APPENDIX E: ECOLOGICAL RESPONSE

Deep Creek Quarry

Response to Submissions Report

This appendix contains the following core documents:

Amended Biodiversity Development Assessment Report (BDAR)

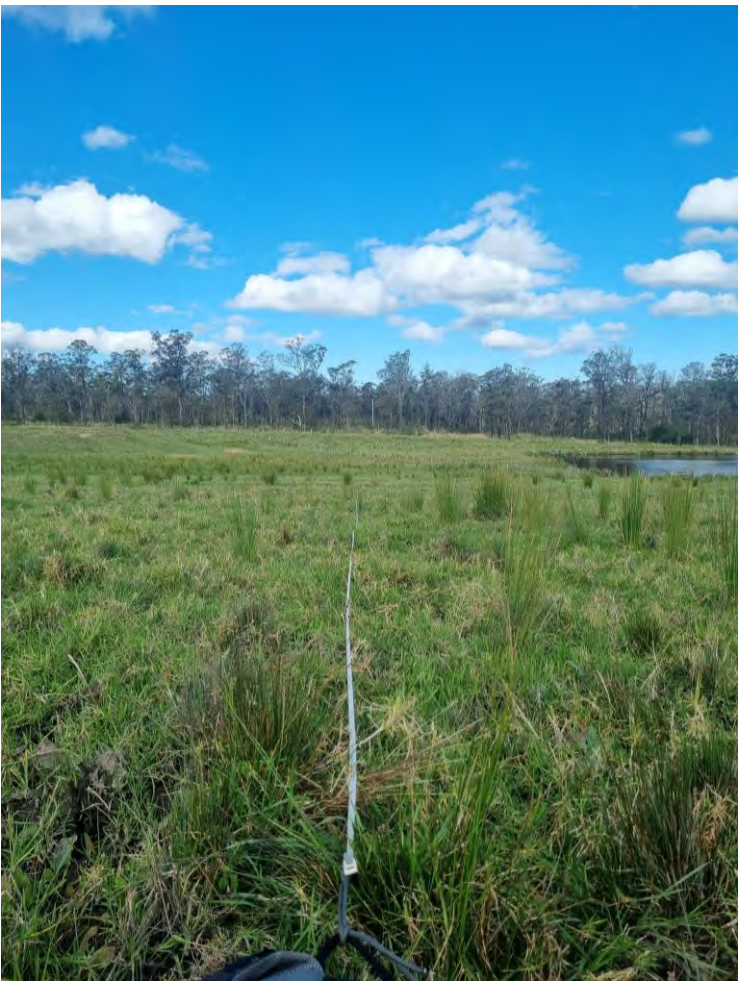
Amended Koala Plan of Management (KPOM)

Biolink report on Koala and New Holland Mouse

Deep Creek Quarry

Biodiversity Development Assessment Report

279 Deep Creek Road, Limeburners Creek NSW 2324







Report prepared for:
Ironstone Developments Pty Ltd

Rev 3
23 December 2022

Deep Creek Quarry

Biodiversity Development Assessment Report

279 Deep Creek Road, Limeburners Creek NSW 2324

Report Prepared for:
Ironstone Developments Pty Ltd

Version Control:

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Rev 3	23 December 2022	David Martin & Mark Dean (Wedgetail)	Samara Schulz (Wedgetail)	Response to Submissions

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Signed:

Date: 16 December 2022

EXECUTIVE SUMMARY

This Biodiversity Development Assessment Report (BDAR) has been prepared for Ironstone Developments Pty Ltd for the proposed Deep Creek Quarry (DCQ) off The Bucketts Way, Limeburners Creek. This report has been prepared in accordance with the Biodiversity Assessment Method (BAM) to assess the biodiversity impact and offsetting obligation of the Project under the under the *Biodiversity Conservation Act 2016* (BC Act).

The Development Site for the project is 31.82 hectares (ha) and occurs within a Study Area that is 44.21 ha. Native vegetation surveys conducted within the Development Site (Section 3) identified four Plant Community Types (PCTs):

- 18.42 ha of 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest is present in four vegetation zones.
- 8.74 ha of PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands is present in three vegetation zones.
- 1.83 ha of PCT 1567: Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast was presented in one zone
- 0.17 ha of PCT 1556 Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast was present in one vegetation zone.
- Additionally, areas of non-native vegetation (1.60 ha), dams (0.08) and excluded areas (1.06 ha) occur within the Development Site.

No vegetation was identified as constituting a Threatened Ecological Community under the BC Act or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Targeted threatened species surveys identified eighteen threatened species within the Study Area. Of these, eighteen are listed under the BC Act and include:

- A total of 573 individuals of *Callistemon linearifolius* (Netted Bottlebrush) were detected within the Study Area during the assessment. A total of 60 individuals occur within the Development Site.
- A total of 1,830 *Tetratheca juncea* (Black-eyed Susan) individuals were detected within the broader Study Area during the assessment. A total of 586 individual plants were detected within the Development Site.
- The Glossy Black-Cockatoo (*Calyptorhynchus lathami*) was observed flying over the Study Area (outside the Development Site) during bird surveys. No evidence of breeding was detected within the Development Site.
- The Little Lorikeet (*Glossopsitta pusilla*) was identified flying over the Study Area during bird surveys. No evidence of breeding was detected within the Development Site.
- Masked Owl (*Tyto novaehollandiae*) was detected during nocturnal surveys (heard calling offsite). No evidence of breeding was detected within the Development Site.

- The Sooty Owl (*Tyto tenebricosa*) was detected during nocturnal surveys (heard calling offsite). No evidence of breeding was detected within the Development Site.
- The Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) was identified via Anabat recordings.
- The Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) was identified via Anabat recordings.
- The Little Bent-winged Bat (*Miniopterus australis*) was identified via Anabat recordings.
- The Southern Myotis (*Myotis macropus*) was identified via Anabat recordings.
- The Golden Tipped Bat (*Phoniscus papuensis*) was identified via Anabat recordings and captured using a harp trap.
- The Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) was identified via Anabat recordings.
- The Greater Broad-nosed Bat (*Scoteanax rueppellii*) was identified via Anabat recordings.
- The Eastern Cave Bat (*Vespadelus troughtoni*) was identified via Anabat recordings.
- The Large-eared Pied Bat (*Chalinolobus dwyeri*) was identified via Anabat recordings.
- however, no camps were detected.
- The Koala (*Phascolarctos cinereus*) was detected within the Development Site via remote cameras and via Koala SATs.
- Squirrel Gliders were recorded within the Development Site via remote cameras

Of the above listed species, *Tetratheca juncea*, the Koala, the Grey-headed Flying-fox and the Large-eared Pied Bat are listed as vulnerable species under the EPBC Act. The New Holland Mouse (*Pseudomys novaehollandiae*), which is listed as vulnerable under the EPBC Act (and not listed under the BC Act) was also detected within the Development Site during terrestrial trapping surveys.

