Biodiversity Development Assessment Report

Johns River Quarry Extension Modification 3

Prepared for Boral Resources (Country) Pty Limited | 26/09/2024

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Document control

Project number	Client	Project manager	LGA
8540	Boral Resources (Country) Pty Limited	Dmitri Medvedko	Mid Coast Council

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D1	Dmitri Medvedko	Stephen Bloomfield, Boral, Arnold Planning	Draft		17 August 2024
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Executive Summary

Context

Niche Environment and Heritage Pty Ltd (Niche) was engaged by Arnold Planning on behalf of Boral Pty Ltd (the client) to prepare a Biodiversity Development Assessment Report (BDAR) for the extension of a quarry in Johns River (the proposed modification). The subject land associated with the proposed extension is located wholly within Lot 2 / DP716380, Bulley Road at Johns River, New South Wales (NSW). The subject land adjoins the existing quarry pit and is 2.03 hectares (ha) in area.

This report describes the ecological values within the subject land as determined by the Biodiversity Assessment Method (BAM) (DPIE 2020a) and determines whether the proposed modification is likely to have an impact on threatened biodiversity listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and identify and quantify any associated biodiversity offsetting requirements.

Methods

The BDAR, undertaken in accordance with the BAM, partially relies on data collected by RPS Consulting Pty Ltd (RPS) as part of a Biodiversity Investigation Report (BIR) (RPS2024). The BIR, which included the conducting of BAM survey plots, and targeted fauna and flora surveys, was reviewed to identify the level of survey effort required to ensure the proposed modification met the minimum BAM requirements. The area assessed in the RPS report is referred to in this BDAR as the RPS Study Area and encompasses Lot 2 / DP716380 (the subject land) as well as parts of Lot 44 / DP816023 and Lot 11 / DP1104156.

The BDAR includes the following:

- Desktop assessments of existing vegetation types and potentially occurring threatened entities
- Traverses to map the type and extent of native vegetation to determine habitat suitability for threatened biodiversity
- Collection of floristic and habitat data from two BAM Plots
- Targeted surveys for 25 threatened flora species:
    - North Brother Wattle (*Acacia courtii*)
    - Dwarf Heath Casuarina (*Allocasuarina defungens*)
    - *Allocasuarina thalassoscopica*
    - Trailing Woodruff (*Asperula asthenes*)
    - Small Pale Grass-lily (*Caesia parviflora var. minor*)
    - Red Helmet Orchid (*Corybas dowlingii*)
    - Leafless Tongue Orchid (*Cryptostylis hunteriana*)
    - White-flowered Wax Plant (*Cynanchum elegans*)
    - Spider orchid (*Dendrobium melaleucaphilum*)
    - *Eucalyptus seeana* - endangered population
    - Big Nellie Hakea (*Hakea archaeoides*)
    - Tree Guinea Flower (*Hibbertia hexandra*)
    - Noah's False Chickweed (*Lindernia alsinoides*)
    - Macadamia Nut (*Macadamia integrifolia*)
    - Slender Marsdenia (*Marsdenia longiloba*)
    - Biconvex Paperbark (*Melaleuca biconvexa*)
    - Grove's Paperbark (*Melaleuca groveana*)
    - Rusty Plum, Plum Boxwood (*Niemeyera whitei*)

- Milky Silkpod (*Parsonsia dorrigoensis*)
- Scrub Turpentine (*Rhodamnia rubescens*)
- Native Guava (*Rhodomyrtus psidioides*)
- Manning Yellow Solanum (*Solanum sulphureum*)
- Magenta Lilly Pilly (*Syzygium paniculatum*)
- Austral Toadflax (*Thesium australe*)
- Cryptic Forest Twiner (*Tylophora woollsii*)

- Targeted surveys for 16 threatened fauna species:
  - Rufous Bettong (*Aepyprymnus rufescens*)
  - Bush Stone-curlew (*Burhinus grallarius*)
  - Eastern Pygmy-possum (*Cercartetus nanus*)
  - Red Goshawk (*Erythrotriorchis radiatus*)
  - Pale-headed Snake (*Hoplocephalus bitorquatus*)
  - Stephens' Banded Snake (*Hoplocephalus stephensii*)
  - Green and Golden Bell Frog (*Litoria aurea*)
  - Stuttering Frog (*Mixophyes balbus*)
  - Southern Myotis (*Notamacropus parma*)
  - Southern Greater Glider (*Petauroides volans*)
  - Squirrel Glider (*Petaurus norfolcensis*)
  - Brush-tailed Phascogale (*Phascogale tapoatafa*)
  - Koala (*Phascolarctos cinereus*)
  - Common Planigale (*Planigale maculata*)
  - Long-nosed Potoroo (*Potorous tridactylus*)

To quantify the proposed biodiversity impacts (both direct and indirect) associated with the proposed modification, an area encompassing the subject land and a 30m buffer, where permissible, has been assessed and is referred to as the Niche Study Area.

It is noted that, while the subject land as a stand-alone area may not have been subject to some of the required survey methods undertaken, as it was a part of the larger area assessed by RPS (2024) (which was surveyed in accordance with the BAM), it is considered that satisfaction of the BAM requirements extends to the subject land.

Results

Plant Community Types

One Plant Community Type (PCT), PCT 3250: Northern Foothills Blackbutt Grassy Forest, was mapped within the Niche Study Area, this encompassing 3.07ha. The subject land is 2.03ha, 1.84ha of which is PCT 3250 that will be directly impacted as part of the proposed modification.

Threatened Ecological Communities

No Threatened Ecological Communities (TEC) occur within the Niche Study Area and the proposed modification will not impact on TECs.

Threatened Flora and Fauna

No species credit species were recorded within the subject land.

The following species credit species were recorded within the RPS Study Area but not the subject land:

- Fauna
    - Powerful owl (*Ninox strenua*), listed as endangered in the BC Act
    - Little Bent-winged bat (*Miniopterus australis*), listed as vulnerable in the BC Act.

  Suitable habitat for these species (i.e. hollow-bearing trees, caves, tunnels) was not identified within the Niche Study Area.

- Flora
    - Scrub turpentine, listed as critically endangered in both the BC and EPBC Acts
    - White-flowered Wax Plant, listed as endangered in both BC and EPBC Acts
    - Red Helmet Orchid, listed as endangered in the BC Act.

The following species credit species was recorded within the Niche Study Area but not the subject land:

- Scrub Turpentine.

The proposed modification will not impact on any species credit species.

Matters of National Environmental Significance (MNES)

The only MNES considered under the EPBC Act Significant Impact Criteria Assessment is the Koala (*Phascolarctos cinereus*). Although Koala activity was not identified during previous surveys (undertaken in accordance with the BAM) within the RPS Study Area, indicators of Koala habitat (Youngentob et al. 2021) were identified within the Niche Study Area. Specifically, vegetation within the subject land contained both locally important and ancillary Koala habitat trees for the central NSW coast region, in accordance with Table 5 of Youngentob et al. As such, a significant impact assessment has been conducted. The proposed modification does not meet the definition of a controlled action under the EPBC Act, however it is recommended that the client refers this action to the Commonwealth for a determination.

Impact Assessment

The proposed modification will result in the following direct impacts:

- Removal of 1.84 ha of PCT 3250
- The removal of habitat for flora and fauna associated with PCT 3250.

Indirect impacts associated with the proposed modification are considered minimal and have not been quantified.

Measures to Avoid and Mitigate Impacts

Measures to avoid the impact of the proposed modification on local flora and fauna include:

- limiting the impact to areas immediately east of the existing quarry.

Measures to reduce the impact of the proposed modification on local flora and fauna include:

- Limiting impacts to areas that are not connected to habitat to the east and south, and
- Limiting impacts to areas that may have been subject of previous disturbance.

Credit Calculations and Offsetting

A total of 64 ecosystem credits are required to offset impacts associated with the clearing of 1.84 ha of PCT 3250.

No species credits are required to be offset as part of the proposed modification.

Glossary and List of Abbreviations

Term or abbreviation	Definition
AoS	Assessment of Significance
ASL	above sea level
Assessment Area	The subject land and the area of land within the 1,500 m buffer zone surrounding the subject land
BAM	Biodiversity Assessment Method
BAM-C	BAM Credit Calculator
BC Act	NSW Biodiversity Conservation Act 2016
BC Regulation	NSW Biodiversity Conservation Regulation 2017
BCS	NSW Biodiversity, Conservation and Science Directorate
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BOM	Bureau of Meteorology
Boral	Boral Resources (Country) Pty Ltd
BOS	Biodiversity Offsets Scheme
BV	Biodiversity Values
cm	centimetre
Cth DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DBH	Diameter at breast height
DECCW	Department of Environment, Climate Change and Water
Development Footprint / Subject land / proposed extension area	1.84ha of land adjoining the eastern side of the existing quarry footprint and the area to be directly impacted by the proposed modification.
DEWHA	Department of the Environment, Water, Heritage and the Arts
DoE	Department of the Environment
DP	Deposited Plan
DPHI	NSW Department of Planning, Housing and Infrastructure (formerly Department of Planning and Environment, DPE)

Term or abbreviation	Definition
DPIE	NSW Department of Planning, Industry, and Environment
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EEC	Endangered Ecological Community
ELA	Eco Logical Australia
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*
GDE	Groundwater Dependent Ecosystems
GDE Atlas	Groundwater Dependent Ecosystems Atlas
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare/s
IBRA	Interim Biogeographic Regionalisation for Australia
IGGAM	Interim Grasslands and other Groundcover Assessment Method
km	kilometre
LEP	Local Environmental Plan(s)
LGA	Local Government Area
LiDAR	Light Detection and Ranging
LLS Act	NSW Local Land Services Act 2013
m	metre
m AHD	metres Australian Height Datum
mm	millimetres
mm/s	millimetres per second
MNES	Matters of National Environmental Significance (from the EPBC Act).
Niche	Niche Environment and Heritage Pty Ltd
Niche Study Area	As illustrated in Figure 1, an area including the subject land and a 30m buffer, excluding the existing quarry pit.
NRAR	Natural Resource Access Regulator
NSW	New South Wales
NSW DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water

Term or abbreviation	Definition
NVRM	Native Vegetation Regulatory map
OEH	Office of Environment and Heritage
PCT	Plant Community Type
PMST	Protected Matters Search Tool
RDP	Rapid Data Point
RL	Relative Level
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
TBDC	Threatened Biodiversity Database Collection
TEC	Threatened Ecological Community
The proposed modification	Johns River Quarry extension
TSSC	Threatened Species Scientific Committee
VEC	Vulnerable Ecological Community
VI	Vegetation Integrity
VZ	Vegetation Zone
WM Act	NSW *Water Management Act 2000*

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Declarations

Certification under clause 6.15 Biodiversity Conservation Act 2016

I certify that this report has been prepared based on the requirements of, and information provided under, the Biodiversity Assessment Method (BAM)and clause 6.15 of the NSW *Biodiversity Conservation Act 2016* (BC Act).

Signature: 

Date: 25 August 2024

BAM Assessor Accreditation no: BAAS22009

This Biodiversity Development Assessment Report (BDAR) has been prepared to meet the requirements of BAM 2020. Annex 2 provides an assessment of compliance with the minimum information requirements as outlined in Appendix K of the BAM.

Details and experience of authors and contributors

This BDAR was prepared by accredited personnel and support staff identified in Table 1. In preparing this report, Niche Environment and Heritage Pty Ltd (Niche) partially relied on data collected by RPS as part of a Biodiversity Investigation Report (BIR) (RPS 2024). RPS and assistant ecologists who contributed to the BIR are included in Table 1.

Table 1 Assessor and support staff qualifications

Name	BAM assessor accreditation number	Position / company	Role	Relevant qualifications
Luke Baker	BAAS17033	General Manager / Niche	Direction, management, and coordination.	BAppSc
Stephen Bloomfield	BAAS19077	Senior Principal – Ecology / Niche	Technical and quality review.	BSc, MConsBio MEIANZ
Dmitri Medvedko	BAAS22009	Associate – Ecology / Niche	Field work and delivery	BSc
Shannon Baker	-	Consultant – Ecology / Niche	Support in field work and report writing	BEnvSc
Mark Aitkens	BAAS17034	Ecologist / RPS	Undertook surveys and composed the BIR for RPS in 2020 – 2022	BSc

Name	BAM assessor accreditation number	Position / company	Role	Relevant qualifications
Tara Boreham[1]	BAAS23039	Senior Ecologist / RPS	Undertook surveys and composed the BIR for RPS in 2020 – 2024	BSc
Dr. Hayden Beck	BAAS19000	Ecologist / RPS	Undertook surveys for RPS in 2020 – 2022	BSc, PhD
Shawn Ryan		Ecologist / RPS	Undertook surveys for RPS in 2020 – 2022	BSc
Dan Creevey	BAAS24019[2]	Ecologist / RPS	Undertook surveys for RPS in 2020 – 2022	BSc
Rhys Corrigan		Ecologist / RPS	Undertook surveys for RPS in 2020 – 2022	BSc

Conflict of interest

I declare that I have considered the circumstances and there is no actual, perceived, or potential conflict of interest.

This declaration has been made in the interests of full disclosure to the decision-maker. Full disclosure has also been provided to the client.

Signature: 

Date: 25 August 2024

BAM Assessor Accreditation no: BAAS22009

[1] Ms. Boreham was not BAM accredited at the time of assisting with the BIR.

[2] Mr. Creevey was not BAM accredited at the time of assisting with the BIR.

1 Introduction

1.1 Background

Boral Resources (Country) Pty Ltd (Boral) owns and operates the Johns River Quarry at Bulleys Road, Johns River (the quarry or the site), a long-standing hard rock quarry that extracts and transports high quality hard rock aggregates for use as road base and in the construction industry. The quarry operates under development consent no. DA 93/31 (as amended) from the (former) Greater Taree Council. DA 93/31 is due to expire in July 2026.

The quarry is located at the northern end of Bulleys Road, approximately 2 km north of the village of Johns River and 500 m north-west of the Pacific Highway. The regional city of Taree is located approximately 38 km south-west of the quarry.

The existing quarry operations area is approximately 16.46 ha and incorporates the extraction area, haul roads, plant area, stockpile and loading area, weighbridge and truck staging area, noise bunds and water management structures, car parking and amenities.

Due to the ongoing demand for high quality hard rock quarry products, Boral is seeking consent from the MidCoast Council to modify DA 93/31 to extend the life of the quarry through a minor extension of the quarry operations area.

The key components of the Johns River Quarry Extension – Modification 3 (the proposed modification) include:

— continuing existing operations for an additional 15 years (until 2041); and
— extending the quarry operations area by 2.03 ha to the north-east to provide access to approximately 2.3 million tonnes (Mt) of additional resource.

There would be no other changes, noting that the proposed modification does not seek to modify:

— the approved rate of extraction;
— the depth of extraction;
— the type of product being extracted;
— existing drill and blast extraction methods;
— truck types or the number of movements;
— hours of operation;
— the number of employees;
— existing site office, amenities, weighbridge and parking area; and
— existing stockpile areas, crushing and screening plant, and mobile machinery.

The following table provides a comparison of the main components of the proposed modification with the original and existing (as modified) consents.

Table 2 Comparison of the main components of the proposed modification

Component	Original consent	Existing (as modified) consent	The proposed modification
Life of the quarry	July 2018	July 2026	July 2041

Component	Original consent	Existing (as modified) consent	The proposed modification
Quarry operations area	15 ha	16.46 ha	18.49 ha
Depth of extraction	RL 35 m	RL 0 m	No change
Approved annual production	100,000 tonnes per annum (tpa)	300,000 tpa[1]	No change
Truck routes	Southbound through Johns River Village and Northbound on Pacific Highway via Bulleys Road / Stewarts River interchange	No change	No change
Truck movements	60 per day	120 per day (60 each way)	No change
Operating hours (including stockpiling, processing, truck loading and dispatch)	Monday to Friday: 6.30 am to 5.30 pm Saturday: 6.30 am to 1.30 pm Sunday: No works	Monday to Friday: 7 am to 6 pm Saturday: 7 am to 1.30 pm Sunday: No works	No change
Blasting hours	Monday to Friday: 11 am to 3 pm	Monday to Friday: 9 am to 3 pm Saturday: 9 am to 1.30 pm	No change

Note 1: DA 93/31 allows for an increase in the annual production rate to 450,000 tpa for approved special projects.

Boral commissioned Niche Environment and Heritage Pty Ltd (Niche) to compose a Biodiversity Development Assessment Report (BDAR) for the proposed extension of the existing quarry pit (the proposed modification).

1.2 The subject land

The proposed extension area, hereafter referred to as the subject land, is the extent of surface disturbance for all activities and development components associated with the proposed modification. The extent of the subject land is 2.03 ha, 1.84 ha of which is occupied by native vegetation. The existing quarry area is 16.46 ha; therefore, the total quarry footprint after the proposed modification is expected to be 18.49 ha.

The subject land is wholly on Lot 2 / DP716380 and consists of a patch of sclerophyll vegetation that measures approximately 50 metres (m) wide and 400 m long, occurring along the eastern edge of the existing quarry pit. Vegetation within the subject land is separated from vegetation to the east and south by fire trails, however it is connected to Middle Brother National Park, a relatively large, intact patch of vegetation, to the north (Figure 1 Site Map).

The subject land is located within the NSW North Coast IBRA Region, the Macleay Hastings IBRA Sub Region, and the Brothers Peaks Mitchell Landscape.

1.3 Study areas

The Niche Study Area is an area encompassing the subject land and a 30 m buffer, excluding the existing quarry pit (refer to Figure 1 Site Map).

The RPS Study Area[3] encompasses Lot 2 / DP716380 (the subject land) as well as parts of Lot 44 / DP816023 and Lot 11 / DP1104156 (refer to Figure 5 Fauna methods - survey effort).

1.4 Approval and assessment process

The following legislation or planning instruments are relevant to works associated with the proposed modification.

1.4.1 State approval and assessment process - entry into the Biodiversity Offsets Scheme

Development consent for the proposed modification is sought under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). In concert with the EP&A Act, the *Biodiversity Conservation Act 2016* (BC Act) provides a framework called the Biodiversity Offsets Scheme (BOS) for assessing and offsetting impacts to biodiversity. Under the BOS, impacts to biodiversity are quantified via the Biodiversity Assessment Method (BAM) and BAM Credit Calculator (BAM-C). The BC Act stipulates that, for a Part 4 activity, entry into the BOS is triggered if:

- The area of native vegetation to be cleared exceeds the clearing threshold associated with the minimum lot size applicable to the property, or
- The land to be cleared is mapped as containing Biodiversity Values (BV) on the BV Map, or
- The development is likely to significantly affect threatened species or ecological communities, in accordance with clause 7.3 of the BC Act (commonly referred to as the five-part test).

As such, entry into the BOS and the preparation of a BDAR is required given the proposed clearing area of 1.84 ha of native vegetation exceeds the clearing threshold of 1 ha for lots with a minimum lot size of between 40 and 1000 ha.

1.4.2 Commonwealth Approval and Assessment Process

Matters of National Environmental Significance (MNES) are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The BAM requires proponents to identify and assess impacts on all nationally listed threatened species and threatened ecological communities that are on or near a proposed development.

Where an MNES is present, or likely to occur, an Assessment of Significance (AoS) is to be undertaken referring to the Significant Impact Criteria provided in the Significant Impact Guidelines for MNES (DoE, 2013). Where a significant impact on an MNES is likely to occur, the matter should be referred to the Australian Government Department of the Environment for approval.

1.4.3 NSW Biosecurity Act 2015

The broad objectives for biosecurity in NSW under the *Biosecurity Act 2015* are to manage biosecurity risks from animal and plant pests and diseases, weeds and contaminants by:

[3] RPS refers to this area as the Project Area in the Biodiversity Investigation Report (BIR).

— Preventing their entry into NSW
— Quickly finding, containing and eradicating any new entries
— Effectively minimising the impacts of those pests, diseases, weeds and contaminants that cannot be eradicated through robust management arrangements.

Under the *Biosecurity Act 2015*, priority weeds are defined in the following categories:

— Weeds of National Significance
— National Environmental Alert List Weeds
— Water weeds
— Native plants considered weeds.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

1.4.4 NSW Water Management Act 2000

The NSW *Water Management Act 2000* (WM Act) provides for the protection, conservation, and ecologically sustainable development of waterways. It controls the carrying out of activities in or near waterways, their ecosystems, ecological processes, biological diversity, and water quality.

Controlled activities carried out in, on or under waterfront land are regulated by the WM Act. The Natural Resource Access Regulator administers controlled activities under the WM Act and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land as a result of the carrying out of proposed work. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 m of the highest bank of the river, lake or estuary. The subject land is over 50 m away from the nearest waterway – a first order stream, according to the Strahler stream classification system (Strahler 1952) and, therefore, the proposed modification will not impact on waterfront land.

1.4.5 State Environmental Planning Policy (SEPP) (Biodiversity and Conservation) 2021

1.4.5.1 Chapter 3 Koala habitat protection 2021

Chapter 3 of the State Environmental Planning Policy (SEPP) (Biodiversity and Conservation) 2021 (Biodiversity and Conservation SEPP) aims to encourage conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline by:

— Requiring the preparation of plans of management before development consent can be granted in relation to areas of core Koala habitat
— Encouraging the identification of areas of core Koala habitat
— Encouraging the inclusion of areas of core Koala habitat in conservation zones.

Chapter 3 of the Biodiversity and Conservation SEPP applies to rural zoned land (RU1 Primary Production, RU2 Rural Landscape and RU3 Forestry) in the 76 LGAs along the eastern seaboard of NSW, including the Mid Coast Council LGA. The Mid Coast Council LGA is within the North Coast Koala Management Area.

Chapter 3 stipulates that a Koala Plan of Management (KPoM) is required before consent can be granted for development in core koala habitat. Chapter 3 defines core Koala habitat as an area of land with a resident population of koalas, evidenced by attributes such as breeding females, being females with young, and recent sightings of and historical records of a population. Potential Koala habitat is defined as areas of native vegetation where trees of the types listed in Schedule 1 of the Biodiversity and Conservation SEPP constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Chapter 3 of the Biodiversity and Conservation SEPP has been considered further in Section 11.

1.4.6 Local Environmental Plan

Local Environmental Plans (LEP) are created by Councils in consultation with their community and guide planning decisions for LGAs. They apply either to the whole or part of an LGA and make provision for the protection or utilisation of the environment through zoning of land and development controls.

Land associated with the Niche Study Area is wholly within Lot 2 on Deposited Plan (DP) 716380 and is currently zoned as RU1 (Primary Production) under the Greater Taree LEP (2010). Mid-Coast Council is currently consolidating the various LEPs of its amalgamated constituent LGAs[4] into a draft Mid-Coast Council LEP. Under this LEP Lot2 DP 716380 is zoned RU4 (Primary Production); there is no proposed land use or zoning change under the draft Mid-Coast Council LEP.

1.5 Assessment objectives and format

The primary objective of this assessment is to use the BAM and associated guidelines to determine the impact the proposed modification would have on biodiversity, avoid and mitigate these impacts, and calculate the proposed modification's biodiversity offset requirement.

This BDAR has two broad stages consistent with the BAM:

- Stage 1 – Biodiversity Assessment that includes:
    - Assessment of landscape features
    - Assessment of native vegetation
    - Assessment of threatened species and populations.
- Stage 2 – Impact Assessment that includes:
    - Strategies to avoid and minimise impacts on biodiversity values
    - Considerations of impact and offset thresholds,
    - Determination and calculation of offset requirements.

Biodiversity impacts as a result of the proposed modification were also evaluated in light of other relevant legislation, specifically the EPBC Act and Biodiversity and Conservation SEPP

1.6 Information Sources

Resources and survey guidelines that were utilised for the application of the BAM are detailed in Table 2. Resources utilised for the AoS are detailed in Section 10.1.

Table 3 Assessment resources and guidelines

Assessment resources / guideline	
Assessment guidelines	BAM (DPIE 2020a)
	BAM Operational Manual – Stage 1 (DPE 2022a)
	BAM Operational Manual – Stage 2 (DPE 2023a)
	BAM-C User Guide (OEH 2018a)

[4] Gloucester Shire, Great Lakes Council, and City of Greater Taree Council merged in 2016 to form the Mid-Coast Council.

Assessment resources / guideline	
	Determining native vegetation land categorisation for application in the BOS (DPE 2023b)
Survey guidelines	Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b)
	'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method (DPIE 2021)
	NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (DPIE 2020c)
	Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (Department of Environment and Conservation [DEC] 2004)
	Species specific survey requirements in the NSW BioNet Threatened Biodiversity Database Collection (TBDC) (NSW DCCEEW 2024b)
	Koala (Phascolarctos cinereus): Biodiversity Assessment Method Survey Guide (DPE 2022b)
	Threatened Reptiles – Biodiversity Assessment Method Survey Guide (DPE 2022c)
	In the absence of specific survey guidelines issued at the state level, Commonwealth survey guidelines were adapted:
	Survey Guidelines for Australia's Threatened Mammals: Guidelines for detecting mammals listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of Sustainability, Environment, Water, Population and Communities [DSEWPaC] 2011a)
	Survey Guidelines for Australia's Threatened Reptiles: Guidelines for detecting reptiles listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (DSEWPaC 2011b)
	Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment, Water, Heritage and the Arts [DEWHA] 2010a)
	Draft Survey Guidelines for Australia's Threatened Orchids: Guidelines for detecting orchids listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment [DOE] 2013)
	Survey Guidelines for Australia's Threatened Bats: Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (DEWHA 2010b)
Previous ecological assessments	Biodiversity Investigation Report (RPS 2024)
Key resources	This assessment used BAM 2020 and the latest version of the BAM-C, (App version 1.4.0.00, data version 67)

2 Landscape Assessment

2.1 Landscape features

Landscape features were identified according to Section 3.1 of the BAM (DPIE 2020a).

The following resources were reviewed by Niche:

- NSW State Vegetation Type Map (SVTM) (NSW DCCEEW 2022a)
- Transitional Native Vegetation Regulatory Map (NSW DCCEEW 2022b)
- NSW Landuse 2017 v1.2 spatial data (NSW DCCEEW 2019)
- NSW BioNet Vegetation Classification (NSW DCCEEW 2024c)
- Water Management (General) Regulation 2018 Hydro Line spatial data (DPIE 2018)
- NSW Hydrography (NSW Government Spatial Services 2024a)
- Historical aerial imagery (NSW Government Spatial Services 2024b)
- Interim Biogeographic Regionalisation for Australia (IBRA), Version 7, regions and subregions (DCCEEW 2024c)
- NSW (Mitchell) Landscapes – version 3.1 (DECCEEW, 2016)
- eSpade v2.2 (DPE 2024c).

Landscape features within the subject land and Assessment Area (i.e. a 1,500 m buffer zone surrounding the subject land) are described in the following sections, in accordance with Section 3.1 of the BAM (DPIE 2020a) and shown in Figure 2 Location Map.

2.1.1 IBRA bioregions and IBRA subregions

The subject land and assessment area is located wholly within the North Coast Bioregion IBRA region and in the Manning – Macleay IBRA subregion.

2.1.2 Rivers, streams, estuaries, and wetlands

The subject land nor the Niche Study Area contain any ephemeral streams or drainage lines. The subject land appears to drain to the east and south, along the fire trail via overland flows, towards Stewards River in the south. The nearest drainage line is over 50 m away and is a first order stream, according to the Strahler stream classification system (Strahler 1952).

2.1.3 Habitat connectivity

The subject land is separated from vegetation to the east by the Pacific Highway and from vegetation to the west by the existing quarry pit. The subject land is effectively connected to Middle Brother National Park to the north and to vegetation on crown land to the south.

2.1.4 Geology, Karst, caves, crevices, cliffs, rocks or other geological features of significance

The Niche Study Area does not contain any karst, caves, crevices, cliffs, rocks or other geological features of significance. Middle Brother Peak, a peak within Middle Brother National Park, contains an escarpment-like cliff but this feature is at least 2.5km north-west of the subject land.

2.1.5 Areas of Outstanding Biodiversity Value (AOBV)

There are no AOBV, as declared by the NSW Minister for the Environment, within the subject land or Assessment Area.

2.1.6 NSW (Mitchell) Landscape

The subject land is located within the Brother Peak Mitchell Landscape Unit (Department of Environment and Climate Change [DECC] 2002). This landscape is not an over cleared landscape, with a total of 11% cleared.

2.1.7 Additional landscape features

No additional landscape features were identified within the subject land or Assessment Area.

3 Native Vegetation

3.1 Plant Community Types, Threatened Ecological Communities, and Vegetation Integrity – Methods

3.1.1 Review of existing information

Plant Community Types (PCTs) and the presence of Threatened Ecological Communities (TECs) within the Niche Study Area were determined according to Section 4.2 of the BAM (DPIE 2020a). Desktop reviews of the SVTM (NSW DCCEEW 2022a), the BIR (RPS 2024), and BioNet Vegetation Classification (NSW DCCEEW 2024c) were used to identify potentially occurring PCTs. Vegetation mapping was refined following field surveys, based on BAM plot data collected by Niche in 2024.

RPS (2024) vegetation mapping was based on data collected in December 2020. This vegetation mapping was used to assist Niche with identifying landscape features, plant community types and vegetation zones.

3.1.2 Mapping native vegetation extent

The percentage of native vegetation cover estimated to remain in the landscape was assessed according to Section 3.2 of the BAM (DPIE 2020a). A 1,500 m buffer was applied to the edge of the subject land and native vegetation within the Assessment Area digitised using the latest available aerial imagery (Esri 2023) and Geographic Information System (GIS) editing tools. Vegetation mapping produced for the BIR (RPS 2024) as well as the SVTM (NSW DCCEEW 2022a) were used to inform native vegetation cover.

The total area of all digitised native vegetation was calculated to determine native vegetation cover within the 1,500 m buffer.

The Assessment Area was calculated to be 857 ha while the total area of native vegetation was calculated at 504 ha. Native vegetation therefore occupies 58% of the Assessment Area. The percentage of intact native vegetation cover was assigned to the >30-70% category as per the BAM (DPIE 2020a).

Native vegetation extent within the study area was mapped using data collected during vegetation surveys. This included vegetation plots and incidental observations. Section 3.2.1 describes the native vegetation extent within the study area.

3.1.3 Plot-based vegetation survey

To determine PCTs and to stratify the subject land into vegetation zones, historical and current aerial photography was analysed. RPS collected data from two BAM plots, from within the Niche Study Area in 2020 and Niche collected data from two BAM plots from within the Niche Study Area in 2024. Plot data collected by RPS was used to supplement data collected by Niche to verify PCTs and stratify PCTs into vegetation zones.

The BAM plots consisted of a 20 m x 20 m (or 400 m^2 equivalent) plot nested within a larger 20 x 50m (or 1000 m^2 equivalent) plot. Composition and structure attributes were collected from the smaller 400 m^2 plot while function attributes were collected from the larger 1000m^2 plot. The following data was collected at each BAM plot location:

- Site details
    - Site name
    - Name of recorder(s)
    - Date
    - Plot orientation, slope, and aspect

  - Easting and northing using a Global Positioning System (GPS)
  - Site photographs.

- The following species composition data was collected within each 400 m^2 plot:
  - Full name of all native and exotic plant species present
  - Growth form group for each native species as prescribed by Appendix F of the BAM (DPIE 2020a) ([T] Tree; [S] Shrub; [G] Grass and grass-like [F] Forb; [EG] Fern; (O) other)
  - If the species is native, exotic, or a high threat weed.
- The following vegetation structure data was collected within each 400 m^2 plot:
  - Estimate of the foliage cover of each recorded species: in decimals if less than 1 percent (%), in whole numbers up to 5% and to the nearest 5% if > 5%
  - Relative abundance rating or count (when less than 10) or estimate (when greater than 10) of the number of individuals of a species within the plot using the following intervals: 20, 50, 100, 500, 1,000, or specify a number greater than 1,000 if required.
- The following function data was collected within each 1,000 m^2 plot (50 m x 20 m):
  - Number of large trees, presence/absence of tree regeneration, tree stem size class, total length of fallen logs, number of hollow-bearing trees
  - Litter cover within five 1 m x 1 m sub-plots
  - High threat weed cover.

Table 3 illustrates the overall flora survey effort for PCT classification and VZ delineation.

Table 4 RPDs and VI Plots

Survey type	Conducted by	Timing	Area surveyed	Quantity	Quantity within Niche study area
Rapid Data Points	RPS	8 December 2020 9 December 2020 10 December 2020	RPS Study Area	11	
VI Plots	RPS	7 December 2020 8 December 2020 9 December 2020 10 December 2020	RPS Study Area	11	1
VI Plots	Niche	6 June 2024	Niche Study Area	2	2

Of the 11 plots surveyed by RPS, plot five was within the Niche Study Area and plot one was immediately adjacent to the Niche Study Area.

3.1.4 Vegetation Integrity survey

The total area of each vegetation zone was calculated using GIS and the minimum number of BAM plots determined in accordance with Section 4.3.4 the BAM (DPIE 2020a). Given the area of native vegetation within the subject land was less than 2 ha and had one vegetation zone, a minimum number of one BAM plots was required. Two VI plots were conducted to definitively determine whether the PCT was the same in the northern and southern portion of the subject land. Plot locations are shown on Figure 3.

3.2 Plant Community Types, Threatened Ecological Communities, and Vegetation Integrity – Results

3.2.1 Native Vegetation Extent

Following vegetation surveys, all vegetated areas of the Niche Study Area were assessed as native vegetation in accordance with the BAM (DPIE 2020a). The subject land contains 1.84 ha of native vegetation consisting of sclerophyll forest (Figure 3).

