses (Reinhold et al 2001). To ensure reliable and accurate results the following protocols (adapted from Lloyd et al 2006) were followed:

- Search phase calls were used in the analysis, rather than cruise phase calls or feeding buzzes (McKenzie et al 2002). Cruise phase or feeding calls were labelled as being unidentifiable.
- Recorded calls containing less than three pulses were not analysed and these sequences were labelled as unidentifiable as they are too short to confidently determine the identity of the species making the call (Law et al 1999).
- For those calls that were useful to identify the species making the call, two categories of confidence were used (Mills et al 1996):
    - Definitely present – the quality and structure of the call profile is such that the identity of the bat species making the calls is not in doubt
    - Potentially present – the quality and structure of the call profile is such that there is some / low probability of confusion with species that produce similar calls profiles

- Calls made by bats which cannot be used for identification purposes such as social calls, short and low-quality calls, cruise and approach phase calls were labelled as unidentifiable.
- Sequences of inferior quality were labelled as unidentifiable as it is not possibly to be identified to microbat species making the call. These calls were however retained in the data as they can be used as an indicator of microbat activity at the site.
- *Nyctophilus* spp. (Long-eared bats) are difficult to identify or separate confidently to species level based upon their recorded calls. Therefore, we have made no attempt to identify any recorded *Nyctophilus* spp. calls to species level (Pennay et al 2004). There are three potential *Nyctophilus* species that could occur in the study area. Two species, *N. geoffroyi* (Lesser Long-eared Bat) and *N. gouldii* (Gould's Long-eared Bat) are relatively common and widely distributed across NSW but the third ***N. corbeni*** **(Corben's Long-eared Bat)** is listed as vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). According to Churchill (2008), Penny et al. (2011) and the Department of the Environment and Energy Species Profile and Threats Database **Corben's Long-eared Bat** and potential habitat for this species is likely to occur within the locality of the study area. Whilst we cannot reliably identify which *Nyctophilus* species is responsible for the recorded calls in the current data set, we also cannot discount the possibility that some of these recorded *Nyctophilus* calls are being made by **Corben's Long-eared Bat**. Therefore, where *Nyctophilus* spp. calls were recorded, we have included this species as potentially being present within the MCO UG4 study area. To confirm the presence / absence of this species at any of the MCO UG4 sites would require use of mist or harp traps to conduct live capture and release. These surveys would need to fulfil the survey requirements present in Commonwealth of Australia (2010) Survey guidelines for Australia's threatened bats. For further information regarding the distribution of this species, please refer to the following link, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=83395 to confirm.
- The Free-tailed Bats (previously referred to as the genus *Mormopterus*) have recently undergone taxonomic revision (Reardon et al 2014) and published reference calls for this group of species (Pennay et al 2004) are believed to contain errors (Greg Ford pers comm.). This report uses nomenclature for Free-tailed Bat species as referred to in Jackson and Groves (2015). The correlation between nomenclature used in this report and that used in NSW State legislation is presented in **Table 1** below. All Free-tailed Bats in the new genus *Ozimops* have potentially overlapping calls and could occur within the UG4 survey area. Within this report these three species will therefore be referred to as *Ozimops* species complex. This species grouping includes *Ozimops petersi* (Inland Free-tailed Bat), *O. planiceps* (Southern Free-tailed Bat) and *O. ridei* (Ride's Free-tailed Bat).
- Sequences not attributed to microbat echolocation calls (e.g. insect buzzes, wind, train and vehicle movement) were dismissed from the analysis.

Table 1: Correlations between current and previous nomenclature for the Free-tailed bats of NSW

Jackson and Groves 2015	Previously known as	Common Name	BC Act
Austronomus australis	*Tadarida australis*	White-striped Free-tailed Bat	
Micronomus norfolkensis	***Mormopterus norfolkensis***	**Eastern Coastal Free-tailed Bat**	**Vulnerable**
Ozimops petersi	*Mormopterus species 3 (small penis)*	Inland Free-tailed Bat	
Ozimops planiceps	*Mormopterus species 4 (long penis eastern form)*	Southern Free-tailed Bat	
Ozimops ridei	*Mormopterus species 2*	Ride's Free-tailed Bat	
Setirostris eleryi	***Mormopterus species 6***	**Bristle-faced Free-tailed Bat**	**Endangered**

Results

Species identified

There were 3,276 call sequences recorded during this survey. Of these, 2,307 (71%) were deemed to be useful because the call profile was of sufficient quality or length to enable positive identification of a bat to genus or species. The remaining 969 (29%) call sequences were either too short or of low quality, thus preventing positive identification of bat species. There was microbat activity, but very few identifiable calls recorded on AB4 due to the high levels of background noise recorded with the data.

There were at least 12 and up to 18 species recorded in this survey (**Table 2)**. Up to five species listed as vulnerable under the NSW BC Act were recorded (**Table 2**, **Figure 1** to **Figure 15**). Three threatened species were confidently recorded during this survey;

- ***Chalinolobus dwyeri*** **(Large-eared Pied Bat)**
- ***Miniopterus orianae oceanensis*** **(Eastern Bent-winged Bat)**
- ***Saccolaimus flaviventris*** **(Yellow-bellied Sheath-tailed bat)**

The quality, shape and characteristic frequency (defining features) of calls assigned to the two threatened species listed below were such that we cannot be certain of their presence within the subject site. Consequently, these species were labelled as being potentially present only. This is because the defining features of the call profiles assigned to these threatened microbats overlap with other more common and non-threatened species. The two microbat species listed below are known to occur within 10 km of the UG4 study area and consequently, may be present at the survey sites. The two threatened species recorded as being potentially present were;

- ***Nyctophilus corbeni*** **(Corben's Long-eared Bats)**
- ***Vespadelus troughtoni*** **(Eastern Cave Bat)**

The **Large-eared Pied Bat** is a subterranean roosting species known to roost in caves, crevices, cliffs and mins as well as in fairy martin nests (Churchill, 2008). This species has been recorded within 5 km of the Moolarben Coal Mine UG4 study area and forages over dry sclerophyll forests and woodland as well as Callitris dominated forest, generally within 2 km of sandstone escarpments or outcrops (Churchill, 2008). Only two (one definite and one potential) call sequences from this species were recorded within the UG4 dataset.

Eastern Bent-winged Bats are another subterranean roosting species known from within 10 km of the UG4 study area. **Eastern Bent-winged Bats** congregate in large numbers at a few maternity caves over spring and summer to breed and raise young and disperse to winter hibernation roosts up to 300 km away from maternity roosts in autumn (Churchill, 2008). **Eastern Bent-winged Bats** forage over the UG4 study area and may roost in caves or old mine workings in the region.

Yellow-bellied Sheath-tailed Bats migrate into temperate southern Australian regions from the tropics during summer when birth of the young occurs (Churchill, 2008). This species roosts in tree hollows and forages widely over many habitat types (Churchill, 2008). It is possible that **Yellow-bellied Sheath-tailed Bats** use tree hollows within the UG4 study area for roosting and birth of young and forage over the entire study area. Only two (one definite and one potential) call sequences from this species were recorded within the UG4 dataset.

Corben's Long-eared Bat is also listed as vulnerable under the EPBC Act. As stated above, the calls of *Nyctophilus* spp. cannot be used to identify individual species. **Corben's Long-eared Bat** is known to occur in the area where surveys were undertaken, and it has therefore been assumed that this threatened species may be present within the UG4 study area. This species roosts in tree hollows, fissures and cracks in trees and under loose bark (Churchill, 2008).

The calls of the **Eastern Cave Bat** are difficult to separate from those of the more common *Vespadelus vulturnus* (Little Forest Bat). Both species are known to occur within 10 km of the Moolarben Coal Mine UG4 study area. **Eastern Cave Bats** are a subterranean roosting species know to roost in sandstone outcrops, mines, boulder piles and have also been known to roost in buildings (Churchill, 2008). They forage in areas containing sandstone outcrops or volcanic escarpments (Churchill, 2008). It is possible that the **Eastern Cave Bat** is present within the UG4 study area.

See the Survey Limitations section provided below for further information on species identifications and overlapping call profiles.

Table 2: Microbat species list derived from ultrasonic call recordings taken at Moolarben Coal Mine, UG4, Sites AB2 (31 October – 2 November 2018) and AB4 (4 January 2019).

Scientific Name	Common Name	AB2	AB4
Austronomus australis	White-striped Free-tailed Bat	X	
Chalinolobus dwyeri*	**Large-eared Pied Bat**	**X**	
Chalinolobus gouldii	Gould's Wattled Bat	X	P
Chalinolobus morio	Chocolate Wattled Bat	X	P
Miniopterus orianae oceanensis*	**Eastern Bent-winged Bat**	**X**	P
Nyctophilus spp. In this region *N. geoffroyi, N. gouldii* and the threatened ***N. corbeni****[1] are likely to be present.	In this region Lesser, Gould's and the threatened **Corben's Long-eared Bats** are likely to be present.	X	
Ozimops species complex. In this region the *O. petersi*, *O. ridei* and *O. planiceps.*	In this region the Inland, Ride's and South-eastern Free-tailed Bat are likely to be present.	X	P
Rhinolophus megaphyllus	Eastern Horseshoe Bat	X	
Saccolaimus flaviventris*	**Yellow-bellied Sheath-tailed Bat**	**X**	
Scotorepens balstoni	Inland Broad-nosed Bat	X	

Scientific Name	Common Name	AB2	AB4
Vespadelus darlingtoni	Large Forest Bat	P	
Vespadelus regulus	Southern Forest Bat	P	P
Vespadelus troughtoni*	**Eastern Cave Bat**	**P**	**P**
Vespadelus vulturnus	Little Forest Bat	X	P

X = Definitely present, P = Potentially present. *listed as threatened under the BC Act and [1] listed as threatened under the EPBC Act

Activity and foraging

The most common species that were recorded were *Chalinolobus gouldii* (Gould's Wattled Bat), *Vespadelus regulus* (Southern Forest Bat) / *Vespadelus vulturnus* (Little Forest Bat) and *Scotorepens balstoni* (Inland Broad-nosed Bat) respectively.

Very low microbat activity levels were recorded at Site AB4 with calls recorded less often than every thirty minutes on average throughout the survey period (9 poor quality calls over 12 hours, **Table 3**). Microbat activity was extremely high at Site AB2, where at least two calls were recorded every minute on average, throughout the survey period (3,267 calls over 24 recording hours, **Table 4**). Very high levels of background noise were recorded at both survey sites.

Some long sequences and multiple feeding buzzes were observed in the data set, particularly from Gould's Wattled Bat, Inland Broad-nosed Bat, the *Ozimops* species complex and the *Vespadelus* group of species.

The presence of feeding buzzes indicate that bats were actively foraging at Site AB2. The lack of feeding buzzes observed for other species / sites could be due to any of the following;

- sample size for the less common species was too small with fewer calls recorded and less opportunity of capturing a feeding buzz,
- little or no foraging activity was being undertaken by the other species or at other sites,
- foraging activity was not occurring close enough to the detector for it to record feeding buzzes,
- the weather conditions were not favourable for the recording of the lower intensity feeding calls,
- characteristic features of the feeding buzz are either not detected by the recording device or lost during the process of converting WAV files into ZC files. or
- bats were predominantly commuting through these areas.

Careful interpretation of these results is recommended because microbat activity at a site is a result of a multitude of factors. Activity can only be measured in a relative sense since it is impossible to determine whether each call is being made by a different bat or the same bat flying past the recorder multiple times. Habitat characteristics vary markedly between sites as do the prevailing microclimatic conditions and both of these can influence the availability of insect prey and the suitability of a site as foraging habitat.

Table 3: Microbat species recorded ultrasonically at Moolarben Coal Mine UG4 Site AB2 31 October – 2 November 2018.