The Project including both the Development Site and mode of construction/operation, has been designed in consideration of the principals of avoid and minimise. A range of alternatives were considered prior to the current design. Direct impacts, indirect impacts and impacts on prescribed matters have been avoided and minimised where possible in the final design of the Project. A range of mitigation and management measures have been incorporated into the Project to reduce impacts on biodiversity during construction and operation.

No Serious and Irreversible Impacts were identified within or due to the Development Site.

The residual impacts of the Project that require offsetting include:

- Impacts on 18.42 ha of PCT 1590, generating a credit obligation of 321 ecosystem credits.
- Impacts on 8.74 ha of PCT 1619, generating a credit obligation of 166 ecosystem credits.
- Impacts on 1.83 ha of PCT 1567, generating a credit obligation of 52 ecosystem credits.
- Impacts on 0.17 ha of PCT 1556, generating a credit obligation of 5 ecosystem credits.

- Impacts on 60 individuals of *Callistemon linearifolius* (Netted Bottlebrush), generating a credit obligation of 92 species credits.
- Impacts on 19.36 ha of *Tetratheca juncea* (Black-eyed Susan) habitat, generating a credit obligation of 572 species credits.
- Impacts on 29.15 ha of Koala habitat, generating a credit obligation of 728 species credits.
- Impacts on 17.70 ha of Southern Myotis habitat, generating a credit obligation of 402 species credits.

An EPBC Referral has been prepared for the project, and the project has been determined to be a controlled action. The EPBC Act controlling provisions for the proposed action are listed threatened species and communities. The project will be assessed under the Bilateral Agreement (Amending Agreement No.1, 2020) between the Commonwealth and NSW Governments. The Department of the Agriculture, Water and the Environment (DAWE) have issued guidelines for preparing assessment documentation relevant to the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) for proposals being assessed under the Amended Bilateral Agreement. These guidelines have been addressed within the assessment.

Contents

EXECUTIVE SUMMARY II
CONTENTS V
1. INTRODUCTION 1
1.1 SCOPE 1
1.2 LOCAL CONTEXT 1
1.3 PROPOSED DEVELOPMENT 1
1.4 INFORMATION SOURCES 6
1.5 LEGISLATIVE CONTEXT 6
1.5.1 *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) 7
1.5.2 *Biodiversity Conservation Act 2016* (NSW) 7
1.5.3 *SEPP (Koala Habitat Protection) 2020* 8
1.5.4 *Biosecurity Act 2015* (NSW) 8
2. LANDSCAPE CONTEXT 9
2.1 LANDSCAPE FEATURES 9
2.2 SITE CONTEXT 10
2.2.1 Native Vegetation Cover 10
2.2.2 Geology and Soils 10
2.2.3 Habitat Connectivity 11
3. NATIVE VEGETATION 12
3.1 METHODOLOGY 12
3.1.1 Data Review 12
3.1.2 Vegetation Surveys 12
3.2 ASSESSMENT RESULTS 13
3.2.1 Plant Community Types 13
3.2.2 Vegetation Zones 14
3.2.3 Threatened Ecological Communities 37
3.2.4 Assessment of Patch Size 37
3.2.5 Vegetation Integrity Score 37
4. THREATENED SPECIES 3
4.1 ASSESSING HABITAT SUITABILITY 3
4.1.1 Habitat Assessment 3
4.1.2 Ecosystem Credit Species 25
4.1.3 Species Credit Species 25
4.2 THREATENED SPECIES SURVEYS 30
4.2.1 Candidate Threatened Flora 30

4.2.2 Candidate Threatened Fauna 40
4.3 IDENTIFIED THREATENED SPECIES 49
5. IMPACT ASSESSMENT 59
5.1 AVOIDING AND MINIMISING IMPACTS 59
5.1.1 Avoid and Minimising Impacts on Native Vegetation and Habitat 59
5.1.2 Avoid and Minimise Impacts on Prescribed Biodiversity Impacts 68
5.2 ASSESSMENT OF IMPACTS 70
5.2.1 Impacts on Native Vegetation, Threatened Ecological Communities and Threatened Species Habitat 70
5.3 MITIGATING AND MANAGING IMPACTS ON BIODIVERSITY VALUES 73
6. IMPACT SUMMARY 77
6.1 SERIOUS AND IRREVERSIBLE IMPACTS 77
6.2 IDENTIFICATION OF IMPACTS REQUIRING OFFSETS 77
6.2.1 Impacts on Native Vegetation 77
6.2.2 Impacts on Threatened Species 78
6.3 IMPACTS NOT REQUIRING FURTHER ASSESSMENT 79
6.4 SECURING THE OFFSET OBLIGATION 79
7. ASSESSMENT OF BIODIVERSITY LEGISLATION 80
7.1 ENVIRONMENT AND BIODIVERSITY CONSERVATION ACT 1999 80
7.1.1 Assessment Requirements 80
7.2 BIOSECURITY ACT 2015 90
7.3 SEPP (KOALA HABITAT PROTECTION) 2020 90
8. REFERENCES 92
APPENDIX 1: THREATENED SPECIES DATABASE SEARCH 94
APPENDIX 2: FLORA AND FAUNA SPECIES LIST 132
APPENDIX 3: PHOTOGRAPHS (BIODIVERSITY AND HABITAT VALUES) 148
APPENDIX 4: KOALA HABITAT MAPPING 154
APPENDIX 5: PREDICTED AND CANDIDATE SPECIES REPORTS 159
APPENDIX 6: FAUNA SURVEY EFFORT WITHIN THE STUDY AREA 160
APPENDIX 7: BIODIVERSITY CREDIT REPORT 186
APPENDIX 8: ASSESSMENTS OF SIGNIFICANCE (EPBC ACT) - HABITAT MAPS 187
APPENDIX 9: PREFERRED KOALA FEED TREE MAPPING (ACCESS/HAUL ROAD) 217
APPENDIX 10: STAFF CONTRIBUTIONS 218
APPENDIX 11: LICENSING 219

Figures

Figure 1 Development Site Map 4
Figure 2 Development Site Location Map 5
Figure 3 Vegetation Zones and Plot Locations 16
Figure 4: Habitat Features 6
Figure 5: Koala Habitat Suitability and Resource Availability 12
Figure 6: Glossy Black Cockatoo Foraging Habitat and Suitable Hollows 18
Figure 7 Threatened Forest Owls Suitable Habitat 20
Figure 8 Targeted Threatened Flora Search (15, 16, 21, 28, 29 August 2019) 36
Figure 9 Targeted Threatened Flora Search (14-18 October 2019) 37
Figure 10 Targeted Threatened Flora Search (5-7 November 2019) 38
Figure 11 Targeted Threatened Flora Search (26-29 November & 3-4 December 2019) 39
Figure 12 Fauna Survey Effort 47
Figure 13 *Callistemon linearifolius* Presence and Species Polygon 54
Figure 14 *Tetratheca juncea* Presence and Species Polygon 55
Figure 15 Koala Presence and Species Polygon 56
Figure 16 Southern Myotis Presence and Species Polygon 57
Figure 17 Squirrel Glider Presence and Species Polygon 58