Areas that do not contain native vegetation within the Niche study area are limited to areas along the existing quarry wall.

Figure 3 shows all areas within the Niche Study Area identified as containing native vegetation.

3.2.2 Plant Community Types

To classify PCTs and VZs within the Niche Study Area, filters for the relevant IBRA region, IBRA sub-region, vegetation formation, and species composition were applied to BioNet Vegetation Classification data (NSW DCCEEW 2024c). Analysis of floristic data from BAM plots and abiotic factors such as landscape position, soil type, geology influence and other relevant information was used to determine the most appropriate PCT and VZ. Justification for PCT classification is provided in Annex 4.

The PCT and its area within the subject land is provided in Table 4 and shown in Figure 3. The subject land contains one VZ and one PCT.

Table 5 PCTs and vegetation zones within the subject land

PCT ID	PCT name	Vegetation class	Vegetation formation	Vegetation zone	Area (ha)	Percent cleared
3250	Northern Foothills Blackbutt Grassy Forest	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests (Grassy sub-formation)	3250_moderate	1.84	30%

Patch size classes were identified in accordance with subsection 4.3.2 of the BAM (DPIE 2020a) which states 'a patch is an area of native vegetation that occurs on the subject land and includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤ 30m for non-woody ecosystems)'. A patch may extend onto adjoining land. Patch sizes are assigned to one of the following classes: < 5 ha, 5-< 25 ha, 25-100 ha and ≥ 100 ha. Native vegetation within the subject land is associated with a patch size of ≥ 100 ha due to its connectivity to Middle Brother National Park.

3.2.3 Threatened Ecological Communities

Based on PCT and TEC associations (NSW DCCEEW 2024b), BC Act-listed TECs may occur within the Assessment Area, while the Protected Matters Search Tool (PMST) search indicated EPBC-Act listed TECs may be present within the 10 km search area (Table 5).

PCT 3250 is not associated with any TEC nor does it resemble any TEC that may occur within the Assessment Area based on PCT-TEC associations (NSW DCCEEW 2024b) (this includes TECs listed as a MNES under the EPBC Act).

Table 6 TECs within the Assessment Area

PCT ID	PCT Name	BC Act TECs	EPBC Act TEC
3021	Northern Lowland Subtropical Rainforest	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions, Lowland Rainforest on Floodplain in the NSW North Coast Bioregion	Lowland Rainforest of Subtropical Australia
3029	Lower North Wet Gully Palm Rainforest	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions, Lowland Rainforest on Floodplain in the NSW North Coast Bioregion	Lowland Rainforest of Subtropical Australia
3089	Lower North Waterhousea Riparian Rainforest	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions, Lowland Rainforest on Floodplain in the NSW North Coast Bioregion	Lowland Rainforest of Subtropical Australia
3165	Northern Brush Box Subtropical Wet Forest	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions, Lowland Rainforest on Floodplain in the NSW North Coast Bioregion	Lowland Rainforest of Subtropical Australia
4002	Northern Lowland Orange Gum Dry Swamp Forest	Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion,	Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions
4004	Northern *Melaleuca quinquenervia* Swamp Forest	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland
4026	Estuarine Sea Rush Swamp Oak Forest	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community
4028	Estuarine Swamp Oak Twig-rush Forest	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community

PCT ID	PCT Name	BC Act TECs	EPBC Act TEC
4042	Lower North Riverflat Eucalypt-Paperbark Forest	Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion	Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions
4044	Northern Creekflat Eucalypt-Paperbark Mesic Swamp Forest	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	N/A

All TECs within the Assessment Area form part of swamp, floodplain, or rainforest communities. The subject land is between 50 and 80 m AHD (Australian Height Datum), it is not within a swamp or floodplain and cannot be described as a rainforest community.

Therefore, as the PCT within the subject land is not associated with any TEC and that the TECs within the Assessment Area are associated with landforms or floristic assemblages not found within the Niche Study Area (i.e. rainforests, swamps, or floodplains), it is concluded that the Niche Study Area does not contain a TEC.

3.2.4 Vegetation Integrity score

Table 6 identities the composition, structure, function, and overall VI score for the one VZ present within the subject land. Relevant benchmark data from BioNet Vegetation Classification was used to calculate the VI score via the BAM-C, as described in BAM subsection 4.3.3(5).

Table 7 Vegetation Integrity Score

PCT ID	Vegetation zone name	Composition condition score	Structure condition score	Function condition score	Current VI score	Future VI score	Change in VI score	Number of hollow-bearing trees
3250	3250_Good	80.7	97.6	99	92	0	92	0

4 Identification of Candidate Threatened Species

4.1 Review of existing information

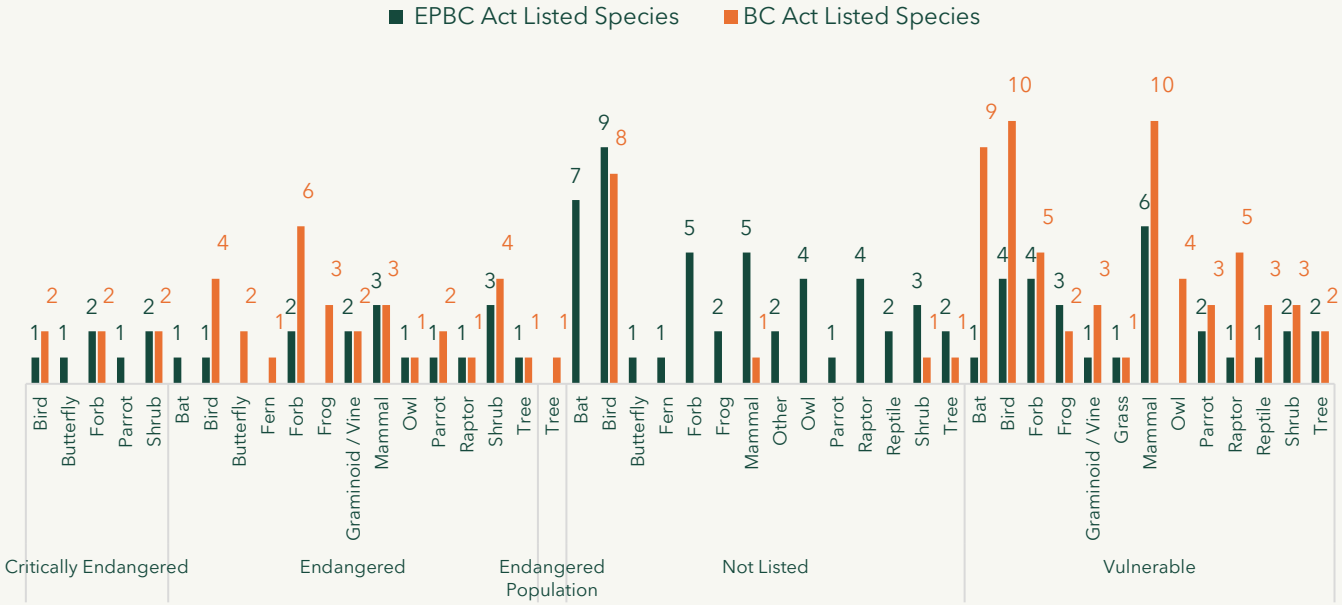
RPS (2024) undertook a comprehensive literature review as part of the BIR and produced a list of threatened species that require survey to verify presence or absence. Giving considering to the revision to PCTs that occurred in 2023 Niche verified and amended the RPS list and utilised the following resources to identify threatened species that can potentially occur on site:

- NSW BioNet Atlas (NSW DCCEEW 2024a): search area a 30 km buffer conducted July 2024.
- PMST: search area the same 30 km buffer used by RPS (Cth DCCEEW 2024a), conducted July 2024.
- NSW BioNet Threatened Biodiversity Database Collection (TBDC) (NSW DCCEEW 2024b)
- The BAM-C (OEH 2021), accessed by Niche in 2024
- National Flying-fox monitoring viewer (Cth DCCEEW 2024d).

Each identified threatened species was assessed in the context of the subject land and species-specific habitat requirements (i.e. species polygons) to determine whether a species or its habitat could potentially occur. With reference to the TBDC (NSW DCCEEW 2024b) habitat requirements or habitat constraints for each species was identified.

Nearly one hundred listed species were identified in the review of existing information. Graph 1 summarises the types and conservation statuses of all identified species except for migratory or marine species.

Graph 1 Types and conservation statuses of identified threatened species



Graph 1 generally illustrates the quantities and types of threatened species. Some species listed in the BC Act are not listed in the EPBC Act and vice versa while some species have different listing statuses at the State or

Commonwealth level which is why Graph 1 serves as an overall indicator of the species types and their conservation significance and paints a general picture of the density and types of listed species that may occur within and around the subject land.

4.2 Assessment of potential Koala Habitat

As defined by Chapter 3 of the Biodiversity and Conservation SEPP, potential Koala habitat is an area of native vegetation where trees of the types listed in Schedule 1 constitute at least 15% of the total number of trees in the upper or lower strata of the canopy. To determine whether the Niche Study Area constitutes potential Koala habitat, the abundance of trees from within Niche plots 1 and 2 was assumed to be consistent throughout the Niche Study Area. Two species from within plots 1 and 2, were listed in Chapter 3 of the Biodiversity and Conservation SEPP. Section 10 includes a Significant Impact Assessment for the Koala.

4.3 Threatened species excluded from further assessment

Of the species identified in the review of background information, species that have no suitable habitat present in the subject land have been excluded. For example, marine species including shorebirds and migratory species that rely on wetlands were excluded from further assessment as the Niche Study Area does not contain marine environments or wetlands, is at least 4 km from suitable habitat for wading birds, and is at least 8 km from any shoreline.

Table 7 presents a list of species that are unlikely to occupy the subject land based on habitat constraints.

Table 8 Species excluded from further assessment

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
Amaurornis moluccana Pale-vented Bush-hen	Vulnerable	Not Listed	The Pale-vented Bush-hen is found in dense vegetation, within 300m of, or in shallows of streams or other natural or artificial wetlands, North of South West Rocks	The Niche Study Area is not north of South West Rocks	BAM-C
Acronychia littoralis Scented Acronychia	Endangered	Endangered	Scented Acronychia is found between Fraser Island in Queensland and Port Macquarie on the north coast of NSW and is restricted to within 5 km of the coastline.	The Niche Study Area is south of Port Macquarie and is more than 5 km away from the coast.	PMST, BAM-C
Anthochaera phrygia Regent Honeyeater	Critically Endangered	Critically Endangered	As per the important habitat map	The Niche Study Area is not within the important habitat map for this species.	PMST, BAM-C
Argynnis hyperbius inconstans Australian Fritillary	Endangered	Critically Endangered	This species requires a high water table and high water nutrient load. It also requires dense swards of the food plant, *Viola betonicifolia* (Arrowhead Violet). *Viola betonicifolia* is the exclusive food plant.	No *Viola betonicifolia* identified within the Niche Study Area. The Nice Study Area does not have any waterbodies or a high water table.	PMST
Arthraxon hispidus Hairy-joint Grass	Vulnerable	Vulnerable	Moisture and shade-loving grass, found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps.	There are no creeks or swamps within the Niche Study Area.	PMST
Caesia parviflora var. minor Small Pale Grass-lily	Endangered	Not Listed	Found in damp places in open forest on wet heathland on sandstone and sand.	The Niche Study Area is not an open forest and it is well-draining and does not contain sandstone or sand.	BAM-C

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat	Vulnerable	Endangered	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in caves, overhangs, mines and concrete structures such as derelict buildings. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies.	The Niche Study Area and areas within 2 km of the Niche Study Area do not contain rocky areas with caves, overhangs, escarpments, outcrops, crevices, old mines or tunnels.	PMST
Coeranoscincus reticulatus Three-toed Snake-tooth Skink	Vulnerable	Vulnerable	Rainforest and occasionally moist eucalypt forest, on loamy or sandy soils. The Three-toed Snake-tooth Skink lives in loose soil, leaf litter and rotting logs, and feeds on earthworms and beetle grubs. Garden beds and urban yards under leaf litter on alluvial soils. The Three-toed Snake-tooth Skink occurs on the coast and ranges from the Macleay valley in NSW to south-eastern Queensland. It is very uncommon south of Grafton.	The Niche Study Area is outside the known range of this species and lacks alluvial or sandy soils.	PMST
Crinia tinnula Wallum Froglet	Vulnerable	Not Listed	Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation	The Niche and RPS Study Areas do not contain acidic swamps on coastal sand plains.	BioNet, BAM-C

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
			communities and disturbed areas, and occasionally in swamp sclerophyll forests. The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months but can occur throughout the year following rain. Eggs of 1.1-1.2mm are deposited in water with a pH of <6 and tadpoles take 2-6 months to develop into frogs. Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge. Males may call throughout the year and at any time of day, peaking following rain. The species polygon boundary for this species aligns with aquatic habitats linked directly to the record and a buffer, incorporating all the PCTs with which the species is associated, of 50m radius from the top of bank.		
Esacus magnirostris Beach Stone-curlew	Critically Endangered	Not Listed	Beach Stone-curlews are found exclusively along the coast, on a wide range of beaches, islands, reefs and in estuaries, and may often be seen at the edges of or near mangroves. They forage in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves. Beach Stone-curlews breed above the littoral zone, at the backs of beaches, or on sandbanks and islands, among low vegetation of grass, scattered shrubs or low trees; also among open mangroves.	The Niche Study Area is at least 8 km away from the coast. Suitable habitat is absent from the Niche Study Area.	BAM-C

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
Euphrasia arguta	Critically Endangered	Critically Endangered	Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. Plants from the Nundle area have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance. The number of plants at a given site may vary over time depending on the season and disturbance history. Near Nundle, local populations had apparently declined at sites that had been disturbed twice within three years, in contrast with sites that were disturbed only once. *Euphrasia arguta* has an annual habit and has been observed to die off over the winter months, with active growth and flowering occurring between January and April.	The Niche Study Area is not considered an open forest.	PMST
Falco hypoleucos Grey Falcon	Vulnerable	Vulnerable	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range.	The Niche Study Area is east of the dividing range.	PMST
Grammitis stenophylla Narrow-leaf Finger Fern	Endangered	Not Listed	*Grammitis stenophylla* is known from thirty (30) locations across New South Wales. The species is known to occur in twenty-four (24) conservations reserves. It is common in several areas, such as the Mount Warning Shield, the sandstone reserves of the lower Clarence, the granites of Washpool, Gibraltar and Nymbioda National Parks, and also Mt Jerusalem and Nightcap National Park. The species was also recently recorded from New England National Park. The Endangered status of this species does not appear to be warranted and requires review. This species inhabits	The Niche Study Area does not contain streams or moist places.	BioNet

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
			moist places, usually near streams, on rocks in rainforest and dry and moist eucalypt forest.		
Grantiella picta Painted Honeyeater	Vulnerable	Vulnerable	Mistletoes at a density of greater than five mistletoes per hectare. Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.	The Niche Study Area does not have a density of five mistletoes per hectare or greater.	PMST
Hirundapus caudacutus White-throated Needletail	Vulnerable	Vulnerable	Migratory and usually seen in eastern Australia from October to April. Breeds in forests in south-eastern Siberia, Mongolia, the Korean Peninsula and northern Japan June-August. Most often seen in eastern Australia before storms, low pressure troughs and approaching cold fronts and occasionally bushfire. These conditions are often used by insects to swarm (e.g. termites and ants) or tend to lift insects away from the surface which favours sighting of White-throated Needletails as they feed. More common in coastal areas, less so inland.	The Niche Study Area contains limited foraging habitat for this species because the Niche Study Area and surrounds do not have significant grassed open areas generally used by this species to feed on insects and take advantage of insect swarms.	PMST, BioNet,
Ixobrychus flavicollis Black Bittern	Vulnerable	Not Listed	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. The species polygon for this species is land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation	The Niche Study Area does not contain wetlands, is not within 40 m of wetlands or waterbodies and is well-draining.	BAM-C

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
Lindernia alsinoides Noah's False Chickweed	Endangered	Not Listed	Grows in swamp forests and wetlands along coastal and hinterland creeks.	The Niche Study Area is well draining and does not contain damp areas and is not adjacent to riparian areas including swamps, shallow areas or freshwater areas.	BAM-C
Litoria brevipalmata Green-thighed Frog	Vulnerable	Not Listed	The species polygon boundary should align with aquatic habitats linked directly to the record and a buffer, incorporating the PCTs with which the species is associated, of 100 m radius from the top of bank. Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range but extends into drier forests in northern NSW and southern Queensland. Breeding occurs following heavy rainfall from spring to autumn, with larger temporary pools and flooded areas preferred. Frogs may aggregate around breeding sites and eggs are laid in loose clumps among water plants, including water weeds. The larvae are free swimming. The frogs are thought to forage in leaf-litter. The species polygon boundary for this species aligns with aquatic habitats linked directly to the record and a buffer, incorporating all the PCTs with which the species is associated, of 100m radius from the top of bank.	The Niche Study Area is well-draining and the mapped first order stream within 100 m of the subject land is not considered suitable habitat for this species as it contains water only during rainfall events and the area surrounding the drainage line is relatively dry, lacking a thick layer of moist leaf litter. The Niche Study Area does not contain waterbodies or wetland environments and is not within 100 m of such areas. The Niche Study Area does not contain large depressions that may hold water, it is well-draining.	BAM-C
Maundia triglochinoides	Vulnerable	Not Listed	Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients.	The Niche Study Area does not contain any swamps, lagoons,	BioNet,

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
Maundia				dams, channels, creeks or shallow freshwater.	
Mixophyes iteratus Giant Barred Frog	Endangered	Vulnerable	Giant Barred Frogs are found along freshwater streams with permanent or semi-permanent water, generally (but not always) at lower elevation. Moist riparian habitats such as rainforest or wet sclerophyll forest are favoured for the deep leaf litter that they provide for shelter and foraging, as well as open perching sites on the forest floor. However, Giant Barred Frogs will also sometimes occur in other riparian habitats, such as those in drier forest or degraded riparian remnants, and even occasionally around dams. Although generally found within about 20m of the stream, outside the breeding season, the Giant Barred Frog may disperse away from the stream (e.g. 50m or further). It is a generalist feeder, with large insects, snails, spiders and frogs included in its diet.	The Niche Study Area does not contain any freshwater streams with permanent or semi-permanent water. The mapped first order stream 50 m from the subject land is not considered suitable habitat for this species as it contains water only during rainfall events and the area surrounding the drainage line is relatively dry, lacking a thick layer of moist leaf litter.	PMST, BioNet, BAM-C
Neophema chrysostoma Blue-winged Parrot	Vulnerable	Vulnerable	They tend to favour grasslands and grassy woodlands and are often found near wetlands both near the coast and in semi-arid zones (Higgins 1999; Holdsworth et al. 2021). Blue-winged parrots breed in Tasmania, coastal south-eastern South Australia and southern Victoria.	The Niche Study Area does not contain grassy woodlands and, therefore, cannot contain suitable foraging habitat for this species.	PMST
Ninox connivens Barking Owl	Vulnerable	Not Listed	Barking Owls will use patches of habitat within fragmented areas especially as foraging habitat but also for roosting and occasionally nesting. Hollows in dead stags are commonly selected for roosting and nesting habitat and are a limited resource due to natural attrition.	No hollows are present within the subject land or within 100 m of the subject land	BioNet, BAM-C

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
			A living or dead tree with a hollow >20 cm diameter that occurs >4 metres above the ground		
Ninox strenua Powerful Owl	Vulnerable	Not Listed	Hollows in dead stags are commonly selected for roosting and nesting habitat and are a limited resource due to natural attrition. Hollows in live trees are also used, and the prey of owls are often hollow-dependent. Powerful Owls may be found nesting in paddock trees and caves. A living or dead tree with a hollow >20 cm diameter that occurs >4 metres above the ground	No hollows are present within the subject land or within 100m of the subject land	BioNet, BAM-C, BIR
Ocybadistes knightorum Black Grass-dart Butterfly	Endangered	Not Listed	The species is highly constrained to short distances up slope from the coast, just above the king tide mark. There are a small number of exceptions where the grass grows at higher elevations. Where good quality patches of grass are established near to an existing colony of butterflies, they will (eventually) colonise them. Larval food source restricted to *Alexfloydia repens* (Floyd's grass).	The Niche Study Area is several kilometres away from the coast and does not contain *Alexfloydia repens*.	BAM-C
Persicaria elatior Knotweed, Tall Knotweed	Vulnerable	Vulnerable	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	The Niche Study Area is well draining and does not contain swamps, streams, or lakes.	PMST
Petalura gigantea Giant dragonfly	Endangered	Not Listed	Live in permanent swamps and bogs with some free water and open vegetation. Adults emerge from late October and are short-lived, surviving for one summer after emergence. Habitat constraints for this species include land within 500m of swamps.	The BIR concluded that the RPS Study Area does not form core habitat for this species. The Niche Study Area does not contain swamps and is not within a 500 m radius of swamps.	BIR

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
Petrogale penicillata Brush-tailed Rock-wallaby	Endangered	Vulnerable	Habitat for this species is considered land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops, or cliff lines	The Niche Study Area is not within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops, or cliff lines	BAM-C
Phaius australis Lesser Swamp-orchid	Endangered	Endangered	Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas.	The Niche Study Area does not contain any swampy areas.	PMST
Pseudomys novaehollandiae New Holland Mouse, Pookila	Not Listed	Vulnerable	Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes It is a social animal, living predominantly in burrows shared with other individuals Distribution is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire.	The Niche Study Area does not contain heathland communities or an understory containing heathland plants.	PMST
Rhizanthella slateri Eastern Underground Orchid	Vulnerable	Endangered	In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. The species is known from sclerophyll forest usually with a deep layer of organic litter.	The Niche Study Area has a thin topsoil layer with a hard, rocky substrate that is generally considered unsuitable for this species.	PMST

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
Scoteanax rueppellii Greater Broad-nosed Bat	Vulnerable	Not Listed	The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species.	The Niche Study Area does not contain any hollows, buildings, or other features that may be utilised by this species as roosting or breeding habitat.	BioNet
Stagonopleura guttata Diamond Firetail	Vulnerable	Vulnerable	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (*Eucalyptus pauciflora*) Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Groups separate into small colonies to breed, between August and January. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests.	Vegetation within the Niche Study Area is not a grassy eucalypt woodland and does not contain *Eucalytpus pauciflora*.	PMST

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
			Birds roost in dense shrubs or in smaller nests built especially for roosting.		
Thesium australe Austral Toadflax	Vulnerable	Vulnerable	Austral Toadflax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	The Niche Study Area is not a grassland, heathland, or grassy woodland and does not contain Kangaroo grass (*Themeda australis*).	BAM-C
Turnix maculosus Red-backed Button-quail	Vulnerable	Vulnerable	Over their Australian range, Red-backed Button-quail inhabit grasslands, open and savannah woodlands with grassy ground layer, pastures and crops of warm temperate areas, typically only in regions subject to annual summer rainfall greater than 400 mm. In NSW, said to occur in grasslands, heath and crops. Said to prefer sites close to water, especially when breeding. The species has been observed associated with the following grasses (in various vegetation formations): Speargrass (*Heteropogon spp.*), Blady Grass (*Imperata cylindrica*), Triodia, Sorghum, and Buffel Grass (*Cenchrus ciliaris*). Observations of populations in other parts of its range suggest the species prefers sites near water, including grasslands and sedgelands near creeks, swamps and springs, and wetlands. Red-backed Button-quail usually breed in dense grass near water, and nests are made in a shallow depression sparsely lined with grass and ground litter.	Vegetation within the Niche Study Area is not classified as grassland, heath, or cropland and is not close to water.	BAM-C

Species name	BC Act listing	EPBC act listing	Habitat*	Justification	Source
Tyto novaehollandiae Masked Owl	Vulnerable	Not Listed	Masked Owls will use patches of habitat within fragmented areas especially as foraging habitat but also for roosting and occasionally nesting. Hollows in dead stags are commonly selected for roosting and nesting habitat and are a limited resource due to natural attrition. A hollow considered suitable habitat for this species can be in a living or dead tree and must be >20 cm diameter at least 4 metres above the ground.	No hollows are present within the subject land or within 100 m of the subject land	BAM-C
Tyto tenebricosa Sooty owl	Vulnerable	Not Listed	Hollows in dead stags are commonly selected for roosting and nesting habitat and are a limited resource due to natural attrition. Hollows in live trees are also used, and the prey of owls are often hollow-dependent. Sooty Owls may be found nesting in paddock trees and caves. Suitable habitat for this species includes caves or cliffs including cliff lines / ledges and escarpments including cliff lines / ledges. A hollow considered suitable habitat for this species can be in a living or dead tree and must be >20 cm diameter at least 4 m above the ground.	No hollows are present within the subject land or within 100 m of the subject land	BioNet
Vespadelus troughtoni Eastern Cave Bat	Vulnerable	Not Listed	Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	Vegetation within the Niche Study Area is not dry open forest and is more than 2 km away from cliffs or rocky overhangs or other potential structures, including man-made structures, that can be considered potential habitat.	BAM-C

* Habitats descriptions are taken from the TBDC (NSW DCCEEW 2024b) and, in the case of the Blue-winged Parrot (*Neophema chrysostoma*), conservation advice prepared for the species (Cth DCCEEW 2023).

4.4 Ecosystem credit species

A total of 39 ecosystem credit or dual credit fauna species were identified. This includes 38 species identified by the BAM-C, and one additional species added from PMST results, the Gang-gang Cockatoo (*Callocephalon fimbriatum*). The Gang-gang cockatoo was added based on habitat considerations in the TBDC (Cth DCCEEW 2024a; NSW DCCEEW 2024b).

Of the species identified by the BAM-C, the Black bittern (*Ixobrychus flavicollis*) and New Holland Mouse (*Pseudomys novaehollandiae*) were removed from further assessment based on habitat constraints, as noted in Table 7. Table 8 presents identified ecosystem and dual credit species.

Table 9 Ecosystem credit species

Scientific name	Common name	BC Act listing	EPBC Act listing
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable	Not Listed
Callocephalon fimbriatum	Gang-gang Cockatoo	Endangered	Endangered
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	Vulnerable	Vulnerable
Chalinolobus nigrogriseus	Hoary Wattled Bat	Vulnerable	Not Listed
Chthonicola sagittata	Speckled Warbler	Vulnerable	Not Listed
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Vulnerable	Vulnerable
Coracina lineata	Barred Cuckoo-shrike	Vulnerable	Not Listed
Daphoenositta chrysoptera	Varied Sittella	Vulnerable	Not Listed
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Endangered
Ephippiorhynchus asiaticus	Black-necked Stork	Endangered	Not Listed
Esacus magnirostris	Beach Stone-curlew	Critically Endangered	Not Listed
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable	Not Listed
Glossopsitta pusilla	Little Lorikeet	Vulnerable	Not Listed
Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable	Not Listed
Hieraaetus morphnoides	Little Eagle	Vulnerable	Not Listed
Hirundapus caudacutus	White-throated Needletail	Vulnerable	Vulnerable
Lathamus discolor	Swift Parrot	Endangered	Critically Endangered
Lophoictinia isura	Square-tailed Kite	Vulnerable	Not Listed
Melanodryas cucullata cucullata	South-eastern Hooded Robin	Endangered	Endangered

Scientific name	Common name	BC Act listing	EPBC Act listing
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Vulnerable	Not Listed
Miniopterus australis	Little Bent-winged Bat	Vulnerable	Not Listed
Miniopterus orianae oceanensis	Large Bent-winged Bat	Vulnerable	Not Listed
Pachycephala olivacea	Olive Whistler	Vulnerable	Not Listed
Pandion cristatus	Eastern Osprey	Vulnerable	Not Listed
Petaurus australis	Yellow-bellied Glider	Vulnerable	Vulnerable
Petroica boodang	Scarlet Robin	Vulnerable	Not Listed
Petroica phoenicea	Flame Robin	Vulnerable	Not Listed
Phoniscus papuensis	Golden-tipped Bat	Vulnerable	Not Listed
Pseudomys novaehollandiae	New Holland Mouse	Not Listed	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Vulnerable
Ptilinopus magnificus	Wompoo Fruit-Dove	Vulnerable	Not Listed
Ptilinopus regina	Rose-crowned Fruit-Dove	Vulnerable	Not Listed
Ptilinopus superbus	Superb Fruit-Dove	Vulnerable	Not Listed
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Vulnerable	Not Listed
Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable	Not Listed
Stagonopleura guttata	Diamond Firetail	Vulnerable	Vulnerable
Syconycteris australis	Common Blossom-bat	Vulnerable	Not Listed
Thylogale stigmatica	Red-legged Pademelon	Vulnerable	Not Listed
Tyto longimembris	Eastern Grass Owl	Vulnerable	Not Listed

4.5 Flora species credit species and populations

A total of 23 threatened flora species and one threatened flora population were identified by the BAM-C as potential candidate threatened flora species. Two species, Trailing woodruff (*Asperula asthenes*) and Macadamia Nut (*Macadamia integrifolia*), were identified by the PMST. These three species were manually added to the BAM-C based on habitat considerations in the TBDC (Cth DCCEEW 2024a; NSW DCCEEW 2024b).

As noted in Table 7, of the species identified by the BAM-C, the Scented Acronychia (*Acronychia littoralis*), Small Pale Grass-lily (*Caesia parviflora var. minor*), Noah's False Chickweed (*Lindernia alsinoides*), Austral Toadflax (*Thesium australe*), and Cryptic Forest Twiner (*Tylophora woollsii*) were excluded from further assessment based on habitat constraints that were identified during the review of existing information and the habitat constraints assessment.

Flora species credit species that can potentially occur within the Niche Study Area based on the review of existing information described in Section 4.1 are listed in Table 9.

Table 10 Flora species credit species

Scientific name	Common name	BC Act listing	EPBC Act listing
Acacia courtii	North Brother Wattle	Vulnerable	Vulnerable
Asperula asthenes	Trailing Woodruff	Vulnerable	Vulnerable
Corybas dowlingii	Red Helmet Orchid	Endangered	Not Listed
Cryptostylis hunteriana	Leafless Tongue Orchid	Vulnerable	Vulnerable
Cynanchum elegans	White-flowered Wax Plant	Endangered	Endangered
Dendrobium melaleucaphilum	Spider orchid	Endangered	Not Listed
Eucalyptus seeana - endangered population	*Eucalyptus seeana* population in the Greater Taree local government area	Endangered Population	Not Listed
Hakea archaeoides	Big Nellie Hakea	Vulnerable	Vulnerable
Hibbertia hexandra	Tree Guinea Flower	Endangered	Not Listed
Macadamia integrifolia	Macadamia Nut	Not Listed	Vulnerable
Marsdenia longiloba	Slender Marsdenia	Endangered	Vulnerable
Melaleuca biconvexa	Biconvex Paperbark	Vulnerable	Vulnerable
Melaleuca groveana	Grove's Paperbark	Vulnerable	Not Listed
Niemeyera whitei	Rusty Plum, Plum Boxwood	Vulnerable	Not Listed
Parsonsia dorrigoensis	Milky Silkpod	Vulnerable	Endangered
Rhodamnia rubescens	Scrub Turpentine	Critically Endangered	Critically Endangered
Rhodomyrtus psidioides	Native Guava	Critically Endangered	Critically Endangered
Solanum sulphureum	Manning Yellow Solanum	Endangered	Endangered
Syzygium paniculatum	Magenta Lilly Pilly	Endangered	Vulnerable

4.6 Fauna species credit species

A total of 38 threatened fauna species were identified by the BAM-C as potential candidate threatened fauna species. Three species, the Green and Golden Bell Frog (*Litoria aurea*), the Gang-gang Cockatoo (*Callocephalon fimbriatum*), and the Red Goshawk (*Erythrotriorchis radiatus*), were manually added to the BAM-C based on PMST search results and habitat constraints listed in the TBDC (Cth DCCEEW 2024a; NSW DCCEEW 2024b).

As per Table 7, of the species identified by the BAM-C, Beach Stone-curlew (*Esacus magnitostris*), Barking Owl (*Ninox connivens*), Powerful Owl (*Ninox strenua*), Black Grass-dart Butterfly (*Ocybadistes knightorum*), Brush-tailed Rock-wallaby (*Petrogale penicillata*), Eastern Cave Bat (*Vespadelus troughtoni*), Giant Barred Frog (*Mixophyes iteratus*), Green-thighed Frog (*Litoria brevipalmata*), Red-backed Button Quail (*Turnix maculosus*), Masked owl (T*yto novaehollandiae*), and Wallum Froglet (*Crinia tinnula*) were excluded from further assessment based on habitat constraints identified during the review of existing information and the habitat constraints assessment.

The review of existing information and / or the results of the habitat constraints assessment identified that breeding habitat for nine dual credit species was not present within the Niche Study Area as outlined in Table 10. Therefore, these species were removed from further assessment and targeted surveys were not undertaken for these species.