Scientific Name	Common Name	Definitely present	Potentially present	Total
Austronomus australis	White-striped Free-tailed Bat	10		10
Chalinolobus dwyeri*	**Large-eared Pied Bat**	1	1	2
Chalinolobus gouldii	Gould's Wattled Bat	734		734
Chalinolobus gouldii / Ozimops species complex	Gould's Wattled Bat / Inland Free-tailed Bat / Ride's Free-tailed Bat / Southern Free-tailed Bat			78
Chalinolobus gouldii / Scotorepens balstoni	Gould's Wattled Bat / Inland Broad-nosed Bat			27
Chalinolobus morio	Chocolate Wattled Bat	9		9
Miniopterus orianae oceanensis*	**Eastern Bent-winged Bat**	6		6
Miniopterus orianae oceanensis* / *Vespadelus darlingtoni / Vespadelus regulus / Vespadelus vulturnus*	**Eastern Bent-winged Bat** / Large Forest Bat / Southern forest Bat / Little Forest Bat			254
Miniopterus orianae oceanensis* / *Vespadelus regulus / Vespadelus vulturnus*	**Eastern Bent-winged Bat** / Southern forest Bat / Little Forest Bat			235
Nyctophilus spp. In this region *N. geoffroyi, N. gouldii* and the threatened ***N. corbeni****[1] are likely to be present.	In this region Lesser, Gould's and the threatened Corben's Long-eared Bats are likely to be present	14		14
Ozimops species complex. In this region *O. petersi, O. planiceps* and *O. ridei.*	In this region the Inland, South-eastern and Ride's Free-tailed Bat are likely to be present			73
Rhinolophus megaphyllus	Eastern Horseshoe Bat	7		7
Saccolaimus flaviventris*	**Yellow-bellied Sheath-tailed Bat**	1	1	2
Scotorepens balstoni	Inland Broad-nosed Bat	206		206
Vespadelus darlingtoni / Vespadelus regulus	Large Forest Bat / Southern Forest Bat			142
Vespadelus darlingtoni / Vespadelus regulus / Vespadelus vulturnus	Large Forest Bat / Southern Forest Bat / Little Forest Bat			40
Vespadelus regulus / Vespadelus vulturnus	Southern Forest Bat / Little Forest Bat			442
Vespadelus troughtoni* / *Vespadelus vulturnus*	**Eastern Cave Bat** / Little Forest Bat			5

Scientific Name	Common Name	Definitely present	Potentially present	Total
Vespadelus vulturnus	Little Forest Bat			19
Unidentifiable calls				962
Total identifiable calls				2305
Total calls				3267
Percentage identifiable calls				71%

*** listed as vulnerable under the BC Act and [1] listed as vulnerable EPBC Act**

Table 4: Microbat species recorded ultrasonically at Moolarben Coal Mine UG4 Site AB4 4 January 2019.

Scientific Name	Common Name	Definitely present	Potentially present	Total
Chalinolobus gouldii / Ozimops species complex.	Gould's Wattled Bat / Inland Free-tailed Bat / Ride's Free-tailed Bat / South-eastern Free-tailed Bat		4	4
Chalinolobus morio / ***Vespadelus troughtoni**** / *Vespadelus vulturnus*	Chocolate Wattled Bat / **Eastern Cave Bat** / Little Forest Bat		2	2
Miniopterus orianae oceanensis* / *Vespadelus regulus / Vespadelus vulturnus*	**Eastern Bent-winged Bat** / Southern forest Bat / Little Forest Bat		3	3
Unidentifiable calls				
Identifiable Calls				9
Total calls				
Percentage identifiable calls				

Survey Limitations

The calls of Gould's Wattled Bat, Inland Broad-nosed Bat and the *Ozimops* species complex can be difficult to separate. Calls were identified as *Ozimops* species complex when the call shape was flat (slope S1 of less than 100 OPS generally) and the frequency was between 24 – 36 kHz. Gould's Wattled Bat was distinguished by a frequency of 27.5 – 32.5 kHz and alternation in call frequency between pulses. Inland Broad-nosed Bat calls have a slope of greater than 200 OPS, are non-alternating and fall between 29 and 34 kHz. When no distinguishing characteristics were present calls were assigned to multi-species groups.

The calls of ***Falsistrellus tasmaniensis*** **(Eastern False Pipistrelle),** ***Scoteanax rueppellii*** **(Greater Broad-nosed Bat)**, *Scotorepens orion* (Eastern Broad-nosed Bat) and *Scotorepens balstoni* (Inland Broad-nosed Bat) can be difficult to separate as their call frequencies and some other call characteristics overlap.

- **Greater Broad-nosed Bats** can be distinguished by a frequency of 32.5 – 36 kHz, lack of a tail or short down-sweeping tail, frequency of the knee greater than 37 kHz, and drop of more than 3 kHz from the knee to the characteristic section. The UG4 study area is beyond the current western limit of records for the **Greater Broad-nosed Bat in this area with nearest records** from Goulburn River National Park 20km to the east.

- **Eastern False Pipistrelle** bat calls have a characteristic frequency between 35.5 and 40.5 kHz, display curved, often steep pulses without up-sweeping tails and sometimes with down-sweeping tails. The pre-characteristic section is often long. This species can only be separated from Eastern Broad-nosed Bat when calls are above 37 kHz. There are no records nor any suitable habitat for **Eastern False Pipistrelle** within 10 km of the UG4 study area as this species prefers tall wet forests where trees are more than 20 m high (Churchill, 2008). As a result, this species has been discounted from the analysis.

- Eastern Broad-nosed Bat calls fall between 34.5 and 37 kHz but can only be separated from Eastern False Pipistrelle when calls are between 34 and 35 kHz, and the frequency of the knee is above 38 kHz.

- Inland Broad-nosed Bat calls fall between 28 and 34 kHz, are curved with no tail or a down-sweeping tail, have a slope of greater than 200 OPS and are non-alternating.

Greater Broad-nosed Bat calls (32.5 – 36 kHz) can be distinguished from Eastern Broad-nosed Bat (34 -37.5 kHz) and Inland Broad-nosed Bat when the frequency of the knee is above 37kHz and there is a drop of more than 3 kHz from the knee to the characteristic section. Eastern Broad-nosed Bat calls often display a frequency of the knee greater than 37 kHz (Pennay et al. 2002). When calls display a range of characteristics they are assigned mixed species labels.

In this geographic region, calls of **Eastern Bent-winged Bat** overlap in frequency with those of *Vespadelus darlingtoni* (Large Forest Bat), *Vespadelus regulus* (Southern Forest Bat) and *Vespadelus vulturnus* (Little Forest Bat). **Eastern Bent-winged Bat** calls (43 – 48.5 kHz) were distinguished by the following characteristics: a down-sweeping tail, drop of more than 2 kHz in the pre-characteristic section, and the pulse shape and time between calls was variable. The Little Forest Bat calls between 42 and 48 kHz in this region, Southern Forest Bat calls between 45 and 47 kHz and Large Forest Bat calls between 41 and 44 kHz. All three *Vespadelus* species have curved calls, a regular pulse shape and up-sweeping tails or no tails. When no distinguishing characteristics were present calls were assigned to multi-species groups.

Calls of Little Forest Bat, **Eastern Cave Bat** and *Chalinolobus morio* (Chocolate Wattled Bat) overlap in the range 47 – 53 kHz. Chocolate Wattled Bat calls have a down-sweeping tail whereas **Eastern Cave Bat** and Little Forest Bat calls have an up-sweeping tail. When no distinguishing characteristics were present calls were assigned to multi-species groups or characterized as unidentifiable.

The calls of **Southern Myotis** and the *Nyctophilus* group of species are difficult to separate. Southern Myotis is not known to occur west of the Great Dividing Range in the region surrounding the Moolarben Coal Mine. All vertical shaped calls were therefore identified as *Nyctophilus* spp.

Example Call Profiles

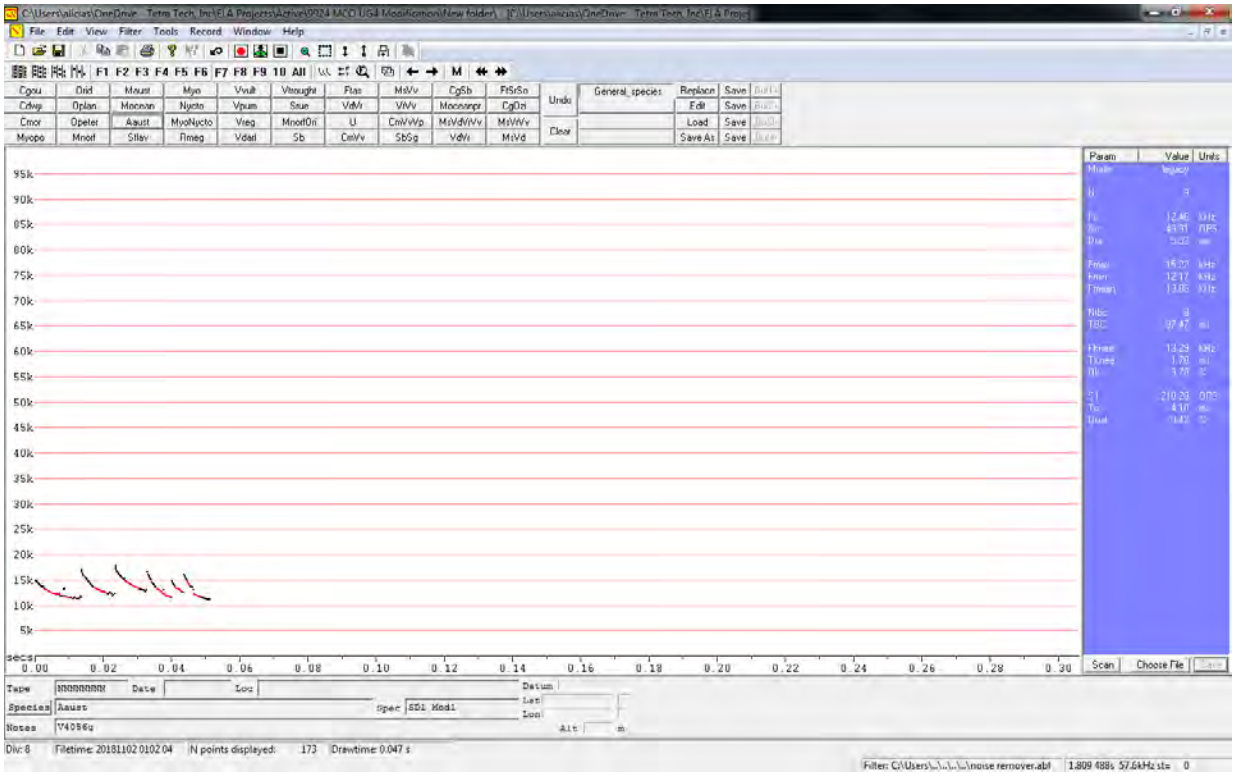

Figure 1: Call profile for *Austronomus australis* (White-striped Free-tailed Bat) recorded at Moolarben Coal Mine UG4 Site AB2 at 0102 (01.02 am) on 2 November 2018

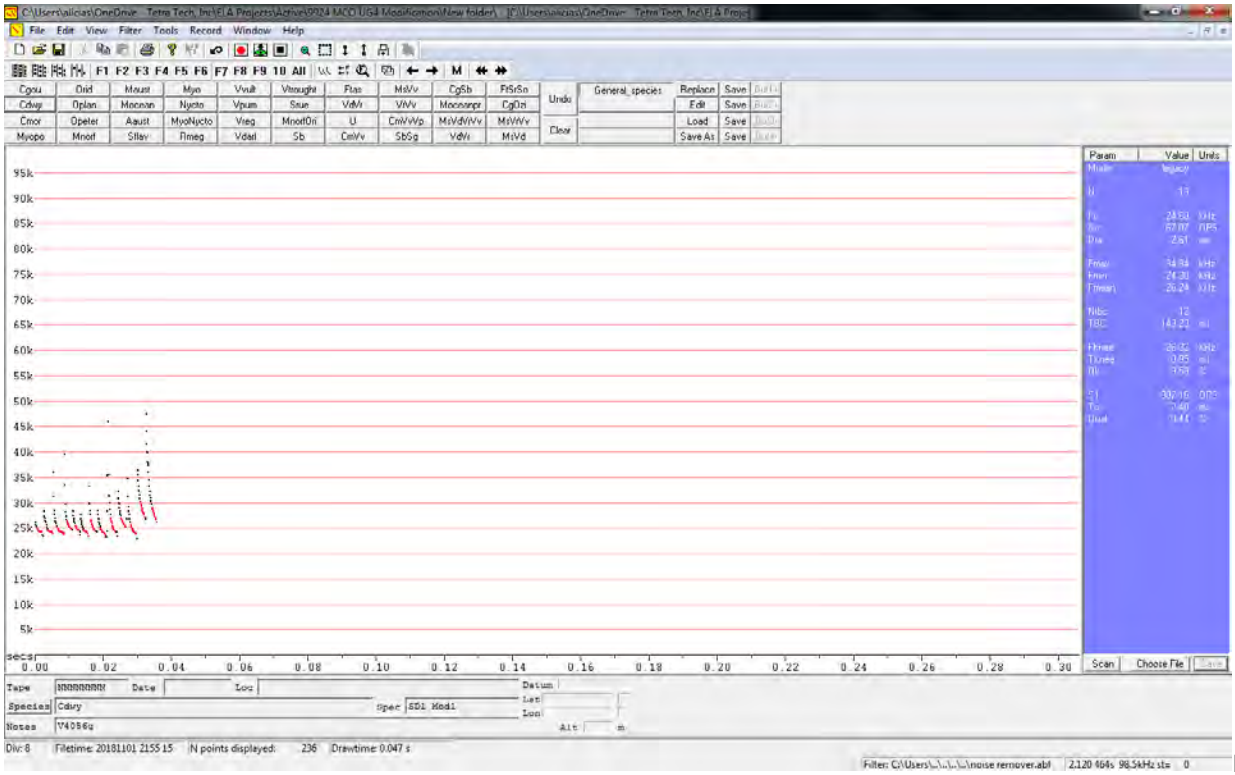

Figure 2: Call profile for *Chalinolobus dwyeri* (Large-eared Pied Bat) recorded at Moolarben Coal Mine UG4 Site AB2 at 2155 (9.55 pm) on 1 November 2018