Tables

Table 1: Landscape features of the Development Site. 9
Table 2 Composition, Structure and Function components of vegetation integrity 13
Table 3 Plant Community Types and other areas within the Development Site 14
Table 4: 12-month cumulative rainfall and Vegetation Class thresholds for the Subject Site 1
Table 5: Benchmark vegetation integrity data applied to the Subject Site 1
Table 6 Current vegetation integrity score for the vegetation zone 2
Table 7: Habitat Trees within the Development Site. 4
Table 8: Koala Habitat Suitability and Resource Availability within the Subject Site. 7
Table 9 Koala habitat assessment 10
Table 10: Glossy Black-Cockatoo *Allocasuarina* spp. tree availability within the Subject Site. . 16
Table 11: Suitable Breeding Habitat / Habitat Constraints – Threatened Forest Owls 19
Table 12: Recognised Swift Parrot Feed Trees – Coastal NSW (Nectar and Lerp feed trees) . 21
Table 13: Swift Parrot Feed Trees availability within the Subject Site. 22
Table 14: Regent Honeyeater Feed Trees 23
Table 15: Regent Honeyeater Feed Trees availability within the Subject Site. 24
Table 16: Species Credit species and justification for inclusion as candidate species. 26
Table 17: Survey of requirements and timing conducted for candidate flora species 30
Table 18: Reference Population Inspections – Threatened Flora 35
Table 19 Survey of threatened fauna species 40
Table 20 Weather Data 46
Table 21 Key Avoidance and Minimisation Requirements 67
Table 22 Change in Vegetation Integrity Scores within the Development Site. 70
Table 23 Assessment of the Project on Prescribed Impacts 72
Table 24 Summary mitigation and management measures for the Project 74
Table 25 Summary of ecosystem credit requirements 77
Table 26 Summary of species credit requirements 78
Table 27 Assessment Requirements (DAWE) 80

Table 28 Impact Assessment Summary – EPBC listed threatened and migratory species 84
Table 29: Timing of impacts to MNES..... 87
Table 30 Summary of species credit requirements 89

1. INTRODUCTION

1.1 SCOPE

This Biodiversity Development Assessment Report (BDAR) has been prepared for Ironstone Developments Pty Ltd for the proposed Deep Creek Quarry (DCQ) at The Bucketts Way, Limeburners Creek (**Figure 1**). This assessment has been undertaken in accordance with the NSW Biodiversity Assessment Method (BAM) (DPIE 2020) under the Biodiversity Conservation Act 2016 (NSW) (BC Act) to support an Environmental Impact Statement (EIS) for the Project.

David Martin is the BAM Accredited Ecologist (BAAS21021) who prepared the BDAR. The case file for the project submitted via the Biodiversity Offset Assessment Management System (BOAMS) is: 00022618/BAAS21021/20/00022619.

The following terms are used throughout this report to describe particular geographical areas:

- **Development Site:** The area to be directly impacted by the proposed Project (31.89 hectares) (Figure 1 and Figure 2).
- **Study Area:** The area comprising the Development Site plus a buffer area ranging from 25 to 50 m wide to account for possible indirect impacts (44.21 hectares) (Figure 2).
- **Locality:** land within a 10 km radius of the Study Area.

1.2 LOCAL CONTEXT

The Study Area is located approximately 10 km northeast of Clarence Town and 11 km northwest of Karuah, within the Local Government Area (LGA) of the Mid-Coast and within the NSW North Coast Interim Biogeographic Regionalisation for Australia (IBRA) Region and the Karuah Manning IBRA Subregion. The majority of the Study Area is located approximately 1.5 km west of The Bucketts Way, with The Bucketts Way and Pacific Highway intersection located a further 11.5 km south at Twelve Mile Creek.

The Study Area consists of vegetated spurs and drainage gullies, with a mosaic of remnant vegetation and previously cleared land for pasture and historical timber harvesting activities. The proposed Development Site is located on mid to upper slopes of a vegetated spur, with the infrastructure areas on the lower and more cleared slopes west of Deep Creek. The proposed site access road crosses Deep Creek and is located upon a combination of disturbed native vegetation and cleared agricultural pastures. The cleared agricultural pastures are currently used for cattle grazing. Surrounding lands contain rural properties of approximately 40-200 ha, with smaller 2-10 ha lots further south off Forest Glen Road.

1.3 PROPOSED DEVELOPMENT

Ironstone Developments Pty Ltd (Ironstone Developments) propose to develop a hard rock quarry called Deep Creek Quarry (DCQ). The Development Site is to be located at lots 472/DP1162208, 48/DP753178, 551/ DP1238818, 552/ DP1238818, and Deep Creek Road and The Bucketts Way Road reserves at Limeburners Creek, Parish of Karuah, County of Gloucester, 279 Deep Creek Road, NSW 2324.

The primary target material for the quarry will be a high-quality rhyolite resource aimed at satisfying State road authority demand for high friction road aggregates in both the local area and throughout NSW. The unique properties of the high-quality rhyolite make this resource ideal for this purpose. The material is also expected to have a demand as a decorative landscape aggregate. The wider quarrying resource comprises a mixture of durable rhyolite, moderately durable trachyte, durable volcanolithic arenite and quartz trachyte.

The extraction footprint of the quarry targets the high friction rhyolite resource that has been determined following resource mapping undertaken by VGT Pty Ltd in December 2013 and 2018; and consideration of ecological constraints from site surveys undertaken by Kleinfelder starting in 2016.

The available hard rock resource is considerably larger than that proposed. In order to focus the quarry on the highest value product a resource of approximately 12 million tonnes has been adopted to be included in the project application.

The project consists of the following:

- Extraction of resource within a single quarry pit.
- The approximate area of disturbance is 31.82 hectares covering the quarry, stockpiles, offices and access roads.
- The quarry pit is approximately 18 hectares in size, quarrying to a floor of approximately 37-42 m AHD.
- Extraction rate of up to 500,000t per annum.
- A project life of up to 30 years.
- Haulage of up to 4000 tonnes per day during peak sales through the gate resulting in up to 125 laden trucks leaving site per day.
- Initial quarry areas will be used to establish stockpile and crushing areas that would provide the resource to construct the access road.
- Access to the site from The Bucketts Way via a new private haul road with a new intersection on The Bucketts Way. The road will include a crossing of Deep Creek, and culvert crossings over other minor drainage lines.
- The weighbridge, workshop and ancillary stockpile area will be located to the south of the pit connected by a dedicated haul road.
- A main material stockpile will be located to the north of the quarry accessed by a dedicated haul road across a drainage gully. It is likely that this area will be established as the need arises for a stockpile area.
- Power will be sourced by a combination of diesel generator and solar power.
- Crushing and separating equipment will be mobile and located in pit. The equipment will be kept on the quarry floor to minimize noise propagation. Crushing rates will be directly linked to sales.
- Water will be sourced from onsite dams, in-pit groundwater, and a pipeline from a former sawmill dam for water supply for site office and dust suppression. Additional water may be imported during drought periods.