Table 11 Dual credit fauna species that were excluded from further assessment

Species name	BC Act listing	EPBC Act listing	Breeding habitat	Justification	Source
Callocephalon fimbriatum Gang-gang Cockatoo	Endangered	Endangered	Potential nest trees are defined as woodland eucalypts containing hollows that are at least 3m above ground and with a diameter of 7cm or larger.	No potential nest trees were identified during the habitat constraints assessment.	PMST
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo	Vulnerable	Vulnerable	Potential nest trees are defined as trees that contain hollows that are at least 8 m above the ground, in stems with a diameter of at least 30 cm, with a hollow diameter at least 15 cm, and a stem angle is at least 45 degrees, near-vertical, or vertical.	No potential nest trees were identified during the habitat constraints assessment.	BAM-C, BioNet
Haliaeetus leucogaster White-bellied Sea-Eagle	Vulnerable	Not Listed	Stick nests – large nests in tall trees or similar structures.	No stick nests were identified during the habitat constraints assessment.	BAM-C, BioNet
Hieraaetus morphnoides Little Eagle	Vulnerable	Not Listed	Stick nests – large nests in tall trees or similar structures.	No stick nests were identified during the habitat constraints assessment.	BAM-C

Species name	BC Act listing	EPBC Act listing	Breeding habitat	Justification	Source
Lathamus discolor Swift Parrot	Endangered	Critically Endangered	As per the important habitat map	The important habitat map for this species does not include the Niche Study Area.	PMST, BioNet, BAM-C
Lophoictinia isura Square-tailed Kite	Vulnerable	Not Listed	Stick nests – large nests in tall trees or similar structures.	No stick nests were identified within the Niche Study Area or within 300 m of the subject land	BAM-C
Miniopterus orianae oceanensis Large Bent-winged Bat	Vulnerable	Not Listed	Potential breeding habitat is caves, tunnels, mines or other structures known or suspected to be used.	No potential breeding habitat is present within the subject land or within 100 m of the subject land.	BAM-C
Pandion cristatus Eastern Osprey	Vulnerable	Not Listed	Stick nests – large nests in tall trees or similar structures.	No stick nests were identified within the Niche Study Area or within 100 m of the subject land	BAM-C
Pteropus poliocephalus Grey-headed Flying-fox	Vulnerable	Vulnerable	Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.	The Niche Study Area does not contain breeding or roosting Flying-fox camps.	PMST, BAM-C

Species name	BC Act listing	EPBC Act listing	Breeding habitat	Justification	Source
			Site fidelity to camps is high; some camps have been used for over a century.		

Table 11 presents fauna species credit species that required survey.

Table 12 Fauna species credit species

Scientific name	Common name	BC Act listing	EPBC Act listing
Aepyprymnus rufescens	Rufous Bettong	Vulnerable	Not Listed
Burhinus grallarius	Bush Stone-curlew	Endangered	Not Listed
Cercartetus nanus	Eastern Pygmy-possum	Vulnerable	Not Listed
Erythrotriorchis radiatus	Red Goshawk	Endangered	Endangered
Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable	Not Listed
Hieraaetus morphnoides	Little Eagle	Vulnerable	Not Listed
Hoplocephalus bitorquatus	Pale-headed Snake	Vulnerable	Not Listed
Hoplocephalus stephensii	Stephens' Banded Snake	Vulnerable	Not Listed
Litoria aurea	Green and Golden Bell Frog	Endangered	Vulnerable
Lophoictinia isura	Square-tailed Kite	Vulnerable	Not Listed
Miniopterus orianae oceanensis	Large Bent-winged Bat	Vulnerable	Not Listed
Mixophyes balbus	Stuttering Frog	Endangered	Vulnerable
Myotis macropus	Southern Myotis	Vulnerable	Not Listed
Ninox connivens	Barking Owl	Vulnerable	Not Listed
Ninox strenua	Powerful Owl	Vulnerable	Not Listed
Notamacropus parma	Parma Wallaby	Vulnerable	Vulnerable
Pandion cristatus	Eastern Osprey	Vulnerable	Not Listed
Petauroides volans	Southern Greater Glider	Endangered	Endangered
Petaurus norfolcensis	Squirrel Glider	Vulnerable	Not Listed
Phascogale tapoatafa	Brush-tailed Phascogale	Vulnerable	Not Listed
Phascolarctos cinereus	Koala	Endangered	Endangered
Planigale maculata	Common Planigale	Vulnerable	Not Listed
Potorous tridactylus	Long-nosed Potoroo	Vulnerable	Vulnerable
Tyto novaehollandiae	Masked Owl	Vulnerable	Not Listed

5 Threatened Species Surveys

5.1 Habitat constraints assessment

Habitat assessments were conducted by RPS (2024) between December 2020 and August 2021 within the RPS Study Area. Niche conducted a detailed habitat assessment within the Niche Study Area, and undertook a search for hollow bearing trees, habitat suitable for bats, and stick nests within 300 m of the subject land. Niche also surveyed dams[5] and streams within 500 m of the subject land.

Habitat assessments undertaken by both Niche and RPS involved detailed recording and analysis of fauna habitat features throughout the respective study areas. Habitat features recorded in both RPS and Niche habitat assessments were:

- Vegetation structure and age
- Site condition
- Dominant flora species
- Presence of livestock
- Evidence of feral animals
- Hollow-bearing trees[6] and decorticating bark
- Nectar or fruit resources
- Rocky areas, including escarpments and outcrops
- Scattered trees
- The abundance of potential roosting habitat, including rocky areas containing caves, tunnels, mines, culverts, overhangs, escarpments, outcrops, crevices or boulder piles
- Logs, fallen timber and leaf litter
- Ephemeral and permanent waterbodies
- Evidence of disturbance (e.g. grazing, fire, tracks, logged stumps, erosion)
- Important feed trees and shrubs (e.g. primary feed trees for Koalas, cockatoos, etc.)
- Abundance of ground or arboreal termite mounds
- Mistletoe.

Habitat constraints for each species credit species were investigated in the TBDC (NSW DCCEEW 2024b) in accordance with Section 5.2.2 of the BAM (DPIE 2020a) and used to inform targeted survey methodology.

5.2 Flora survey methods

Threatened flora surveys were undertaken in accordance with the Threatened Flora Survey Guideline (Flora Guideline) (DPIE 2020b). The Flora Guideline provides for the width between parallel transects based on the life form and vegetation density as well as the length of field traverses and total survey effort required in hours.

The Niche Study Area contains 1.84 ha of dense vegetation of suitable habitat for numerous flora species credit species. As such, according to the Flora Guideline, at 5 traverse separation widths, the survey effort for 1.84ha in dense vegetation should be 3.68 km and should take approximately 2.44 person hours.

Niche completed parallel traverses spaced 5 m apart, with at least 2 – 5 m visual coverage on either side of the traverse within the Niche Study Area in June 2024. RPS completed parallel traverses spaced 10 m apart across

[5] Dams actively used by the quarry for operational purposes were not surveyed for habitat.

[6] Where present, Niche recorded hollow types (e.g. spout, trunk hollow, etc.), hollow height above ground, diameter, and orientation (e.g. north, south, west, east). These parameters were recorded to assist in determining habitat suitability for various hollow-dwelling animals (e.g. owls, cockatoos, microbats, arboreal mammals).

most of the RPS Study Area in December 2020 and in August 2021. It is noted that the Niche Study Area comprised part of the RPS parallel traverse survey effort.

Where suitable habitat overlapped for species of a different life form, the smaller distance between transects was adopted. Survey effort focused on seasonal requirements for optimal detection of each candidate species. Surveys were scheduled for maximum opportunity to observe flowering or fruiting species, where required.

Table 12 summarises the threatened flora survey effort within the Niche Study Area and Figure 4 illustrates flora survey tracks.

Table 13 Threatened flora survey effort within the Niche Study Area

Survey type	Conducted by	Timing	Total length (km)	Total person hours committed
10m parallel transects	RPS	7 December 2020 8 December 2020 9 December 2020 10 December 2020	9.5	16
5m parallel transects	RPS	2 August 2021 3 August 2021	0.2	0.5
5m parallel transects	Niche	7 June 2024	5	6

5.3 Fauna survey methods

Niche did not undertake any targeted fauna surveys as most species that are likely to occur within the Niche Study Area were surveyed for by RPS during an extensive, year-long fauna survey campaign. Species that were identified as candidate species requiring survey by Niche but not by RPS either did not have suitable habitat within the Niche Study Area or would have been detected by RPS during their survey campaign because they have identical survey requirements to the species targeted by RPS.

RPS employed several field survey techniques to target threatened fauna species within the RPS Study Area between January and August 2021 (RPS 2024).

Table 13, summarises the threatened fauna survey effort undertaken by RPS.

Table 14 Threatened fauna survey effort

Survey type	Dates	Threatened species targeted
Point/area Bird Census	January and May 2021	Little Eagle, Square-tailed Kite, White-bellied Sea-Eagle, White- eared Monarch
Ground/ Arboreal Trapping	February 2021	Squirrel Glider, Brush-tailed Phascogale, Eastern Pygmy Possum, Common Planigale
Dog Detection	June 2021	Koala, Spotted-tailed Quoll, Eastern Underground Orchid

Survey type	Dates	Threatened species targeted
Passive Acoustics Survey (Songmeter)	January – April 2021 and August 2021	Koala, Green-thighed Frog, Daveise's Treefrog, Giant Barred Frog, Stuttering Frog, Bush Stone-curlew
Nest Box Surveys	February – March 2021	Eastern Pygmy Possum, Common Planigale
Infra-red Cameras	January – April 2021	Koala, Parma Wallaby, Long-nosed Potoroo, Rufous Bettong
Spotlighting	January 2021	Koala, Squirrel Glider, Greater Glider, Powerful Owl, Masked Owl, Barking Owl, Sooty Owl, Stephens Banded Snake, Pale-headed Snake, Brush-tailed Phascogale, Parma Wallaby, Grey-headed Flying Fox, Bush Stone-curlew, Long-nosed Potoroo
Stag watching	May 2021	Squirrel Glider, Greater Glider, Brush-tailed Phascogale, Powerful Owl, Masked Owl, Barking Owl, Sooty Owl, Glossy-black Cockatoo
Anabat Census	February 2021	All microbats
Harp Trap	February 2021	Southern Myotis
Herpetofauna searches	January 2021	Green-thighed Frog, Daveise's Treefrog, Giant Barred Frog, Stuttering Frog, Stephens Banded Snake, Pale-headed Snake, *Coeranoscincus reticulatus*
Funnel traps	January 2021	*Coeranoscincus reticulatus*, Stephens Banded Snake, Pale-headed Snake

5.4 Habitat constraints assessment results

The results of the Niche and RPS habitat assessments are generally consistent, however Niche did not identify hollows within the Niche Study Area or within 300 m of the subject land. With reference to the RPS habitat mapping, they have not stipulated which locations are hollows and which are standing dead trees (stags). Niche identified several stags consistent with the RPS locations, however these were devoid of decorticating bark, fissures, or hollows and, therefore, had no value as breeding habitat for bats or hollow-dwelling animals, such as owls or gliders.

The Niche Study Area did not contain:

— creeks or swamps,
— sandstone, sand, sandy, or alluvial soil,
— rocky areas, outcrops caves or overhangs, and
— mistletoes at a density of five mistletoes per hectares or greater.

No flying fox camps or stick nests were identified within 300m of the subject land by Niche or by RPS.

The mapped first order stream to the east of the Niche Study Area was an ephemeral drainage line that was void of habitat features favourable for frogs such as deep, moist leaf litter. The Niche Study Area was fairy well-draining.

The dam in the north-eastern portion of the RPS Study Area did not have tannin-stained water or shallow banks and appeared to be fairy deep.

5.5 Flora Survey Results

No threatened flora was detected within the subject land by Niche or by RPS. Several individuals of Scrub turpentine (*Rhodamnia rubescens*) were detected within the Niche Study Area, but outside the subject land (Figure 8). This species is a count species and is outside the proposed Disturbance Footprint. As such, it is not a requirement to prepare a polygon or calculate an offset obligations for this species.

Table 14 outlines threatened flora survey results.

Table 15 Threatened flora survey results

Species name	Survey period prescribed by the BAM-C	Month surveyed	Results and discussion
Acacia courtii North Brother Wattle	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas. This species identified by RPS as a candidate species with a high likelihood of occurrence but was not one of the species credit species surveyed for by RPS in December.
Asperula asthenes Trailing Woodruff	October November December	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas and was one of the species credit species surveyed for by RPS in December.
Corybas dowlingii Red Helmet Orchid	June July	June (Niche) December (RPS)	This species was not detected within the Niche Study Areas by Niche or RPS but was detected by RPS within the larger RPS Study Area as illustrated in BIR Figure 3-9.
Cryptostylis hunteriana Leafless Tongue Orchid	November December January	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas but was not considered a candidate species by RPS. This species was identified in PMST search results by RPS and RPS determined the likelihood of occurrence for this species to be none. This species was not identified for RPS by the BAM-C but was identified by the BAM-C for Niche due to the re-classification of PCTs that occurred between the writing of this report and the writing of the BIR. Since habitat for this species is not well defined, removing this species from further assessment due to degraded habitat would not be reasonable but other habitat constraints listed by the TBDC support RPS's assessment regarding the low or negligible likelihood of occurrence for this species. Although the BAM-C associates the PCT within the subject land with this species, vegetation within the subject land lacks most of the woodland species the TBDC lists as typical of the environment for this species - Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Scribbly Gum (*Eucalyptus haemastoma*), Brown Stringybark (*Eucalyptus capitellata*), and Red Bloodwood (*Corymbia gummifera*). Finally and, possibly, most importantly, RPS conducted extensive surveys that nearly tripled the minimum time and distance requirements for this species within the Niche Study Area during the survey time

Species name	Survey period prescribed by the BAM-C	Month surveyed	Results and discussion
			prescribed by the BAM-C and did not detect this species so, even though the species was not considered a candidate species by RPS, because RPS did not detect this species during extensive surveys within the Niche Study Area, it is determined that this species is absent from within the Niche Study Area.
Cynanchum elegans White-flowered Wax Plant	All year	June (Niche) December (RPS)	This species was not detected within the Niche Study Areas by Niche or RPS but was detected by RPS within the larger RPS Study Area as illustrated in BIR Figure 3-9.
Dendrobium melaleucaphilum Spider orchid	August September	June (Niche) December (RPS)	This species was not detected within the Niche Study Area by Niche or RPS. Niche surveyed for this species outside of the prescribed survey time by the BAM-C and RPS did not identify this species as a candidate species. This species is an orchid that, like most other *Dendrobium spp.,* is lithophytic or epiphytic and is distinguished from *D. tetragonum*, a species that is not threatened, by the flowers, which usually occur in August or September. The intent of undertaking the surveys during the prescribed survey time is to conclusively determine what species of *Dendrobium* an identified orchid is. Vegetative parts of the Spider orchid are visible year-round. No lithophytic or epiphytic orchids were identified within the Niche Study Area so, therefore, the Spider orchid is determined to be absent.
Eucalyptus seeana - endangered population *Eucalyptus seeana* population in the Greater Taree local government area	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas. RPS did not identify this species as a candidate species.
Grammitis stenophylla Narrow-leaf Finger Fern	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas. RPS did not identify this species as a candidate species.
Hakea archaeoides Big Nellie Hakea	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas. This species was identified by RPS as a candidate species that did not require further assessment due to a low likelihood of occurrence.

Species name	Survey period prescribed by the BAM-C	Month surveyed	Results and discussion
Hibbertia hexandra Tree Guinea Flower	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas. This species was identified by RPS as a candidate species that did not require further assessment due to a low likelihood of occurrence.
Macadamia integrifolia Macadamia Nut	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas. This species not identified by RPS as a candidate species.
Marsdenia longiloba Slender Marsdenia	November December January February	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas and was one of the species credit species surveyed for by RPS in December.
Melaleuca biconvexa Biconvex Paperbark	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas and was one of the species credit species surveyed for by RPS in December.
Melaleuca groveana Grove's Paperbark	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas. This species was identified by RPS as a candidate species that did not require further assessment due to a low likelihood of occurrence.
Niemeyera whitei Rusty Plum, Plum Boxwood	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas and was one of the species credit species surveyed for by RPS in December.
Parsonsia dorrigoensis Milky Silkpod	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas and was one of the species credit species surveyed for by RPS in December.
Rhodamnia rubescens Scrub Turpentine	All year	June (Niche) December (RPS)	This species was detected within the Niche Study Areas by Niche and RPS and was detected by RPS within the larger RPS Study Area as illustrated in BIR Figure 3-9. This species is within the Niche Study Area but outside the subject land. It is a count species credit species so there is no species polygon or credit obligations associated with this species because it is not within the subject land.

Species name	Survey period prescribed by the BAM-C	Month surveyed	Results and discussion
Rhodomyrtus psidioides Native Guava	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas and was one of the species credit species surveyed for by RPS in December.
Solanum sulphureum Manning Yellow Solanum	All year	June (Niche) December (RPS)	This species was not detected within the RPS or Niche Study Areas. This species not identified by RPS as a candidate species.
Syzygium paniculatum Magenta Lilly Pilly	April May June	June (Niche) December (RPS)	This species was not detected within the Niche Study Areas by Niche or RPS.
Tylophora woollsii Cryptic Forest Twiner	January February March April	June (Niche)	This species was not detected within the Niche Study Area. This species was identified by RPS as a candidate species that did not require further assessment due to a low likelihood of occurrence. This species was surveyed for by Niche outside of the prescribed survey period, however, surveys were conducted after considerable rainfall, consistent with the survey requirements in the TBDC. No twiners (*Tylophora spp.*) were observed during targeted surveys so this species is considered absent.

5.6 Fauna Survey Results

RPS detected the following four threatened fauna species within the RPS Study Area (Figure 8 Threatened Species Recorded During Survey):

- Glossy-black Cockatoo
- Powerful Owl
- Varied Sittella
- Little Bent-winged bat.

The Varied Sittella is an ecosystem credit species, the Glossy-black Cockatoo and Litle Bent-winged bat are dual credit species, and the Powerful Owl is a species credit species. The latter three species were detected through acoustic recordings and analysis.

Habitat for Glossy-black Cockatoo, Litle Bent-winged bat and Powerful Owl was not detected within the Niche Study Area. Table 15 details the results of the threatened fauna survey.

This BDAR identified one MNES that may be impacted by the proposed modification, core Koala (*Phascolarctos cinereus*) habitat. Section 10.1 includes an AoS for the EPBC Act listed species.

Table 16 Threatened fauna survey results

Species name	Survey period prescribed by the BAM-C	Survey effort prescribed by the BAM / TBDC	Survey effort undertaken by RPS			Results and discussion
			Survey type	Date range	Survey coverage	
Aepyprymnus rufescens Rufous Bettong	All year	Camera traps	Infrared camera traps baited with peanut butter	12 January - 25 May 2021	14 locations for 134 nights	This survey effort for this species is considered adequate and this species was not detected in the Niche or RPS Study Area's.
Burhinus grallarius Bush Stone-curlew	All year	No specific survey type prescribed by the BAM / TBDC.	Opportunistic surveys	In conjunction with all other survey methods	RPS Study Area	This survey effort for this species is considered adequate and this species was not detected in the Niche or RPS Study Area's.
			Passive acoustic surveys	12 January – 14 February 2021	33 days, 2 locations, dusk to dawn recording – 66 recorder days	
				31 March – 27 April 2021	27 days, 4 locations, dusk to dawn recording – 108 recorder days	
				2 and 3 August 2021	2 days, 1 location, dusk to dawn recording – 2 recorder days	
			Infrared camera traps baited with peanut butter	12 January - 25 May 2021	14 locations for 134 nights	

Species name	Survey period prescribed by the BAM-C	Survey effort prescribed by the BAM / TBDC	Survey effort undertaken by RPS			Results and discussion
			Survey type	Date range	Survey coverage	
			Spotlighting	Each night from 11 – 15 January 2021	5 surveys, 2 people, 1 hour per night	
Cercartetus nanus Eastern Pygmy-possum	October November December January February March	No specific survey type prescribed by the BAM / TBDC. Surveys undertaken in accordance with the Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (DSEWPaC, 2011a)	Ground and arboreal trapping	29 – 31 March 2021	40 Ground Elliott traps, size A for 3 nights 20 Ground Elliott traps, size B for 3 nights 12 Arboreal traps for 3 nights	This survey effort for this species is considered adequate and this species was not detected in the Niche or RPS Study Area's.
			Nest boxes	30 March – 26 May 2021	10 nest boxes in 3 traplines for 57 days	
Erythrotriorchis radiatus Red Goshawk	All year	No specific survey type prescribed by the BAM / TBDC.	Stick nest search	During threatened flora parallel transect searches, see Table 11.		This survey effort for this species is considered adequate as stick nests are a readily identifiable and distinct feature of breeding habitat for this species. This species was not detected in the Niche or RPS Study Area's.
Hoplocephalus bitorquatus	November	Spotlighting – 4 surveys, 2 person hours / survey and	Spotlighting	Each night from 11 – 15 January 2021	5 surveys, 2 people, 1 hour per night	The survey effort for this species is considered adequate. The

Species name	Survey period prescribed by the BAM-C	Survey effort prescribed by the BAM / TBDC	Survey effort undertaken by RPS			Results and discussion
			Survey type	Date range	Survey coverage	
Pale-headed Snake	December January February March	72 trap nights of funnel traps	Funnel traps	Each night from 12 – 14 January 2021	3 nights 4 traplines 120m / trapline 10 funnels / trapline	spotlighting effort amounted to 10 person hours over five nights, this being two person hours and one additional night above the survey effort prescribed by the BAM. The funnel trap survey effort amounted to 120 trap nights at four traplines over three nights of ten funnels per trapline, which is significantly above the 72 trap nights prescribed by the BAM. RPS also undertook a habitat survey, a method that does not align with the survey effort prescribed by the BAM for this species. This species was not detected in the Niche or RPS Study Area's.
			Habitat survey (Herpetofauna searches)	11 – 15 January 2021	Transects across the RPS Survey Area	
Hoplocephalus stephensii Stephens' Banded Snake	October November December January February March	Spotlighting – 4 surveys, 2 person hours / survey	Spotlighting	Each night from 11 – 15 January 2021	5 surveys, 2 people, 1 hour per night	The survey effort for this species is considered adequate. The spotlighting effort amounted to 10 person hours over five nights, this being two person hours and one additional night above the survey effort prescribed by the BAM.
			Funnel traps	Each night from 12 – 14 January 2021	3 nights 4 traplines 120m / trapline 10 funnels / trapline	

Species name	Survey period prescribed by the BAM-C	Survey effort prescribed by the BAM / TBDC	Survey effort undertaken by RPS			Results and discussion
			Survey type	Date range	Survey coverage	
			Habitat survey	11 – 15 January 2021	Transects across the RPS Survey Area	RPS also undertook funnel trapping and a habitat survey, methods that do not align with the survey effort prescribed by the BAM for this species. This species was not detected in the Niche or RPS Study Area's.
Litoria aurea Green and Golden Bell Frog	November December January February March	Four (4) aural visual surveys, 480 minutes each and / or 154 recorder days of passive acoustic recordings.	Passive acoustic surveys	12 January – 14 February 2021	33 days, 2 locations, dusk to dawn recording – 66 recorder days	The survey effort for this species falls short of the minimum survey requirements prescribed by the BAM but is still considered adequate to determine presence or absence of this species due to considerations outlined in Section 5.7. This species was not detected in the Niche or RPS Study Area's.
				31 March – 27 April 2021	27 days, 4 locations, dusk to dawn recording – 108 recorder days	
			Aural visual surveys (called Call recognition and spotlighting surveys in the BIR, see BIR Section 2.4.2.3.1)	11 – 15 January 2021	Transects across the RPS Survey Area	
Mixophyes balbus Stuttering Frog	September October	Four (4) aural visual surveys, 480 minutes each and / or 154 recorder days	Passive acoustic surveys	12 January – 14 February 2021	33 days, 2 locations, dusk to dawn recording – 66 recorder days	The survey effort for this species falls short of the minimum survey requirements prescribed by the

Species name	Survey period prescribed by the BAM-C	Survey effort prescribed by the BAM / TBDC	Survey effort undertaken by RPS			Results and discussion
			Survey type	Date range	Survey coverage	
	November December January February March	of passive acoustic recordings.		31 March – 27 April 2021	27 days, 4 locations, dusk to dawn recording – 108 recorder days	BAM but is still considered adequate to determine presence or absence of this species due to considerations outlined in Section 5.7. This species was not detected in the Niche or RPS Study Area's.
			Aural visual surveys (called call recognition and spotlighting surveys in the BIR, see BIR Section 2.4.2.3.1)	11 – 15 January 2021	Transects across the RPS Survey Area	
Myotis macropus Southern Myotis	October November December January February March	Sixteen (16) harp traps or mist net nights over four nights. or Sixteen (16) nights of passive acoustic recording over four nights	Passive acoustic recording	27 February – 30 March 2021	31 days of recording in 3 locations for a total of 124 nights of passive acoustic recording.	This survey effort for this species is considered adequate and this species was not detected in the Niche or RPS Study Area's.
			Harp traps	30 – 31 March 2021	1 location for 2 nights	
Notamacropus parma Parma Wallaby	All year	No specific survey type prescribed by the BAM / TBDC. Surveys undertaken in accordance with the Survey guidelines for Australia's	Infrared baited camera traps	12 January - 25 May 2021	14 locations for 134 nights	This survey effort for this species is considered adequate and this species was not detected in the Niche or RPS Study Area's.

Species name	Survey period prescribed by the BAM-C	Survey effort prescribed by the BAM / TBDC	Survey effort undertaken by RPS			Results and discussion
			Survey type	Date range	Survey coverage	
		threatened mammals: Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (DSEWPaC, 2011a)	Spotlighting	Each night from 11 – 15 January 2021	5 surveys, 2 people, 1 hour per night	
Petauroides volans Southern Greater Glider	All year	No specific survey type prescribed by the BAM / TBDC. Surveys undertaken in accordance with the Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (DSEWPaC, 2011a)	Spotlighting	Each night from 11 – 15 January 2021	5 surveys, 2 people, 1 hour per night	This survey effort for this species is considered adequate and this species was not detected in the Niche or RPS Study Area's.
			Stag watching	24 – 27 May 2021	8 locations total, timed stationary point survey for 45 minutes at each location	
Petaurus norfolcensis	All year	TBDC states a retracted survey time from March -	Spotlighting	Each night from 11 – 15 January 2021	5 surveys, 2 people, 1 hour per night	This survey effort for this species is considered adequate and this

Species name	Survey period prescribed by the BAM-C	Survey effort prescribed by the BAM / TBDC	Survey effort undertaken by RPS			Results and discussion
			Survey type	Date range	Survey coverage	
Squirrel Glider		August should be adopted on sites with *Eucalyptus robusta* and *Banksia spp.* The Niche Study Area did not have either species. Surveys undertaken in accordance with the Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (DSEWPaC, 2011a)	Stag watching	24 – 27 May 2021	8 locations total, timed stationary point survey for 45 minutes at each location	species was not detected in the Niche or RPS Study Area's.
			Trapping	29 – 31 March 2021	2 Squirrel glider PVC traps for 3 nights	
Phascogale tapoatafa Brush-tailed Phascogale	December January February March April May June	Baited camera traps – 4 cameras for 4 weeks, bait replaced after 2 weeks or sooner.	Infrared baited camera traps	12 January - 25 May 2021	14 locations for 134 nights	The BIR does not list baited camera traps as one of the survey techniques designed to target this species specifically. However, the camera trapping survey effort is consistent with the survey requirements in the TBDC and, therefore, the survey effort for this species is considered adequate.
			Spotlighting	Each night from 11 – 15 January 2021	5 surveys, 2 people, 1 hour per night	
			Stag watching	24 – 27 May 2021	8 locations total, timed stationary point survey for 45 minutes at each location	

Species name	Survey period prescribed by the BAM-C	Survey effort prescribed by the BAM / TBDC	Survey effort undertaken by RPS			Results and discussion
			Survey type	Date range	Survey coverage	
			Ground and arboreal trapping	29 – 31 March 2021	40 Ground Elliott traps, size A for 3 nights 20 Ground Elliott traps, size B for 3 nights 12 Arboreal traps for 3 nights	The BIR indicates trapping, spotlighting, and stag watching target this species specifically. This species was not detected in the Niche or RPS Study Area's.
Phascolarctos cinereus Koala	All year – Spotlighting, Spot Assessment Technique, and detection dogs September, November, and December – Acoustic recording When daily minimum temperature is above 18°C. So, generally, during March, April, May,	Spot Assessment Technique (SAT) or detection dogs and spotlighting or passive acoustic recording or drone survey	Dog detection	26 – 30 April 2021	2 dogs Five days 47km of searches	The BIR indicates dog detection, passive acoustic recording, infrared baited camera traps, and spotlighting was undertaken to target this species specifically. The date range for passive acoustic recording was not compliant with the prescribed date range for this survey technique and camera traps are not listed as an employed survey method; however, the survey intensity and timing for dog detection and spotlighting surveys exceeded the minimum requirements for these survey methods and were undertaken in the RPS Study Area, an area that includes the Niche Study Area and is much larger. Therefore, the survey effort is considered adequate. This species was not
			Passive acoustic recording	27 February – 30 March 2021	31 days of recording in 3 locations for a total of 124 nights of passive acoustic recording.	
			Infrared baited camera traps	12 January - 25 May 2021	14 locations for 134 nights	

Species name	Survey period prescribed by the BAM-C	Survey effort prescribed by the BAM / TBDC	Survey effort undertaken by RPS			Results and discussion
			Survey type	Date range	Survey coverage	
	June, July, August, September, October, November, and December – Drone Surveys		Spotlighting	Each night from 11 – 15 January 2021	5 surveys, 2 people, 1 hour per night	detected in the Niche or RPS Study Area's.
Planigale maculata Common Planigale	All year	Pitfall traps, 3 pitfall traps per 1 ha of suitable habitat for 4 consecutive nights with an additional trap line per hectare of suitable habitat for areas of suitable habitat between 1 and 10 ha.	Baited ground trapping	29 – 31 March 2021	40 Ground Elliott traps, size A for 5 consecutive nights[7] 20 Ground Elliott traps, size B for 5 consecutive nights	The survey effort for this species falls short of the minimum survey requirements prescribed by the BAM but is still considered adequate to determine presence or absence of this species due to considerations outlined in Section 5.8. This species was not detected in the Niche or RPS Study Area's.
			Nest boxes	30 March – 26 May 2021	10 nest boxes in 3 traplines for 57 days	
Potorous tridactylus Long-nosed Potoroo	All year	14 nights of camera trapping.	Infrared baited camera traps	12 January - 25 May 2021	14 locations for 134 nights	This survey effort for this species is considered adequate and this species was not detected in the Niche or RPS Study Area's.

[7] BIR Table 2-6 states 3 nights of trapping was undertaken, however section 2.4.2.4.1 states trapping was undertaken for five consecutive nights. RPS confirmed trapping was undertaken for five nights.

5.7 Survey Adequacy for the Stuttering Frog (*Mixophyes balbus*) and Green and Golden Bell Frog (*Litoria aurea*)

The NSW Survey Guide for Threatened Frogs (DPIE 2020c) prescribes slightly different survey windows to those surveyed by RPS. However, RPS did comply with the survey techniques and intensities for these species. Both species require four nights of aural visual surveys of 480 minutes each for a 500 m transect of suitable habitat and / or 154 recorder days of passive acoustic recording with the first and last survey being a minimum of 14 days apart. The survey period for the Stuttering frog (*Mixophyes balbus*) is from September to March and the for the Green and the Golden Bell Frog (*Litoria aurea*) it is November and March.

RPS undertook a total of 174 days of passive acoustic recordings consisting of:

- Two recorders deployed for 33 days between 12 January to 14 February, 2021
- Four recorders deployed for 27 days between 31 March and 27 April, 2021.

Recorders were deployed near areas of potential habitat – ephemeral first order streams, suitable habitat for the Stuttering Frog, and the dam in the northeast portion of the RPS Study Area, potential, albeit unlikely, habitat for the Green and Golden Bell Frog. It is likely that, assuming the recorders had a coverage radius of 50 m, not all areas of potential habitat for the Stuttering Frog within 100 m of the subject land was covered.

So, while the total amount of recorder days exceeds the minimum requirements stated in the NSW Survey Guide for Threatened Frogs, one hundred and four (104) of these recorder days were in April, which is a month outside of the prescribed survey window for both species.

The likelihood of detecting both species in April 2021 was high considering meteorological conditions. The Green and Golden Bell Frog is more likely to call after moderate or heavy rainfall (White 1995) and during months when the air temperature (dry bulb) is between 14 – 25°C (Ford 1983, 1986; Thomson et al. 1996; Hamer 1998). The National Recovery Plan for the Stuttering Frog states this species breeds from early spring to mid-autumn, usually after heavy rainstorms (Hunter et. al. 2011).

With reference to BoM weather station 060141 (RPS 2024) the following weather conditions were experienced by the subject land during, and around the time of, f survey:

- Minimum temperatures during April averaged 15°C with temperatures decreasing towards the end of the month
- Rainfall between March and April was characterised by five periods of significant rain:
    - one four-day period starting on March 10
    - an eight-day period starting on March 16
    - a three-day period starting on March 29
    - a two-day period starting on April 6
    - a two-day period starting on April 17th.

  Of these rain events, the eight-day rain event in March had the warmest minimum average temperature followed by the rain event on April 6.

Average minimum temperatures were several degrees higher in January than in April however there was significantly more rainfall in March and April; therefore, the weather conditions for frogs to be calling were considered to generally be more favourable during March and April rather than January and February in 2021. As such, data collected during April 2021 is considered appropriate for determining presence or absence of this species although April is outside of the prescribed survey period for these species.

In addition to passive acoustic recording, RPS undertook a form of aural visual searches in January (referred to in the BIR as herpetofauna searches, call recognition or spotlighting surveys). While it does not appear that call playback formed part of the BIR frog survey, and the amount of hours spent on each survey method is unclear, it is noted that the entire RPS Study Area was covered by these survey techniques.