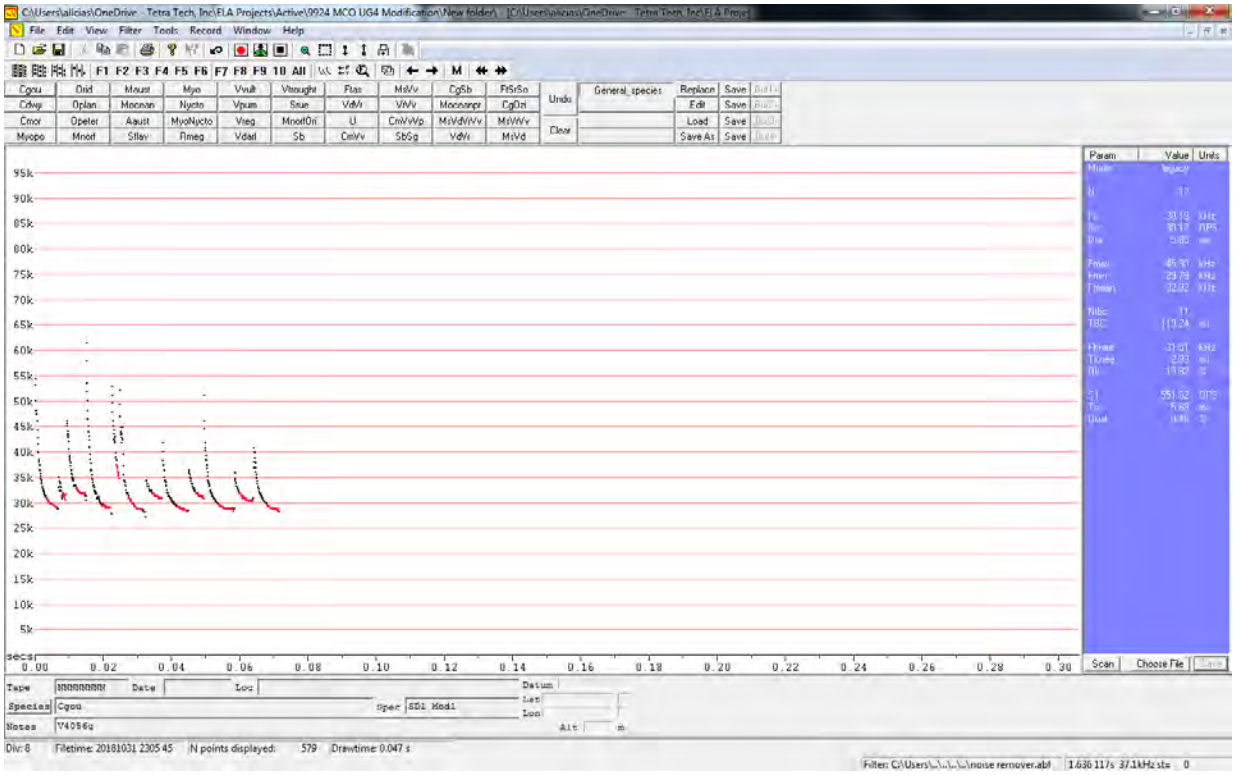

Figure 3: Call profile for *Chalinolobus gouldii* (Gould's Wattled Bat) recorded at Moolarben Coal Mine UG4 Site AB2 at 2305 (11.05 pm) on 31 October 2018

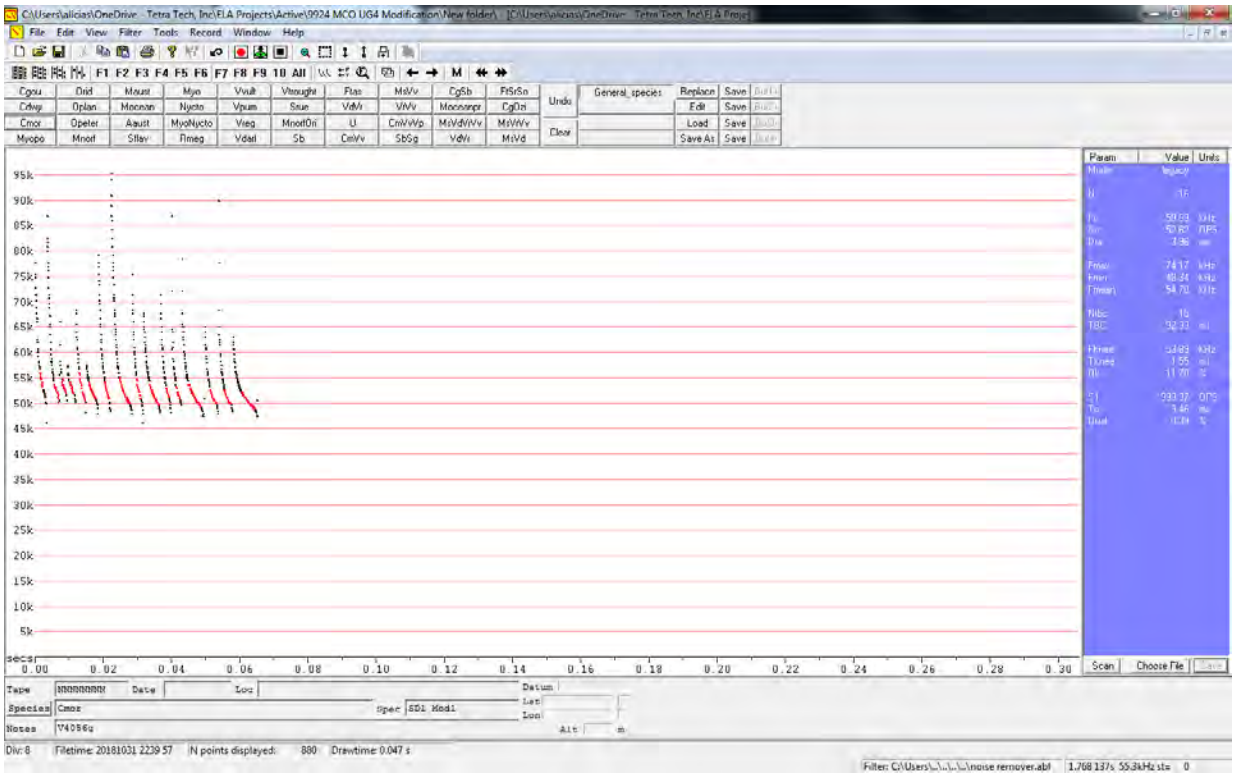

Figure 4: Call profile for *Chalinolobus morio* (Chocolate Wattled Bat) recorded at Moolarben Coal Mine UG4 Site AB2 at 2239 (10.39 pm) on 31 October 2018

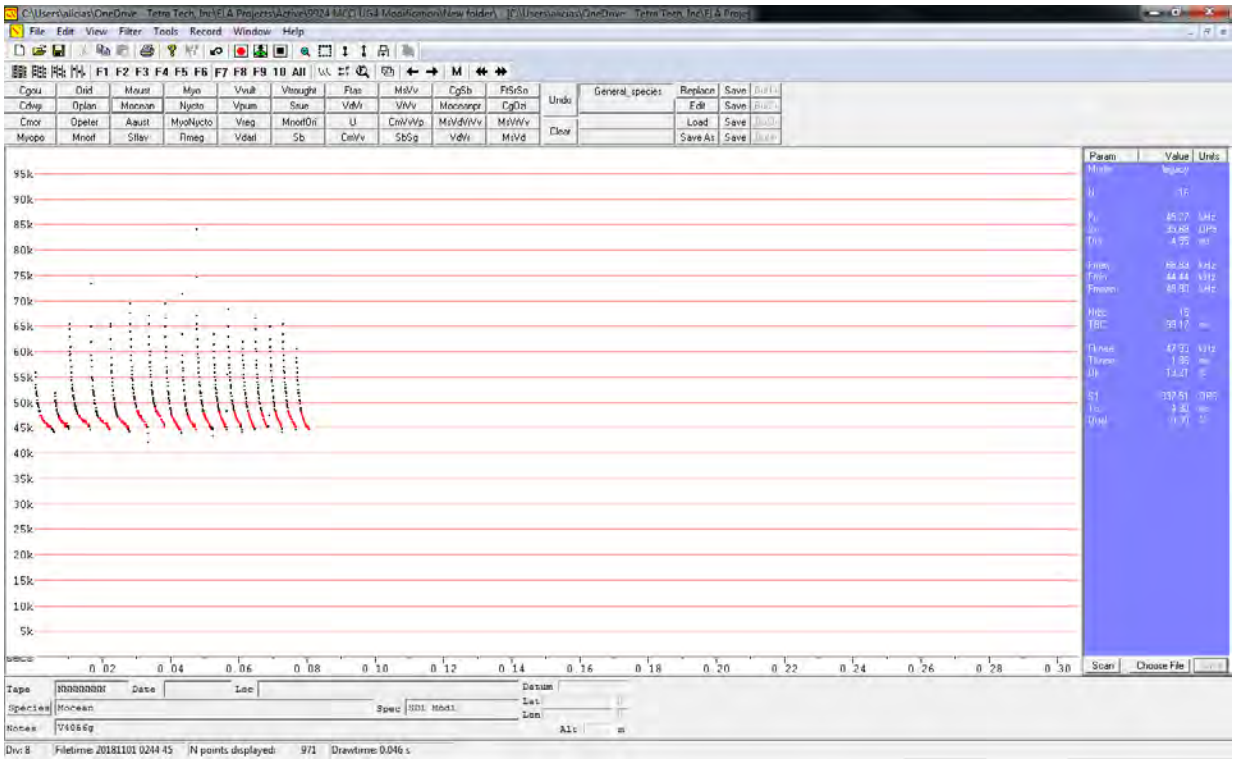

Figure 5: Call profile for *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat) recorded at Moolarben Coal Mine UG4 Site AB2 at 0244 (2.44 am) on 1 November 2018.