- Rehabilitation of the site following completion of extraction to open grassland and native vegetation that may provide a dwelling site generally consistent with the existing approved subdivision plans for the property.

Access to the quarry will be via a dedicated quarry access road constructed within a portion of land to be subdivided from Lot 551 and Lot 552 DP 1238818. The proposed creek crossing of Deep Creek is expected to use box or pipe culverts. The box or pipe culverts will be set to a height of at least a 1 in 10-year ARI.

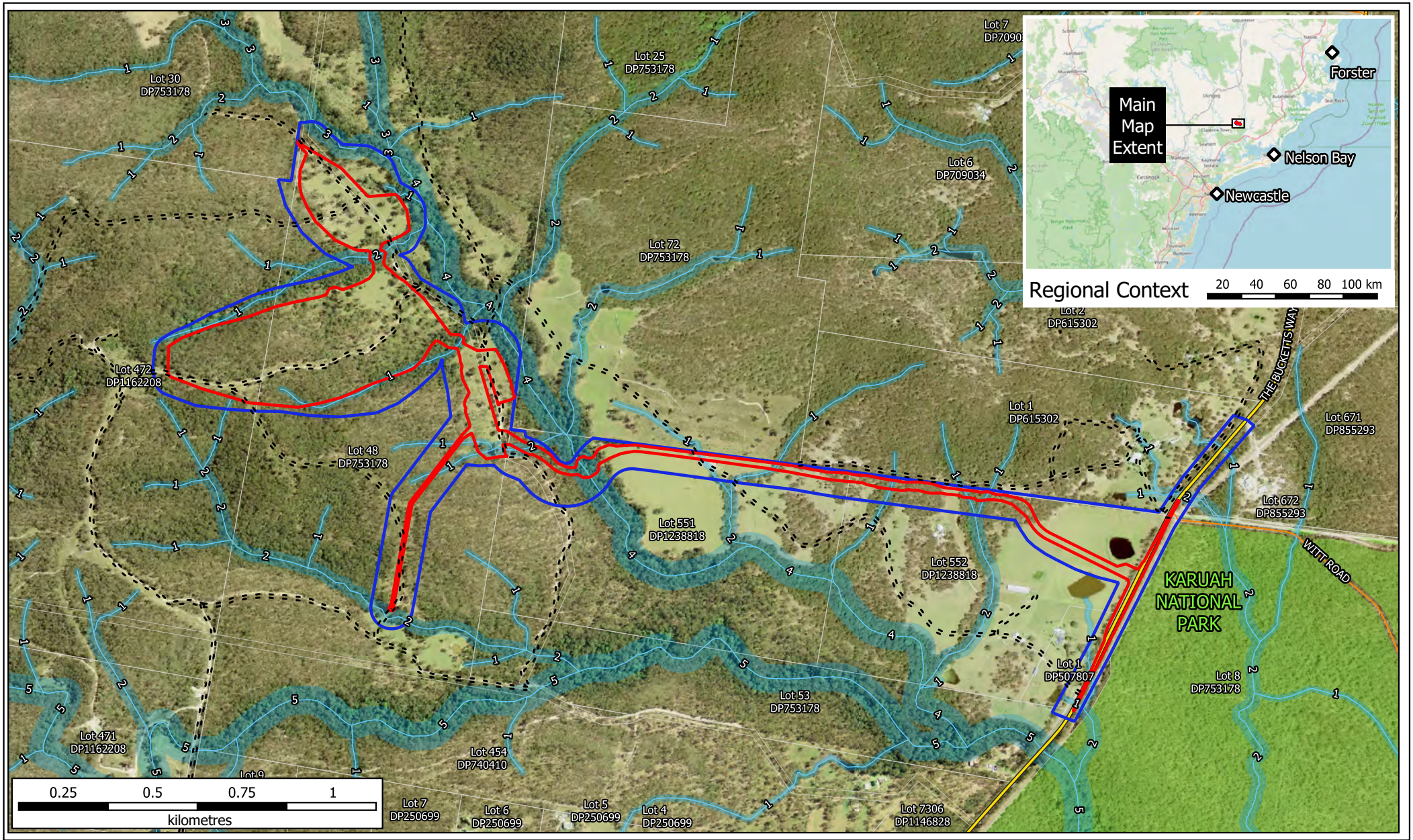
Construction of the DCQ will include alterations to existing roads as follows:

- Construction of a new intersection on the The Bucketts Way connected to the quarry via a new access road (on land to be subdivided from Lot 551 and Lot 552 DP 1238818).
- Up to 155 m deceleration lane prior to the proposed site access for northbound traffic along The Bucketts Way.
- The existing southbound lane following the proposed site access will become an acceleration lane for vehicles making a right turn out of the DCQ access road, while The Bucketts Way will be widened to allow for an additional southbound overtaking lane outside the acceleration lane for a distance of up to 400 m.
- Construction of the additional southbound lane will commence 182 m north of the proposed DCQ access, allowing for the delineation of a new right turn / deceleration lane into the proposed DCQ access road.

The DCQ will commence with campaign crushing, potentially moving to fixed plant as the project reaches full production. Electricity for the operations will be by diesel generator and solar power.

The DCQ is expected to employ up to 10 full-time staff, with further support for the local and regional construction industry and associated haulage contractors.

- The DCQ construction will be undertaken during the following hours:
- 7:00 am to 5:00 pm Monday to Friday, 8:00 am to 1:00 pm Saturday.
- No works on Sunday or public holidays.
- Quarrying Operations (crushing and processing):
- 7:00 am to 5:00 pm Monday to Friday, 8:00 am to 1:00 pm on Saturday.
- No quarrying on Sunday or public holidays.
- Maintenance activities may be undertaken at anytime providing they are not audible at neighbouring dwellings.
- Loading and dispatch of product trucks:
- 6:00 am to 6:00 pm Monday to Friday, 6:00 am to 1:00 pm Saturday.
- No haulage on Sunday or public holidays.