Results suggest the survey effort was substantial given the detection of other frog species, such as the Common eastern froglet (*Crinia signifera*), Brown Striped Marsh Frog (*Limnodynastes peronii*), Red-backed Toadlet (*Pseudophryne coriacea*), Stony-creek Frog (*Litoria wilcoxii*), Red-eyed Green Tree Frog (*Litoria chloris*), and Green Treefrog (*Litoria caerulea*) were detected. Of these species, the Red-backed Toadlet and Stony-creek Frog utilise similar habitats as the Stuttering frog. The Stony-creek frog utilises streams to lay eggs and the Stuttering Frog utilises streams for foraging habitat (Australian Museum Australian Museum. 2022). Both the Red-backed Toadlet and Stuttering Frog utilise leaf litter to lay eggs. The Common eastern froglet and Brown Striped Marsh Frog are found in similar environments to the Green and Golden Bell Frog, such as dams and similar waterbodies. Based on these results, it is reasonable to believe that all areas of suitable habitat for both species were surveyed.

5.8 Survey Adequacy for the Common Planigale (*Planigale maculata*)

The survey effort prescribed by the TBDC for the Common Planigale involves three pitfall traps per hectare of suitable habitat for four consecutive nights. For areas of suitable habitat between one and 10 ha, an additional trap array must be installed per hectare of suitable habitat; therefore, for 1.5 ha of suitable habitat, four pitfall trap arrays must be used. The survey effort undertaken by RPS involved three trap lines, each consisting of 25 size A Elliott traps and 10 size B Elliott traps, across the RPS Study Area for five consecutive nights.

Pitfall trap arrays usually have two traps, one on each end of a 10 m drift fence; so, the number of traps deployed by RPS was significantly greater than the number of traps in four arrays. Furthermore, the trapping effort was undertaken for five, as opposed to four nights and the length of the drift fence, or trap array, installed by RPS was 100 m as opposed to 10 m. As such, the total trapping effort for this species involved 300 m of drift fence over five nights with 105 traps. While this effort is technically not compliant with the TBDC as it is one pitfall trap array short of the prescribed minimum, the total length of drift fence, the number of trapping nights, and the number of traps used exceeds the minimum requirements for this species.

6 Meteorological conditions

Meteorological conditions were generally favourable during both the RPS and Niche survey campaigns. Adequate rainfall prior to general and targeted floristic surveys ensured vegetation was in optimal or near optimal condition. Surveys whose outcome could be significantly affected by weather (i.e. spotlighting, herpetofauna searches, harp trapping, stag watching, trapping, and bird censuses) were not conducted during periods of extreme or near extreme temperatures or winds and were conducted in periods of generally mild weather conditions to increase the chance of species detection. Annex 6 includes a tabulated summary of weather conditions during survey efforts conducted by RPS and Niche. Plate 2 summarises weather conditions during and leading up to the Niche survey campaign conducted in June 2024. Weather data is taken from weather station 060141 located at Taree Airport, approximately 30 km south of Johns River (BoM 2024).

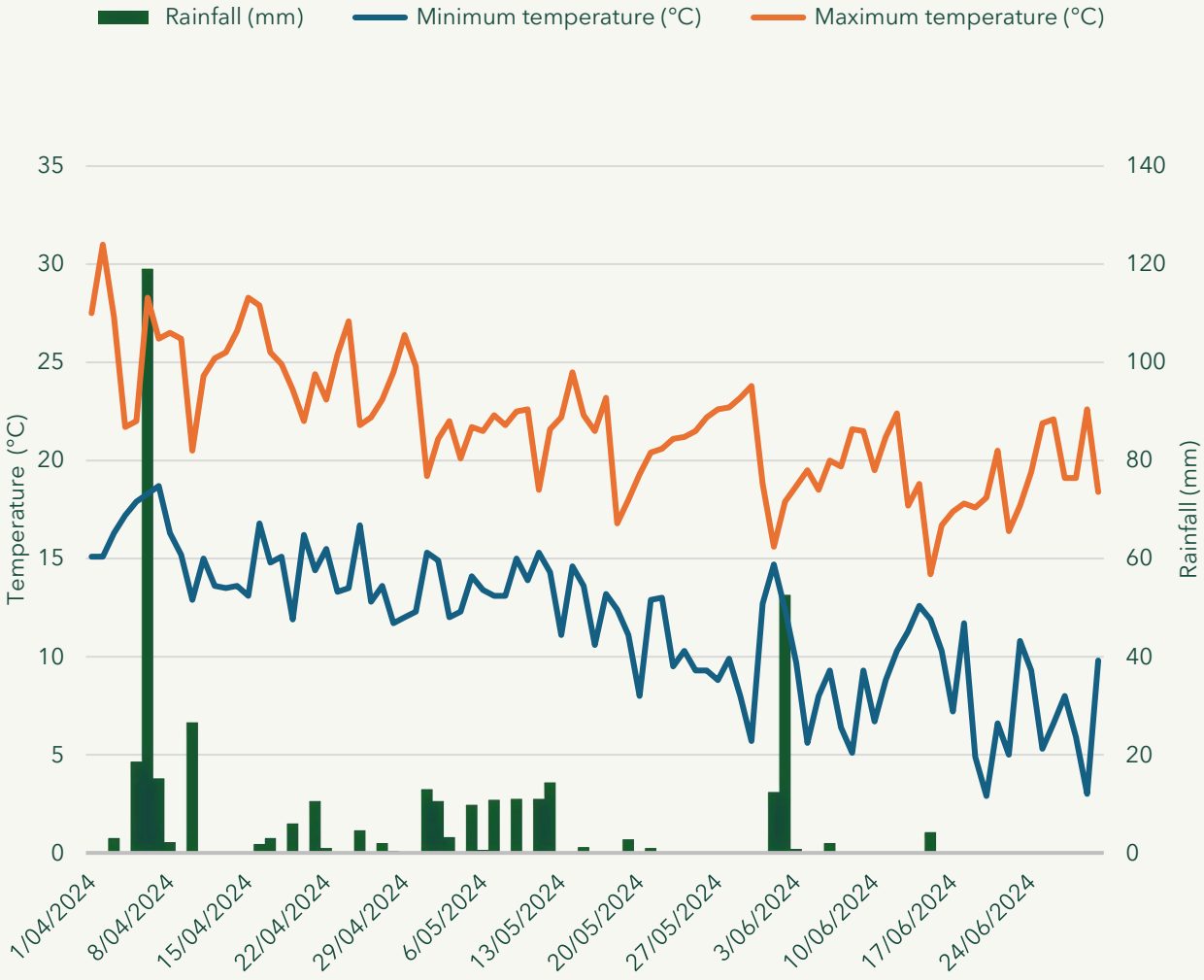


Plate 1 April, May, and June Rainfall and Temperature

7 Limitations

Land tenure reduced access options for habitat surveys, nonetheless an adequate understanding of habitat constraints surrounding the subject land was achieved.

Throughout the course of the field survey, the VZs were modified based on site traverses and VI plot results. The vegetation zone mapping was further refined post-field survey using aerial photographic interpretation (API), topography, field observations and consideration of quantitative data collected during VI plots to confirm condition types.

Numerous plant and animal species are cryptic or difficult to detect. Some cryptic plant species are more easily detected at certain times of the year, such as during flowering events. Some fauna species can only be detected during certain seasons (e.g. migration patterns or intra-torpor periods). These limitations were addressed by conducting surveys over a range of seasonal and climatic conditions to maximise seasonal coverage of survey effort and species detectability. This was also coupled with thorough analysis of species' specific habitat requirements and employing a range of survey techniques.

The following limitations were recognised within the BIR (RPS 2024):

— Seasonality
— Data availability and accuracy.

8 Impact Assessment

This impact assessment forms Stage 2 of the BDAR as per Section 8 of the BAM.

8.1 Avoid and Minimise Impacts

In accordance with the BAM, proponents must demonstrate the measures employed to avoid, mitigate and offset impacts of the proposed modification on biodiversity values. This section outlines the avoidance, management and mitigation measures that have been incorporated into the design of the proposed modification or will be employed during pre-operation and operation phase of the proposed modification to reduce impacts.

8.1.1 Avoidance Measures

Avoidance and minimisation for this proposed modification has been demonstrated through several refinements made to the initial concept design.

Efforts to avoid and minimise impacts through location and design of the proposed modification are detailed in Table 17.

Table 17 Avoidance Measures

Avoidance principle (as per Section 7.1 of the BAM [DPIE, 2020a])	Measures implemented
Siting of the proposed modification	
Locating the proposed modification in areas where there are no biodiversity values	The location of the subject land has been designed to avoid several biodiversity features within the larger RPS Study Area. Overall, the proposed modification design has achieved the following: – Complete avoidance of all TECs identified within the larger RPS Study Area – The subject land is located in a small patch of vegetation that is somewhat disconnected from other patches of vegetation on two sides, and avoids more intact native vegetation to the north of the existing quarry pit. – The proposed modification avoids areas that contain actual or potential habitat for threatened species and avoids impacts to hollow bearing trees.
Locating the proposed modification in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a low VI score)	
Locating the proposed modification in areas that avoid habitat for species with a high biodiversity risk weighting or land mapped on the important habitat map, or native vegetation that is a TEC or a highly cleared PCT	
Locating the proposed modification outside of the buffer area of breeding habitat features such as nest trees or caves	
Location considerations for the proposed modification	

Avoidance principle (as per Section 7.1 of the BAM [DPIE, 2020a])	Measures implemented
An analysis of alternative modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology	Clearing methodologies would be tailored to reduce impacts to adjoining vegetation where practicable.
An analysis of alternative routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route	Site access was designed to have minimal impact on the subject land's biodiversity values by being entirely situated within established tracks.
An analysis of alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location	A larger extension was considered during the early planning phase and the proposed modification design was revised to avoid and minimise impacts to biodiversity features, including TECs, hollow bearing trees, and waterways.
An analysis of alternative sites within a property for the proposed modification that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site	
Proposed modification design	
Reducing the clearing footprint of the proposed modification by minimising the number and type of facilities	The proposed extension is limited to the east of the existing quarry pit only.
Locating ancillary facilities in areas where there are no biodiversity values	No additional ancillary facilities or site access routes will be established – ancillary facilities associated with the existing quarry will be utilised for the proposed modification and existing tracks will be used for plant and vehicle movement.
Locating ancillary facilities where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a low VI score)	
Locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (i.e. an EEC, CEEC or an entity at risk of a SAII)	
Implementing actions and activities that provide for rehabilitation, ecological restoration and/ or ongoing maintenance of retained areas of native vegetation, threatened species, threatened ecological communities and their habitat	Mitigation measures are detailed in Section 8.1.2 of this report and include measures to ensure biodiversity values are maintained.

8.1.2 Mitigation Measures (pre-operation and operation)

Management and mitigation to be implemented prior to and during the operational phase of the proposed modification are detailed in Table 18. These will be integrated into a Biodiversity Management Plan (BMP) or

within an Environmental Management Plan (EMP) that will be developed during a future Development Approval (DA) stage.

Table 18 Mitigation Measures

Mitigation measure and timing	Outcome	Responsibility
Pre-operation		
Prior to any clearing, the clearing footprint is to be clearly delineated on site	This will prevent inadvertent clearing of native vegetation that occurs outside the subject land	Manager
A suitably qualified ecologist must inspect the subject land at least two weeks prior to clearing for potential and actual habitat, clearly mark identified habitat features in the field, and issue a series of recommendations to mitigate impacts to identified habitat features in a pre-clearing report.	This will minimise the risk of harm to native fauna or habitat during clearing.	Manager, Ecologist
Pre-clearing measures identified in the pre-clearing report must be implemented		
Any other mitigation measures as determined in the EMP and/or conditions of consent will be strictly followed	To protect biodiversity within the Niche Study Area as determined in the BMP or by council	Manager
Operation		
Felled or cleared vegetation must be contained within the subject land	This is to prevent damage to native vegetation that occurs outside the clearing footprint	Manager, Clearing contractor
Recommendations of the pre-clearing report for the clearing (pre-operation) phase must be implemented.	This will minimise the risk of harm to native fauna or habitat during clearing.	Manager, Ecologist
Installing appropriate erosion and sediment controls and undertaking the proper washdown procedures.	This will eliminate the risk or introducing weeds or diseases.	Manager
Any other mitigation measures as determined in the EMP and/or conditions of consent should be strictly followed.	To protect biodiversity within the Niche Study Area as determined in the BMP or by council	Manager

8.2 Direct Impacts

Stage 2 of the BAM (DPIE 2020a) provides the requirements for the impact assessment of the BDAR. The impact assessment has incorporated findings from the specialist studies (OWAD 2021; RPS 2024) to assess the potential direct, indirect and prescribed impacts in line with Chapter 8 of the BAM (DPIE 2020a). Direct impacts

of the proposed modification on native vegetation, TECs, threatened species and their habitat are assessed according to Section 8.1 of the BAM (DPIE 2020a).

8.2.1 Clearing native vegetation

The proposed modification involves disturbing 2.03 ha of land, 1.84 ha of which is native vegetation consisting of PCT 3250.

8.2.2 Clearing of Threatened Ecological Communities

The proposed modification does not involve the clearing of any TECs.

8.2.3 Rocky habitat

The proposed modification does not involve impacts to rocky habitats.

8.2.4 Waterways

The proposed modification does not involve impacts to waterways.

8.2.5 Hollow bearing trees

The proposed modification does not involve impacts to hollow bearing trees.

8.2.6 Scattered trees and mistletoe

The proposed modification does not involve impacts to scattered trees. The proposed modification involves clearing one mistletoe.

8.2.7 Direct impacts on threatened species

The proposed modification does not involve direct impacts on threatened species.

8.2.8 Loss of fauna during habitat clearance

Fauna loss during habitat clearance can be managed by engaging a suitably qualified ecologist to inspect the subject land two weeks prior to clearing for potential and actual habitat, issue a series of recommendations to mitigate impacts to identified habitat features in a pre-clearing report, and implement those recommendations.

8.3 Indirect impacts

There are no areas of indirect impacts that require offsets. Indirect impacts relevant to the proposed modification are inadvertent impacts on adjacent habitat or vegetation, reduced viability of adjacent habitat due to edge effects, noise, dust or light spill, transport of weeds and pathogens from the site to adjacent vegetation, trampling of threatened flora species, and rubbish dumping. Indirect impacts associated with the proposed modification would be temporary and will be managed via the measures described in Table 19.

Table 19 Summary of indirect impacts

Indirect impact	Impacted entities	Timing	Extent	Duration	Impact / consequence	Avoidance / mitigation
Inadvertent impacts on adjacent habitat or vegetation	PCTs situated at the interface	Pre-operation and operation	Adjacent (within 100 m) of the subject land.	Short-term	There is a risk of disturbance and/ or destruction of adjacent habitats and vegetation through soil disturbance, operational activities, and unauthorised vehicle movements potentially resulting in accidental clearing, sedimentation and erosion, and mobilisation of contaminants into adjoining native vegetation and aquatic habitats. However, the consequence of the impacts is expected to be minor following the implementation of mitigation measures to protect these areas.	Prior to any clearing, the subject land is to be clearly delineated on site. The clearing footprint is to be limited to the subject land. All trees are to be felled within the development / clearing footprint.
Reduced viability of adjacent habitat due to noise, dust, or light spill	Nocturnal and diurnal fauna	Pre-operation and operation	Adjacent (within 100 m) of the subject land.			Risk of edge effects will be reduced through use of dust suppression, installation of erosion and sediment controls, and limiting noise and vibration. Dust, noise and vibration, and erosion and sedimentation are to be managed via Boral's environmental operational procedures during operation.
Reduced viability of adjacent habitat due to edge effects and transport of weeds or pathogens	Flora and fauna	Pre-operation and operation	Adjacent (within 100 m) of the subject land.			
Trampling of threatened flora species	Scrub Turpentine	Pre-operation and operation	Adjacent (within 100 m) of the subject land.	Short, medium, and long term	There is a risk the population of Scrub turpentine identified to the north of the subject land, within the Niche Study Area, will be impacted during the pre-operational and operational phases.	The pre-operation and operation footprint will be limited to the subject land. The extent of the subject land must be clearly delineated in the field

Indirect impact	Impacted entities	Timing	Extent	Duration	Impact / consequence	Avoidance / mitigation
Rubbish dumping	PCTs situated at the interface	Pre-operation and operation	Adjacent (within 100 m) of the subject land.	Short, medium, and long term	There is a risk rubbish will be dumped within areas adjoining the subject land.	and vegetation to the north of the subject land will be an environmental no-go zone.
Potential impacts to downstream areas of waterways	First order streams and associated fauna	Pre-operation and operation	Adjacent (within 100 m) of the subject land.	Short term	There is a potential for erosion and sedimentation impacting habitats and reducing water quality conditions. However, the consequence of the impacts is expected to be minor following the implementation of recommended mitigation measures to protect these areas.	Erosion and subsequent sedimentation will be managed through the installation of erosion and sediment controls during the pre-operational phase and will be managed in accordance with Boral's environmental operational procedures during operation.

8.4 Prescribed Impacts

Prescribed impacts to biodiversity are impacts that result from the proposed modification in addition to, or instead of, impacts from clearing vegetation and / or loss of habitat. These impacts must be assed as part of the BOS, as per Clause 6.1 of the NSW Biodiversity Conservation Regulation 2017 (BC Regulation). The BC Regulation states:

1) *The impacts on biodiversity values of the following actions are prescribed (subject to subclause (2) as biodiversity impacts to be assessed under the biodiversity offsets scheme—*
   a) *the impacts of development on the following habitat of threatened species or ecological communities—*
      i) *karst, caves, crevices, cliffs and other geological features of significance,*
      ii) *rocks,*
      iii) *human made structures,*
      iv) *non-native vegetation,*
   b) *the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range,*
   c) *the impacts of development on movement of threatened species that maintains their lifecycle ,*
   d) *the impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining or other development),*
   e) *the impacts of wind turbine strikes on protected animals,*
   f) *the impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community.*

Prescribed impacts will be managed and mitigated via the measures detailed in Table 20.

Table 20 Summary of prescribed impacts

Prescribed Impact	Presence	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature
Karst, caves, crevices, cliffs and other geological features of significance,	☑ No ☐ Yes	N/A	
Human made structures	☑ No ☐ Yes	N/A	
Non-native vegetation	☐ No ☑ Yes	Non-native vegetation within the Niche Study Area forms part of the existing quarry infrastructure.	No threatened entities are likely to use the area of non-native vegetation within the subject land.

Prescribed Impact	Presence	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature
Habitat connectivity	☐ No ☑ Yes	The landscape within the Assessment Area contains large continuous patches of native vegetation in Middle Brother National Park and associated bushland.	Habitat connectivity will remain largely intact as the vegetation within the subject land is mostly disconnected from larger patches of vegetation. To the west, the subject land is disconnected by the existing quarry, and to the east by a small fire trail. Vegetation in the subject land is connected to Middle Brother National Park to the north by a corridor approximately 50 m wide. The patch of vegetation within the subject land is relatively small and adjoins an existing quarry pit and, therefore, its removal is not considered to significantly impede on overall habitat connectivity in the larger landscape.
Wind turbine strikes on protected animals,	☑ No ☐ Yes	N/A	
Waterbodies, water quality and hydrology	☑ No ☐ Yes	N/A	
Vehicle strikes	☑ No ☐ Yes	N/A	

9 Serious and Irreversible Impacts

The BC Act and the L*ocal Land Services Act 2013* (LLS Act) impose various obligations on decision-makers in relation to impacts on biodiversity values that are at risk of Serious and Irreversible Impacts (SAII). These obligations generally require a decision-maker to determine whether the residual impacts of a proposed development on biodiversity values (that is, the impacts that would remain after any proposed avoid or mitigate measures have been considered) are serious and irreversible (DPIE 2020b).

The BC Act and the BC Regulation provide a framework to guide the consent authority in making a determination in relation to SAII. The framework consists of a series of principles defined in the BC Regulation and supporting guidance, provided for under section 6.5 of the BC Act, to interpret these principles (DPIE 2020b). Guidance to assist a decision-maker to determine a SAII (DPIE 2020b) includes Table 1 that states criteria to interpret the principles. Namely, an impact is considered serious and irreversible under Part 6.7 of the BC Regulation if it:

- Will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline
- Will further reduce the population size of the species that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or will further degrade or disrupt an ecological community that is already observed, inferred or reasonably suspected to be severely degraded or disturbed
- Impacts on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution
- Impacts on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

Under the BAM, an assessor must provide information on a range of factors affecting the vulnerability of a species or TEC at risk of SAII.

The presence of threatened entity at risk of SAII was ruled out through targeted surveys. As such, no threatened biodiversity at risk of SAII are considered likely to occur in the study area.

The proposed modification is considered unlikely to result in a SAII to any TEC or threatened species.

10 Impacts to Matters of National Significance

This Section presents the results of an assessment of likely proposed modification impacts to MNES in accordance with the Commonwealth Significant Impact Guidelines 1.1 Matters of National Environmental Significance (the Significant Impact Guidelines) (Department of the Environment 2013). Information sources used to inform the assessment include:

- Commonwealth Species Profile and Threats Database for relevant species and communities (DCCEEW, 2024)
- Conservation Advice for *Phascolarctos cinereus* (Koala) combined populations of Queensland, NSW and the Australian Capital Territory (Department of Agriculture, Water and the Environment [DAWE] 2022)
- A review of koala habitat assessment criteria and methods (Youngentob et. al. 2021)
- NSW BioNet Atlas search with a 30 km buffer (NSW DCCEEW 2024a), conducted July 2024.

10.1 Significant Impact Assessment for the Koala

The listing status of the Koala was upgraded from Vulnerable to Endangered under the EPBC Act on the 12 February 2022. The Koala Significant Impact Assessment (Table 21 Assessment of the proposed impacts to the Koala against significant impact criteria) addresses this revised listing status using the current information available from DAWE.

10.1.1 Koala Ecology and distribution

Koalas are widely distributed from north-east Queensland, extending south through NSW and Victoria into South Australia. They occur in a variety of vegetation types although are primarily associated with eucalypt woodland and forest habitat types that contain suitable food trees (TSSC 2012).

Although Koala use a variety of trees, including many non-eucalypts, for feeding and resting, their diet is generally restricted to the foliage of Eucalyptus species and related genera, including *Corymbia, Angophora,* and *Lophostemon*. However, Koalas are known to have distinct, localized feeding preferences throughout their range, selecting some species in preference to others (TSSC 2012).

10.1.2 Assessment against significant impact criteria for the Koala

Impacts from the proposed modification relevant to Koala and subject to further assessment against the Commonwealth Significant Impact Guidelines include:

- Loss of 1.84 ha of Koala habitat
- Low risk of increased habitat fragmentation and loss of connectivity.

The results of the significant impact assessment are detailed in Table 23. The assessment concludes that impacts from the proposed modification to the Koala are not likely to be significant. This is largely due to the relatively small clearing area (1.84 ha) and the degree of existing disturbance (i.e. existing quarry, presence of weeds, pests, and fire trails). However, while this assessment concludes impacts from the proposed modification are not significant, it is recommended that the proposed modification is referred to the Commonwealth for a determination.

Table 21 Assessment of the proposed impacts to the Koala against significant impact criteria

Criterion	Assessment	Rationale
Lead to a long-term decrease in the size of a population	The proposed impact will not lead to a long term decrease in the population size	Evidence of one or more Koalas within the last 5 years combined with the size of, and the vegetation types contained in, Middle Brother National Park strongly suggest the area and connected bushland host a population of Koalas. The subject land, however, is connected to Middle Brother National Park by a small strip of bushland and borders a quarry and a private residence in an area dissected by fire trails. Results of the field survey effort, an effort that was conducted in accordance with the BAM and included techniques for passive and direct detection, strongly suggest habitat in the subject land and around the quarry, in general, is low use habitat. This conclusion is supported by the general configuration of habitat within the landscape. The subject land forms essentially a "dead end" with no connectivity to the south and west and limited connectivity to the east. Furthermore, the proposed impact is limited to 1.84 ha which forms a relatively small, almost negligible area of vegetation within the surrounding landscape. Based on the relatively small scale of the proposed impact, the relatively low connectivity of the subject land to surrounding bushland, and evidence that the subject land and quarry area in general (RPS Study Area) is a low use Koala habitat area, it is concluded that the proposed impact will not lead to a long term decrease in the population size.
Reduce the area of occupancy of the species	The proposed impact will not decrease the area of occupancy for the species	Field and desktop assessment results suggest that the subject land is a low use Koala habitat area and the proposed impact is limited to the removal of approximately 1.84 ha of woody vegetation. The surrounding landscape contains several square kilometres of native vegetation. Therefore, the proposed impact will not decrease the area of occupancy for the species.
Fragment an existing population into two or more populations	The proposed impact will not fragment an existing population	The patch of vegetation that contains the subject land is too small to support a standalone population of Koalas and is connected to a larger tract of vegetation on only one side, to the north. Therefore, it is highly unlikely the proposed impact will lead to the increased fragmentation of an existing population.
Adversely affect habitat critical to the survival of a species	The proposed impact will impact habitat critical to the survival of the species	In accordance with the Superseded EPBC Act Referral Guidelines Koala Habitat Assessment Tool, Koala habitat within the subject land can be considered critical to the survival of the species. Whilst these habitats will be adversely impacted, the scale of impact is considerably small and unlikely to result in a significant impact to any potentially occurring local population.
Disrupt the breeding cycle of a population	The proposed impact will not disrupt the breeding cycle of a population	Given the geographic and temporal scale (i.e. very small section of habitat to be cleared) and location of impacts (i.e. existing habitats subject to existing fragmentation), the works are not considered likely to disrupt the breeding cycle of a local Koala population.
Modify, destroy, remove, isolate, or decrease the availability or quality of	The proposed impact will not modify, destroy, remove, isolate, or decrease the	Clearing vegetation in the subject land is unlikely to modify, destroy, remove, isolate, or decrease the quality of habitat to the extent that the species is likely to decline.

Criterion	Assessment	Rationale
habitat to the extent that the species is likely to decline	availability or quality of habitat to the extent that the species is likely to decline	Vegetation within the subject land is a low use area that adjoins an existing quarry, and is too small to support a standalone population. The proposed impacts will not result in the decline of a local Koala population due to a decrease of habitat availability or quality.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The proposed impact may result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	Ground disturbance has the potential to lead to the establishment of non-native plants, such as the biosecurity restricted WoNS Lantana, which was identified during the field survey. However, due to the relatively small area of disturbance and proposed controls, these risks are considered negligible.
Introduce disease that may cause the species to decline, or	The proposed impact will not introduce disease that may cause the species to decline.	The proposed impact is unlikely to introduce diseases – the only possible route for introducing new diseases during clearing is via contaminated plant or equipment. Proposed controls to mitigate this risk include appropriate vehicle washdown procedures.
Interfere with the recovery of the species	The proposed impact will not interfere with the recovery of the species.	The proposed removal of 1.84 ha in an area that is separated from a large tract of native vegetation on three sides will not interfere with the recovery of the Koala. Furthermore, desktop and field assessment results suggest that the quarry area (RPS Study Area) supports low levels of Koala activity.

11 Assessment under the Biodiversity and Conservation SEPP – Assessment of Koala Habitat

Based on floristic data collected by Niche, Tallowood (*Eucaluptus microcorys*) is the only tree species within the subject land that is in Schedule 1, and it constitutes 2%[8] of the total number of trees in the upper or lower strata of the tree component. Therefore, the Niche Study Area does not contain potential Koala habitat according to Chapter 3 of the Biodiversity and Conservation SEPP.

As described in the BIR (Section 2.1.4.2) (RPS 2024), a detailed survey in accordance with the BAM was undertaken between 2020 and 2021 to quantify Koalas activity within the RPS Study Area. No Koala activity was detected. However, BioNet (NSW DCCEEW 2024a) contains two Koala sightings from December 2020 in the subject land and 41 Koala sightings from within 10 km of the subject land since 1990. Four of these sightings are from the past four years and within 2 km of the subject land with the most recent sighting in October 2023. This sighting is from the southern side of the Pacific Highway. Due to the lack of habitat crossings for 50 km in either direction of the sighting, the sighted individual is not considered a part of the population that may exist to the north of the Pacific Highway within Middle Brother National Park and associated bushland.

Sightings are split almost equally to the north and to the south of the Pacific Highway. Middle Brother National Park contains 16 Koala sightings from several sources between 1999 and 2020:

- Four sightings from 2004 are from a community wildlife survey
- Two sightings from 2022 are from a scientific license dataset
- One sighting from 2013 is from the wildlife rehabilitation database
- Three from 2020 are from a spring survey conducted by the Hastings-Macleay Koala Recovery Partnership
- Six sightings from between 1999 and 2019 are from state forests.

All three sightings from spring surveys conducted by the Hastings-Macleay Koala Recovery Partnership and at least four of the six sightings reported by state forests are not direct observations but observations of scat. The individual recorded in the wildlife rehabilitation database was impacted with chlamydia and the remaining five records do not have sufficient metadata to further qualify the observations.

The set of Koala observations within Middle Brother National Park suggests that if there is a resident Koala population as defined by Chapter 3 of the Biodiversity and Conservation SEPP; it is limited to several individuals at best, although the size and viability is questionable considering the scarcity of observations, the lack of direct observations, and the presence of chlamydia. It is acknowledged that indirect observations such as observations of scat provide an indicative metric of Koala activity in an area and can be used to support population studies (Phillips 2016) although direct inference of population size from indirect observations is unreliable.

A null result after rigorous and recent targeted Koala surveys within the RPS Study Area, an area encompassing both the subject land and the Niche Study Area, surveys that included methods for both indirect and direct observation and were compliant with the BAM, combined with the recency and types of observations included

[8] A detailed methodology is described in Section 4.2.

in BioNet with 10 km of the subject land suggest that the RPS Study Area and, therefore, the subject land does not contain core Koala habitat as defined by Chapter 3 of the Biodiversity and Conservation SEPP.

Given the subject land and the Niche Study Area are not potential or core Koala habitat, further assessment of the proposed modification under the Biodiversity and Conservation SEPP is not required. However, the Koala is listed as a MNES and an Assessment of Significance under the EPBC Act is provided in Section 10.

12 Summary

12.1 Impacts on native vegetation (ecosystem credits)

Table 18 identifies the ecosystem credits that require offsetting as per subsection 9.2.1(1)BAM (DPIE 2020a). Current and future VI scores, as well as the change in VI score for each vegetation zone are provided in Table 6. Impacts requiring offsetting are highlighted in Figure 3. The total credit requirement for impacted native vegetation (PCT32550_good) is shown in Table 23. The BAM-C Credit Reports also detail the impacted area and ecosystem credit requirement (Annex 6).

Table 22 Impacts that require and offset – ecosystem credits

Vegetation zone	Impact area (ha)	Current VI score	Final VI score	Change in VI score	Total credit requirements
3250_moderate	1.84	92	0	92	64

12.2 Impacts on threatened species and their habitat (species credits)

The proposed modification is not expected to result in impacts to threatened species or their habitat. As such, no biodiversity credits are required to offset impacts to species credit species.

12.3 Indirect and prescribed impacts

Indirect and prescribed impacts that remain after measures to avoid, minimise, and mitigate have been applied, may be offset using additional biodiversity credits (above the credit requirement generated by the BAM C for direct impacts) and/or other conservation measures.

The proposed modification will not result in prescribed impacts and or long-term indirect impacts. Short-term indirect impacts will be managed via the measures prescribed in Table 19. As such, no additional biodiversity credits are required to offset prescribed or indirect impacts.

12.4 Impacts to Matters of National Environmental Significance

One assessment of significance under the EPBC Act was required for the endangered Koala, which concluded that the proposed modification was unlikely to result in a significant impact.

13 References

Anstis, M. (2002). Tadpoles of South-eastern Australia: A guide with keys. Reed New Holland, Sydney.

Atlas of Living Australia (ALA) (2023). Spatial Portal. Available from: https://spatial.ala.org.au/?q=lsid:https://biodiversity.org.au/afd/taxa/f579a6fc-ae01-4338-ba3c-16cdc4e53246.

Australian Museum. (2022). Stony Creek Frog. Available from: https://australian.museum/learn/animals/frogs/lesueurs-frog/

Boral (2023). Pollution Incident Response Management Plan – Johns River Quarry. Version 12: August 2023. Available from: https://www.boral.com.au/management-plan-pirmp-tmp-nmp-wmp-etc/2023-johns-river-pirmp.

Bureau of Meteorology (BOM) (2024). Climate statistics for the Taree Airport (Station ID 060141) weather station. Australian Government Bureau of Meteorology, Canberra, ACT. Available from: http://www.bom.gov.au/climate/data.

Commonwealth Department of Climate Change, Energy, the Environment and Water (2023). Conservation Advice for *Neophema chrysostoma (*blue-winged parrot*)*. Canberra: Department of Climate Change, Energy, the Environment and Water. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/726-conservation-advice-31032023.pdf.

Commonwealth Department of Climate Change, Energy, the Environment and Water (Cth DCCEEW) (2024a). Protected Matters Search Tool. Commonwealth Department of Climate Change, Energy, the Environment and Water, Canberra, ACT. Available from: https://www.dcceew.gov.au/environment/epbc/protected-matters-search-tool [Accessed 17 July 2024].

Commonwealth Department of Climate Change, Energy, the Environment and Water (Cth DCCEEW) (2024b). Species profile and threats database. Commonwealth Department of Climate Change, Energy, the Environment and Water, ACT. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

Commonwealth Department of Climate Change, Energy, the Environment and Water (Cth DCCEEW) (2024c). Interim Biogeographic Regionalisation for Australia, Version 7, regions and subregions. Commonwealth Department of Climate Change, Energy, the Environment and Water, ACT. Available from: https://datasets.seed.nsw.gov.au/dataset/interim-biogeographic-regionalisation-for-australia-ibra-version-7-subregions and https://datasets.seed.nsw.gov.au/dataset/interim-biogeographic-regionalisation-for-australia-ibra-version-7-regions

Commonwealth Department of Climate Change, Energy, the Environment and Water (Cth DCCEEW) (2024d). Interactive Flying-fox Web Viewer. Commonwealth Department of Climate Change, Energy, the Environment and Water, ACT. Available from: https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf

Commonwealth Department of the Environment (DoE) (2013). Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999. Canberra, ACT. Available from: https://www.dcceew.gov.au/environment/epbc/publications/significant-impact-guidelines-11-matters-national-environmental-significance

Department of Agriculture, Water and the Environment (DAWE) (2022a). Conservation Advice for *Phascolarctos cinereus* (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory. Commonwealth Department of Agriculture, Water and the Environment, Canberra, ACT. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/85104-conservation-advice-12022022.pdf.