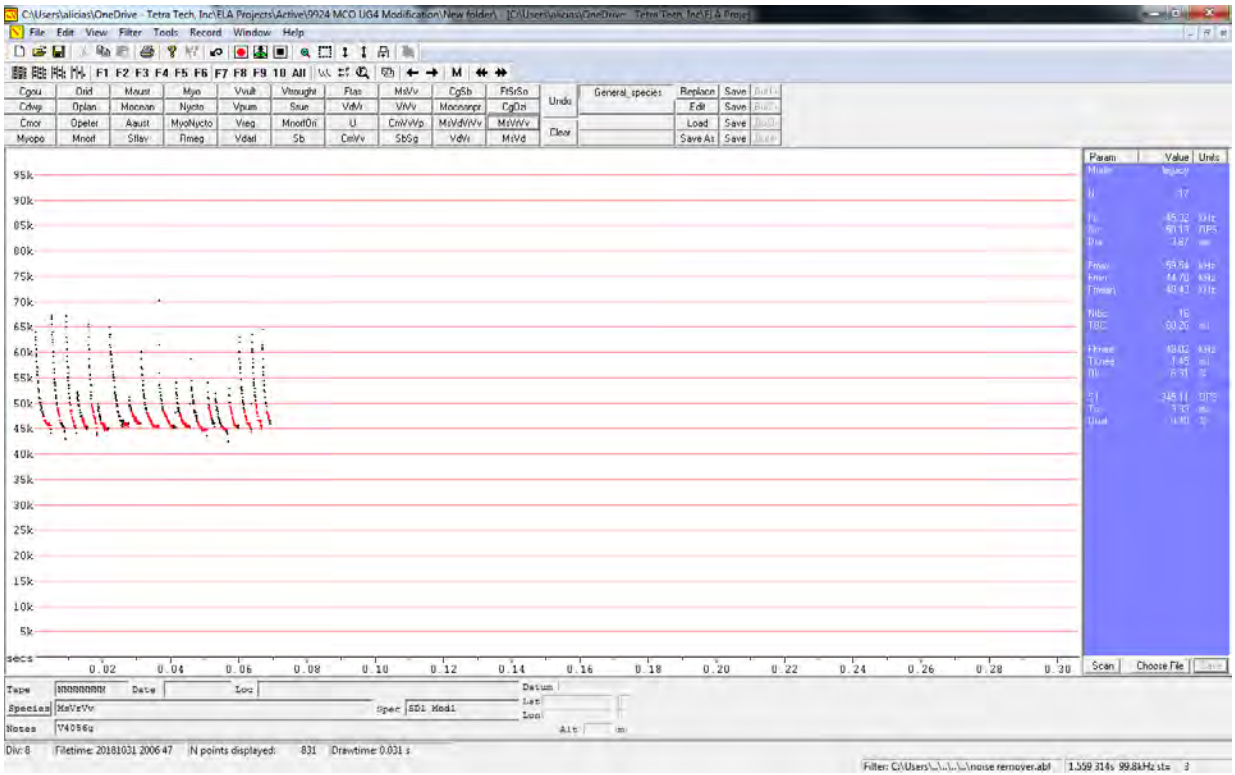

Figure 6: Call profile for *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat) / *Vespadelus regulus* (Southern Forest Bat) / *Vespadelus vulturnus* (Little Forest Bat) recorded at Moolarben Coal Mine UG4 Site AB2 at 2006 (8.06 pm) on 31 October 2018

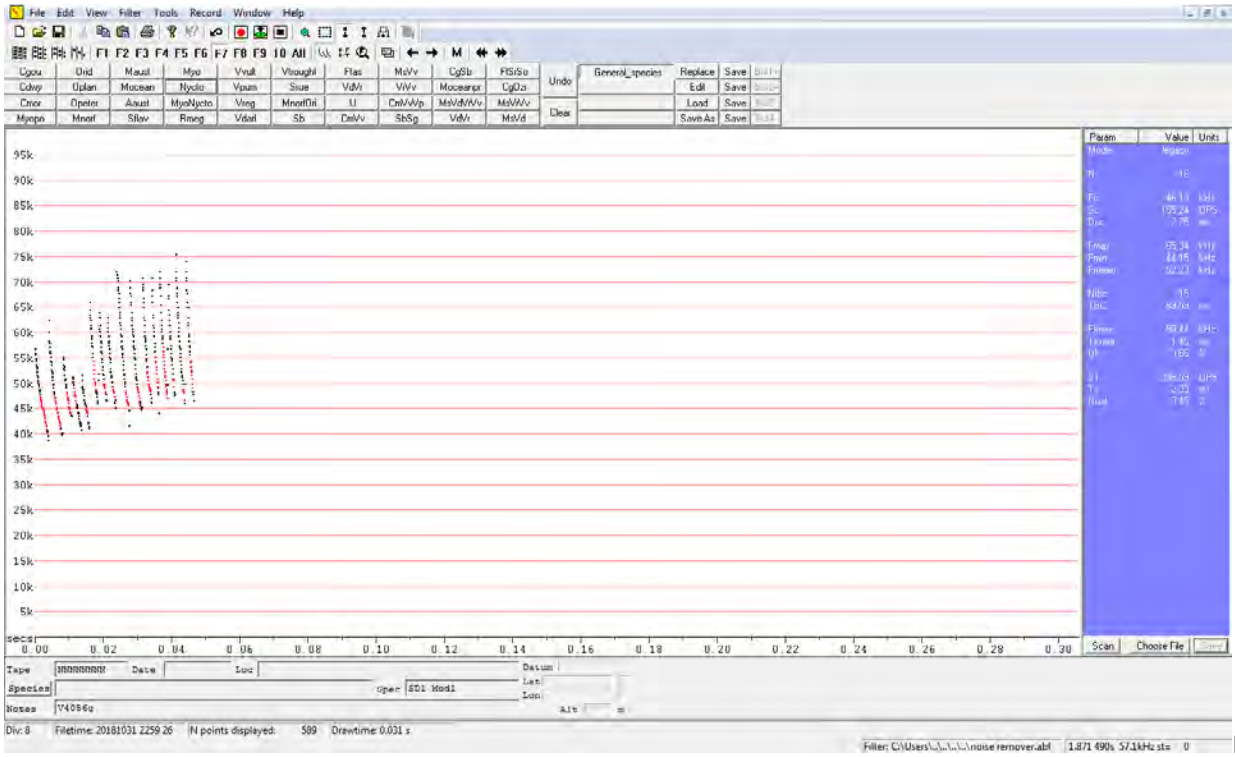

Figure 7: Call profile for *Nyctophilus* spp. (potentially *Nyctophilus geoffroyi* (Lesser Long-eared Bat), *Nyctophilus gouldi* (Gould's Long-eared Bat) or the threatened *Nyctophilus corbeni* (Corben's Long-eared Bat)) recorded at Moolarben Coal Mine UG4 Site AB2 at 2259 (10.59 pm) on 31 October 2018

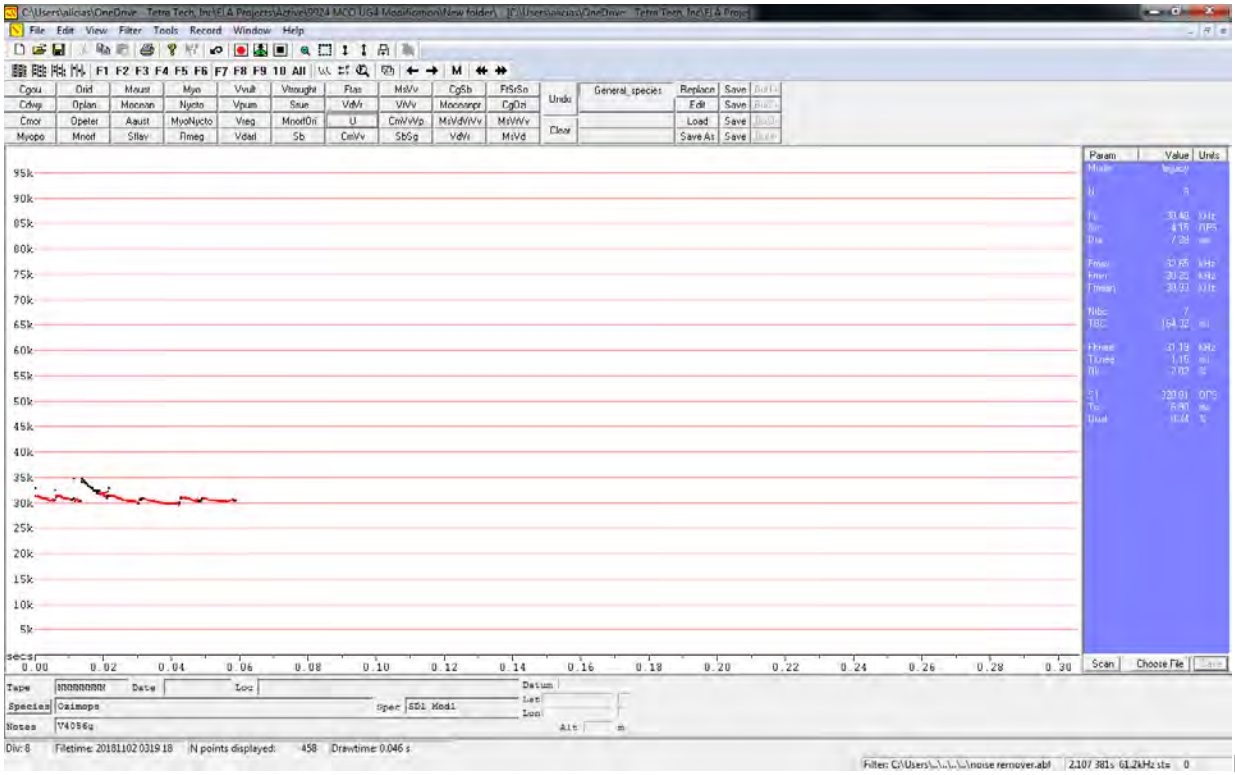

Figure 8: Call profile for *Ozimops* species complex recorded at Moolarben Coal Mine UG4 Site AB2 at 0319 (3.19 am) on 1 November 2018

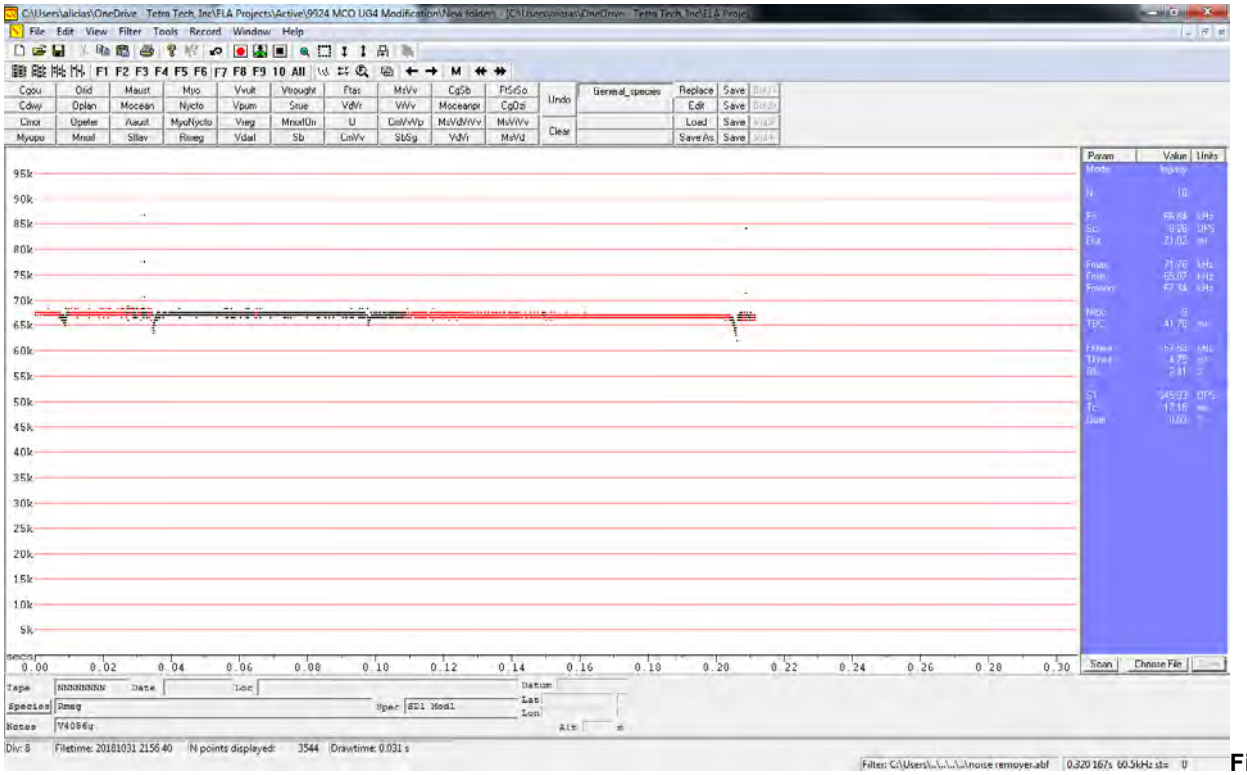

Figure 9: Call profile for *Rhinolophus megaphyllus* (Eastern Horseshoe Bat) recorded at Moolarben Coal Mine UG4 Site AB2 at 2156 (9.56 pm) on 31 October 2018