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Legend

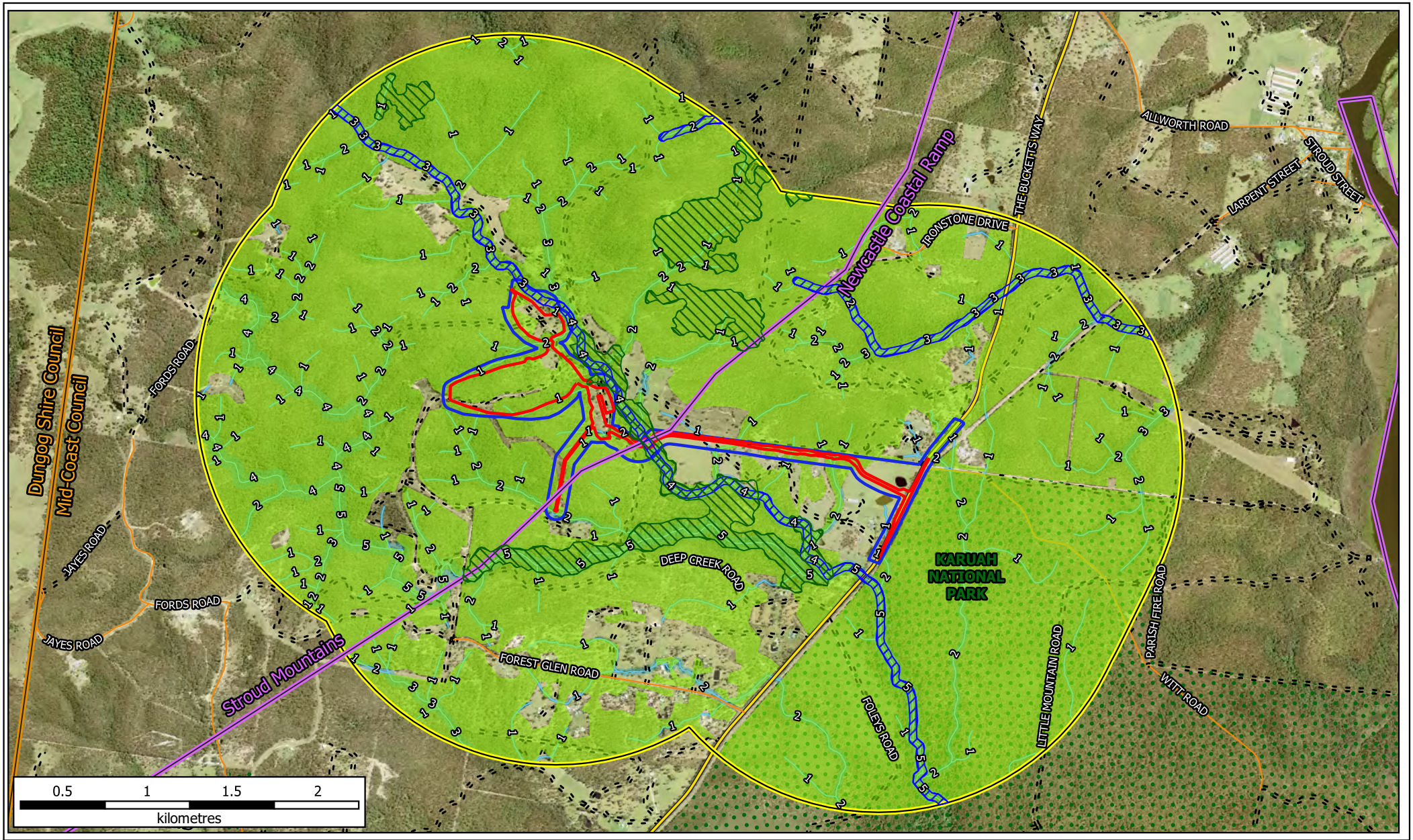
- Development Site Boundary
- Study Area
- Lot Boundaries
- National Park
- Watercourse (labelled with stream order)
- Riparian Buffer
- Arterial Road
- Local Road
- Tracks

Development Site Map

Figure: **1**

Ironstone Developments Pty Ltd
Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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Legend

- Development Site Boundary
- Study Area
- National Park
- Mitchell Landscapes (v3)
- Local Government Area Boundary
- 1500m Buffer
- Native Vegetation Assessment
- Watercourse (with stream order)
- Riparian Buffer
- ArterialRoad
- LocalRoad
- Track-Vehicular

Biodiversity Values (V9)

- Identified Old Growth Forest
- Protected Riparian Land

Development Site Location Map

Figure: **2**

Ironstone Developments Pty Ltd
Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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1.4 INFORMATION SOURCES

Knowledge from existing literature pertaining to the Development Site and broader locality was used to inform the BDAR. The following information sources were used:

- The NSW BioNet Vegetation Classification (https://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx).
- The NSW BioNet Atlas of NSW (http://www.bionet.nsw.gov.au/).
- The NSW Threatened Biodiversity Data Collection (part of BioNet)
- The Department of the Agriculture Water and the Environment (DAWE) Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES) (http://www.environment.gov.au/epbc/pmst/).
- Relevant published literature (see Section 8).

Government databases and other data sources were accessed throughout the project, from prior to commencement of surveys (2019) to completion of the BDAR (September 2021), and for this response to submissions (December 2022).

1.5 LEGISLATIVE CONTEXT

This assessment was undertaken in accordance with and/or in consideration of the following Acts and Policies:

- Commonwealth:
  - Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
  - Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations)
- New South Wales:
  - Biodiversity Assessment Method (BAM) (DPIE 2020).
  - Biodiversity Conservation Act 2016 (NSW) (BC Act).
  - Biodiversity Conservation Regulation 2017 (NSW) (BC Regulation).
  - Biosecurity Act 2015 (NSW).
  - Draft State Environmental Planning Policy (Environment).
  - Environmental Planning and Assessment Act 1979 (EP&A Act).
  - Local Land Services Act 2013 (NSW) (LLS Act).
  - State Environmental Planning Policy (Koala Habitat Protection) 2020 (Koala SEPP)
  - State Environmental Planning Policy (Coastal Management) 2018 (SEPP Coastal Management).
  - State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017.
  - Water Management Act 2000 (NSW) (WM Act).

1.5.1 *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act)

Under the EPBC Act, actions which are likely to have a significant impact on matters of national environmental significance (MNES) are required to be referred for a determination as to whether they are a controlled action which requires approval under the EPBC Act. An action includes a project, development, undertaking, activity, or series of activities. The EPBC Act identifies nine MNES:

1. World Heritage properties.
2. National heritage places.
3. Wetlands of international importance (Ramsar Convention).
4. Listed threatened species and communities.
5. Migratory species listed under international agreements.
6. Great Barrier Reef Marine Park.
7. Commonwealth marine areas.
8. Nuclear actions.
9. Water resources in respect to CSG and large coal mines.

An EPBC Referral has been submitted for the project. The project has been determined to be a controlled action and will be assessed under the Bilateral Agreement (Amending Agreement No.1, 2020) between the Commonwealth and NSW Governments. The EPBC Act controlling provisions for the proposed action are listed threatened species and communities (sections 18 and 18A).

All protected matters that may be impacted by the development under the controlling provisions have been assessed in accordance with the Guidelines for preparing assessment documentation relevant to the EPBC Act for proposals being assessed under the Amended Bilateral Agreement. Accordingly, the BDAR has been prepared to address assessment requirements provided by the Department of the Agriculture, Water and the Environment (DAWE) as follows:

- An assessment of all impacts that the action is likely to have on each matter protected by provisions of Part 3 of the EPBC Act has been provided.
- Information pertaining to the project and its relevant impacts has been provided to allow the Federal Minister to make an informed decision on whether or not to approve the project.

A summary of how protected matters have been addressed is presented in **Section 7.1**.

1.5.2 *Biodiversity Conservation Act 2016* (NSW)

Biodiversity Assessment Pathway

The Secretary's Environmental Assessment Requirements (SEARs) for the Project (State Significant Development (SDD) 11591659) require the biodiversity assessment to provide an assessment of the likely biodiversity impact of the development in accordance with Section 7.9 of the BC Act and the BAM. Section 7.9 of the BC Act requires that all SSD applications are to be accompanied by a BDAR, unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values. No such determination has been made for the Project and, accordingly, a BDAR is required for the Project.