Department of Agriculture, Water and the Environment (DAWE) (2022b). National Recovery plan for the Koala: *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory). Commonwealth Department of Agriculture, Water and the Environment, Canberra. Available from: https://www.dcceew.gov.au/sites/default/files/documents/recovery-plan-koala-2022.pdf.

Department of Environment and Conservation (DEC) (2004). Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft. Commonwealth Department of Climate Change, Energy, the Environment and Water, Canberra, ACT. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/draft-threatened-biodiversity-survey-guide.pdf.

Department of Environment, Climate Change, Energy, the Environment and Water (DECCEEW) (2016). Descriptions for NSW (Mitchell) Landscapes Version 3.1 (2016). NSW Department of Environment and Climate Change, Sydney, NSW. Available from: https://datasets.seed.nsw.gov.au/dataset/nsw-mitchell-landscapes-version-3-1

Department of Planning and Environment (DPE) (2022a). Biodiversity Assessment Method 2020 Operational Manual – Stage 1. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/research-and-publications/publications-search/biodiversity-assessment-manual-2020-operational-manual-stage-1.

Department of Planning and Environment (DPE) (2022b). Koala (Phascolarctos cinereus): Biodiversity Assessment Method Survey Guide. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/koala-phascolarctos-cinereus-biodiversity-assessment-method-survey-guide-220249.pdf.

Department of Planning and Environment (DPE) (2022c). Threatened reptiles - Biodiversity Assessment Method survey guide. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/research-and-publications/publications-search/threatened-reptiles-biodiversity-assessment-method-survey-guide.

Department of Planning and Environment (DPE) (2023b). Determining native vegetation land categorisation for application in the Biodiversity Offsets Scheme. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/research-and-publications/publications-search/determining-native-vegetation-land-categorisation-for-application-in-the-biodiversity-offsets-scheme

Department of Planning and Environment (DPE) (2024c). eSPADE v2.2. NSW Department of Planning and Environment, Sydney, NSW Available from: https://www.environment.nsw.gov.au/eSpade2WebApp.

Department of Planning, and Environment (DPE) (2023a). Biodiversity Assessment Method Operational Manual – Stage 2. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/research-and-publications/publications-search/biodiversity-assessment-method-operational-manual-stage-2

Department of Planning, Industry and Environment (DPIE) (2018). Water Management (General) Regulation 2018 Hydro Line spatial data. NSW Department of Planning and Environment, Sydney, NSW. Available at URL: https://www.dpie.nsw.gov.au/water/licensing-and-trade/controlled-activity-approvals/waterfront-land-e-tool/hydro-line-spatial-data.

Department of Planning, Industry and Environment (DPIE) (2020a). Biodiversity Assessment Method. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-2020-200438.pdf.

Department of Planning, Industry and Environment (DPIE) (2020b). Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method. NSW Department of Planning and

Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/surveying-threatened-plants-and-habitats-nsw-survey-guide-biodiversity-assessment-method-200146.pdf.

Department of Planning, Industry and Environment (DPIE) (2020c). NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/nsw-survey-guide-for-threatened-frogs-200440.pdf.

Department of Planning, Industry and Environment (DPIE) (2021). 'Species credit' threatened bats and their habitats NSW guide for the Biodiversity Assessment Method. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/speciescreditthreatenedbatsandtheirhabitatsnswguideforbiodiversityassessmentmethod200573.pdf.

Department of Primary Industries (DPI) (2022). Myrtle rust in Australia. NSW Department of Primary Industries,

Department of Regional New South Wales (DRNSW) (2018). NSW Seamless Geology Edition 1. State Government of NSW and Department of Regional New South Wales 2018. Available from: https://minview.geoscience.nsw.gov.au/.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2011a). Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999. Commonwealth Department of Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT. Available from: https://www.environment.gov.au/epbc/publications/survey-guidelines-australias-threatened-mammals.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2011b). Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999. Commonwealth Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT. Available from: https://www.environment.gov.au/epbc/publications/survey-guidelines-australias-threatened-reptiles.

Department of the Environment (DOE) (2013). Draft survey guidelines for Australia's threatened orchids. Commonwealth Department of Agriculture, Water and the Environment, Canberra, ACT. Available from: https://www.environment.gov.au/resource/draft-survey-guidelines-australias-threatened-orchids.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010a). Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act. Commonwealth Department of the Environment, Water, Heritage and the Arts, Canberra, ACT. Available from: https://www.environment.gov.au/epbc/publications/survey-guidelines-australias-threatened-birds.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010b). Survey guidelines for Australia's threatened bats. Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999. Commonwealth Department of the Environment, Water, Heritage and the Arts, Canberra, ACT. Available from: https://www.agriculture.gov.au/sites/default/files/documents/survey-guidelines-bats.pdf.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2013). Matters of National Environmental Significance - Significant impact guidelines 1.1. Department of the Environment. Available from: https://www.dcceew.gov.au/sites/default/files/documents/commonwealth-guidelines_1.pdf.

Esri. "World Imagery" [basemap]. Scale not given. (29 September 2023). https://www.arcgis.com/apps/mapviewer/index.html?layers=10df2279f9684e4a9f6a7f08febac2a9. (09 June, 2024)

Fairfull, S. 2013. Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management. Fisheries NSW, Wollongbar.

Ford, M.A. (1983). The body and call forms of the frogs Litoria aurea and Litoria raniformis in New Zealand. M.Sc. Thesis, University of Auckland, Auckland.

Ford, M.A. (1986). Some observations of reproductive behaviour in captive smooth-backed green frogs (Litoria aurea). Tane 31, 113-120.

Hunter, D., Gillespie, G. (2011). National Recovery Plan for the Stuttering Frog Mixophyes balbus. Victorian Government Department of Sustainability and Environment (DSE). Melbourne

Narayan, E. and Vanderneut, T. (2019). Physiological stress in rescued wild koalas are influenced by habitat demographics, environmental stressors, and clinical intervention. Frontiers in endocrinology, 10: 18.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2019). NSW Landuse 2017 v1.2. Published by State Government of NSW and NSW Department of Climate Change, Energy, the Environment and Water 2019. Available from: https://datasets.seed.nsw.gov.au/dataset/nsw-landuse-2017-v1p2-f0ed.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2022a). NSW State Vegetation Type Map. Published by State Government of NSW and NSW Department of Climate Change, the Environment and Water 2022. Edition C2.0M2.0 released December 2023. Available from: https://datasets.seed.nsw.gov.au/dataset/nsw-state-vegetation-type-map.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2022b). Transitional Native Vegetation Regulatory Map Viewer. Published by State Government of NSW and NSW Department of Climate Change, the Environment and Water 2022. Available from: https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=NVRMap.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2022c). Probable Vegetation Groundwater Dependent Ecosystems - Hunter / Central Rivers. Published by State Government of NSW and NSW Department of Climate Change, the Environment and Water 2022. Available from: https://datasets.seed.nsw.gov.au/dataset/probable-vegetation-gde-hunter-central-rivers

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2024a). NSW BioNet Atlas Database. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet. [Accessed July 2024)

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) (2024b). NSW BioNet Threatened Biodiversity Database Collection, NSW Department of Planning and Environment, Sydney, NSW. Available from: ttps://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet.

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW (2024c). NSW BioNet Vegetation Classification database. NSW Department of Planning, Industry and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/NSWvCA20PRapp/LoginPR.aspx.

NSW Government (2010). Greater Taree Local Environmental Plan 2010. NSW Legislation.

NSW Government Spatial Services (2024a). NSW Hydrography. NSW Spatial Services (DCS), Sydney, NSW. Available from: https://datasets.seed.nsw.gov.au/dataset/nsw-hydrography.

NSW Government Spatial Services (2024b). Historic Imagery Viewer – Spatial Collaboration Portal. NSW Spatial Services, Sydney, NSW. Available from: https://www.spatial.nsw.gov.au/products_and_services/aerial_and_historical_imagery.

Office of Environment and Heritage (OEH) (2017). Interim Grasslands and other Groundcover Assessment Method Determining Conservation Value of Grasslands and Groundcover Vegetation in NSW. NSW Office of Environment and Heritage, Sydney, NSW.

Office of Environment and Heritage (OEH) (2018a). Biodiversity Assessment Method (BAM) Calculator – User Guide. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-calculator-user-guide-240080.pdf.

Office of Environment and Heritage (OEH) (2018b). 'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/species-credit-threatened-bats-survey-guide-180466.pdf.

Office of Environment and Heritage (OEH) (2018c). A review of Koala tree use across New South Wales. NSW Department of Planning and Environment, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Native-animals/review-of-koala-tree-use-across-nsw-180385.pdf.

Office of Environment and Heritage (OEH) (2021). The BAM Calculator. Accessed by Niche in 2024.

OWAD Environment (2021). Johns River Targeted Threatened Species Survey Report. Prepared for Boral Johns River

Phillips, S., Callaghan, J., (2011). The Spot Assessment Technique: A tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus. Australian Zoologist 35(3).

RPS (2024). Boral Quarries – Johns River, Biodiversity Investigation Report. Prepared for Boral Johns River.

Strahler, A. (1952). Quantitative Analysis of Watershed Geomorphology. Transactions, American Geophysical Union. Volume 28, Number 6. Washington, D.C., United States

Thomson, S.A., Littlejohn, M.J., Robinson, W.A. and Osborne, W.S. (1996). Taxonomy of the Litoria aurea complex: a re-evaluation of the Southern Tableland populations of the Australian Capital Territory and New South Wales. Australian Zoologist 30, 158-169.

Threatened Species Scientific Committee (TSSC) (2022). Notice and reasons for the Final Determination Phascolarctos cinereus - endangered species. Commonwealth Department of Sustainability, Environment, Water, Population and Communities. Canberra, ACT. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/Determinations/final-determination-phascolarctos-cinereus-endangered-species.pdf?la=en&hash=005D26A4C7215AF7CF913ADE39FCC02F0E211089.

White, A.W. (1995a). The Green and Golden Bell Frog. Frog Facts 5: 1-4

White, N.A. (1999). Ecology of the koala (Phascolarctos cinereus) in rural south-east Queensland, Australia. Wildlife Research, 26: 731-744.

Woinarski, J., Burbidge, A.A. and Harrison, P.L. (2014). The Action Plan for Australian Mammals 2012. CSIRO Publishing, Collingwood, NSW.

Youngentob, K.N, Marsh, K.F., Skewes, J. (2021). A review of koala habitat assessment criteria and methods. Report prepared for the Department of Agriculture, Water and the Environment, Canberra, November.

Annex 1. Figures

Niche study area

Development footprint / Subject land

Transport

Minor road

Strahler Stream Order

1

Hydrography

Waterbody

Administrative and Property Boundaries

Lot

N

0 60

m

GDA2020 MGA Zone 56

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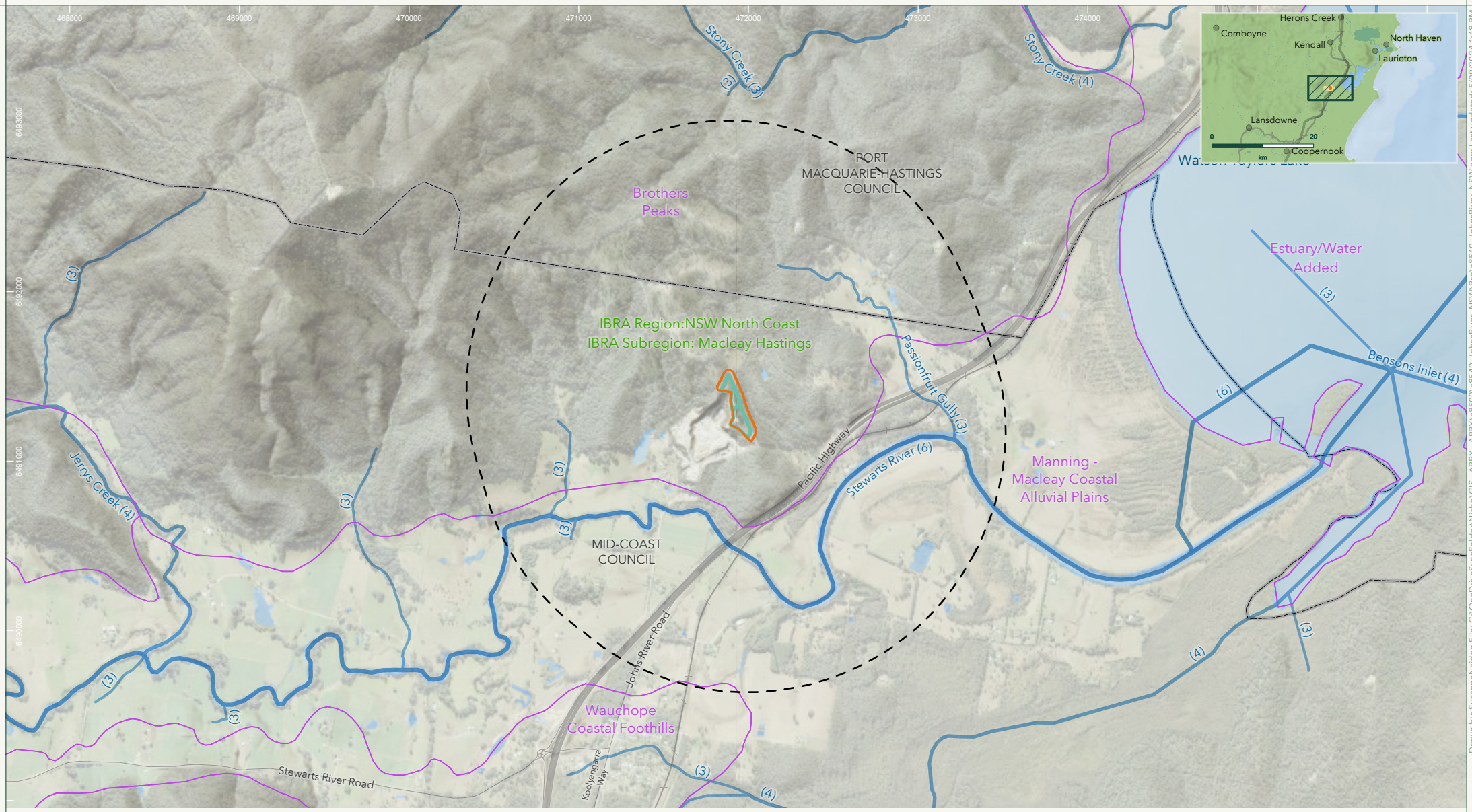
Niche

Figure 1

Site Map

Johns River Quarry Extension

Niche PM: Dmitri Medvedko
Niche Proj. #: 8540
Client: Boral



Niche study area
Development footprint / Subject land
1500m study area buffer

IBRA Region/Subregion
Mitchell Landscapes

Transport
Major road
Minor road
Rail

Hydrography
3
4
6
Waterbody

Administrative and Property Boundaries
Local Government Area

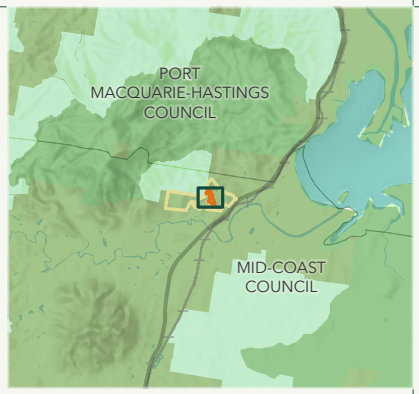
0 600
m
GDA2020 MGA Zone 56

Figure 2

Location Map

Johns River Quarry Extension

Niche PM: Dmitri Medvedko
Niche Proj. #: 8540
Client: Boral



Niche study area

Development footprint / Subject land

BAM plots

Vegetation zone

0: Non-native

3250: Northern Foothills Blackbutt Grassy Forest - Good

N

0 60

m

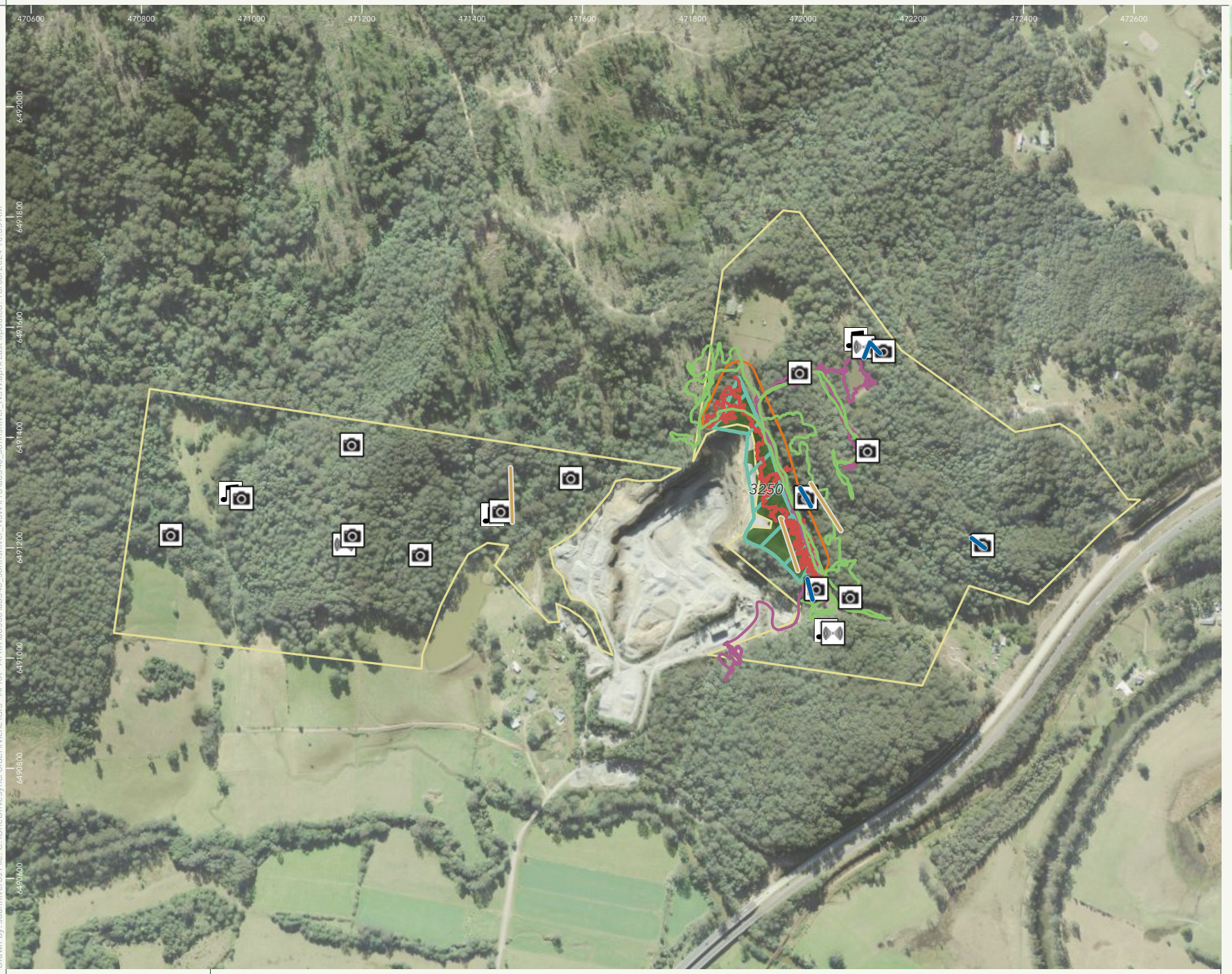
GDA2020 MGA Zone 56

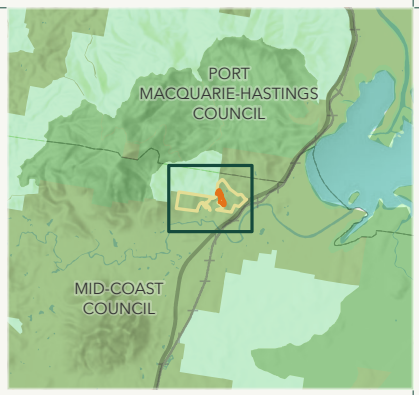
Figure 3

Vegetation zones and plot locations

Johns River Quarry Extension

Niche PM: Dmitri Medvedko
Niche Proj. #: 8540
Client: Boral





Niche study area
RPS study area
Development footprint / Subject land

Niche 2024 Habitat Constraints Assessment

June 6, 2024 Survey 1
June 7, 2024 Survey 1
June 7, 2024 Survey 2

Fauna survey method

Elliot traplines
Funnel traplines
Acoustic survey
Bat recorder
Camera trap

Vegetation zone

0: Non-native
3250: Northern Foothills Blackbutt Grassy Forest - Good

0 240
m
GDA2020 MGA Zone 56

Figure 5

Fauna methods - survey effort

Johns River Quarry Extension

Niche PM: Dmitri Medvedko
Niche Proj. #: 8540
Client: Boral

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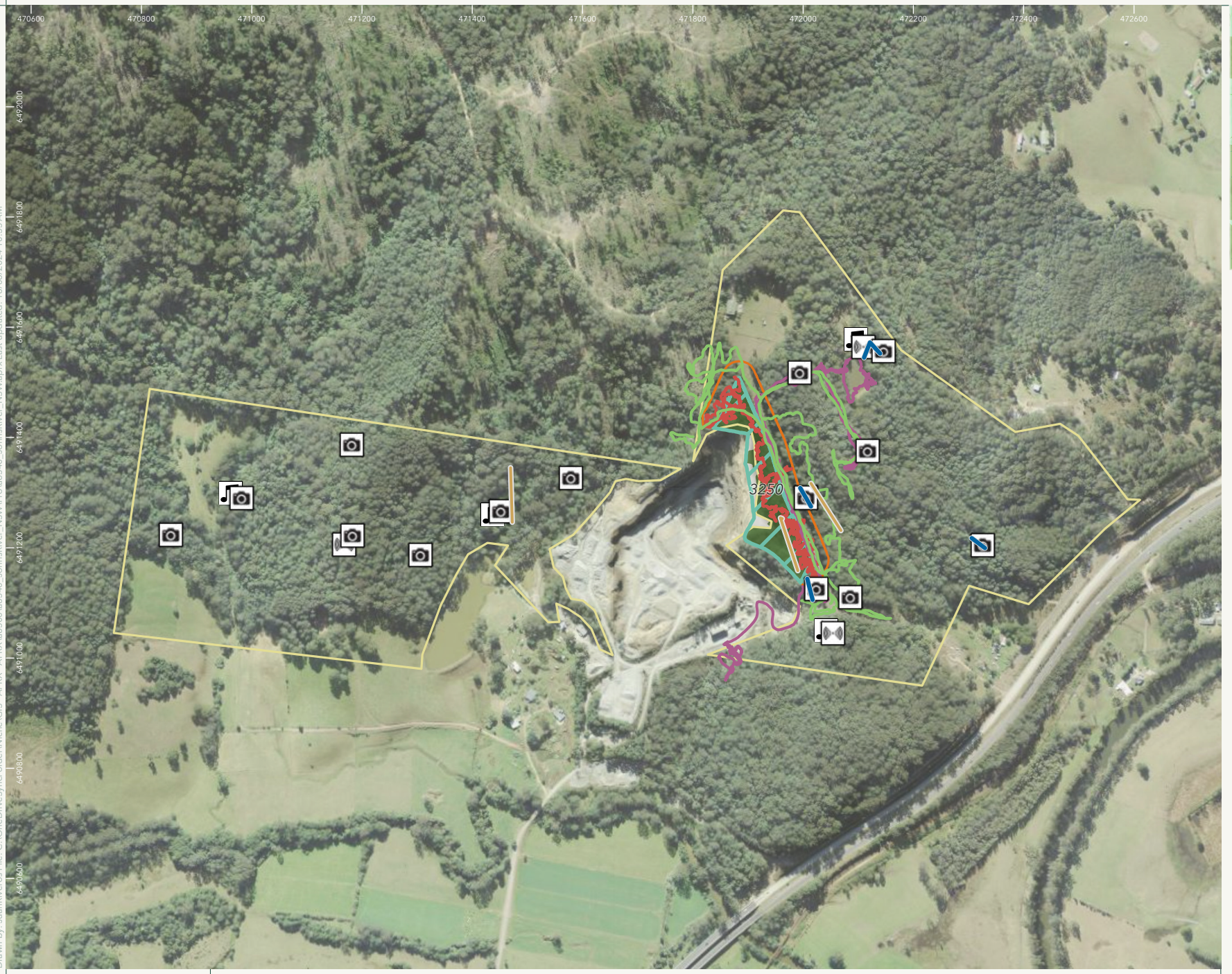
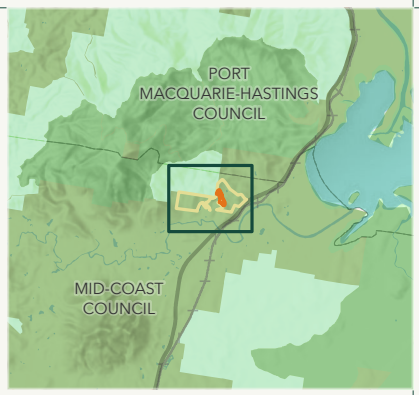




Niche study area
RPS study area
Development footprint / Subject land

Niche 2024 Habitat Constraints Assessment

June 6, 2024 Survey 1
June 7, 2024 Survey 1
June 7, 2024 Survey 2

Fauna survey method

Elliot traplines
Funnel traplines
Acoustic survey
Bat recorder
Camera trap

Vegetation zone

0: Non-native
3250: Northern Foothills Blackbutt Grassy Forest - Good

0 240
m
GDA2020 MGA Zone 56

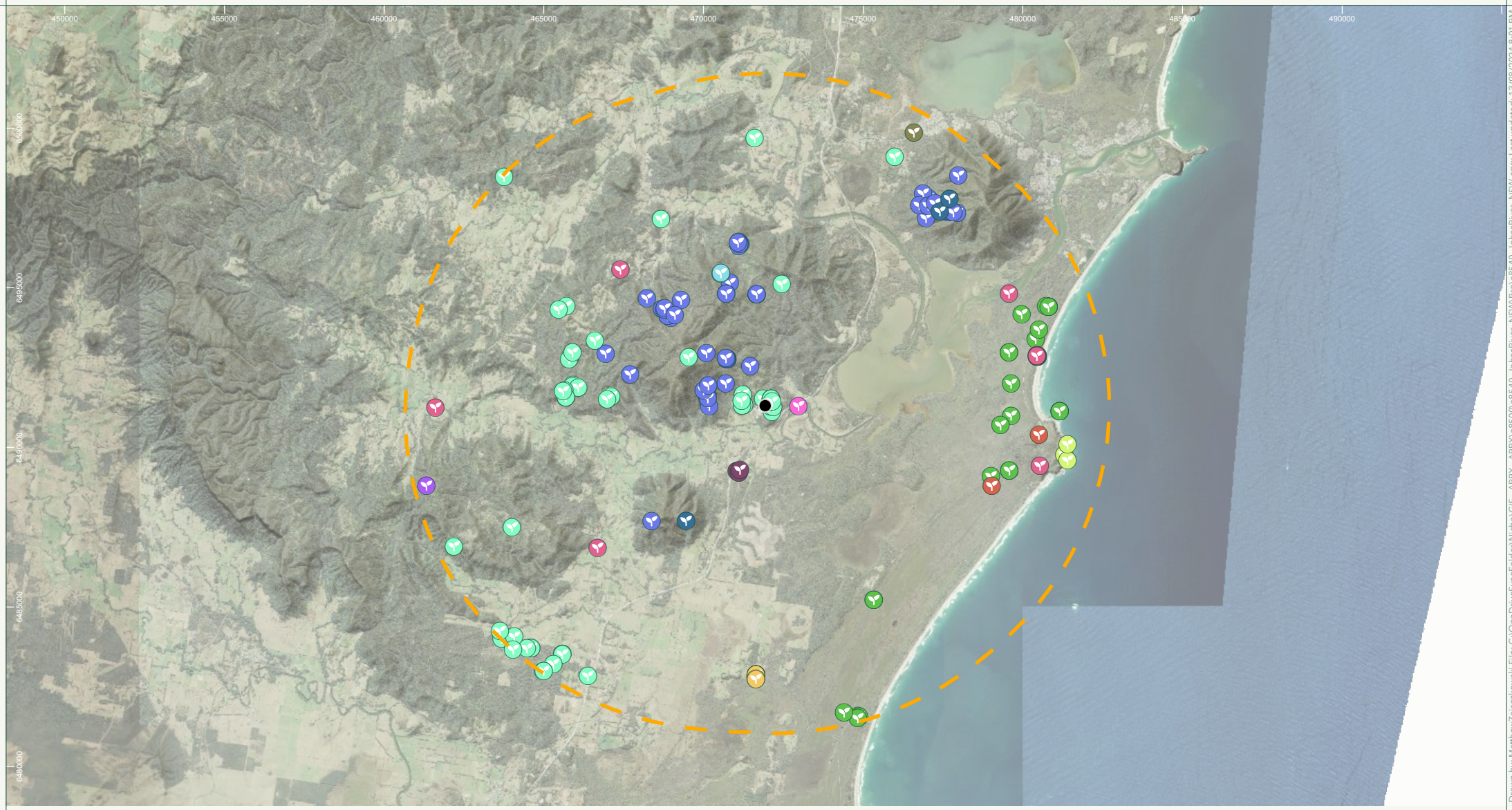
Figure 5

Fauna methods - survey effort

Johns River Quarry Extension

Niche PM: Dmitri Medvedko
Niche Proj. #: 8540
Client: Boral

Drawn by: JuanRiveros File: C:\OneDriveSyncFolder\Niche\GIS_APRX_APRX\a8500\a8540_JohnsRiver_NSWProv\a8540_JohnsRiver_NSWaprx Last updated: 16/08/2024 10:35 AM



Development footprint location

10 km buffer

Threatened Flora (BioNet, 2024)

- Acacia courtii
- Allocasuarina defungens
- Allocasuarina thalassoscopica
- Cynanchum elegans
- Hibbertia hexandra
- Lindernia alsinoides
- Maundia triglochinoides
- Melaleuca biconvexa
- Melaleuca groveana
- Rhodamnia rubescens
- Rhodomyrtus psidioides
- Thesium australe
- Tylophora woollsii

* Sensitive species not displayed

Corybas dowlingii

Grammitis stenophylla

Grevillea caleyi

Oberonia titania

0 4

km

GDA2020 MGA Zone 56

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Niche

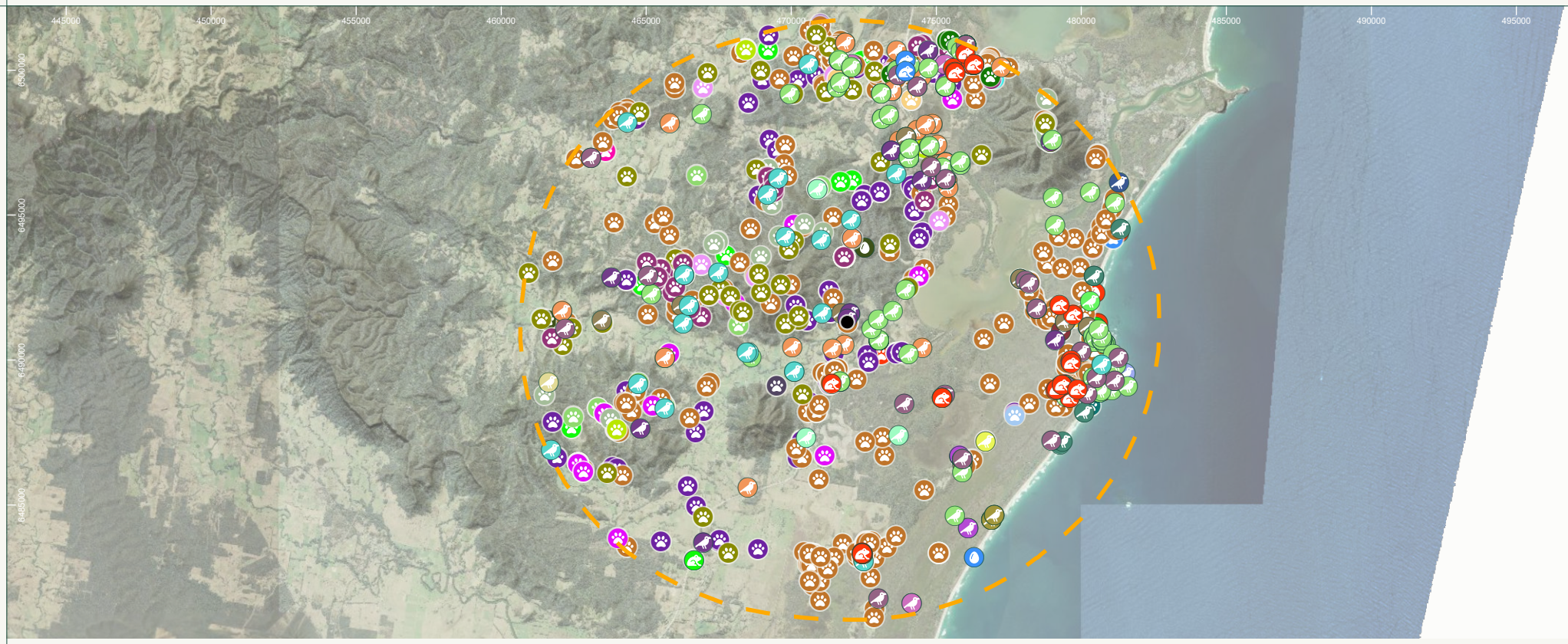
Figure 6

NSW Bionet Atlas Threatened Species 10km Search – Flora

Johns River Quarry Extension

Niche PM: Dmitri Medvedko
Niche Proj. #: 8540
Client: Boral

NSW Office of Environment and Heritage's BioNet Atlas, which holds the data from a number of custodians. Data Obtained 13/12/2023. | Hillshade: Esri, Geoscience Australia, NASA, NGA, USGS/ public/NSW_Imagery: © Department of Customer Service 2020 | Watercourses, Waterbodies, Road and Rail alignments, Protected areas of NSW © Spatial Services 2021. | Niche uses GDA2020 as standard for all project-related data. In order to ensure that data from numerous sources and coordinate systems is aligned, on-the-fly transformation to GDA2020 MGA Zone 56 is used in the map above. For ease of reference, the grid tick marks and labels shown around the border of the map are presented in GDA2020 MGA Zone 56.