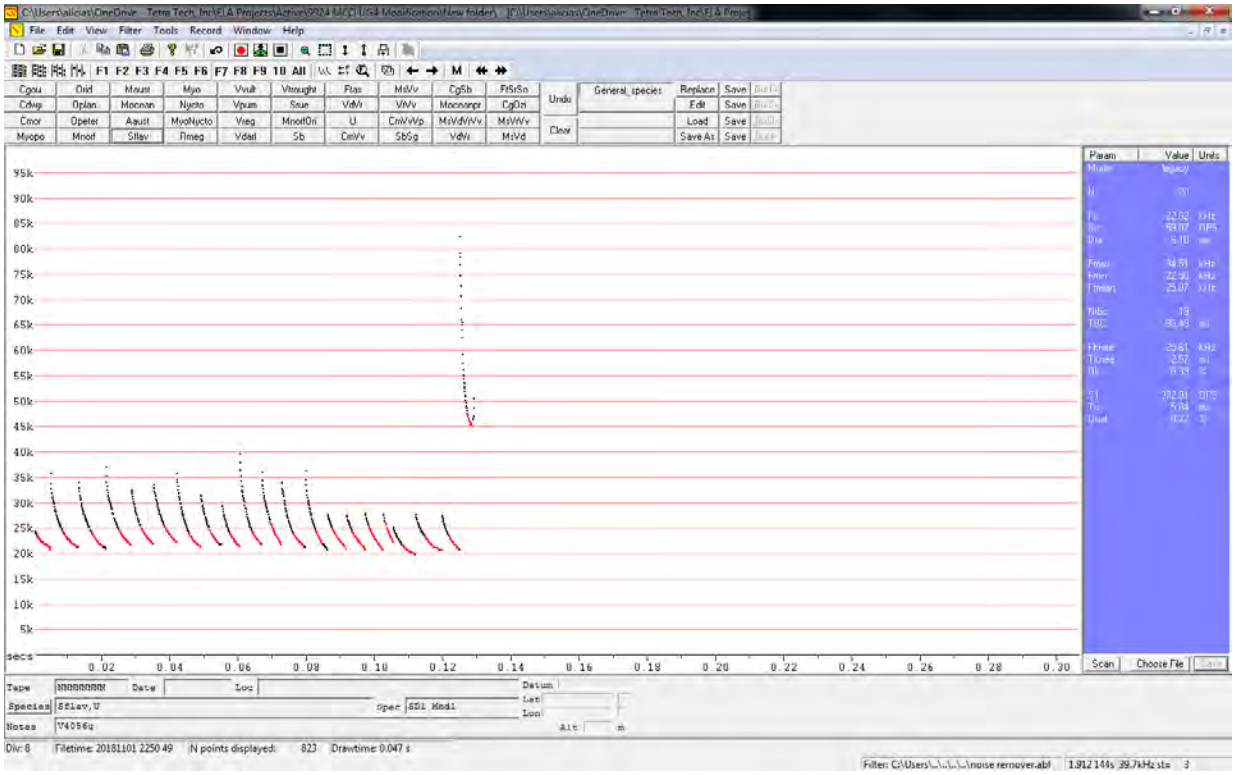

Figure 10: Call profile for *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat) recorded at Moolarben Coal Mine UG4 Site AB2 at 2250 (10.50 pm) on 1 November 2018

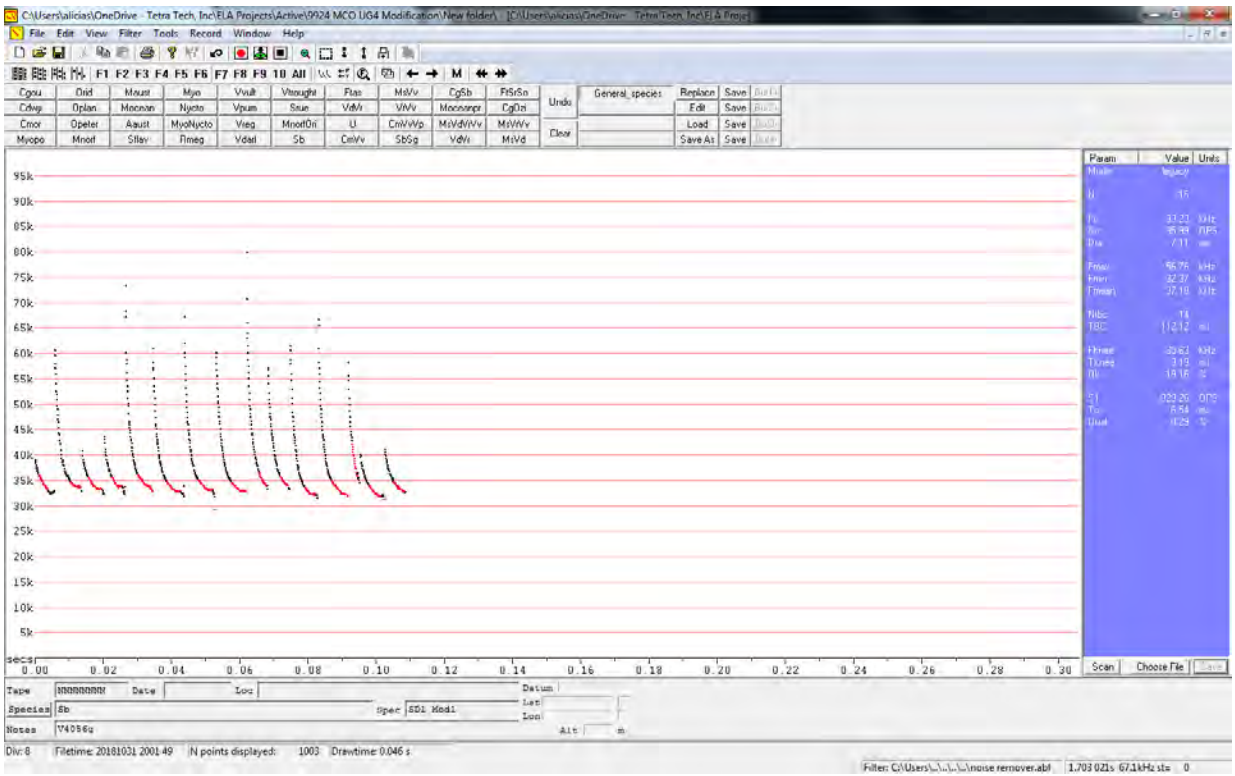

Figure 11: Call profile for *Scotorepens balstoni* (Inland Broad-nosed Bat) recorded at Moolarben Coal Mine UG4 Site AB2 at 2001 (8.01 pm) on 31 October 2018

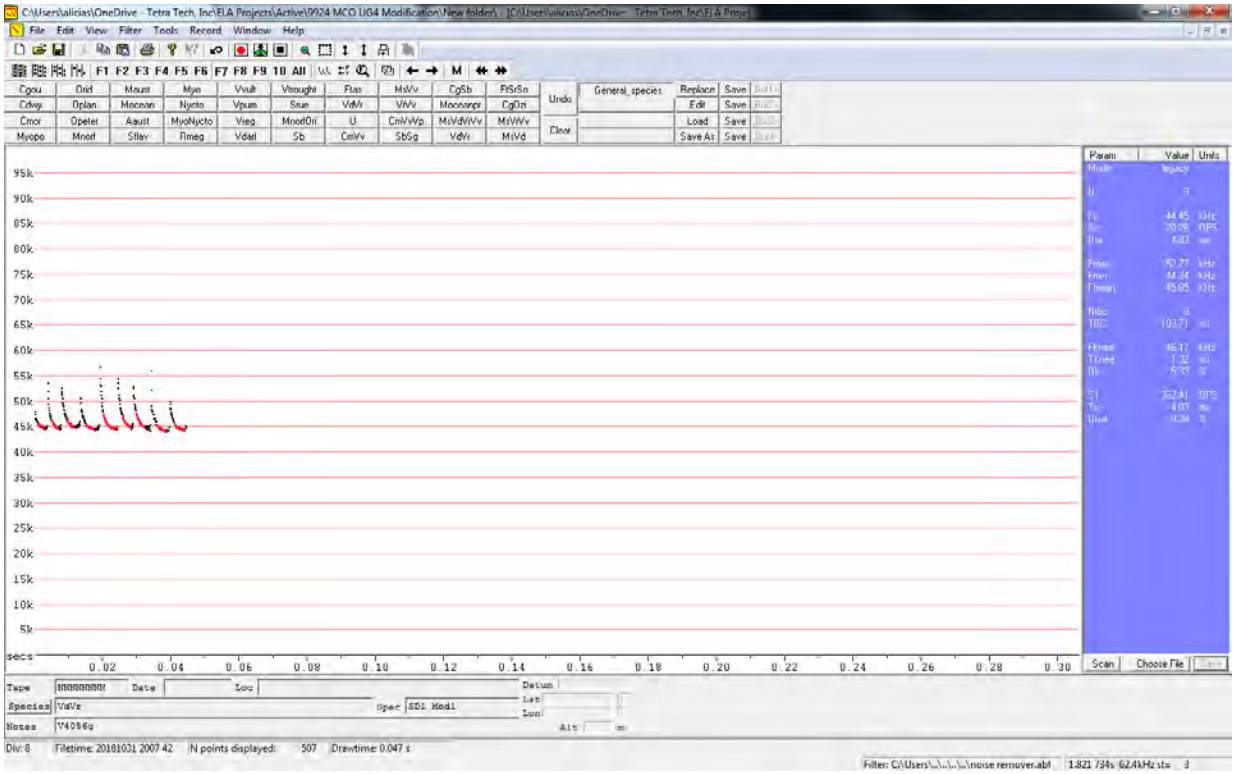

Figure 12: Call profile for *Vespadelus darlingtoni* (Large Forest Bat) / *Vespadelus regulus* (Southern Forest Bat) / *Vespadelus vulturnus* (Little Forest Bat) recorded at Moolarben Coal Mine UG4 Site AB2 at 2007 (8.07 pm) on 31 October 2018

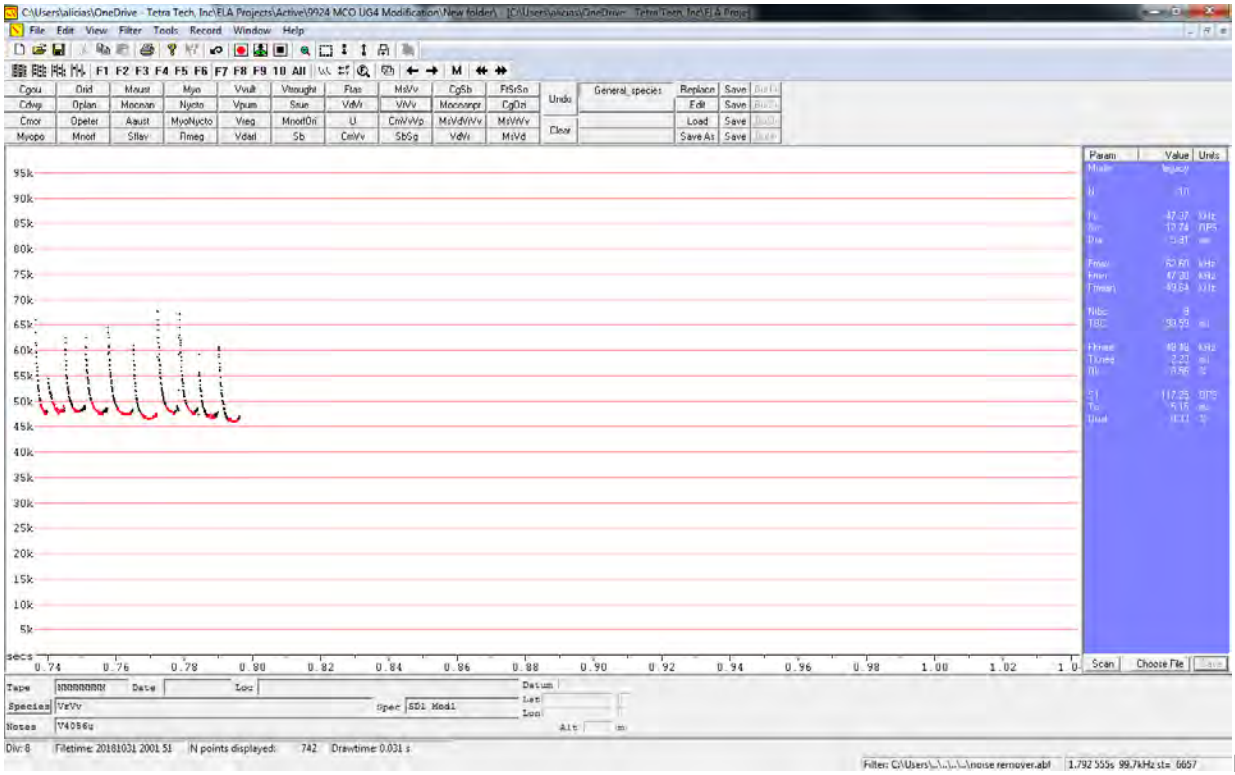

Figure 13: Call profile for *Vespadelus regulus* (Southern Forest Bat) / *Vespadelus vulturnus* (Little Forest Bat) recorded at Moolarben Coal Mine UG4 Site AB2 at 2001 (8.01 pm) on 31 October 2018