Biodiversity Assessment Method

The Project has been assessed in accordance with the BAM (DPIE 2020a). The Biodiversity Accredited Assessor System (BAAS) Case number for the Project is 00022618/BAAS18041/20/00022619. David Martin (Assessor Number BAAS21021) is the Biodiversity Accredited Assessor for the project.

1.5.3 *SEPP (Koala Habitat Protection) 2020*

State Environmental Planning Policy (Koala Habitat Protection) 2021 (known hereafter as the "Koala SEPP 2021") aims to encourage the conservation and management of areas of natural vegetation that provide habitat for Koalas to support a permanent free-living population over their present range and reverse the current trend of Koala population decline.

The Koala SEPP 2021 applies to each Local Government Area listed in Schedule 1 of the SEPP. Where a Koala Plan of Management (KPoM) applies to the land, Clause 8 of the Koala SEPP 2021 applies to the development. In that case the proposed development must be consistent with the approved KPoM that applies to the land.

Mid-Coast LGA is listed in Schedule 1 of the Koala SEPP 2021. However, as the site is currently zoned as RU2 – Rural Landscape, SEPP 2021 does not apply, instead Koala SEPP 2020 (hereafter known as the "Koala SEPP") remains the relevant Koala habitat protection planning instrument for the project.

An assessment of Koala habitat is presented in Section 4.1.1.3. An assessment of Koala habitat in accordance with the SEPP is presented in Section 7.3.

1.5.4 *Biosecurity Act 2015* (NSW)

Under the *Biosecurity Act 2015* (NSW) dealings with plants are subject to 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." Under the act a biosecurity impact "is an adverse effect on the economy, environment, or the community that arises, or has the potential to arise, from a biosecurity matter." This legislation is addressed in Section 7.2.

2. LANDSCAPE CONTEXT

2.1 LANDSCAPE FEATURES

The landscape features and site context detailed in Section 3 of the BAM (DPIE 2020) are described in **Table 1**. These landscape features are also shown on **Figure 2**.

Table 1: Landscape features of the Development Site.

Landscape Features	Development Site
Interim Biogeographic Regionalisation for Australia (IBRA) bioregion	NSW North Coast. The Development Site occurs within the southern portion of the NSW North Coast IBRA Region.
IBRA subregion	Karuah Manning. The Development Site occurs within the Karuah Manning IBRA sub-region.
LGA	The Development Site occurs within the Mid Coast LGA.
Mitchell Landscapes	Stroud Mountains. This landscape is described as "Northwest oriented ranges with high peaks and parallel valleys on extensively faulted and folded middle Devonian lithic sandstones, mudstone, chert and minor volcanics, Carboniferous conglomerate, lithic sandstone, mudstone, interbedded dacite and ignimbrite, Permian pebbly lithic sandstone, with interbedded rhyolite, dacite and basalt. Strong structural control, general elevation 50 to 680m, local relief 400m. Higher slopes with gradational structured loams merging to red brown to yellow texture-contrast soils on lower slopes and in valleys. Mixtures of moist and dry forests and rainforest understorey with; Brush Box (*Lophostemon confertus*), Flooded Gum (*Eucalyptus grandis*), Turpentine (*Syncarpia glomulifera*), Scentless Rosewood (*Synoum glandulosum*), Lilly Pilly (*Acmena* spp.), Rose Maple (*Cryptocarya erythroxylon*), Narrow-leaved Palm Lily (*Cordyline stricta*), Southern Mahogany (*Eucalyptus botryoides*), Spotted gum (*Corymbia maculata*) and Grey Ironbark (*Eucalyptus paniculata*). River Oak (*Casuarina cunninghamiana*) along all major streams."
Rivers, streams and estuaries	The following waterways are relevant to the project: • The northern stockpile area is located within 5 m of a mapped 1st order drainage line along the eastern border. This drainage line flows into Deep Creek to the east. • The northern crossing area between the northern stockpile area and the main shell pit intersects a second order ephemeral drainage gully. This drainage line flows into Deep Creek to the northeast. • The main pit intersects the mapped path of a first order ephemeral drainage line along the southern border and is located within 5 m of two further first order ephemeral drainage lines along the northern and southern border. All three drainage lines are tributaries of Deep Creek. It should be noted the pit area only intersects a short section of the 1st order creek on the southern side, with the actual creek alignment typically lower and outside the pit area. • The first order ephemeral drainage line intersected by the main pit is again intersected by the southern crossing area located between the main shell pit and the office and weighbridge area. • The office and weighbridge area and the proposed water pipeline corridor intersected two unnamed ephemeral drainage lines. The two ephemeral drainage lines converge within the proposed footprint of the office and weighbridge area prior to flowing into Deep Creek to the east. • The current footprint of the access road crosses Deep Creek, a fourth order stream. The proposed access road further crosses five mapped paths of first order ephemeral drainage lines, all being tributaries of Deep Creek. Deep Creek flows southeast from

Landscape Features	Development Site
	the proposed DCQ, joining the Karuah River approximately 11 km downstream of The Bucketts Way.
Wetlands	There are no important wetlands (as defined by the BAM) within or adjacent to the Study Area; however, downstream reaches of Deep Creek are mapped as Coastal Wetlands under the State Environmental Planning Policy (Coastal Management) 2018. The Karuah River flows into Port Stephens approximately 7.5 km downstream of the point of confluence with Deep Creek. Downstream reaches of Deep Creek flow into the Karuah National Park which is classified as a World Conservation Union (IUCN) protected area Category IV (Habitat / Species Management Area), being a protected area mainly managed for conservation through management intervention. The quarry has been positioned on a spur line, largely between two first order ephemeral creeks with a quarry floor level above that of the nearby Deep Creek.
Connectivity of different areas of habitat	The Study Area currently consists of vegetated spurs and drainage gullies, with a mosaic of remnant vegetation and land cleared for pasture. Native bushland within the Study Area has good connectivity with surrounding bushland, which is extensive within the locality. The proposed DCQ pit is located on mid to upper slopes of a vegetated spur, with the infrastructure areas on the lower and more cleared slopes west of Deep Creek. The proposed site access road crosses Deep Creek and is located upon a combination of disturbed native vegetation and cleared agricultural pastures. The cleared agricultural pastures are currently used for cattle grazing. The Subject Land is surrounded by rural properties of approximately 40-200 ha, with smaller 2-10 ha lots further south off Forest Glen Road.
Areas of geological significance and soil hazard features	There are no areas of geological significance within the Development Site or Study area. The Study Area is not within a mapped area with the potential to contain Acid Sulphate Soils (ASS) under the Great Lakes LEP, nor is it mapped within the extent of potential ASS under the NSW OEH Acid Sulfate Soils Risk mapping layer within the NSW Government's Sharing and Enabling Environmental Data (SEED) mapping system (Office of Environment and Heritage 1998; State of NSW 2020).
Areas of outstanding biodiversity value	There are no areas of outstanding biodiversity value mapped within the Development Site or Study Area.