- Development footprint location
- 10 km buffer

Threatened Fauna (BioNet, 2024)

Amphibia
- Green and Golden Bell Frog
- Green-thighed Frog
- Wallum Froglet

Aves
- Australasian Bittern
- Black Bittern
- Black-necked Stork
- Brolga
- Brown Treecreeper (eastern subspecies)
- Bush Stone-curlew
- Dusky Woodswallow
- Eastern Curlew
- Little Eagle
- Little Lorikeet
- Little Tern
- Pied Oystercatcher
- Red Knot
- Rose-crowned Fruit-Dove
- Sooty Oystercatcher
- South-eastern Hooded Robin
- Swift Parrot
- Varied Sittella
- White-bellied Sea-Eagle
- White-eared Monarch
- White-throated Needletail
- Wompoo Fruit-Dove

Mammalia
- Australian Fur-seal
- Brush-tailed Phascogale
- Common Blossom-bat
- Common Planigale
- Dugong
- Eastern Cave Bat
- Eastern Chestnut Mouse
- Eastern Coastal Free-tailed Bat
- Eastern False Pipistrelle
- Eastern Pygmy-possum
- Golden-tipped Bat
- Greater Broad-nosed Bat
- Grey-headed Flying-fox
- Koala
- Large Bent-winged Bat
- Little Bent-winged Bat
- Rufous Bettong
- Southern Greater Glider
- Southern Myotis
- Southern Right Whale
- Spotted-tailed Quoll
- Squirrel Glider
- Yellow-bellied Glider
- Yellow-bellied Sheathtail-bat

Reptilia
- Green Turtle
- Hawksbill Turtle
- Loggerhead Turtle
- Stephens' Banded Snake

* Sensitive species not displayed
- Barking Owl
- Eastern Grass Owl
- Eastern Osprey
- Gang-gang Cockatoo
- Giant Barred Frog
- Masked Owl
- Powerful Owl
- Sooty Owl
- South-eastern Glossy Black-Cockatoo
- Square-tailed Kite

0 5
km
GDA2020 MGA Zone 56

Drawn by: MatthewZajaczkowski File: C:\OneDriveSyncFolder\NicheVGIS - APRX - APRX\a8500\a8540_JohnsRiver_NSW\Pro\a8540_JohnsRiver_NSW.aprx Last updated: 13/08/2024 8:01 PM

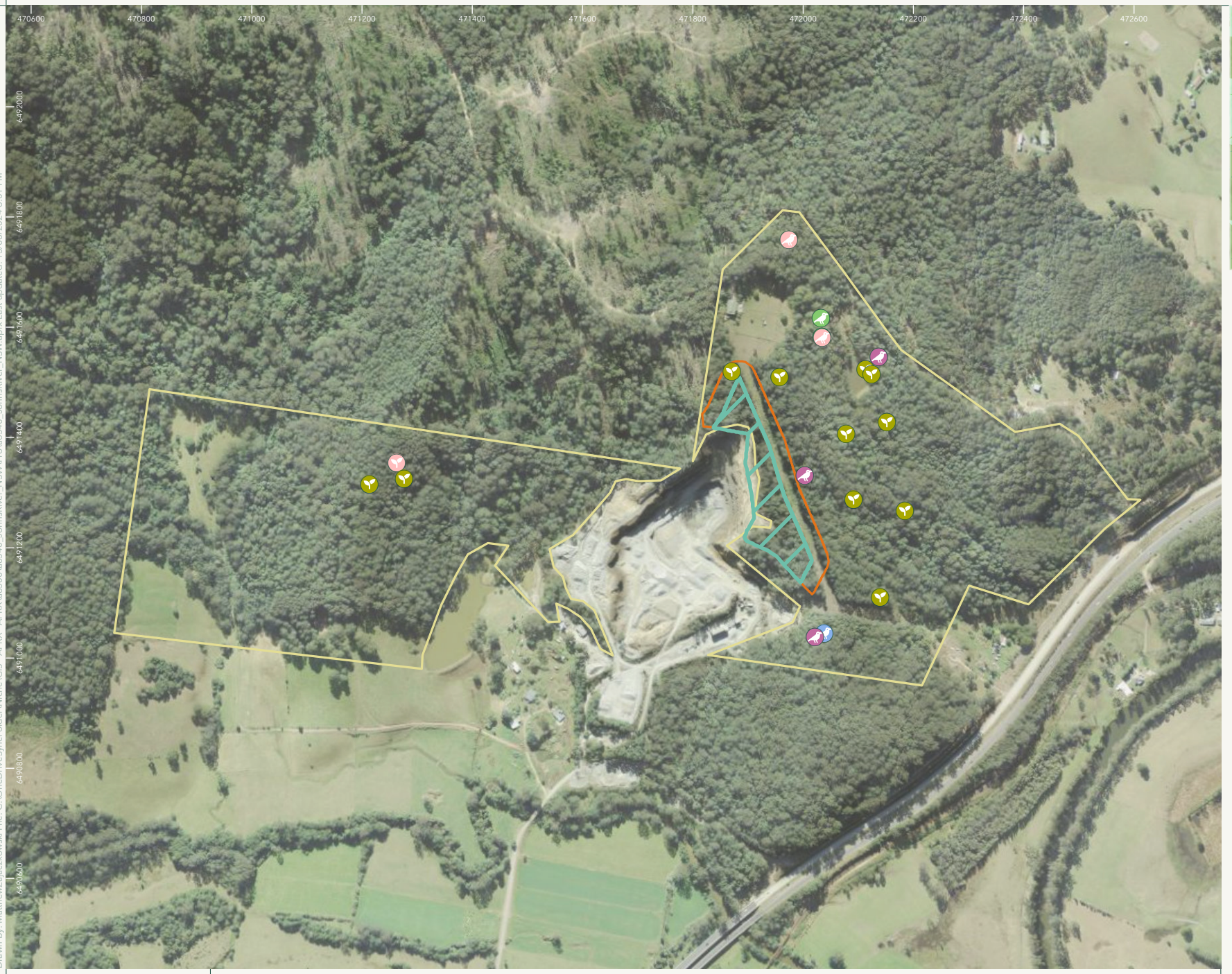
Niche

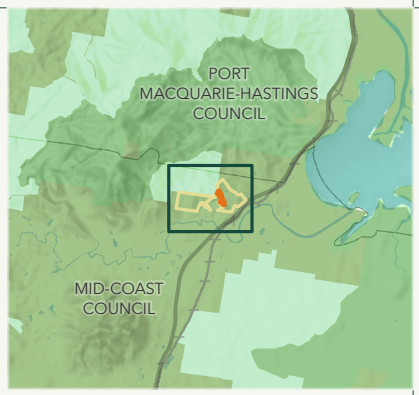
Figure 7

NSW Bionet Atlas Threatened Species 10km Search – Fauna

Johns River Quarry Extension

Niche PM: Dmitri Medvedko
Niche Proj. #: 8540
Client: Boral





- Niche study area
- RPS study area
- Development footprint / Subject land

Threatened species

Threatened fauna

- Glossy Black-Cockatoo
- Little Bent-wing Bat
- Powerful Owl
- Varied Sitella

Threatened flora

- *C. elegans*
- *R. rubescens*

0 240
m
GDA2020 MGA Zone 56

Figure 8

Threatened species recorded during survey

Johns River Quarry Extension

Niche PM: Dmitri Medvedko
Niche Proj. #: 8540
Client: Boral

Drawn by: MatthewZajaczkowski File: C:\OneDriveSyncFolder\Niche\GIS_APRX_APRX\a85000\a8540_JohnsRiver_NSW\Pro\a8540_JohnsRiver_NSW.aprx Last updated: 13/08/2024 8:01 PM

Hillshade: Esri, Geoscience Australia, NASA, NGA, USGS/ World_Ocean_Base: NIWA, GeosciencesAustralia, Esri, Garmin, NaturalVue/ public/NSW_Imagery: © Department of Customer Service 2020 | Watercourses, Waterbodies, Road and Rail alignments, Protected areas of NSW © Spatial Services 2021. | Niche uses GDA2020 as standard for all project-related data. In order to ensure that data from numerous sources and coordinate systems is aligned, on-the-fly transformation to GDA2020 MGA Zone 56 is used in the map above. For ease of reference, the grid tick marks and labels shown around the border of the map are presented in GDA2020 MGA Zone 56.

Annex 2. Assessment of compliance

BAM ref.	BAM requirement	Section reference(s) in the BDAR
Chapters 2 and 3	Information	
	Introduction to the biodiversity assessment including:	
	☐ brief description of the proposed modification	1
	☐ identification of subject land boundary, including: ☐ operational footprint ☐ construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure	1.2
	☐ general description of the subject land	1.2
	☐ sources of information used in the assessment, including reports and spatial data	Table 2
	☐ identification and justification for entering the BOS	1.4.1
	Maps and tables	
	☐ Map of the subject land boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure	Figure 1
Sections 3.1 and 3.2, Appendix E	Information	
	Identification of site context components and landscape features, including:	
	☐ general description of subject land topographic and hydrological setting, geology and soils	2.1.4 2.1.2

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ per cent native vegetation cover in the assessment area (as described in BAM Section 3.2)	3.1.2
	☐ IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.))	2.1.1
	☐ rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3.) and Appendix E)	2.1.2
	☐ wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(3.))	2.1.2
	☐ connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.))	2.1.3
	☐ karst, caves, crevices, cliffs, rocks and other geological features of significance and for vegetation clearing proposals, soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(12.))	2.1.4
	☐ areas of outstanding biodiversity value occurring on the subject land and assessment area (as described in BAM Subsection 3.1.3(8–9.))	2.1.5
	☐ any additional landscape features identified in any SEARs for the proposed modification	2.1.6
	☐ NSW (Mitchell) landscape on which the subject land occurs	1.2
	☐ details of field reconnaissance undertaken to confirm the extent and condition of landscape features and native vegetation cover (as described in Operational Manual Stage 1 Section 2.4)	2.1
	Maps and tables	
	☐ Site Map ☐ Property boundary ☐ Boundary of subject land	Figure 1 Site Map

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ Cadastre of subject land (including labelling of Lot and DP or section plan if relevant) ☐ Landscape features identified in BAM Subsection 3.1.3	
	☐ Location Map ☐ Digital aerial photography at 1:1,000 scale or finer ☐ Boundary of subject land ☐ Assessment area (i.e. the subject land and either 1,500 m buffer area or 500 m buffer for linear development) ☐ Landscape features identified in BAM Subsection 3.1.3 ☐ Additional detail (e.g. local government area boundaries) relevant at this scale	Figure 2 Location Map
	Landscape features identified in BAM Subsection 3.1.3 and to be shown on the Site Map and/or Location Map include:	
	☐ IBRA bioregions and subregions ☐ rivers, streams and estuaries ☐ wetlands and important wetlands ☐ connectivity of different areas of habitat ☐ karst, caves, crevices, cliffs, rocks and other geological features of significance and if required, soil hazard features ☐ areas of outstanding biodiversity value occurring on the subject land and assessment area ☐ any additional landscape features identified in any SEARs for the proposed modification ☐ NSW (Mitchell) landscape on which the subject land occurs	Figure 2 Location Map

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	Data	
	☐ All report maps as separate jpeg files	Provided separately
	Individual digital shape files of:	
	☐ subject land boundary	Provided separately
	☐ assessment area (i.e. subject land and 1,500 m buffer area) boundary	Provided separately
	☐ cadastral boundary of subject land	Provided separately
	☐ areas of native vegetation cover	Provided separately
	☐ landscape features	Provided separately
Chapter 4, Appendix A and Appendix H	Information	
	☐ Identify native vegetation extent within the subject land, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery (as described in BAM Section 4.1(1–3.) and Subsection 4.1.1)	3.2.1
	☐ Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM Subsection 4.1.2)	3.2.1
	☐ Review of existing information on native vegetation including references to previous vegetation maps of the subject land and assessment area (described in BAM Section 4.1(3.) and Subsection 4.1.1)	3.1.2

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2	3.1.2 3.1.4
	☐ Where relevant, describe the use of more appropriate local data, provide reasons that support the use of more appropriate local data and include the written confirmation from the decision-maker that they support the use of more appropriate local data (as described in BAM Subsection 1.4.2 and Appendix A)	N/A
	For each PCT within the subject land, describe:	
	☐ PCT name and ID	Table 4
	☐ vegetation class	Table 4
	☐ extent (ha) within subject land	Table 4
	☐ evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM Section 4.2(1–3.))	Annex 3
	☐ plant species relied upon for identification of the PCT and relative abundance of each species	Annex 3
	☐ if relevant, TEC status including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2(1–2.))	
	☐ estimate of per cent cleared value of PCT (BAM Subsection 4.2.1(5.))	Table 4
	Describe the vegetation integrity assessment of the subject land, including:	
	☐ identification and mapping of vegetation zones (as described in BAM Subsection 4.3.1)	3.1.4
	☐ description of vegetation zones within the subject land (as described in Operational Manual Stage 1 Table 2 and Subsection 3.3.2)	Table 4

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ area (ha) of each vegetation zone	Table 4
	☐ assessment of patch size (as described in BAM Subsection 4.3.2)	3.2.1
	☐ survey effort (i.e. number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4(1–2.)	3.1.4
	☐ use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3(5.))	3.2.4
	Where use of more appropriate local benchmark data is proposed (as described in BAM Subsection 1.4.2, BAM Subsection 4.3.3(5.) and BAM Appendix A):	
	☐ identify the PCT or vegetation class for which local benchmark data will be applied ☐ identify published sources of local benchmark data (if benchmarks obtained from published sources) ☐ describe methods of local benchmark data collection (if reference plots used to determine local benchmark data)	
	☐ provide justification for use of local data rather than BioNet Vegetation Classification benchmark values	
	☐ provide written confirmation from the decision-maker that they support the use of local benchmark data	
	Maps and tables	
	☐ Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of all areas of native vegetation including areas that are ground cover only, cleared areas (as described in BAM Section 4.1(1–3.)) and all parts of the subject land that do not contain native vegetation (BAM Subsection 4.1.2)	Figure 3
	☐ Map of PCTs within the subject land (as described in BAM Section 4.2(1.))	Figure 3
	☐ Map of vegetation zones within the subject land (as described in BAM Subsection 4.3.1)	Figure 3

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCT boundaries	Figure 3
	☐ Map of TEC distribution on the subject land and table of TEC listing, status and area (ha)	
	☐ Map of patch size locations for each native vegetation zone and table of patch size areas (as described in BAM Subsection 4.3.2)	
	Table of current vegetation integrity scores for each vegetation zone within the site and including:	Table 7 Vegetation Integrity Score
	☐ composition condition score ☐ structure condition score ☐ function condition score ☐ presence of hollow bearing trees	
	Data	
	☐ All report maps as separate jpeg files	Provided separately
	☐ Plot field data (MS Excel format)	Provided separately
	☐ Plot field datasheets	N/A
	Digital shape files of:	
	☐ PCT boundaries within subject land	Provided separately
	☐ TEC boundaries within subject land	N/A

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ vegetation zone boundaries within subject land	Provided separately
	☐ floristic vegetation survey and vegetation integrity plot locations	Provided separately
Chapter 5	Information	
	Identify ecosystem credit species likely to occur on the subject land, including:	
	☐ list of ecosystem credit species derived from the BAM-C (as described in BAM Subsection 5.1.1 and Section 5.2(1.))	Table 8
	☐ justification and supporting evidence for exclusion of any ecosystem credit species based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2)	Table 7
	☐ justification for addition of any ecosystem credit species to the list	4.4
	Identify species credit species likely to occur on the subject land, including:	
	☐ list of species credit species derived from the BAM-C (as described in BAM Subsection 5.1.1)	Table 9 Table 11
	☐ justification and supporting evidence for exclusions based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2)	Table 7 Table 10
	☐ justification and supporting evidence for exclusions based on degraded habitat constraints and/or microhabitats on which the species depends (as described in BAM Subsection 5.2.2)	Table 7 Table 10
	☐ justification for addition of any species credit species to the list	4.6 4.5
	From the list of candidate species credit species, identify:	

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ species assumed present within the subject land (if relevant) (as described in BAM Subsection 5.2.4(2.a.)) ☐ species present within the subject land on the basis of being identified on an important habitat map for a species (as described in BAM Subsection 5.2.4(2.d.)) ☐ species for which targeted surveys are to be completed to determine species presence (BAM Subsection 5.2.4(2.b.)) ☐ species for which an expert report is to be used to determine species presence (BAM Subsection 5.2.4(2.c.))	Table 9 Table 11
	Present the outcomes of species credit species assessments from:	
	☐ threatened species survey (as described in BAM Section 5.2.4)	Table 14 Table 15
	☐ expert reports (if relevant) including justification for presence of the species and information used to make this determination (as described in BAM Subsection 5.2.4, Section 5.3, Box 3)	
	Where survey has been undertaken include detailed information on:	
	☐ survey method and effort (as described in BAM Section 5.3)	Table 12 Table 13
	☐ justification of survey method and effort (e.g. citation of peer-reviewed literature) if approach differs from the department's taxa-specific survey guides or where no relevant guideline has been published	5.2 5.3 Table 15
	☐ timing of survey in relation to requirements in the TBDC or the department's taxa-specific survey guides. Where survey was undertaken outside these guides include justification for the timing of surveys	Table 14 Table 15

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ survey personnel and relevant experience	Details and experience of authors and contributors
	☐ describe any limitations to surveys and how these were addressed/overcome	7
	Where an expert report has been used in place of survey (as described in BAM Section 5.3, Box 3), include:	
	☐ justification of the use of an expert report ☐ identify the expert, provide evidence of their expert credentials and departmental approval of expert status ☐ all requirements of Box 3 have been addressed in the expert report	
	Where use of local data is proposed (BAM Subsection 1.4.2):	
	☐ identify relevant species ☐ identify data to be amended ☐ identify source of information for local data, e.g. published literature, additional survey data, etc. ☐ justify use of local data in preference to VIS Classification or TBDC data	
	☐ provide written confirmation from the decision-maker that they support the use of local data	
	Species polygon completed for species credit species present within the subject land (assumed present or determined on the basis of survey, expert report or important habitat map) ensuring that:	
	☐ the unit of measure for each species is documented	

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	for species assessed by area:	
	☐ the polygon includes the extent of suitable habitat for the target species within the subject land (as described in BAM Subsection 5.2.5)	
	☐ a description of, and evidence-based justification for, the habitat constraints, features or microhabitats used to map the species polygon including reference to information in the TBDC for that species and any buffers applied	Table 7 Table 10
	for species assessed by counts of individuals:	
	☐ the number of individual plants present on the subject land (as described in BAM Subsection 5.2.5(3.))	
	☐ the method used to derive this number (i.e. threatened species survey or expert report) and evidence-based justification for the approach taken	
	☐ the polygon includes all individuals located on the subject land with a buffer of 30 m around the individuals or groups of individuals on the subject land	
	☐ Identify the biodiversity risk weighting for each species credit species identified as present within the subject land (as described in BAM Section 5.4)	
	Maps and tables	
	☐ Table showing ecosystem credit species in accordance with BAM Subsection 5.1.1, and identifying:	Table 9 Ecosystem credit species
	☐ the ecosystem credit species removed from the list	
	☐ the sensitivity to gain class of each species	

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ Table detailing species credit species in accordance with BAM Section 5.2 and identifying:	Table 10 Flora species credit species Table 12 Fauna species credit species
	☐ the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or microhabitat features are not present	Table 8 Species excluded from further assessment Table 11 Dual credit fauna species that were excluded from further assessment
	☐ the candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map	
	☐ Table detailing species credit species recorded or assumed as present within the subject land, habitat constraints or microhabitats associated with the species, counts of individuals (flora)/extent of suitable habitat (flora and fauna) (as described in BAM Subsection 5.2.6) and biodiversity risk weighting (BAM Section 5.4)	
	☐ Map indicating the GPS coordinates of all individuals of each species recorded within the subject land and the species polygon for each species (as described in BAM Subsection 5.2.5)	Figure 8 Threatened Species Recorded During Survey
	Data	
	☐ Digital shape files of suitable habitat identified for survey for each candidate species credit species	Provided separately
	☐ Survey locations including GPS coordinates of any plots, transects, grids	Provided separately

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ Digital shape files of each species polygon including GPS coordinates of located individuals	Provided separately
	☐ Species polygon map in jpeg format	Provided separately
	☐ Expert reports and any supporting data used to support conclusions of the expert report	
	☐ Field datasheets detailing survey information including prevailing conditions, date, time, equipment used, etc.	
Chapter 6	Information	
	Identify potential prescribed biodiversity impacts on threatened entities, including:	8.2
	☐ karst, caves, crevices, cliffs, rocks and other geological features of significance (as described in BAM Subsection 6.1.1) ☐ occurrences of human-made structures and non-native vegetation (as described in BAM Subsection 6.1.2) ☐ corridors or other areas of connectivity linking habitat for threatened entities (as described in BAM Subsection 6.1.3) ☐ waterbodies or any hydrological processes that sustain threatened entities (as described in BAM Subsection 6.1.4)	
	☐ protected animals that may use the proposed wind farm development site as a flyway or migration route (as described in BAM Subsection 6.1.5)	
	☐ where the proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community (as described in BAM Subsection 6.1.6)	
	☐ Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts	
	☐ Describe the importance of habitat features to the species including, where relevant, impacts on life cycle or movement patterns (e.g. Subsection 6.1.3)	

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	Where the proposed development is for a wind farm:	
	☐ identify a candidate list of protected animals that may use the development site as a flyway or migration route, including: resident threatened aerial species, resident raptor species and nomadic and migratory species that are likely to fly over the proposed modification area (as described in BAM Subsection 6.1.5)	
	☐ provide details of targeted survey for candidate species of wind farm developments undertaken in accordance with BAM Subsection 6.1.5(2–3.)	
	☐ predict the habitual flight paths for nomadic and migratory species likely to fly over the subject land and map the likely habitat for resident threatened aerial and raptor species (BAM Subsection 6.1.5(4.))	
	Where the proposed modification may result in vehicle strike:	
	☐ identify a list of threatened fauna or protected fauna species that are part of a TEC and at risk of vehicle strike due to the proposed modification	
	Maps and tables	
	☐ Map showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human-made structures, etc.)	
	☐ Map showing location of potential vehicle strike locations	
	☐ Maps of habitual flight paths for nomadic and migratory species likely to fly over the site and maps of likely habitat for threatened aerial species resident on the site (for wind farm developments only)	
	Data	
	☐ Digital shape files of prescribed impact feature locations	
	☐ Prescribed impact features map in jpeg format	

BAM ref.	BAM requirement	Section reference(s) in the BDAR
Chapter 7	Information	
	Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposed modification location in accordance with Chapter 7, including an analysis of alternative:	
	☐ modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology	8.1.1
	☐ routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route	8.1.2
	☐ alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location	Table 17
	☐ alternative sites within a property on which the proposed modification is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site	Table 17
	☐ Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design (as described in BAM Sections 7.1 and 7.2)	Table 17 Table 18
	☐ Identification of any other site constraints that the proponent has considered in determining the location and design of the proposed modification (as described in BAM Subsection 7.2.1(3.))	
	☐ Detail measures or options considered but not implemented because they are not feasible and/or practical (e.g. due to site constraints)	
	Maps and tables	
	☐ Table of measures to be implemented to avoid and minimise the impacts of the proposed modification, including action, outcome, timing and responsibility	Table 17 Table 18

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ Map of alternative footprints considered to avoid or minimise impacts on biodiversity values; and of the final proposal footprint, including construction and operation	
	☐ Maps demonstrating indirect impact zones where applicable	
	Data	
	Digital shape files of:	
	☐ alternative and final proposal footprint	
	☐ direct and indirect impact zones	
	☐ Maps in jpeg format	
Chapter 8, Sections 8.1 and 8.2	Information	
	☐ Determine the impacts on native vegetation and threatened species habitat, including a description of direct impacts of clearing of native vegetation, threatened ecological communities and threatened species habitat (as described in BAM Section 8.1)	8.2.1
	Assessment of indirect impacts on vegetation and threatened species and their habitat including (as described in BAM Section 8.2):	
	☐ description of the nature, extent, frequency, duration and timing of indirect impacts of the proposed modification	8.3
	☐ documenting the consequences to vegetation and threatened species and their habitat including evidence-based justifications	8.3
	☐ reporting any limitations or assumptions, etc. made during the assessment	

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ identification of the threatened entities and their habitat likely to be affected	10.1
	Assessment of prescribed biodiversity impacts (as described in BAM Section 8.3) including:	8.4
	assessment of the nature, extent frequency, duration and timing of impacts on the habitat of threatened species or ecological communities associated with:	
	☐ karst, caves, crevices, cliffs, rocks and other features of geological significance	Table 20
	☐ human-made structures	Table 20
	☐ non-native vegetation	Table 20
	☐ connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	Table 20
	☐ movement of threatened species that maintains their life cycle	Table 20
	☐ water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities	Table 20
	☐ assessment of the impacts of wind turbine strikes on protected animals	
	☐ assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC	Table 20
	☐ evaluate the consequences of prescribed impacts	Table 20
	☐ describe impacts that are uncertain	
	☐ document limitations to data, assumptions and predictions	

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	Maps and tables	
	☐ Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts	Table 7 Vegetation Integrity Score Table 22 Impacts that require and offset – ecosystem credits
	Data	
	N/A	
Chapter 8, Sections 8.4 and 8.5	Information	
	Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Sections 8.4 and 8.5 including:	
	☐ techniques, timing, frequency and responsibility ☐ identify measures for which there is risk of failure ☐ evaluate the risk and consequence of any residual impacts	Table 18
	☐ document any adaptive management strategy proposed	
	Identification of measures for mitigating impacts related to:	
		Table 18

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ displacement of resident fauna (as described in BAM Subsection 8.4.1(2.))	
	☐ indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.))	
	☐ mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2)	
	☐ Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5)	
	Maps and tables	
	☐ Table of measures to be implemented before, during and after construction to mitigate and manage impacts of the proposed modification, including action, outcome, timing and responsibility	
	Data	
	N/A	
Chapter 9	Information	
	Identification and assessment of impacts on TECs and threatened species that are at risk of a serious and irreversible impacts (SAII, in accordance with BAM Section 9.1) including:	9
	☐ addressing all criteria in Subsection 9.1.1 for each TEC listed as at risk of an SAII present on the subject land	
	☐ for each TEC, report the extent of the TEC in NSW	
	☐ addressing all criteria in Subsection 9.1.2 for each threatened species at risk of an SAII present on the subject land	
	☐ for each threatened species, report the population size in NSW	

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ documenting assumptions made and/or limitations to information ☐ documenting all sources of data, information, references used or consulted ☐ clearly justifying why any criteria could not be addressed	
	☐ Identification of impacts requiring offset in accordance with BAM Section 9.2	8
	☐ Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.)	
	☐ Identification of areas not requiring assessment in accordance with BAM Section 9.3	
	Maps and tables	
	☐ Map showing the extent of TECs at risk of an SAII within the subject land	
	☐ Map showing location of threatened species at risk of an SAII within the subject land	
	Map showing location of:	
	☐ impacts requiring offset	Figure 3 Vegetation Zones and Plot Locations
	☐ impacts not requiring offset	
	☐ areas not requiring assessment	
	Data	
	Digital shape files of:	
	☐ extent of TECs at risk of an SAII within the subject land	

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	☐ location of threatened species at risk of an SAII within the subject land	
	☐ boundary of impacts requiring offset	
	☐ boundary of impacts not requiring offset	
	☐ boundary of areas not requiring assessment	
	☐ Maps in jpeg format	
Chapter 10	Information	
	Ecosystem credits and species credits that measure the impact of the development on biodiversity values, including:	
	☐ future vegetation integrity score for each vegetation zone within the subject land (Equation 25 and Equation 26 in BAM Appendix H) ☐ change in vegetation integrity score (BAM Subsection 8.1.1) ☐ number of required ecosystem credits for the direct impacts of the proposed modification on each vegetation zone within the subject land (BAM Subsection 10.1.2)	Table 7 Vegetation Integrity Score Table 22 Impacts that require and offset – ecosystem credits
	☐ biodiversity risk weighting for each	
	☐ number of required species credits for each candidate threatened species that is directly impacted on by the proposed modification (BAM Subsection 10.1.3)	Table 23
	Maps and tables	
	☐ Table of PCTs requiring offset and the number of ecosystem credits required	Table 23
	☐ Table of threatened species requiring offset and the number of species credits required	

BAM ref.	BAM requirement	Section reference(s) in the BDAR
	Data	
	☐ Submitted proposal in the BAM Calculator	
Chapter 10	Information	
	☐ Description of credit classes for ecosystem credits and species credits at the development or clearing site or land to be biodiversity certified (BAM Section 10.2)	BAM-C Credit Report
	☐ BAM credit report in pdf format	BAM-C Credit Report
	Maps and tables	
	☐ Table of credit class and matching credit profile	BAM-C Credit Report
	Data	
	☐ BAM credit report in pdf format	BAM-C Credit Report

Annex 3. PCT justification

PCT identification

Vegetation within the Niche Study Area constitutes a Wet Sclerophyll Forests (Grassy Sub-formation) vegetation formation due to the presence of soft-leaved, mesophyllous, shrubs, fern and herbs in the sub-strata. The list of PCTs was filtered by the vegetation formation and the IBRA-sub region, resulting in a total of twenty-two PCTs.

PCT 3250 aligned as best fit due to numerous characteristic species and topographic and geological factors matching those recorded within the Niche Study Area.

Characteristic species of PCT 3250

The canopy very frequently includes *Eucalyptus pilularis* dominating with the highest cover and commonly *Eucalyptus microcorys*, sometimes with locally high cover. Other canopy species occasionally include *Corymbia intermedia* and *Syncarpia glomulifera*, rarely with *Angophora costata*, *Eucalyptus resinifera* and *Eucalyptus propinqua*. *Allocasuarina torulosa* occurs very frequently and occasionally forms a mid-dense sub-canopy.The shrub Polyscias sambucifolia is very frequently present, commonly with vine *Billardiera scandens*, usually as scattered individuals. *Polyscias sambucifolia* is sometimes locally abundant and forms thickets in less frequently burnt sites. The grassy ground layer almost always includes a high cover of Imperata cylindrica, very frequently with Pteridium esculentum, *Lomandra longifolia*, *Entolasia stricta* and *Themeda triandra*, all usually with low cover.

— The native vegetation comprised of numerous species characteristic of PCT 3250, including *Eucalyptus pilularis* (Blackbutt), *Corymbia intermedia* (Pink Bloodwood), *Syncarpia glomulifera* (Turpentine), *Eucalyptus microcorys* (Tallwood), *Allocasurina torulosa* (Forest Oak), *Breynia oblongifolia* (Coffee Bush), *Billardiera scandens* (Hairy Apple Berry), *Polyscias sambucifolia* (Elderberry Panax), *Imperata cylindrica* (Blady Grass), and a few *Entolasia* and *Lomandra* species. Those species underlined were recorded as dominant species within the survey plots (either through though cover or abundance) which align with those species reflected in PCT 3250.

Topography and Geological Factors

This PCT occurs mainly in warm, wet locations receiving 1200-1580 mm mean annual rainfall, at low to mid-elevations of 10-370 m asl.

— Data from the Bureau of Meteorology (2023), Moorland (Denro-An) AWS (station 60024) has recorded a mean annual rainfall of 1459.2 mm for the area aligning with the climatic attributes of this PCT. Additionally, the elevation of the subject land is recorded at 47 m asl which aligns with the topographic characteristics of PCT 3250.

Occurs extensively on the coast, coastal ranges and foothills ranges between Grafton and Gosford:

— The subject land is located in the township of Johns River, situated between Grafton and Gosford. The location of the subject land aligns with the geographic criteria for PCT 3250.

It occurs mainly on clay-rich sedimentary or meta-sedimentary substrates, occasionally higher-quartz sediments, on ridge to mid-slope sites which are frequently burnt.

— Information from the Geological Survey of NSW (GSNSW) Seamless Geology (version 2022.8.3) indicates the Study Area has been mapped as:

— Middle Brother Granodiorite (Tabm) of the Brother Granodiorite (Tab). This geological formation covers the entire Subject land. eSpade mapping indicates the Brother Granodiorite parent unit, has been characterised as dark, fine-grained hornfelsic rocks and quartzites in areas of contact metamorphism and inclusions of country rock. Regolith is sandy clay as weathered substrate, mostly between 100–150 cm deep.