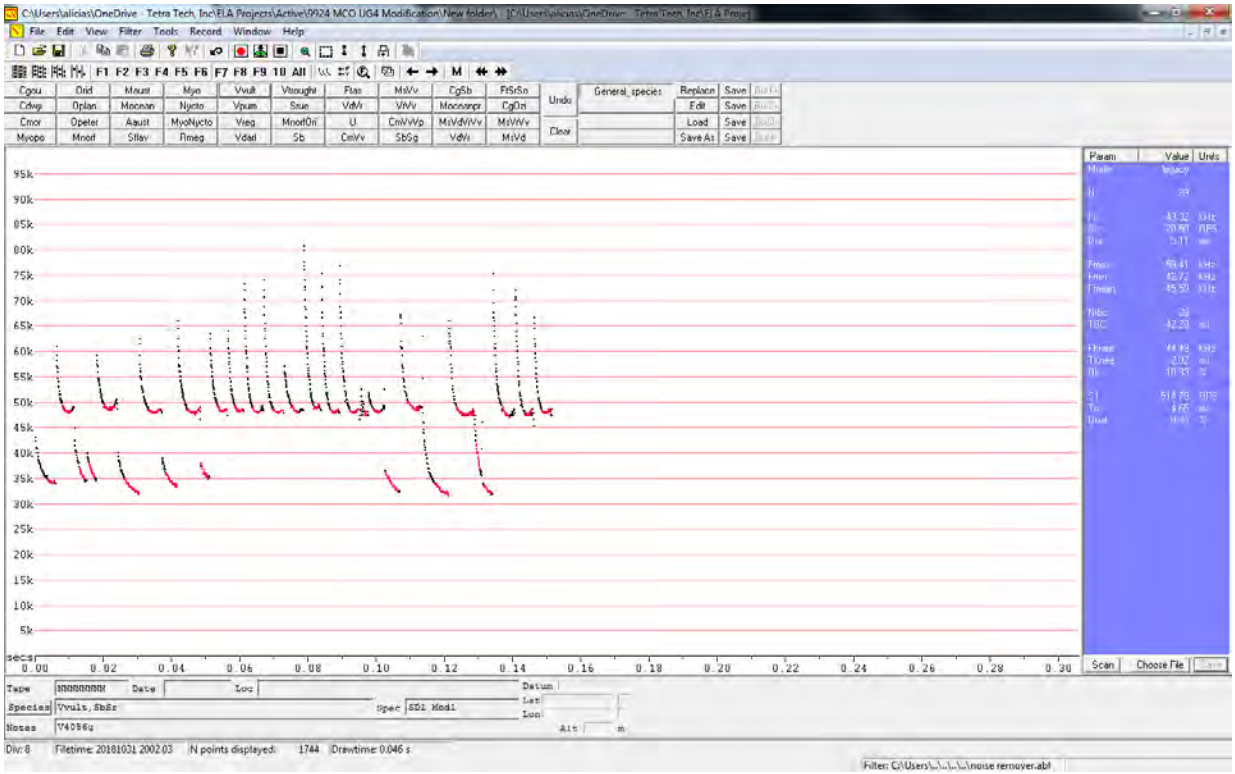

Figure 14: Call profile for *Vespadelus vulturnus* (Little Forest Bat) upper call and *Scotorepens balstoni* (Inland Broad-nosed Bat) lower call recorded at Moolarben Coal Mine UG4 Site AB2 at 2002 (8.02 pm) on 31 October 2018

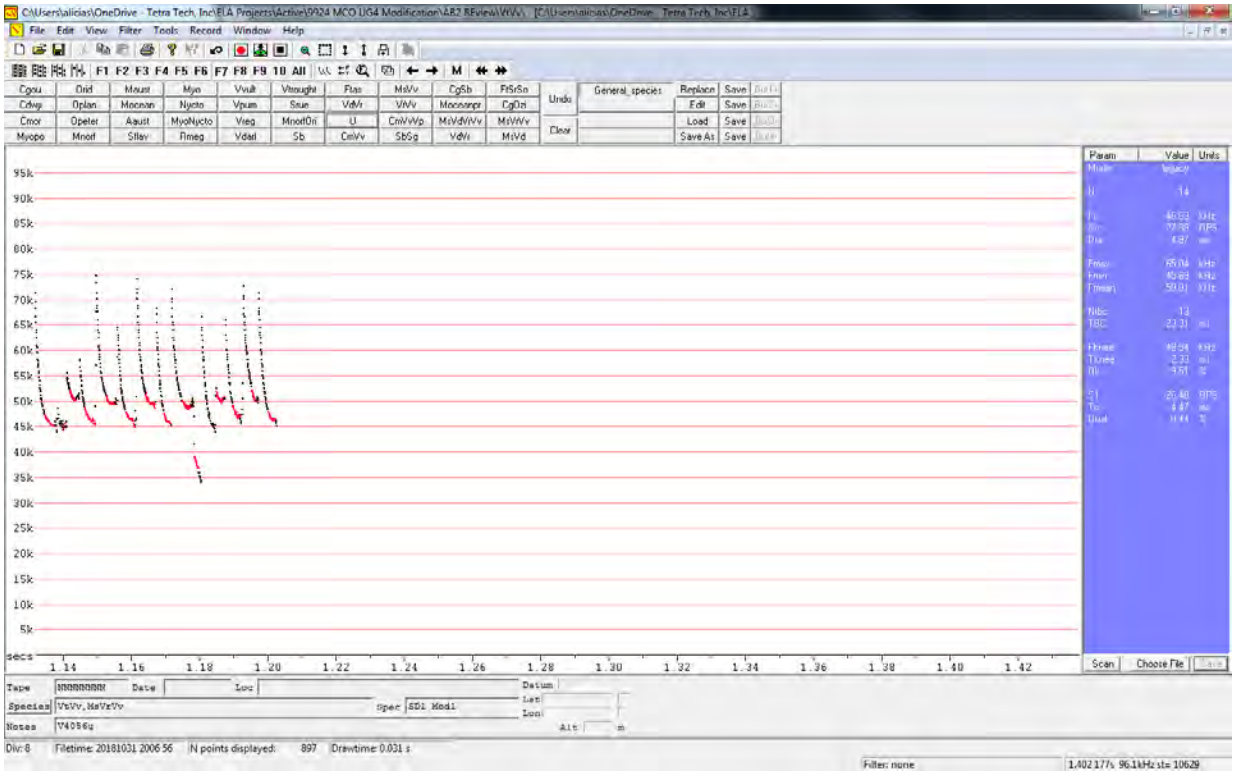

Figure 15: Call profile for *Vespadelus troughtoni* (Eastern Cave Bat) / *Vespadelus vulturnus* (Little Forest Bat) upper call and *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat) / *Vespadelus regulus* (Southern Forest Bat / *Vespadelus vulturnus* (Little Forest Bat) lower call recorded at Moolarben Coal Mine UG4 Site AB2 at 2006 (8.06 pm) on 31 October 2018

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Appendix E: Likelihood of Occurrence Table

Scientific Name	Common Name	BC ACT	EPBC ACT	Distribution	Habitat	Likelihood of Occurrence	Impact Assessment Required
Anthochaera phrygia	Regent Honeyeater	E4A	CE	Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North-West Plains, North-West and South-West Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions; also recorded in the Central Coast and Hunter Valley regions (OEH 2019).	Eucalypt woodland and open forest, wooded farmland and urban areas with mature eucalypts, and riparian forests of *Casuarina cunninghamiana* (River Oak) (OEH 2019).	Potential	No – OEH have confirmed that no critical habitat exists within the development footprint
Calidris ferruginea	Curlew Sandpiper	E1	CE, M	Occurs along the entire coast of NSW, and sometimes in freshwater wetlands in the Murray-Darling Basin (OEH 2019).	Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland (OEH 2019).	Unlikely	No
Grantiella picta	Painted Honeyeater	V	V	Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas (OEH 2019).	Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests (OEH 2019).	Likely	Yes
Lathamus discolor	Swift Parrot	E1	CE	Migrates from Tasmania to mainland in Autumn-Winter. In NSW, the species mostly occurs on the coast and south west slopes (OEH 2019).	Box-ironbark forests and woodlands.	Potential	No – OEH have confirmed that no critical habitat exists within the development footprint.
Leipoa ocellata	Malleefowl	E1	V	Arid and semi-arid zones. In NSW, populations occur in the south west mallee centred on Mallee Cliffs National Park and extending east to near Balranald; in the Scotia mallee west of the Darling River; and in the Goonoo forest near Dubbo. Recorded less recently in the Pilliga forests, around Cobar and Goulburn River NP (OEH 2019).	Predominantly mallee communities. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands, or other woodlands dominated by Mulga or native Cypress Pine species.	Unlikely	No
Polytelis swainsonii	Superb Parrot	V	V	In NSW, occurs on inland slopes of the Great Divide and on adjacent plains, especially along the major river-systems.	Box-gum woodland, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest.	Potential	Yes

Scientific Name	Common Name	BC ACT	EPBC ACT	Distribution	Habitat	Likelihood of Occurrence	Impact Assessment Required
Rostratula australis	Australian Painted Snipe	E1	E	In NSW most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valley (OEH 2019)s.	Swamps, dams and nearby marshy areas.	Unlikely	No
Galaxias rostratus	Flathead Galaxias	E4A (FM ACT)		Southern part of the Murray Darling Basin; now only known from the upper Murray River near Tintaldra and wetland areas near Howlong (OEH 2019).	Still or slow moving water bodies such as wetlands and lowland streams, with rock or sandy bottoms and aquatic vegetation.	Unlikely	No
Litoria booroolongensis	Booroolong Frog	E1	E	Restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. Several populations have recently been recorded in the Namoi catchment (OEH 2019).	Permanent streams with some fringing vegetation cover such as ferns, sedges or grasses.	Unlikely	No
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Recorded from Rockhampton in Qld south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney basin and the NSW north-west slopes (OEH 2019).	Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country.	Likely	Yes
***Dasyurus maculatus maculatus* (SE mainland population)**	Spotted-tailed Quoll	V	E	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Qld.	Rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Unlikely	No
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Distribution coincides approximately with the Murray Darling Basin; the Pilliga Scrub region is the distinct stronghold for this species.	Mallee, *Allocasuarina luehmannii* (Bulloak) and box eucalypt-dominated communities, especially box/ironbark/cypress-pine vegetation (OEH 2019).	Likely	Yes
Petauroides volans	Greater Glider		V	Eastern Australia, from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest).	Eucalypt forests and woodlands. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows (OEH 2019).	Unlikely	No

Scientific Name	Common Name	BC ACT	EP BC ACT	Distribution	Habitat	Likelihood of Occurrence	Impact Assessment Required
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	V	In NSW they occur from the Qld border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit.	Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges.	Unlikely	No
Phascolarctos cinereus	Koala	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands.	Eucalypt woodlands and forests.	Potential	Yes
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Along the eastern coast of Australia, from Bundaberg in Qld to Melbourne in Victoria.	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Unlikely	No
Hirundapus caudacutus	White-throated Needletail		V	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide (OEH 2019).	Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland.	Potential	Yes
Motacilla flava	Yellow Wagtail		M	Regular summer migrant to mostly coastal Australia. In NSW recorded Sydney to Newcastle, the Hawkesbury and inland in the Bogan LGA.	Swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land, lawns.	Unlikely	No
Myiagra cyanoleuca	Satin Flycatcher		M	In NSW, widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains (OEH 2019).	Eucalypt-dominated forests, especially near wetlands, watercourses, and heavily-vegetated gullies.	Unlikely	No
Rhipidura rufifrons	Rufous Fantail		M	Coastal and near coastal districts of northern and eastern Australia, including on and east of the Great Divide in NSW.	Wet sclerophyll forests, subtropical and temperate rainforests. Sometimes drier sclerophyll forests and woodlands.	Unlikely	No
Numenius madagascariensis	Eastern Curlew		CE, M	Summer migrant to Australia. Primarily coastal distribution in NSW, with some scattered inland records.	Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish	Unlikely	No

Scientific Name	Common Name	BC ACT	EPBC ACT	Distribution	Habitat	Likelihood of Occurrence	Impact Assessment Required
					lakes, saltworks and sewage farms.		