2.2 SITE CONTEXT

Details of the landscape assessment for the Development Site, according to the BAM (DPIE 2020) using the site-based assessment methodology and determined by remote sensing and GIS, are provided below.

2.2.1 Native Vegetation Cover

Native vegetation cover was assessed as per Section 3.2 of the BAM. Whereby, the native vegetation cover is assessed on the Development Site and within a 1,500 m buffer area surrounding the outside edge of the boundary of the Development Site. This 1,500 m site buffer has an area of 1,926 ha which has a native vegetation cover of 1,693 ha or 88%.

2.2.2 Geology and Soils

Three soil landscapes occur across the study area. The Ironstone Mountain soil landscape occurs on ridge tops and steep slopes. The Branch soil landscape occurs on low to mid-slopes and the Ten Mile Road soil landscape occurs in the low gully areas.

The Ironstone Mountain Soil Landscape is characterised by steep hills on Carboniferous sediments in the Clarence town Hills region. Slopes are typically 20 to >40% with a local relief to 120 m and an elevation of 100–180 m. The vegetation is typically uncleared open forest. The Ironstone Mountain Landscape Variant occurs on the ridge crests of the site.

The soils are typically comprised of shallow (50 cm), well-drained gravelly Bleached Loams/ Lithosols, moderately deep (<80 cm), well-drained stony Yellow Earths and some moderately deep well-drained Yellow Podzolic Soils on midslopes and some crests. Qualities and Limitations include steep slopes, foundation hazard, mass movement hazard, very high-water erosion hazard, rock outcrops (localised) and shallow stony soils of low fertility.

The Branch soil landscape broad plains on deep Pleistocene clay deposits in the Medowie Lowlands. Slope gradients are typically <2%, local relief is <1 m and elevation is 15 to<30 m. The vegetation is typically partially cleared tall open-forest and woodland. The Branch soil landscape is typically comprised of deep (>300 cm), very poorly drained Prairie Soils (Soloths). Qualities and Limitation include seasonal waterlogging, foundation hazard, highly erodible, strongly acid soils with extremely low wet strength, low fertility and low permeability. The Ten Mile Road soil landscape is typically undulating low hills on Carboniferous sediments and acid volcanics in the Medowie Lowlands and Clarencetown Hills regions. The local relief is typically 40–80 m with an elevation between 70–150 m and slopes between 5–10%. The vegetation is typically uncleared open forest.

Soils are typically moderately deep (55 cm) to deep (>200 cm) well to imperfectly drained brown Soloths, yellow Soloths and shallow (<45 cm), well-drained Bleached Loams/Lithosols. Qualities and limitations include high water erosion hazard, localised shallow soils, high run-on and seasonal waterlogging and strongly to extremely acid soils of low fertility.

2.2.3 Habitat Connectivity

The native vegetation within the Study Area has moderate to good internal habitat connectivity. Cleared areas containing scattered trees and smaller patches of forest occur in the northern, central and eastern portions (i.e. the development was designed to utilise cleared areas within the land holding). Dense well-connected forest vegetation occurs in the western portion of the Study Area.

The forest vegetation in the western portion of the Study area is continuous with large areas of forest to the west and south. The riparian vegetation within Deep Creek provides a habitat linkage between vegetation to the north and the south (i.e. the riparian zone of Deep Creek was avoided where possible during the development design).

The Connectivity Modelling of the Karuah-Myall Catchments, NSW, Australia (Lechner and Fung, 2018) was undertaken for MidCoast Council to assess the importance of existing national parks, forest reserves and other protected areas in maintaining habitat connectivity within the region. The study showed that all patches of vegetation within the Karuah-Myall catchment are linked. A delta Integral Index of Connectivity (dIIC) was developed for patches and linkages within the catchment. This analysis showed that the Study Area lies within an area that forms part of an important habitat linkage between Karuah State Forest to the east and a vegetation patch to the west.

Avoidance measures to maintain internal and external habitat connectivity are discussed in Section 5.1.

3. NATIVE VEGETATION

3.1 METHODOLOGY

Native vegetation across the Study Area was assessed in accordance with Section 4 of the BAM (DPIE 2020).

3.1.1 Data Review

Vegetation mapping has been previously conducted across the majority of the Study Area by Kleinfelder (2017). This mapping was reviewed and updated based on the vegetation surveys outlined below to refine the vegetation mapping for the current Project and map areas not previously covered.

3.1.2 Vegetation Surveys

3.1.2.1 Vegetation Mapping and Surveys

The boundaries of each of the identified vegetation communities within the Study Area were mapped using a combination of rapid data points (RDP) and walking transects, using the polygons produced through aerial photo interpretation (API) to assist in targeting survey effort. RDPs involved collecting waypoints over the Study Area using hand-held GPS units and recording dominant species, structure and condition. Walking transects involved verifying polygons that were homogenous in floristic composition and condition, as well as walking vegetation ecotones and using the recorded tracks to define vegetation community boundaries. The RDPs and survey tracks were then overlaid on an aerial photograph and used to delineate and/or clarify vegetation boundaries.

3.1.2.2 Linework and Attribution

RDPs and plots were classified and tagged with a Plant Community Type (PCT) by field ecologists. Polygons produced from the API work adopted the PCT of the sample point that they intersected.

3.1.2.3 Vegetation Zones

Vegetation zones were identified and delineated within the Study Area in accordance with Section 4.3 of the BAM (DPIE 2020). A vegetation zone is defined in the BAM (DPIE 2020) as a relatively homogenous area that is the same vegetation type and broad condition.

Native woody vegetation zones were defined as groups of four or more trees within 50 m of each other. Scattered trees which do not meet this definition were included in non-woody vegetation zones or exotic vegetation zones.

Native non-woody vegetation zones were defined as those areas which contained >50% native ground and/or shrub cover.

3.1.2.4 Plant Community Type Determination

Each vegetation community identified within the Study Area was assigned to the closest equivalent PCT from those listed in the BioNet Vegetation Classification database. The closest equivalent PCT for each vegetation community was determined through a comparison of the floristic descriptions of PCTs in the database with the plot / transect data collected from the site. In addition to floristic and structural similarity, the landscape position, soil type and other diagnostic features of the vegetation

communities on the sites were also compared to the descriptions in the database in order to determine the most suitable PCT. Threatened ecological communities (TECs) as defined under the BC Act and EPBC Act were also identified if present.

3.1.2.5 Assessing Vegetation Integrity (Site Condition)

Following stratification of the Development Site into vegetation zones, plots/transects were undertaken to collect site condition data for the composition, structure and function attributes listed in Table 2 in accordance with Section 4.3 of the BAM (DPIE 2020). The location of the plots/transects were selected through stratified random sampling to provide a representative sample of the variation in vegetation composition and condition within each vegetation zone.