Whilst PCT 3250 does not align with the sedimentary aspect of the PCT criteria, the PCT has been mapped within this area on SVTM, and the geology features clay rich sediments.

Alternative PCTs Considered

The following PCTs were ultimately ruled out due to the below reasoning:

PCT	Justification for exclusion
3241	Canopy vegetation is not dominated by the canopy species that define this PCT - *Eucalyptus acmenoides* and *Corymbia maculata*. The shrub layer of this PCT has some of the shrub species on site, specifically B*reynia oblongifolia*, *Notelaea longifolia*, and *Pittosporum revolutum* but this PCT's description does not mention some of the most abundant shrubs that were detected – *Trochocarpa laurina* and *Ozothamnus diosmifolius*. Furthermore, this PCT is associated with sedimentary substrates north of the Hunter River, towards Port Macquarie. Soils on site are not sedimentary, they are coastal belt granitoids.
3244	The canopy assemblage of this PCT does not match the canopy assemblage of vegetation on site although the mid-storey and groundcover layers of this PCT and vegetation on Site are similar. However, the bulk of this PCT is geographically constrained to between the Watagan Ranges and Taree and Taree, the northernmost extent of this PCT is approximately 35km south of the site. Furthermore, this PCT is associated with clay-rich or acid volcanics, neither of which are present on the clearing site.
3251	The floristic assemblage of this PCT is not represented in the Niche Study Area.
3252	The elevation and Canopy composition of this PCT does not align with that of the Niche Study Area.
3253	The canopy composition and geology doesn't not align with the Niche Study Area, although the groundcover is generally consistent.
3254	The floristic assemblage of this PCT is not represented in the Niche Study Area.
3160	The floristic assemblage of this PCT is not represented in the Niche Study Area.
3165	The floristic assemblage of this PCT and landform is not represented in the Niche Study Area.
3166	The elevation range for this PCT does not correspond to the elevation of the Niche Study Area.
3168	The floristic assemblage of this PCT is not represented in the Niche Study Area.
3169	The floristic assemblage of this PCT is not represented in the Niche Study Area.
3171	The landform occupied by this PCT is not within the Niche Study Area.
3174	The floristic assemblage of this PCT is not represented in the Niche Study Area.
4043	This Niche Study Area is higher than 10 m AHD and is not an alluvial flat.

PCT	Justification for exclusion
3433	This PCT is geographically constrained between Tuggerah and Strathford. Tuggerah, the northernmost extent of this PCT is approximately 200m south of the clearing site.
3436	No melaleuca trees were detected within the Niche Study Area.
3544	Although the Niche Study Area is within the geographic constraints of this PCT and the canopy of the site's vegetation includes *Eucalyptus pilularis*, vegetation lacks the two other main indicator species of this PCT – *Angophora costata* and *Corymbia gummifera*. Furthermore, the mid stratum on the clearing site lacks *Banksia serrata*, and other indicator species of this PCT.
3549	Soils on within the Niche Study Area are not quaternary sands, they are coastal belt granitoids.
3167	The rainfall for this PCT is 1626 mean rainfall whereas local mean annual rainfall is 1400 mm.
3248	The elevation and mean rainfall for this PCT so not align well with those within the Niche Study Area.
3249	The elevation and mean rainfall for this PCT so not align well with those within the Niche Study Area.

Annex 4. VI Plot Data

Composition and structure data

VI plot 1

Genus	Species	Cover	Abundance	Native or Exotic	Growth Form Group
Acacia	*floribunda*	0.2	2	Native	Shrub (SG)
Acmena	*smithii*	2	5	Native	Tree (TG)
Acronychia	*imperforata*	5	16	Native	Shrub (SG)
Adiantum	*hispidulum*	8	50	Native	Fern (EG)
Allocasuarina	*torulosa*	5	10	Native	Tree (TG)
Alphitonia	*excelsa*	2	5	Native	Tree (TG)
Billardiera	*scandens*	0.3	10	Native	Other (OG)
Blechnum	*spp.*	10	150	Native	Fern (EG)
Breynia	*oblongifolia*	3	5	Native	Shrub (SG)
Callicoma	*serratifolia*	0.1	1	Native	Shrub (SG)
Cayratia	*clematidea*	0.2	5	Native	Other (OG)
Cordyline	*stricta*	0.1	1	Native	Other (OG)
Corymbia	*intermedia*	15	2	Native	Tree (TG)
Cryptocarya	*obovata*	0.1	1	Native	Tree (TG)
Cyperus	*eragrostis*	0.1	1	Exotic	HTW
Dianella	*caerulea*	0.5	3	Native	Forb (FG)
Dichondra	*repens*	0.1	2	Native	Forb (FG)
Echinopogon	*caespitosus*	0.1	5	Native	Grass & grasslike (GG)
Entolasia	*marginata*	10	800	Native	Grass & grasslike (GG)

Genus	Species	Cover	Abundance	Native or Exotic	Growth Form Group
Eucalyptus	*propinqua*	30	7	Native	Tree (TG)
Eucalyptus	*microcorys*	5	2	Native	Tree (TG)
Eustrephus	*latifolius*	1	10	Native	Other (OG)
Geitonoplesium	*cymosum*	10	100	Native	Other (OG)
Glochidion	*ferdinandi*	0.1	1	Native	Tree (TG)
Glycine	*tabacina*	3	200	Native	Other (OG)
Guioa	*semiglauca*	0.1	5	Native	Tree (TG)
Hydrocotyle	*laxiflora*	0.1	10	Native	Forb (FG)
Imperata	*cylindrica*	30	400	Native	Grass & grasslike (GG)
Jagera	*pseudorhus*	0.1	1	Native	Tree (TG)
Lantana	*camara*	25	200	Exotic	HTW
Leucopogon	*juniperinus*	2	4	Native	Shrub (SG)
Lomandra	*longifolia*	0.1	1	Native	Grass & grasslike (GG)
Lophostemon	*confertus*	1	1	Native	Tree (TG)
Morinda	*jasminoides*	3	10	Native	Other (OG)
Notelaea	*longifolia*	1	5	Native	Tree (TG)
Opercularia	*diphylla*	0.2	10	Native	Forb (FG)
Oplismenus	*aemulus*	15	300	Native	Grass & grasslike (GG)
Ozothamnus	*diosmifolius*	30	100	Native	Shrub (SG)
Pandorea	*pandorana*	0.2	3	Native	Other (OG)
Panicum	*spp.*	0.1	1	Native	Grass & grasslike (GG)

Genus	Species	Cover	Abundance	Native or Exotic	Growth Form Group
Paspalum	*mandiocanum*	50	500	Exotic	Weed other
Pittosporum	*undulatum*	0.5	1	Native	Shrub (SG)
Polyscias	*sambucifolia*	0.5	5	Native	Shrub (SG)
Pratia	*purpurascens*	0.2	100	Native	Forb (FG)
Rubus	*parvifolius*	0.1	3	Native	Shrub (SG)
Senna	*pendula*	0.1	1	Exotic	HTW
Smilax	*australis*	1	1	Native	Other (OG)
Stephania	*japonica*	0.5	15	Native	Other (OG)
Tetrastigma	*nitens*	0.2	10	Native	Other (OG)
Trochocarpa	*laurina*	1	5	Native	Tree (TG)

VI plot 2

Genus	Species	Cover	Abundance	Native or Exotic	Growth Form Group
Allocasuarina	*torulosa*	5	5	Native	Tree (TG)
Alphitonia	*excelsa*	0.2	5	Native	Tree (TG)
Aristida	*vagans*	2	50	Native	Grass & grasslike (GG)
Breynia	*oblongifolia*	3	5	Native	Shrub (SG)
Cheilanthes	*sieberi*	0.1	1	Native	Fern (EG)
Cinnamomum	*camphora*	0.1	1	Exotic	HTW
Cissus	*hypoglauca*	0.1	2	Native	Other (OG)
Clematis	*aristata*	0.5	5	Native	Other (OG)
Cymbopogon	*refractus*	0.1	1	Native	Grass & grasslike (GG)
Desmodium	*varians*	0.5	5	Native	Other (OG)
Echinopogon	*caespitosus*	0.1	5	Native	Grass & grasslike (GG)
Entolasia	*marginata*	5	80	Native	Grass & grasslike (GG)
Eucalyptus	*pilularis*	65	8	Native	Tree (TG)
Geitonoplesium	*cymosum*	0.1	2	Native	Other (OG)
Glochidion	*ferdinandi*	0.1	1	Native	Tree (TG)
Glycine	*clandestina*	0.1	5	Native	Other (OG)
Gomphocarpus	*fruticosus*	0.1	1	Exotic	Weed other
Hibbertia	*scandens*	0.1	1	Native	Other (OG)
Hypochaeris	*glabra*	0.1	1	Exotic	Weed other
Imperata	*cylindrica*	70	1000	Native	Grass & grasslike (GG)
Lantana	*camara*	10	30	Exotic	HTW

Genus	Species	Cover	Abundance	Native or Exotic	Growth Form Group
Leucopogon	*juniperinus*	3	30	Native	Shrub (SG)
Lomandra	*filiformis*	0.1	3	Native	Grass & grasslike (GG)
Lomandra	*longifolia*	0.1	1	Native	Grass & grasslike (GG)
Lomandra	*hystrix*	0.1	1	Native	Grass & grasslike (GG)
Lomatia	*silaifolia*	2	10	Native	Shrub (SG)
Lophostemon	*confertus*	3	4	Native	Tree (TG)
Notelaea	*longifolia*	8	20	Native	Tree (TG)
Opercularia	*diphylla*	0.1	1	Native	Forb (FG)
Oplismenus	*aemulus*	0.5	20	Native	Grass & grasslike (GG)
Ozothamnus	*diosmifolius*	5	52	Native	Shrub (SG)
Pandorea	*pandorana*	0.1	3	Native	Other (OG)
Panicum	*simile*	0.1	5	Native	Grass & grasslike (GG)
Paspalum	*mandiocanum*	0.1	1	Exotic	Weed other
Phyllanthus	*similis*	5	20	Native	Forb (FG)
Polyscias	*sambucifolia*	0.5	5	Native	Shrub (SG)
Pratia	*purpurascens*	0.3	10	Native	Forb (FG)
Rubus	*parvifolius*	1	10	Native	Shrub (SG)
Senna	*pendula*	0.1	1	Exotic	HTW
Stephania	*japonica*	0.5	5	Native	Other (OG)
Syncarpia	*glomulifera*	20	10	Native	Tree (TG)

Function Data

Plot #	Large Trees	HBTs	Litter Cover (%)	Fallen Logs (m)	Tree Stem Class Sizes					
					5 – 10 cm	10 – 20 cm	20 – 30 cm	30 – 50 cm	50 – 80 cm	Tree Regeneration
1	1	0	72.0	75.0	✓	✓	✓	✓	✓	✓
2	2	0	67.0	45.0	✓	✓	✓	✓	✓	✓

Annex 5. BAM-C credit report

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00046742/BAAS22009/24/00046743	Johns River Quarry Extension	14/03/2024
Assessor Name	Report Created	BAM Data version *
Dmitri E Medvedko	27/09/2024	67
Assessor Number	BAM Case Status	Date Finalised
BAAS22009	Open	To be finalised
Assessment Revision	Assessment Type	BOS entry trigger
6	Part 4 Developments (General)	BOS Threshold: Area clearing threshold

* 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	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Northern Foothills Blackbutt Grassy Forest												
1	3250_Moderate	Not a TEC	92	92.0	1.8	PCT Cleared - 30%	High Sensitivity to Gain			1.50		64
											Subtotal	**64**
											Total	**64**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits

Annex 6. Meteorological conditions during RPS surveys

2.7 Survey Timing and Weather Conditions

Weather conditions for days surveys were undertaken is provided in **Table 2-7**.

Table 2-7: Temperature (maximum and minimum) and Rainfall during the Survey Period (sourced from Taree Airport station number 60141)

Date	Day	Min Temp (°C)	Max Temp (°C)	Rain (mm)
Summer 2020/2021	7/12/2020	20	26	0.2
	8/12/2020	16.5	28	0
	9/12/2020	9.6	25.2	0

Date	Day	Min Temp (ºC)	Max Temp (ºC)	Rain (mm)
	10/12/2020	11.4	28	3
	11/12/2020	17.7	20.9	0
	11/01/2021	15.8	27.3	0
	12/01/2021	16.1	29	0
	13/01/2021	16.8	28.5	0
	14/01/2021	17.8	31	0
	15/01/2021	20.6	27.9	24.5
	16/01/2021	17.2	27.2	0
	17/01/2021	12.2	28	0
	18/01/2021	15.5	26.3	0
	19/01/2021	18.5	28.5	0
	20/01/2021	17.9	22.9	16
	21/01/2021	14.5	25.7	0
	22/01/2021	16	30.4	0
	23/01/2021	16.4	32.8	0
	24/01/2021	17.4	31.3	0
	25/01/2021	16.9	31.6	0
	26/01/2021	20.3	33.6	0
	27/01/2021	19.7	30.1	0
	28/01/2021	21.4	27.2	0
	29/01/2021	20.1	26	31
	30/01/2021	20.2	29.2	9
	31/01/2021	19.6	28.5	0
	1/02/2021	19.6	28.4	0
	2/02/2021	19.3	24.8	13.8
	3/02/2021	18.1	25.1	1.2
	4/02/2021	16.2	28.2	0
	5/02/2021	18.2	29	0
	6/02/2021	20.3	27.8	0
	7/02/2021	19.6	29.4	5
	8/02/2021	19.2	26.2	0
	9/02/2021	17.7	25.6	0
	10/02/2021	16.2	22.7	4.2
	11/02/2021	15.1	25.7	0
	12/02/2021	14.6	30	0
	13/02/2021	21.2	24	39.6
	14/02/2021	18.9	25.8	0
	15/02/2021	17.4	23.7	0
	16/02/2021	18.4	26.1	17.6
	17/02/2021	18.9	25.3	12.6
	18/02/2021	17.6	25.7	18.4
	19/02/2021	18.9	26.7	1.8
	20/02/2021	20.2	25.4	4.4
	21/02/2021	20.7	24	21.8
	22/02/2021	20	30	0

Date	Day	Min Temp (ºC)	Max Temp (ºC)	Rain (mm)
	23/02/2021	20.4	22.7	6
	24/02/2021	17.9	22.9	0.9
	25/02/2021	18.6	29	0.1
	26/02/2021	17.6		0
	27/02/2021	21.7	24.3	0
	28/02/2021	20.2	28.9	8.8
Autumn 2021	1/03/2021	20.9	30	0
	2/03/2021	21	27.4	0
	3/03/2021	19	22.4	0
	4/03/2021	16.7	25.5	0
	5/03/2021	14.3	28.4	0
	6/03/2021	17.7	24.6	0
	7/03/2021	16.6	26	0
	8/03/2021	17.6	30.1	0
	9/03/2021	15.3	30.2	0
	10/03/2021	19.4	25.2	29
	11/03/2021	19.6	25.1	3.8
	12/03/2021	19.3	28.1	3.8
	13/03/2021	18	29.9	1.8
	14/03/2021	19.2	27.8	0
	15/03/2021	16.4	23.1	0
	16/03/2021	13.4	23.1	0.2
	17/03/2021	17	23.2	11.2
	18/03/2021	17.9	21.2	30.2
	19/03/2021	18.5	21.9	77
	20/03/2021	18.9	24.1	238.8
	21/03/2021	19.6	21	69
	22/03/2021	18.7	20.6	8.8
	23/03/2021	18.1	22	20.2
	24/03/2021	17.1	28.2	0
	25/03/2021	15.4	28.7	0
	26/03/2021	16.1	26.3	0
	27/03/2021	15.6	27.5	0
	28/03/2021	14.7	26.7	0
	29/03/2021	16.8	25.8	45.6
	30/03/2021	16.7	24.6	3.4
	31/03/2021	16.3	23.3	4.6
	1/04/2021	15.3	25.1	0
	2/04/2021	14.1	25.3	0
	3/04/2021	14.1	25.5	0
	4/04/2021	13.3	25.2	0
	5/04/2021	17.2	27.8	0
	6/04/2021	17.2	25.8	3.8
	7/04/2021	17.3	25.9	13.8
	8/04/2021	18	24.5	0

Date	Day	Min Temp (ºC)	Max Temp (ºC)	Rain (mm)
	9/04/2021	14	30.1	7.8
	10/04/2021	16.5	27.9	0
	11/04/2021	12.3	22.1	0
	12/04/2021	6.6	20.2	0
	13/04/2021	9	22.9	0
	14/04/2021	7.1	28.1	0
	15/04/2021	12.9	26	0
	16/04/2021	15	23.6	0
	17/04/2021	14.3	16.3	35.2
	18/04/2021	11.6	21.1	35
	19/04/2021	11	23.3	0
	20/04/2021	9.6	24.4	0
	21/04/2021	9	22.5	0
	22/04/2021	6.6	22.3	0
	23/04/2021	7.5	21.7	0
	24/04/2021	7.2	22.3	0
	25/04/2021	7.8	22.7	0
	26/04/2021	10.1	22.8	0
	27/04/2021	10.2	22.6	0
	28/04/2021	12.3	22.8	0
	29/04/2021	8.5	22.7	0
	30/04/2021	11.1	22.8	0
	1/05/2021	10.3	24.5	0.4
	2/05/2021	9.7	21.5	0.2
	3/05/2021	11.8	23.8	1.8
	4/05/2021	10.3	23.1	2.6
	5/05/2021	12.6	19.3	7
	6/05/2021	15.2	22.9	0
	7/05/2021	17.1	22.9	0
	8/05/2021	12.2	26.3	0
	9/05/2021	15.5	21.2	0
	10/05/2021	10.9	24.7	7
	11/05/2021	11.4	21.4	14.4
	12/05/2021	12	22.2	0
	13/05/2021	14.2	22.5	1.6
	14/05/2021	7.4	22.3	0
	15/05/2021	6	19.5	0
	16/05/2021	9.9	18.9	0
	17/05/2021	0.9	19.1	0
	18/05/2021	7.4	19.9	0
	19/05/2021	4.8	21.3	0
	20/05/2021	3.7	22.3	0
	21/05/2021	7.6	22.2	0
	22/05/2021	13.1	19.4	24.2
	23/05/2021	10.1	21	1

Date	Day	Min Temp (ºC)	Max Temp (ºC)	Rain (mm)
	24/05/2021	10.1	19.5	0
	25/05/2021	12.2	22.1	0
	26/05/2021	7.6	24.4	0
	27/05/2021	8.5	19.4	0

Annex 7. Fauna survey methodology from the BIR

2.4.2 Fauna

2.4.2.1 Non-specific Surveys

2.4.2.1.1 Opportunistic

Opportunistic sightings obtained from active searches used secondary indications (scratches, scats, diggings, tracks etc.) and direct observation to census resident fauna. Observations recorded included:

- Distinctive scats left by mammals;
- Scratch marks made by various types of arboreal animals;
- Nests made by various birds;
- Feeding scars on Eucalyptus trees made by Gliders;
- Whitewash, regurgitation pellets and prey remains from Owls;

- Aural recognition of bird and frog calls;
- Skeletal material of vertebrate fauna;
- Searches beneath rocks and logs for reptiles and frogs; and
- Chewed Allocasuarina cones – indicative of foraging Glossy Black-cockatoo (*Calyptorhynchus lathami*).

2.4.2.1.2 Spotlighting

Spotlighting surveys were conducted by two ecologists using a high-powered torch to search for evidence of nocturnal mammals. Spotlighting surveys commenced at dusk and consisted of 60-minute transects.

2.4.2.1.3 Stag watching

Stag watching surveys were conducted by two ecologists for 45-minutes on dusk. Stag watching efforts were conducted at potential nest sites for large forest owls, arboreal mammals and birds were undertaken.

2.4.2.1.4 IR Camera surveys

Infra-Red (IR) cameras were established for remote activation over a continuous recording period of at least 14 nights. IR cameras were terrestrial with trap placement stratified by vegetation typing. IR cameras were placed on trees to target micro habitat of interest. Baited traps were deployed with baits comprising a mixture of peanut butter, honey, olive oil, vanilla, pistachios and rolled oats.

2.4.2.1.5 Passive Acoustics Recordings: Nocturnal species

Passive acoustic recorders (song meters) were set to record night sounds for a minimum two week period. SM4 song meters were arranged with at least 500 m spacing to minimise any overlapping recordings. Song meters were programmed to record from sunset to sunrise with a sampling rate of 22 kHz and resolution of 16 bits. Song meter data (wave files) were analysed using automated analysis methods for Koala bellows. A 95% detection probability for Koalas has been estimated for this method (Law et al 2020).

2.4.2.2 Avifauna (Bird) Census

The following targeted sampling methods were deployed in addition to the non-specific methods outlined in **Section 2.4.2.1**.

2.4.2.2.1 Timed Stationary Point Survey

A timed stationary point survey was used to survey bird species within the Project Area. Species heard or visually observed within 50 m of the sample point for 20 minutes were recorded as occurring within the Project Area. Visual/ auditory bird observations made within the observation period, but beyond 50 m, were recorded as opportunistic sightings. Surveys were conducted within three hours of sunrise to improve the consistency of sampling conditions across all sites (i.e. period of highest bird activity).

2.4.2.2.2 Transect Surveys

Breeding habitat for these candidate species were undertaken on foot using belt transects throughout the Project Area across all four seasons, in conjunction with threatened flora searches (see **Section 3.2.1.3**). Surveys utilised sound and visual recognition to identify species.

2.4.2.3 Herpetofauna (Reptile and Frog) Census

The following targeted sampling methods were deployed in addition to the non-specific methods outlined in **Section 2.4.2.1**.

2.4.2.3.1 Call recognition and spotlighting surveys

Call recognition and spotlighting surveys (i.e. aural/ visual detection methods) were conducted for 10-20 minutes each at various locations within the Project Area. Searches included nocturnal and diurnal surveys. Streamside surveys for stream obligate species, including tadpoles searching (i.e. dip netting) were performed in suitable ephemeral water bodies. Swamps, semi-permanent pools and flooded roadside ditches were surveyed. Surveys were performed under optimal conditions and followed high rainfall events.

2.4.2.3.2 Passive acoustic surveys

See **Section 2.4.2.1.5** for details on passive acoustic surveys for frog species.

2.4.2.3.3 Funnel trapping

Funnel traps are typically a wire frame wrapped with shade cloth, approximately 75 cm long and 18 x 18 cm^2, with a funnel opening of 45 millimetres diameter at both ends. Drift fences of 25m length were used to guide fauna into the funnel traps. An example of a deployed drift fence with funnel traps is shown in **Plate 2-1**.

Plate 2-1: Example of drift fence and funnel trap array

2.4.2.4 Mammal Census

The following targeted sampling methods were deployed in addition to the non-specific methods outlined in **Section 2.4.2.1**.

2.4.2.4.1 Ground and Arboreal Trapping

Ground and arboreal trap lines were deployed to detect small mammal species. Each ground mammal trapping line consisted of 10 Elliott B and 25 Elliott A traps. Each arboreal mammal trapping lines consisted of 10 Elliott B traps. All traps were set for five consecutive nights.

Terrestrial traps were set 5-10 m apart depending on available habitat (under logs, shrubs and close to bush rock) and arboreal traps were set at >3 m height to target glider species. All traps were baited with a mixture of peanut butter, honey and rolled oats. Traps were checked each morning, within 2 hours of sunrise. Any fauna captured was identified and then released, and the bait replaced.

2.4.2.4.2 Harp Trapping

Harp traps were deployed to detect the Southern Myotis (*Myotis macropus*). One trap night consists of a full night using a standard 4.2 m^2 catch area harp trap strung with 3kg (or less) monofilament nylon line. Traps were set before sunset and left open overnight, checked at least once during the night and then at or just before dawn. Traps were placed at least 20m apart to sample intra-site variability.

2.4.2.4.3 Nest Boxes

Nest boxes targeting Eastern Pygmy Possum were temporarily installed for three months within the Project Area. Locations and nest box specifications targeted small mammals. Nest boxes were checked for nesting presence of individuals, nesting material or evidence of use during their retrieval. An example of the nestbox used is shown in **Plate 2-2**.

Plate 2-2: Example of Nest Box

2.4.2.4.4 Echolocation Call Detection: Microchiropteran bats

Passive detection equipment was used to record the ultrasonic calls of microchiropteran fauna or microbats. Anabat Express detectors were deployed within areas of potential development and stratified using topography (e.g. ridge and riparian zone) and vegetation formation. An example of a deployed Anabat express device is shown in **Plate 2-3**.

Plate 2-3: Example of Anabat Express placement

Detectors were set to record microbat calls for the entire night after sunset for each deployed evening. Detectors were deployed for a minimum of three nights at the specified locations.

Each call sequence ('pass') was assigned to one of three categories, according to the confidence with which identification could be made, being:

- Definite – Pass identified to species level and could not be confused with another species;
- Probable – Pass identified to species level and there is a low chance of confusion with another species; or
- Possible – Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species.

2.4.2.4.5 Transect Surveys

Potential flying fox camps were searched for on foot using transect surveys of the Project Area, watching for flying bats and listening for their distinctive calls. In conjunction with threatened species surveys, observations for Koala activity (individual, scratch marks, scats etc) were search for throughout the Project Area.

2.4.2.4.6 Dog Detection

Specialist dog detection surveys were performed for target threatened flora species (i.e. Koala and Spotted-tail Quoll). Detection dogs trained in the scent detection of the target threatened flora species were deployed across the Project Area. A comprehensive survey was performed where the detection dog was allowed to work independently of its handler to search habitat in a trained non-discriminant search pattern. Interactions

with the detection dog were limited to initial directions to start survey and period redirections where necessary to retain the dog on task in a safe manner. Dog – handler working distances were maintained to 20-30 m. Tracked search paths were logged by GPS. Quality control processes were routinely performed to assure survey efficacy. A detailed explanation of the survey methods and processes involved in the performing of the dog detection survey is provided in **Appendix B**.

2.4.2.5 Habitat Assessment

2.4.2.5.1 General

The nature and extent of fauna habitats within the Project Area was systematically assessed during the targeted flora parallel transect survey (see **Section 2.4.1.3**). Site assessments for threatened and native fauna included consideration of important indicators of habitat condition and complexity, including the occurrence of microhabitats such as tree hollows, fallen logs, bushrock, caves and crevices, manmade structures, riparian areas, wetlands and water bodies. Indirect indicators of fauna use of the site, such as droppings, diggings, footprints, scratches, nests, burrow paths and runways, were recorded.

2.4.2.5.2 Hollow-bearing Trees

Hollows-bearing trees were mapped during the tree canopy species mapping described in **Section 2.4.1.4**. For each of these trees, the number and class of hollow were quantified. Hollow classes are listed below:

- Class 1: <5 cm (typically used by microbats, small birds and arboreal mammals);
- Class 2: 5-20 cm (typically used by small to medium parrots and medium to large arboreal mammals);
- Class 3: >20-50 cm (typically used by medium to large parrots, owls and large arboreal mammals); and
- Class 4: >50 cm (typically used by owls and large arboreal mammals).

Annex 8. OWAD Environment Johns River targeted threatened species survey report

JOHNS RIVER TARGETED THREATENED SPECIES SURVEY REPORT

Prepared by
OWAD Environment

For
RPS Group

DOCUMENT CONTROL SHEET

Project Number: 210101

Client: RPS Group

Report Title: Johns River targeted threatened species survey report

Report Author: Olivia Woosnam

Report Reviewer: Alex Dudkowski

Project Summary: This report presents the results of a comprehensive field assessment conducted in April 2021 on a property in Johns River, New South Wales, with professional field detection dogs certified for the detection of Koala, Quoll and Underground Orchid.

Document preparation and distribution history

Report version	Date completed	Prepared by	Reviewed by	Sent to client on
Version 1	13/05/2021	Olivia Woosnam	Alex Dudkowski	14/05/2021

Signed on behalf of OWAD Environment

Olivia Woosnam, Director
Date: 14 May 2021

JOHNS RIVER TARGETED THREATENED SPECIES SURVEY REPORT

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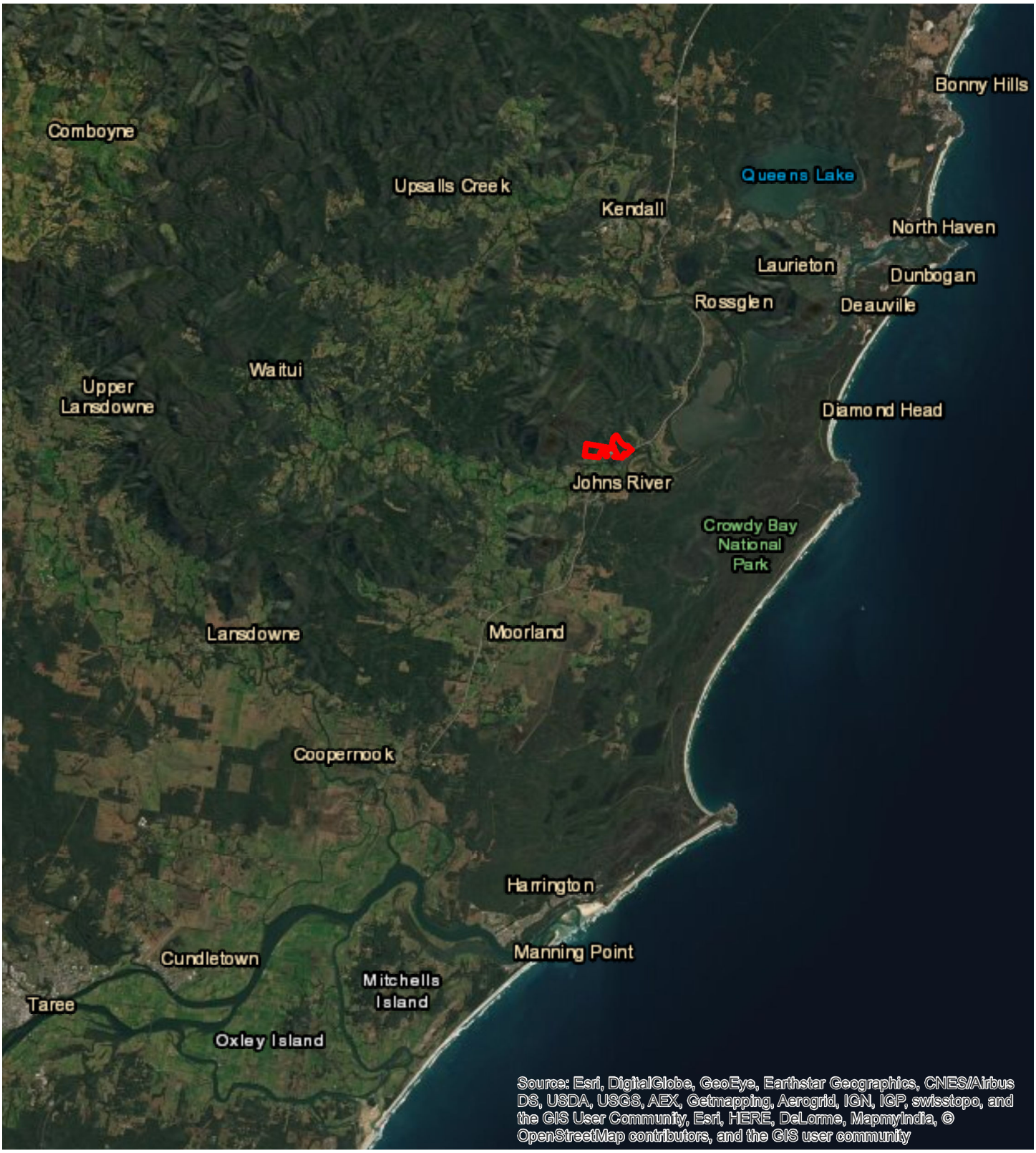
1.0 INTRODUCTION

This report presents the results of a field survey conducted in April 2021 on a site located in Johns River, Mid Coast Council Local Government Area, New South Wales (see **Figure 1**), with purpose-bred professional field detection dogs certified for the detection of:

- Koala *Phascolarctos cinereus*;
- Three species of Quoll (Spotted-tailed Quoll *Dasyurus maculatus*, Northern Quoll *D. hallucatus* and Eastern Quoll *D. viverrinus*); and
- Two species of Underground Orchid (Eastern Underground Orchid *Rhizanthella slateri* and Barrington Tops Underground Orchid *R. speciosa*).

The subject site is approximately 65ha in size, of which approximately 50ha currently supports native forest. It is understood that the site is being investigated for a potential expansion of the existing adjoining Boral Quarry.

This report may be used by RPS Group to inform the overall assessment of the site's ecological values.



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LEGEND

Subject site

FIGURE 1: SITE LOCATION

Johns River targeted threatened species survey report

OWAD ENVIRONMENT

2.0 STUDY TEAM, CERTIFICATIONS AND PERMITS

The field assessment was conducted by the OWAD Environment (OWAD) team, comprised of:

- Olivia Woosnam – Lead ecologist, Certified Environmental Practitioner[1], Certified Detection Dog Handler;
- Alex Dudkowski – Field ecologist, Certified Environmental Practitioner[2], Certified Detection Dog Handler;
- Wrangham Pink Knockout (aka 'Taz') – Purpose-bred professional detection canine certified for the detection of Koala, three Quoll species and two Underground Orchid species; and
- Wrangham Mistral Bowscale (aka 'Missy') – Purpose-bred professional detection canine certified for the detection of Koala, three species of Quolls and two species of Underground Orchids.