Scientific Name	Common Name	BC Act	EPBC ACct	Distribution	Habitat	Likelihood of Occurrence	Impact Assessment Required
Commersonia procumbens		V	V	Endemic to NSW, found in the Dubbo-Mendooran-Gilgandra region, the Pilliga and Nymagee areas, the Upper Hunter region, and in Goonoo State Conservation Area (OEH 2019).	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.	Known to occur within the area.	No. Surveys did not locate any individuals within the study area
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	In NSW, recorded mainly on coastal and near coastal ranges north from Victoria to near Forster, with two isolated occurrences inland north-west of Grafton.	Coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest.	Unlikely	No
Dichanthium setosum	Bluegrass	V	V	In NSW, found on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes.	Cleared woodland, grassy roadside remnants and highly disturbed pasture, on heavy basaltic black soils and red-brown loams with clay subsoil (OEH 2019).	Unlikely	No
Euphrasia arguta		E4A	CE	In NSW, recently recorded only from Nundle area of the north western slopes and tablelands, from near the Hastings River and from the Barrington Tops.	Eucalypt forest with a mixed grass and shrub understorey, disturbed areas, along roadsides.	Unlikely	No
Grevillea obtusiflora		E1	E	Subspecies *obtusiflora* occurs near Rylstone, while subspecies *fecunda* occurs in the Capertee Valley, north-west of Lithgow, and in the Gardens of Stone National Park.	Subspecies *obtusiflora* occurs in low open eucalypt forest. Subspecies *fecunda* occurs within low, open scrub beneath open, dry sclerophyll forest, on orange, sandy loam soils with sandstone boulders (OEH 2019).	Unlikely	No

Scientific Name	Common Name	BC Act	EPBC ACct	Distribution	Habitat	Likelihood of Occurrence	Impact Assessment Required
Homoranthus darwinioides		V	V	Central tablelands and western slopes of NSW, occurring from Putty to the Dubbo district. Found west of Muswellbrook between Merriwa and Bylong, and north of Muswellbrook to Goonoo State Forest.	Woodland with shrubby understorey, usually in gravely sandy soils.	Potential	No. Was not located during targeted surveys
Leucochrysum albicans* var. *tricolor	Hoary Sunray	P	E	In NSW it occurs on the Southern Tablelands and adjacent areas in an area roughly bounded by Albury, Bega and Goulburn.	Grassland, woodland and forest, generally on relatively heavy soils.	Unlikely	No
***Pelargonium* sp. Striatellum (G.W.Carr 10345)**	Omeo Storksbill	E1	E	Known from only 3 locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst.	Irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and wetland or aquatic communities.	Unlikely	No
Philotheca ericifolia		P	V	Known only from the upper Hunter Valley and Pilliga to Peak Hill district (between West Wyalong and the Pilliga Scrub).	Dry sclerophyll forest, heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops (OEH 2019).	Potential	No. Was not located during targeted surveys.
Prasophyllum petilum	Tarengo Leek Orchid	E1	E	Four sites in NSW: at Boorowa, Captains Flat, Ilford and Delegate. Also experimentally introduced at Bowning Cemetery NSW.	Natural Temperate Grassland, grassy woodland, and Box-Gum woodland.	Unlikely	No
***Prasophyllum* sp. Wybong (C.Phelps ORG 5269)**	Leek Orchid		CE	Endemic to NSW, it is known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. Most populations are small, although the Wybong population contains by far the largest number of individuals.	It is a perennial orchid that will appear as a single leaf over winter and spring. This species will occur within open eucalypt woodlands and grasslands.	Unlikely	No
Swainsona recta	Small Purple-pea	E1	E	Queanbeyan and Wellington-Mudgee areas. Historically also recorded at Carcoar, Culcairn and Wagga Wagga (OEH 2019).	Grassland, open woodland and open forests dominated by *Eucalyptus blakelyi, E. melliodora*, *E. rubida* (Candlebark Gum) and *E. goniocalyx* (Long-leaf Box).	Potential	No. Was not located during targeted surveys.
Thesium australe	Austral Toadflax	V	V	In eastern NSW it is found in very small populations scattered along the coast, and from the Northern to Southern Tablelands.	Grassland on coastal headlands or grassland and grassy woodland away from the coast.	Unlikely	No

Scientific Name	Common Name	BC Act	EPBC ACct	Distribution	Habitat	Likelihood of Occurrence	Impact Assessment Required
Tylophora linearis		V	E	In NSW, found in the Barraba, Mendooran, Temora and West Wyalong districts in the northern and central western slopes. Records include Crow Mountain near Barraba, Goonoo, Pilliga West, Cumbil, and Eura State Forests, Coolbaggie Nature Reserve, Goobang National Park, and Beni Conservation Area	Dry scrub, open forest, dry woodlands of *Eucalyptus fibrosa*, *E. sideroxylon*, *E. albens*, *Callitris endlicheri*, *C. glaucophylla* and *Allocasuarina luehmannii*.	Unlikely	No

Ecological Community	BC ACT	EPBC ACT	Distribution	Likelihood of occurrence	Impact assessment required
Central Hunter Valley eucalypt forest and woodland	E	CE	The community occurs in the Hunter Valley region mostly in the north east of the Sydney Basin IBRA and the Hunter Valley subregion. It is also known from the Kerrabee IBRA subregion. This community occurs on soils derived from the Permian sedimentary bedrock found on valley floors and lower hillslopes and low ridges. The community is an open forest or woodland dominated by eucalypt species with a sparse mid-layer of shrubs and a ground layer of grasses (OEH 2019).	No – was not mapped within the Study Area	No
White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland	E	CE	The Box-Gum Grassy Woodlands and DNG community occurs in an arc along the western slopes and tablelands of the Great Dividing Range from southern Queensland through NSW to central Victoria. It occurs in the Sydney Basin. The community is characterised by a species-rich understory of native tussock grasses, herbs and scattered shrubs with an overstorey of White Box, Yellow Box or Blakely's Red Gum. Grey Box may also be dominant (OEH 2019).	Yes	Yes

Appendix F: Assessment of Significance (MNES)

WHITE BOX YELLOW BOX BLAKELY'S RED GUM GRASSY WOODLAND

An action is likely to have a significant impact on a CEEC if there is a real chance of possibility that it will:

- **reduce the extent of an ecological community**

The action involves the removal of 0.3 ha of White Box Yellow Box Blakely's Red Gum Woodland from the proposed development footprint.

- **fragment or increase fragmentation of an ecological community**

The proposed action will remove a maximum of approximately 0.3 ha of vegetation which meets the listing criteria for this community. The disturbance area only forms a small part of a larger patch of the community and as such, the proposed action will not permanently fragment the ecological community.

- **adversely affect habitat critical to the survival of an ecological community**

The small scale of disturbance (approximately 0.3 ha) will not adversely affect habitat critical to the survival of this CEEC.

- **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**

Mitigation measures provided for the proposed action have specified construction of appropriate sediment controls. No groundwater or surface water is proposed to be extracted through implementation of the action. Whilst top soil will be disturbed through the construction of the access track and the installation of the dewatering sites this will remain on site. The proposed action will not modify or destroy abiotic factors necessary for the survival of the CEEC.

- **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**

The proposed action will not cause substantial change to species composition of the CEEC due to the small scale of the proposed disturbance (approximately 0.3 ha).

- **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**
  - **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**

Weed control mitigation and management measures have been included within the approved BMP for the Moolarben Coal Complex. Weeds and exotic species will be managed within the development footprint to avoid the spread and to manage any incursions that may arise.

- **interfere with the recovery of an ecological community**

Due to the small scale of the disturbance, the proposed action will not interfere with the recovery of the CEEC.

GRANTIELLA PICTA (PAINTED HONEYEATER)

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- **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**

The proposed action will result in the removal of approximately 6 ha of woodland (PCT 281 vegetation zone, 3 and 4, PCT 479 vegetation zone 6 and 7, and PCT 1711 vegetation zone 8), which is potential foraging habitat for this species. Given the highly mobile nature of this species and the availability of alternate habitat outside of the action area within the locality, the proposed works do not have the potential to substantially fragment or destroy or isolate an area of important habitat for this species.

- **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**

No harmful invasive species are expected to become established in areas of potential habitat for this species as a result of the proposed works. Weed, sediment and erosion controls will be in place during the proposed works to mitigate the potential spread and/or introduction of invasive species.

- **seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**

The proposed development will not impact upon breeding habitat for this species, and the potential foraging habitat which occurs in the study area would form at most a fraction of the species' range within the locality. Within the proposed development footprint the amount of mistletoe is low. Given this, the proposed clearing of vegetation is unlikely to seriously disrupt the lifecycle of any proportion of the species.

POLYTELIS SWAINSONII (SUPERB PARROT)

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

a. Lead to a long-term decrease in the size of an important population of a species

No breeding habitat or areas of important habitat (OEH 2019) have been recorded within the development footprint and only potential foraging habitat is likely to be present. The extent of habitat to removed (approximately 6 ha of suitable foraging habitat) is such that the proposed action is unlikely to lead to a long-term decrease in the local population size of this species.

b. Reduce the area of occupancy of an important population

No breeding habitat or areas of important habitat (OEH 2019) have been recorded within the development footprint. The proposed action is unlikely to reduce the area of occupancy of this species. Approximately 6 ha of suitable foraging habitat is to be removed of which only approximately 4.5 ha is contiguous.

c. Fragment an existing population into two or more populations

The proposed action will not result in any barriers to movement and is unlikely to fragment an existing population of this species into two or more populations given that the potential access tracks are only 10 m wide which would not pose a barrier to this species. The proposed development will remove approximately 6 ha of vegetation much of which is already affected by a vehicle access track.

d. Adversely affect habitat critical to the survival of a species

The proposed action is unlikely to affect breeding habitat for Superb Parrot as they are not known to breed within the area. The proposed action has the potential to affect foraging habitat, with foraging habitat including woodlands dominated by eucalypts, particularly Yellow Box or Grey Box. No areas of critical habitat have been mapped within the development footprint. The extent of clearing is unlikely to adversely affect habitat critical to the survival of this species.

e. Disrupt the breeding cycle of an important population

No breeding habitat occurs within the area. No areas of critical habitat have been mapped within the development footprint. The proposed action is unlikely to disrupt the breeding cycle of this species.

f. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

No breeding habitat or areas of important habitat (OEH 2019) have been recorded within the development footprint. It is unlikely that the proposed activity will modify, destroy, remove or isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.

g. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

There are currently no invasive species recorded within the development footprint. No harmful invasive species are expected to become established in areas of potential habitat for this species as a result of the proposed works. Weed, sediment and erosion controls will be in place during the proposed works to mitigate the potential spread and/or the introduction of invasive species.

h. Introduce disease that may cause the species to decline, or

The proposed activity is unlikely to result in the establishment of a disease that may cause this species to decline.

i. Interfere substantially with the recovery of the species

Considering the limited extent of the impact, the proposed activity is unlikely to substantially interfere with the recovery of this species.

NYCTOPHILUS CORBENI (CORBEN'S LONG-EARED BAT)

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

a. Lead to a long-term decrease in the size of an important population of a species

The extent of woodland habitat to be removed (approximately 6 ha) is such that the proposed activity is unlikely to lead to a long-term decrease in the local population size of this species.

b. Reduce the area of occupancy of an important population

The proposed action will not result in any barriers to movement and is unlikely to reduce the area of occupancy of these species. The proposed linear development already has a vehicle access track through the area.

c. Fragment an existing important population into two or more populations

The proposed development is unlikely to result in any barriers to movement, and the extent of habitat to be removed is unlikely to fragment an existing population of this species into two or more populations.

d. Adversely affect habitat critical to the survival of a species

Corben's Long-eared Bat inhabits a variety of habitats and is more commonly found in box/ironbark/cypress-pine vegetation. The extent of clearing is unlikely to adversely affect habitat critical to the survival of this species.

e. Disrupt the breeding cycle of an important population

No important population of Corben's Long-eared Bat is considered likely to occur within the study area; therefore, the proposed action will not disrupt the breeding cycle of an important population.

f. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposed development will result in the removal of approximately 6 ha of woodland (PCT 281 vegetation zone 3 and 4, PCT 479 vegetation zone 6 and 7, and PCT 1711 vegetation zone 8), which represents potential habitat for this species. Given the mobile nature of this species, the proposed works do not have the potential to modify, destroy, remove or isolate or decrease the availability of habitat to the extent that the species is likely to decline,

g. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

No harmful invasive species are expected to become established in areas of potential habitat for this species as a result of the proposed works. Weed, sediment and erosion controls will be in place during the proposed works to mitigate the potential spread and/or the introduction of invasive species.

h. Introduce disease that may cause the species to decline, or

No harmful diseases are expected to be introduced as a result of the proposed works.

i. Interfere substantially with the recovery of the species

Considering the limited extent of impact, the proposed activity is unlikely to substantially interfere with the recovery of this species.

CHALINOLOBUS DWYERI (LARGE-EARED PIED BAT)

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

a. Lead to a long-term decrease in the size of an important population of a species

No important population of Large-eared Pied Bats is considered likely to occur within the study area. Mitigation measures will be undertaken to ensure the impact is contained within the development footprint, to reduce impact to breeding habitat. The proposed action is unlikely to lead to a long-term decrease in the size of the local population.

b. Reduce the area of occupancy of an important population

There will be a loss of approximately 4.5 ha in potential foraging habitat for the local population (PCT 479 vegetation zone 6 and 7, and PCT 1711 vegetation zone 8). These sections of suitable habitat occur along the proposed access track development which is continuous with the surrounding vegetation. Due to its mobile nature, the proposed action is unlikely to reduce the area of occupancy of the local population.

c. Fragment an existing important population into two or more populations

The proposed action will not result in any barriers to movement and is unlikely to fragment an existing population of this species into two or more populations. Approximately 4.5 ha of potential foraging habitat occurs within the proposed development.

d. Adversely affect habitat critical to the survival of a species

Mitigation measures will be undertaken to ensure there is no impact to breeding habitat. Potential breeding habitat of rocky outcrops occurs within 100 m of the development footprint and actions will be put in place so that development activities will not impact on the potential breeding footprints such as undertaking consultation with suitably qualified and/or experienced persons prior to clearing activities near this site. Given these actions the proposed development is unlikely to adversely affect habitat critical to the survival of this species.

e. Disrupt the breeding cycle of an important population

Mitigation measures will be undertaken to ensure there is no impact to breeding habitat. Therefore, the proposed action is unlikely to disrupt the breeding cycle of the local population.

f. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposed action will result in the loss of approximately 4.5 ha of potential foraging habitat. Due to the mobile nature of this species, it is unlikely that the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

g. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

No harmful invasive species are expected to become established in areas of potential habitat for this species as a result of the proposed works. Weed, sediment and erosion controls will be in place during the proposed works to mitigate the potential spread and/or the introduction of invasive species.

h. Introduce disease that may cause the species to decline, or

No harmful diseases are expected to become established as a result of the proposed works.

i. Interfere substantially with the recovery of the species

Considering the limited extent of impact, the proposed activity is unlikely to substantially interfere with the recovery of this species.

HIRUNDAPUS CAUDACUTUS (WHITE-THROATED NEEDLETAIL)

An action is likely to have a significant impact on a migratory species if there is real chance or possibility that it will:

a. 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

The proposed action will remove or modify approximately 6 ha of woodland. This species is highly mobile, with an aerial habitat, flying over a range of areas, from woodland areas to cleared areas. Given this, the proposed action does not have the potential to modify, destroy or isolate an area identified as of critical importance for this specie**s.**

b. 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

No harmful invasive species are expected to become established in areas of potential habitat for this species as a result of the proposed works. Weed, sediment and erosion controls will be in place during the proposed works to mitigate the potential spread and/or the introduction of invasive species.

c. Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The proposed development will not impact upon breeding habitat or foraging habitat for this species. This species is non-breeding within Australia, and forages aerially, in areas ranging from heavy forests to open habitats. Given this, the proposed clearing of vegetation is unlikely to seriously disrupt the lifecycle of any proportion of this species**.**

SEPP 44 AND EPBC ACT KOALA HABITAT ASSESSMENT

The proposed development was assessed against the SEPP 44. Mid-Western Regional Council is listed as one of the Councils to which SEPP 44 applies.

Under SEPP 44, there are two categories of koala habitat:

- Core Koala habitat, meaning an area with a resident population of Koalas, evidenced by attributes such as breeding females, recent sightings and historical records. The impact area is not considered Core Koala habitat as:
  - No Koalas were identified during field surveys effort. There are two historical records of Koalas observed within a 10 km radius of the development footprint (OEH 2019) with the most recent being tracks and scratching found at Ulan Coal Mine. The other record (scats) was in the Murragamba area approximately 4 km south of the development footprint.

- Potential Koala habitat, meaning areas of native vegetation where the key Koala feed trees of the types listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. The impact area is not considered Potential Koala habitat as:
  - No species of key Koala feed trees of the types listed in Schedule 2 were identified in the development footprint. Four species of secondary feed trees were observed across the development footprint (*Eucalyptus blakelyi, E. melliodora, E. moluccana and E. parramattensis*). The proposed development within the north consisted of *E. blakelyi* which consists of greater than 15%, however this is a secondary feed tree. *E. macrorhyncha* is a supplementary feed tree and only at Plot 21 (PCT479 – Moderate (zone 6) located at ventilation shaft compound A) did the canopy cover, together with *E. melliodora* and *E. blakelyi* exceed 15%.

The development footprint has been further assessed using the 'EPBC Act referral guidelines for the vulnerable Koala' (Department of the Environment [DoE], 2014). A decision as to whether a proposed action will have or is likely to have a significant impact on the Koala is made using two key considerations outlined in the EPBC guidelines:

- Adversely affecting habitat critical to the survival of the Koala and/or
- Interfering substantially with the recovery of the Koala through the introduction or exacerbation of key threats in areas of habitat critical to the survival of the Koala (Section 8).

Habitat destruction is recognised as the primary adverse effect on habitat critical to the survival of the koala. Whether or not there are other impacts, the loss of habitat critical to the survival of the Koala can be sufficient to trigger a significant impact. Application of the Koala habitat assessment tool from the proposed impact area was undertaken, resulting in a score of 5/10 (**Table 38**). A score of five or greater means that an assessment of significance may be required as the habitat may be critical to survival of the koala.

Table 38: Koala habitat assessment tool

Attribute	Score	Habitat Appraisal
Koala occurrence. Evidence of Koalas within 2 km in the last 5-10 years.	0	NSW BIoNet has the closest recording being approximately 2.5 km away at Ulan Coal Mine. Tracks and scratchings were observed in 2015. There is no evidence of koala within the development footprint.
Vegetation structure and composition. Woodland with two or more known koala feed tree species.	2	On-ground surveys revealed that the development footprint contains secondary feed trees of *Eucalyptus blakelyi* and *E. melliodora*.
Habitat connectivity. Area is part of a contiguous landscape <1000 ha but >500 ha.	1	GIS mapping shows the development footprint of the proposed southern access track is contiguous, however given the lack of feed trees in this section it is unlikely to support koalas. The proposed location of ventilation shaft compound is located in predominately cleared land of low vegetation condition. The proposed development areas within the north consist of *E. blakelyi* which are contiguous with the vegetation along the river and consists of red gum woodlands adjacent to riparian zones.
Key existing threats. Little or no evidence of koala mortality by dogs or vehicles	2	There are no records of koala being struck by vehicles or attacked by dogs within the study area. The closest records of koalas based on tracks and scratching are 2.5 km from the development footprint.
Recovery value. Habitat is unlikely to be important for recovery objectives.	0	No evidence of breeding or using the area as a stepping stone was observed within the development footprint.
Total	**5**	Habitat is critical to the survival of the koala

Given that the habitat score is 5 the impact area contains habitat critical to the survival of the koala as per the koala habitat assessment tool (DoE 2014). In particular, the area in the northern section will result in the removal of *E. blakelyi* which are listed koala feed trees. Approximately 1.2 ha of PCT 281 in moderate and good condition will be affected. Given that less than 2 ha of habitat containing known koala food trees with a habitat score of 5, it is concluded that the Modification is unlikely to have a significant impact on the Koala.

In summary the assessment can be attributed to the following key factors:

- Low numbers of preferred feed trees within the footprint clearing will not present a significant impact to the overall habitat quality of the surrounding environment.
- Fragmentation and isolation of populations will not occur as the trees are contiguous to surrounding vegetation.
- Koala fatalities will not be increased due to the absence of a permanent Koala population.
- The increased risk of disease introduction is minimal due to the existing use of the study area as a vehicle assess track.
- The proposed development will not result in the creation of any additional barriers to movement.

Appendix G: BAM credit summary report

BAM Credit Summary Report

Proposal Details

Assessment Id
00014375/BAAS18153/19/00014376

Proposal Name
MCO UG4 Modification

BAM data last updated *
30/08/2019

Assessor Name
Cheryl O'Dwyer

Report Created
17/09/2019

BAM Data version *
13

Assessor Number
BAAS18153

BAM Case Status
Open

Date Finalised
To be finalised

Assessment Revision
3

Assessment Type
Major Projects

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

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion								
5	479_Low	30.5	0.0	0.25	High Sensitivity to Potential Gain	1.50		1
6	479_Mod	36.1	0.9	0.25	High Sensitivity to Potential Gain	1.50		12

7	479_Good	43.7	2.8	0.25	High Sensitivity to Potential Gain	1.50		46
							Subtotal	**59**
Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion								
1	281_Cleared	10.9	2.8	0.25		1.50	TRUE	0
2	281_Low	31.6	1.0	0.25	High Sensitivity to Potential Gain	2.00	TRUE	16
3	281_Mod	31.0	1.2	0.25	High Sensitivity to Potential Gain	2.00	TRUE	18
4	281_Good	59.0	0.3	0.25	High Sensitivity to Potential Gain	2.00	TRUE	8
							Subtotal	**42**
Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin								
8	1711_Good	48.3	0.6	0.25	High Sensitivity to Potential Gain	1.50		10
							Subtotal	**10**
							Total	**111**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Callocephalon fimbriatum / Gang-gang Cockatoo (Fauna)						
479_Good	43.7	0.43	0.25	2	N/A	9
					Subtotal	**9**

Calyptorhynchus lathami / Glossy Black-Cockatoo (Fauna)						
479_Good	43.7	0.43	0.25	2	N/A	9
					Subtotal	**9**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)						
479_Good	43.7	2.8	0.25	3	True	92
479_Mod	36.1	0.86	0.25	3	True	23
1711_Good	48.3	0.55	0.25	3	True	20
					Subtotal	**135**
Tylophora linearis / Tylophora linearis (Flora)						
281_Mod	31.0	1.16	0.25	2	False	18
281_Good	59.0	0.27	0.25	2	False	8
					Subtotal	**26**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)						
479_Mod	36.1	0.86	0.25	3	True	23
479_Good	43.7	2.8	0.25	3	True	92
1711_Good	48.3	0.55	0.25	3	True	20
					Subtotal	**135**

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00014375/BAAS18153/19/00014376	61	3	17/09/2019

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Cheryl O'Dwyer	BAAS18153	MCO UG4 Modification	Open

Assessment Type	Date Finalised
Major Projects	To be finalised

PCT list

Include	PCT common name	Credits
Yes	**479 -** Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	59
Yes	**1711 -** Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin	10
Yes	**281 -** Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	42

Species list

Include	Species	Credits
Yes	***Calyptorhynchus lathami*** (Glossy Black-Cockatoo)	9
Yes	***Chalinolobus dwyeri*** (Large-eared Pied Bat)	135
Yes	***Tylophora linearis*** (Tylophora linearis)	26
Yes	***Vespadelus troughtoni*** (Eastern Cave Bat)	135
Yes	***Callocephalon fimbriatum*** (Gang-gang Cockatoo)	9

Biodiversity payment summary report

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

IBRA sub region	PCT common name	Baseline price	Dynamic coefficient	Market coefficient	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Kerrabee	**479 -** Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion **Warning: This PCT has NO trades recorded**	$4,248.35	0.71782200	2.51860000	19.99%	$20.00	1.0000	$6,009.29	59	$354,548.22
Kerrabee	**1711 -** Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin **Warning: This PCT has NO trades recorded**	$4,248.35	0.71782200	2.51860000	19.99%	$20.00	1.0000	$6,009.29	10	$60,092.92

Kerrabee	**281 -** Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion **Warning: This PCT has NO trades recorded**	$4,248.35	0.71782200	2.51860000	19.99%	$20.00	1.0000	$6,009.29	42	$252,390.26

Subtotal (excl. GST)	**$667,031.40**
GST	**$66,703.14**
Total ecosystem credits (incl. GST)	**$733,734.54**

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10140	***Calyptorhynchus lathami*** (Glossy Black-Cockatoo)	Vulnerable	$506.66	19.9900%	$20.00	9	$5,651.47
10157	***Chalinolobus dwyeri*** (Large-eared Pied Bat)	Vulnerable	$725.00	19.9900%	$20.00	135	$120,140.21
10815	***Tylophora linearis*** (Tylophora linearis)	Vulnerable	$346.03	19.9900%	$20.00	26	$11,315.24

Biodiversity payment summary report

10829	***Vespadelus troughtoni*** (Eastern Cave Bat)	Vulnerable	$725.00	19.9900%	$20.00	135	$120,140.21
10975	***Callocephalon fimbriatum*** (Gang-gang Cockatoo)	Vulnerable	$506.66	19.9900%	$20.00	9	$5,651.47

Subtotal (excl. GST)	**$262,898.60**
GST	**$26,289.86**
Total species credits (incl. GST)	**$289,188.46**
Grand total	**$1,022,923.00**

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