Both canines and their handlers were professionally trained by expert trainer Steve Austin CCPDT[3], and are certified by the CCDCA[4] for the detection of Koala, Quoll (*D. maculatus, D. hallucatus* and *D. viverrinus*) and Underground Orchid (*R. slateri* and *R. speciosa*).

OWAD's detection canines are Working English Springer Spaniels. Taz is famous for being Australia's very first dog to obtain certification for Koala detection in 2015, as well as the first to obtain certification for Quoll detection in 2016. Her cousin Missy joined OWAD in 2017 after completing her mission as Australia's first noxious weed detection dog (New South Wales Government Hawkweed Detection Dog Program). More recently, Taz and Missy jointly achieved another Australian first by becoming the first canines certified for the detection of threatened flora species (*Rhizanthella speciosa* and *R. slateri*).

In the last five years alone, OWAD's detection dogs have completed >5,000km of searches on applied studies in search of their targets across numerous regions of Queensland and New South Wales.

Each time OWAD acquires a new dog from the expert trainer, the dog is thoroughly tested before it is deployed on its first applied study. A new dog is not deployed for project work until it consistently performs to 100% target detection rate (i.e. does not miss a single target in a controlled environment) and 100% discrimination rate (i.e. never indicates on non-targets in both controlled and uncontrolled environments). Extensive field trials are performed over several consecutive full days to replicate the demanding conditions of project work, and to test the dog's physical endurance and mental focus to ensure it is able to work long hours over long consecutive days while maintaining 100% target detection rate and 100% discrimination rate.

With regard to Koala, OWAD has to date submitted over 4,000 scats or pap samples found by their detection dogs to a specialist laboratory for genetic testing. To date 100% of scats submitted have been confirmed by genetic analysis as originating from Koala. These samples regularly include some pap and scats of highly unusual shapes that would not typically be associated with

[1] Olivia Woosnam – CEnvP № 742

[2] Alex Dudkowski – CEnvP № 495

[3] Certification Council of Professional Dog Trainers

[4] Canine Conservation Detection Certification of Australia

Koala. The origin of some of these samples has on several occasions been questioned by the laboratory geneticists upon receiving these, and understandably so. OWAD staff themselves can occasionally be surprised at the highly unusual appearance or even atypical smell of some of the material indicated on by their dogs. However, what better way to scientifically measure the scent discrimination ability of their dogs, than to subject the material they indicate on to genetic testing by an external laboratory that has no vested interest in the performance of OWAD's detection dogs. Moreover, if any such material were ever found to not originate from Koala, OWAD would want to know immediately so as to address and remediate the issue via targeted training sessions. However, to date 100% of all scat or pap samples found by OWAD's detection dogs which have been submitted to genetic testing, have been confirmed as originating from Koala. The discrimination rate of OWAD's detection dogs is therefore maintained at 100% accuracy not only via ongoing training and reinforcement, but is also scientifically proven to be 100% correct via extensive and ongoing genetic testing undertaken by a third party.

This field assessment was conducted under OWAD's Animal Research Authority and Animal Care and Ethics Committee approval TRIM18/567 for "targeted flora and fauna species surveys using professional detection dogs" (issued by the NSW Government Department of Primary Industries) and OWAD's Scientific Licence SL101634 for "targeted fauna & flora species surveys using professional detection dogs" (issued by the NSW Government Department of Planning, Industry and Environment).

3.0 METHODS

3.1 SAMPLING DESIGN

For this survey, convenience sampling was selected as the most appropriate design in order to maximise search effort while enabling the survey team to avoid perilous terrain or dangerous obstacles.

3.2 FIELD ASSESSMENT

3.2.1 Detection dog searches

One detection dog was handled at a time. The dog was led out of the work vehicle on leash and walked on leash to the starting point of a search. Once ready to begin a search, the dog was taken off the leash and prompted by the handler to start working using specific cues. The dog scanned the environment by 'tracking' as well as 'air scenting', in search for targets that may be located on the ground (e.g. Koala scats, Quoll scats or Underground Orchids) or above the ground (e.g. live Koalas or Koala scats that may be located in bushes or on branches).

The dogs worked independently and searched non-discriminatorily, following their trained search pattern. They were purposely not directed to any specific trees or tree species, nor to any specific feature so as to avoid 'handler bias'. The handler only gave the dog the initial general direction of the search. During searches the dog was redirected, recalled or stopped at a distance using a dog whistle (model Acme 210.5) as needed to keep the dog within the subject site as well as for safety reasons (e.g. to prevent the dog from running into barbed wire or to keep it from entering perilous areas). The handler kept the dog within immediate sight at all times to ensure the dog's safety. Therefore in densely vegetated areas the dog was kept relatively close to the handler (within 20-30m), and in more open areas the dog was allowed to work further away from the handler (up to approximately 100m away).

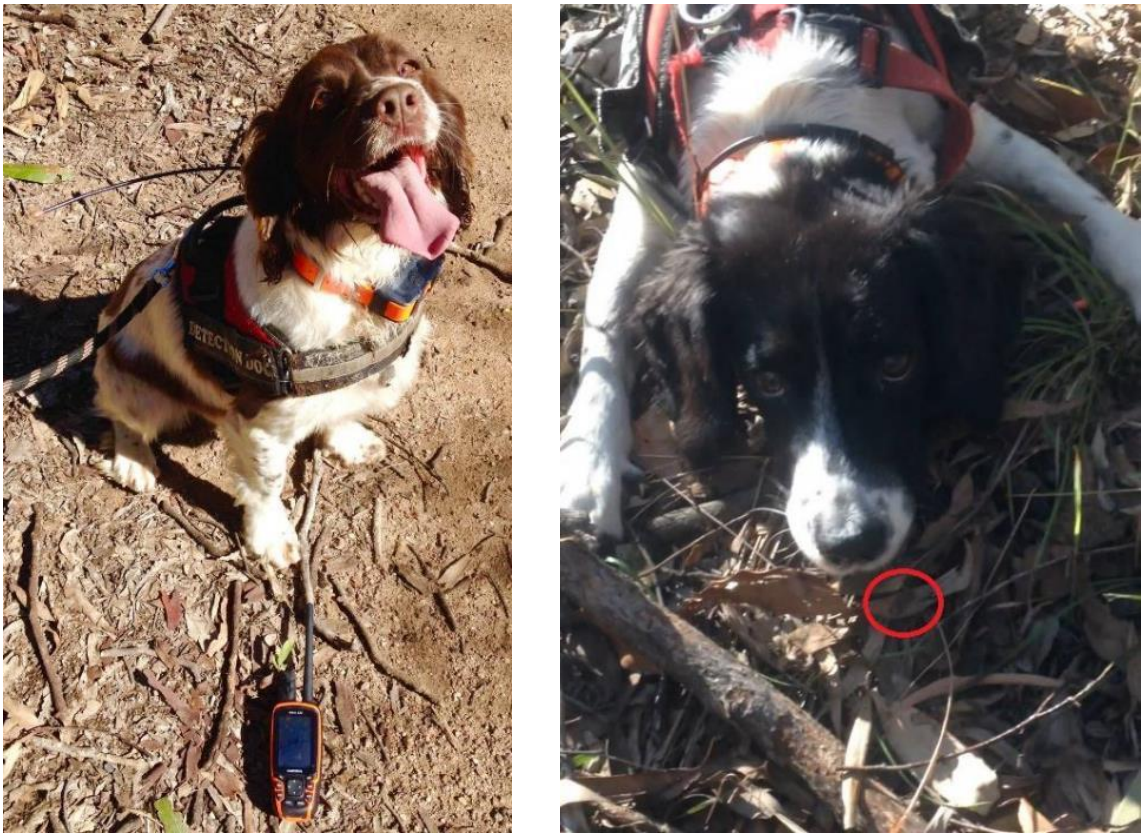
The detection dogs' search tracks were recorded with two Garmin T5 dog tracking collars (one for each dog) paired with the handler's Alpha100 handheld GPS unit, and recorded the detection dogs' position at a rate of one waypoint every 2.5 seconds. In order to minimise the risk of data loss in case of handheld GPS unit malfunction, the study team recorded all data with two handheld GPS units (the handler's Garmin Alpha100 unit, and a Garmin GPSMap78 unit). In order to further minimise the risk of data loss in case of equipment malfunction, OWAD carried one spare T5 collar and one additional handheld GPS unit (model Garmin Astro320) that is paired with all three tracking collars. While working, the detection dogs wore a red 'detection dog' jacket with reflective stripe at all times.

When OWAD's detection dogs find a target that is located on the ground, they lie down with their nose on it and hold the indication until the handler give them a 'bridging cue'. When a dog indicates on a target, the handler may either:

- Move in close immediately – The dog holds the indication while the handler comes close. Once the handler is close, the dog assists the handler recover the target. Once the handler has recovered and confirmed the target, the handler bridges and rewards the dog; or
- Give the dog a 'blind reward' – The handler does not move close immediately, but instead gives the dog the bridging cue from a distance and rewards the dog. Once the dog has been rewarded, the handler then asks the dog to 'show me'. This prompts the dog to return to the location and indicate on the target again. This time the handler follows the dog and once the

handler has recovered and confirmed the target, the handler bridges and rewards the dog again.

If a target is visually obstructed by leaf litter and/or dense ground vegetation, the dogs are specifically trained to use their paws and/or nose to expose the target. In instances where the leaf litter or the low-lying vegetation is particularly thick, the handler prompts the dog to physically retrieve the target with a 'soft mouth'. This is a frequent occurrence especially with Koala scats, in which case the dog shuffles through the debris or vegetation and picks up a scat in its mouth, then deposits it at the surface or spits it out in the handler's hands. In the case of Underground Orchids, the dog may dig in an attempt to reach the plant. If the dog cannot quickly expose a plant and starts digging too frantically, the handler removes the dog from the area (and e.g. ties it to a tree further away); the handler and assistant then carefully search the exact location by hand so as to minimise the risk of damaging the plant.



Left: 'Taz' in work gear − jacket, tracking collar and paired handheld GPS unit
Right: 'Missy' indicating on a Koala scat

3.2.2 Opportunistic searches

When the detection dogs were not actively searching (e.g. study team walking or driving between areas), the study team continued to pay attention to the leaf litter and/or tree canopies in case any targets were opportunistically spotted.

3.2.3 Quality Assurance

Field Quality Assurance procedures

In all studies undertaken by OWAD, field quality assurance (FQA) procedures are undertaken to ensure that the data collected in the field is representative of the true site conditions and is therefore valid for interpretation. OWAD's FQA procedures include the use of experienced ecology expert staff, Certified Environmental Practitioners, purpose-bred field detection dogs professionally raised and trained for the task, certification of both the dogs and their handlers for each target, extensive field trials conducted over several consecutive full days for each new dog and/or each new target prior to the canine being deployed on project work for said target, the use of appropriate study designs and survey protocols, and the implementation of daily field quality control (FQC) searches.

FQC searches are performed each day on all applied projects performed by OWAD. Either the detection dog finds a naturally occurring target within the first few minutes or hours of working each day, in which case there is no need for a third party to deposit a target for FQC purposes. Or, if no naturally occurring target is found within the first few minutes or hours of commencing work each day, then a third party (if available an accompanying staff external to OWAD; or if not available, then the OWAD assistant / the OWAD staff that is not handling a dog) randomly deposits a target, ensuring the handler does not know when or where an FQC target has been placed. When a target is placed for FQC purposes, the assistant starts a chronometer (without the handler knowing) when the dog/handler team is within approximately 100 metres from the FQC target, and records the time it takes the dog/handler team to find a target (whether the FQC target or naturally occurring target, whichever is found first).

An FQC search enables the assessment of the dog/handler team's ability to find a target in the specific conditions of a particular site at a particular time, within a maximum time of 5 minutes. This enables to ensure that there are no exceptional circumstances or factors that may be disabling or impeding the dog/handler team's ability to find targets (e.g. a scent that may be obscuring target odours for the dog; handler fatigue or distraction which may affect the handler's ability to correctly handle the dog, etc.). Crucially, the handler is never informed in advance where or when a target has been placed for FQC purposes. Not disclosing this information is crucial to ensuring there is no bias in how the handler handles the dog. It is only after the dog/handler team has found a target during an FQC search that the third party/or the assistant discloses that this was an FQC search. On projects where no or very few naturally occurring targets are found, a target is placed for FQC purposes at least once per day; however the third party/or field assistant may choose to perform more than one FQC search on any given day.

Field Quality Control search interpretation

- Should the dog/handler team find a deposited FQC target within 5 minutes, the FQC search is marked as successful, the time is recorded for record-keeping purposes and work continues. The coordinates of the FQC target are recorded for reporting purposes.

- Should the dog/handler team find a naturally occurring target within 5 minutes after an FQC search has started, the FQC search is marked as successful, the time is recorded for record-keeping purposes and work continues. The coordinates of the naturally occurring target are recorded for reporting purposes.

- Should the dog/handler team fail to find a target within 5 minutes after an FQC search has commenced[5] (whether the deposited FQC target or a naturally occurring target), the field assistant would immediately stop the handler and disclose that an FQC search has failed. In the event that an FQC search were to fail, the survey team would cease work immediately to try and identify the reason for failure. Upon identification of the potential cause, a 'controlled search' would be immediately conducted to confirm the reason for initial failure. Should the controlled search also fail, the study team would reassess the site conditions / the environmental conditions / the detection dog(s) / the handler(s) / the search protocol etc. If the cause for failure cannot be quickly identified and remediated, the study team would liaise with the client. No further survey work would be conducted until the reason(s) for failure is or are identified and remediated.

3.3 FIELD DATA ENTRY

At completion of each survey day, the detection dogs' search tracks and all relevant coordinates were saved electronically. In order to minimise the risk of data loss, a copy of this data was saved daily in at least three devices (e.g. computer, external hard drive and USB key), with at least one of these devices kept in a different physical place to the other devices (e.g. USB key kept in the work vehicle, computer and external hard drive kept in the accommodation).

[5] This instance has never occurred to date.

4.0 SURVEY RESULTS

The site was surveyed over five days from 26 to 30 April 2021.

The detection dogs searched a total of 47km.

No naturally occurring targets were found during this survey.

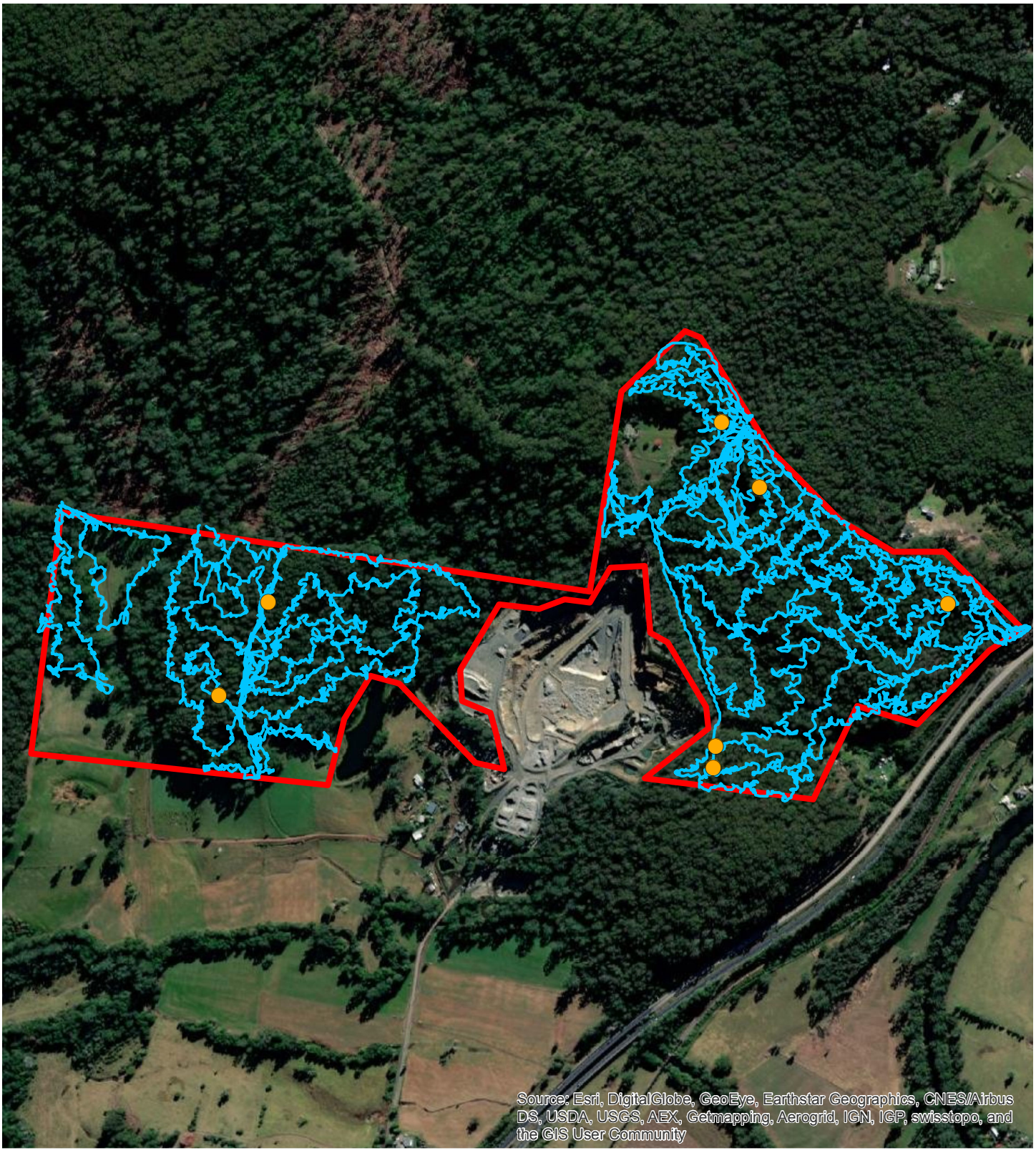
Field Quality Assurance was successful, with all Field Quality Control searches resulting in the dog/handler team finding the FQC target in well under 5 minutes. A total of seven FQC searches were performed using Koala scats (n=4), a Spotted-tailed Quoll scat (n=1) and Underground Orchid samples (*R. slateri* n=1, *R. speciosa* n=1).

The results of this survey are therefore guaranteed to be a true and accurate reflection of Koala, Quoll and Underground Orchid presence/absence in the areas searched within the subject site, at the time this survey was conducted.

Figure 2 shows the detection dog search tracks and the locations of the targets placed for FQC purposes.

The video below shows some footage of the dogs working while conducting this survey.

Video – click on image to play
(internet connection required)



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LEGEND

- Subject site
- Detection dog search tracks (total 47km)
- Targets deposited for FQC purposes

FIGURE 2: SURVEY RESULTS

Johns River targeted threatened species assessment

OWAD ENVIRONMENT

5.0 OBSERVATIONS AND DISCUSSION

In OWAD's extensive experience across numerous regions of New South Wales, it is highly unusual to find no evidence of Koala presence. This is in fact the very first project OWAD conducts in New South Wales where no evidence of the species is found. To date even in severely fragmented landscapes or in regions of known very low Koala density, OWAD had found evidence of the species (e.g. Blayney: evidence of Koala found in two days; Pilliga East State Forest: evidence of Koala found in one day).

It is unknown why the Koala appears to be currently absent from the subject site. The site appears to be well connected to the greater landscape, supports native forest that would be suitable for the species, and the greater landscape itself has relatively good connectivity. One would expect the Koala to be present on the site and in the greater landscape.

It must be noted here that the survey team observed remarkably few signs of any native terrestrial fauna currently utilising the site. The only signs seen were one macropod scat and two sets of macropod footprints, two small reptiles (skinks) and a few locations with Possum scats. However, the survey team observed that the old bark of numerous – and indeed the majority of – Grey Gums *Eucalyptus propinqua* were heavily scratched. These old scratches were largely Possum marks, and some Goanna marks. Some of the old pieces of bark lying on the forest floor *may* have had Koala scratch marks, however these were too scarce and the pieces of bark too small to ascertain this with any confidence whatsoever. Exceptionally few Grey Gums had scratch marks on the new bark, and the very few fresh marks observed were only Possum marks. None of the fresh marks observed were consistent with Koala in any way. The two photos below are representative of the bark of the vast majority of Grey Gums observed on site.

Animal scratch marks on old *E. propinqua* bark

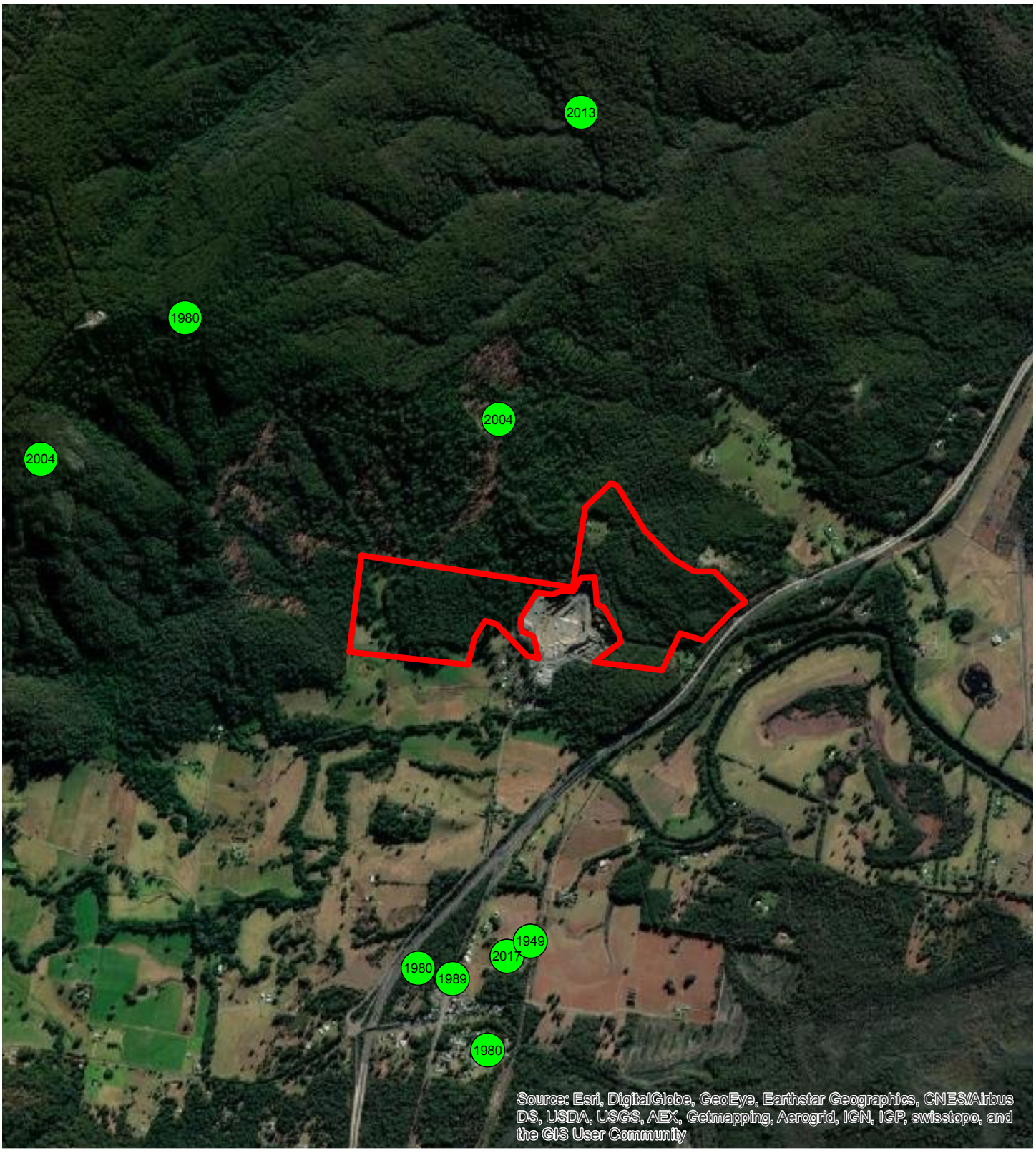
After completing this field survey and given that no evidence of Koala presence was detected, the Atlas of Living Australia was consulted[6]. Even though databases do have limitations and are not necessarily a reliable source to determine a species' presence/absence with any confidence, in regions where the Koala is regularly seen this is typically reflected on the ALA at least to a certain extent. Moreover the site abuts Middle Brother National Park, is near a State Forest, and the small township of Johns River is located just south of the site. One would therefore assume that if Koalas were spotted in recent years, there would be opportunities for State Government staff, Forestry Corporation ecologists, independent ecologists or the general public to report sightings to the ALA. One would also expect that if Koalas were killed on the highway in the locality, at least a portion of these would be reported to the ALA.

However, upon consulting the ALA on 10 May 2021, the database only has eight Koala records within 2km from the site (see **Figure 3**). The most recent record is from 2017 near the township of Johns River and is located >1.5km south of the site on the other side of the highway. The nearest one to the site (approximately 1km north) dates from 2004. Another record approximately 1.5km west of the site also dates from 2004. The remaining five records are historical records dated between 1949 and 1989. In summary the ALA only has three Koala records in the last 32 years within 2km from the site, which is a surprisingly low number.

With regard to Spotted-tailed Quoll *Dasyurus maculatus*, the ALA does have a few records within approximately 2km of the subject site (see **Figure 4**). The most recent record dates from June 2020, along the highway approximately 2km northeast of the site. There are no Eastern Quoll *D. viverrinus* nor Northern Quoll *D. hallucatus* records within 2km of the subject site on the ALA. The nearest Eastern Quoll record is in Port Macquarie approximately 40km north-northeast of the subject site, and the nearest Northern Quoll record is near Tomerong approximately 450km south-southwest of the subject site. Even though the survey team did not find any evidence of Quoll on the subject site during this survey, given the relatively recent Spotted-tailed Quoll sighting reported to the ALA it considered possible that the species may visit the site on occasions. There was however no evidence of current or recent presence detected during this survey.

With regard to Eastern Underground *Rhizanthella slateri*, the nearest known population is located in Bulahdelah approximately 80km south-southwest of the subject site. The Barrington Tops Underground Orchid *R. speciosa* is currently known from only one location in Barrington Tops National Park, approximately 100km west-southwest of the subject site. During this assessment, the survey team did see numerous areas that could be potentially suitable for one or both species in the sense that the majority of the forested areas of the site are dominated by Eucalyptus species with a good amount of leaf litter/organic material on the forest floor; both of which are characteristics observed at the locations where these species are known to occur. However, little more is currently known about the ecological requirements of both these species. Neither of these two species was detected by the detection dogs during this field survey in the areas of the subject site assessed and the search effort applied across the subject site was relatively intensive, thereby providing increased confidence in these species' absence. However, it may be desirable for a qualified ecologist to supervise any future excavation works on the site to check for potential *Rhizanthella* presence.

[6] OWAD purposely never consults any kind of database prior to any survey so as not to have any bias either way (as bias can alter how the handler handles the detection dogs).



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Created by: OW
On: 10/05/2021

LEGEND

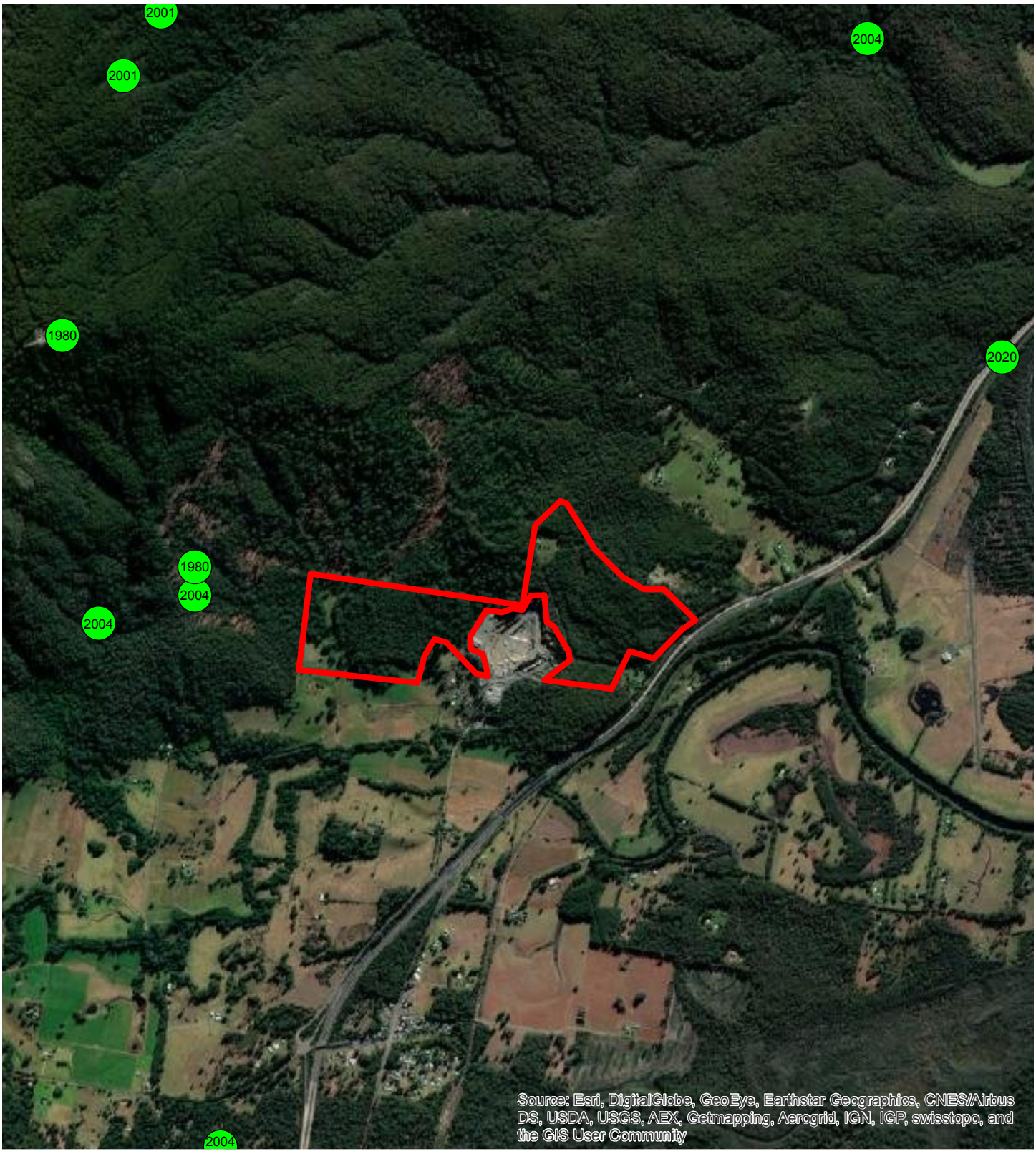
Subject site

yyyy Atlas of Living Australia Koala records (yyyy = year observation made)

FIGURE 3: KOALA RECORDS EXTRACTED FROM THE ALA

Johns River targeted threatened species assessment

OWAD ENVIRONMENT



0 500 1,000 2,000 Meters

N

Project No.: 210101
Created by: OW
On: 10/05/2021

LEGEND

Subject site

yyyy — Atlas of Living Australia Spotted-tailed Quoll records (yyyy = year observation made)

FIGURE 3: SPOTTED-TAILED QUOLL RECORDS EXTRACTED FROM THE ALA

Johns River targeted threatened species assessment

OWAD ENVIRONMENT

6.0 CONCLUSION

The subject site was assessed with professional field detection dogs for presence/absence of Koala, Quoll and Underground Orchid.

The site was surveyed in April 2021 over the course of five days. The detection dogs searched a total of 47km in search for any of these target species.

No evidence of Koala, Quoll or Underground Orchid was detected.

The absence of Koala in particular, is highly surprising. The reason for this species' absence is unknown.

This report may be used by RPS Group to inform the overall assessment of the site's ecological values.

7.0 STUDY LIMITATIONS

7.1 TARGET SPECIES DETECTABILITY

The use of purpose-bred, expertly raised and trained professional detection dogs minimises the risk of not detecting a target species when they are in fact present. Professional detection dogs and their handlers are extensively trained by a professional detection canine expert. The dogs are then continuously trained and developed by their designated handlers, and the handlers and the dogs obtain professional certification once fully operational. Before deploying a detection dog in the field, OWAD thoroughly tests each dog. A dog is not deployed for project work until it consistently performs to 100% target detection rate and 100% scent discrimination rate (i.e. never indicates on non-targets) in field trials performed over several consecutive full days in the field. Moreover, OWAD has developed Field Quality Assurance procedures to ensure the accuracy of their field findings.

Even though the professional detection dogs used in this study can perceive the scent of their target objects (whether Koala scat, Quoll scat or Underground Orchid) long after these have decomposed, they are purposely trained to not indicate on target *scent* alone. Instead, they are intentionally trained to indicate on and retrieve only target *objects*. This ensures that they do not indicate on Koala or Quoll scats that are so old that they have lost all structural integrity (hence no longer recognisable by humans), or on old Underground Orchid plants that are long dead; and that OWAD's findings are contemporary and inform only about current or recent Koala, Quoll or Underground Orchid presence; not historical distribution.

The findings of this survey are only reflective of the target species' presence/absence in the areas assessed, at the time these were assessed. Here no evidence of Koala, Quoll or Underground Orchid was detected; this does not preclude the possibility of either of these species being present in the future in the areas searched during this study.

7.2 LIMITATIONS OF DATA INTERPRETATION

The results included in this report, and interpretation thereof, are limited to the site and the areas within the site investigated as part of this study. The results included in this report cannot be extrapolated to any other site or any other geographic area not investigated as part of this study.

Niche

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