Table 2 Composition, Structure and Function components of vegetation integrity

Growth form groups used to assess composition (species richness) and structure (percent foliage cover)	Function attributes
• Tree (TG) • Shrub (SG) • Grass and grass-like (GG) • Forb (FG) • Fern (EG) • Other (OG)	• Number of large trees • Tree regeneration (presence/absence) • Tree stem size class (presence/absence) • Total length of fallen logs • Litter cover • High threat exotic vegetation cover (HTE) • Hollow-bearing trees (HBT)

The number of plots/transects undertaken across the site meets the minimum number of transects required for each vegetation zone area as detailed in Section 4.3.4, Table 3 of the BAM (DPIE 2020). The locations of the plots/transects undertaken on the Development Site are shown on Figure 3.

3.1.2.6 Floristic Identification and Nomenclature

Floristic identification and nomenclature is based on classification by Royal Botanic Gardens and Domain Trust, Sydney, published on PlantNET (the NSW Plant Information Network System http://plantnet.rbgsyd.nsw.gov.au).

For use in the BAM Calculator, native species were assigned to growth forms as per their classification in BioNet, and High Threat Weeds were classified as per the list published by The Biodiversity Conservation Division (BCD, formerly known as the Office of Environment and Heritage or OEH).

3.2 ASSESSMENT RESULTS

3.2.1 Plant Community Types

The site contains the following Plant Community Types (PCTs):

- *PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest.*
- *PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands.*
- *PCT 1567: Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast.*

- *PCT 1556: Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast.*

Additionally, the site contains areas of non-native vegetation, including exotic grasslands, dams, and cleared land (existing roads/ tracks).

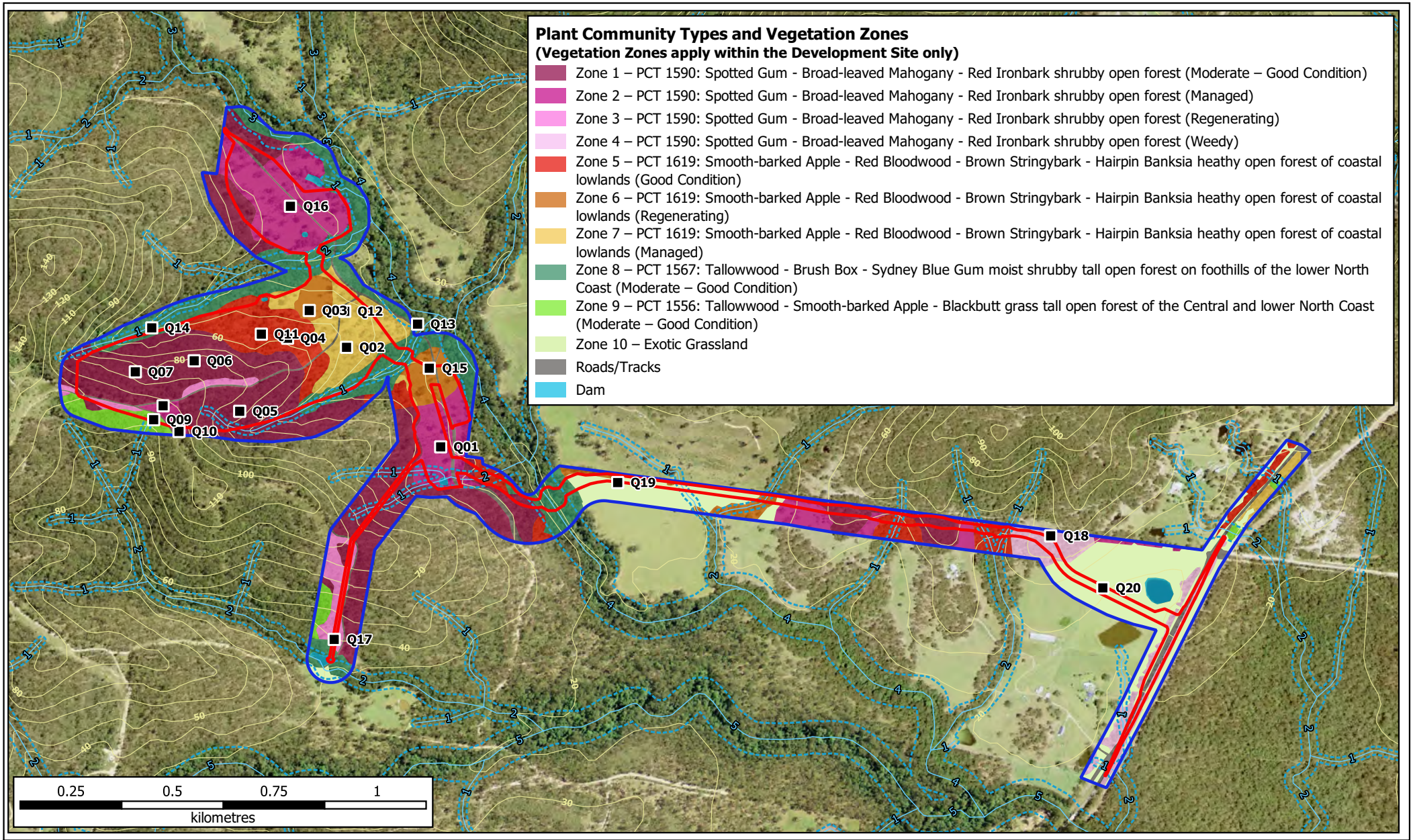
3.2.2 Vegetation Zones

Details on the vegetation zones (including vegetation formation and class, condition class and area) defined within the Development Site are outlined in Table 3. Full descriptions of each vegetation zone are provided in the following sub-sections. **Figure 3** shows the distribution of PCTs and vegetation zones within the Development Site. Plot data sheets and an excel of plot data have been provided as separate documents along with the BDAR.

Table 3 Plant Community Types and other areas within the Development Site

Zone	PCT	Condition Class	Vegetation Formation	Vegetation Class	Area (ha)
1	*PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest*	Mod-Good	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter – Macleay Dry Sclerophyll Forests	10.59
2	*PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Regenerating)*	Managed	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter – Macleay Dry Sclerophyll Forests	6.48
3	*PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Managed)*	Regenerating	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter – Macleay Dry Sclerophyll Forests	0.62
4	*PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Weedy)*	Weedy	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter – Macleay Dry Sclerophyll Forests	0.72
Sub-total of PCT 1590					**18.42**
5	*PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (High)*	Mod-Good	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	3.87
6	*PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands* (Managed)	Managed	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	1.79

Zone	PCT	Condition Class	Vegetation Formation	Vegetation Class	Area (ha)
7	PCT 1619: *Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands* (Regenerating)	Regenerating	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	3.07
Sub-total of PCT 1619					**8.74**
8	1567: Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast.	Mod-Good	Wet Sclerophyll Forests (Shrubby sub-formation)	North Coast Wet Sclerophyll Forests	1.83
Sub-total of PCT 1567					**1.83**
9	1556: Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast	Mod-Good	Wet Sclerophyll Forests (Shrubby sub-formation)	North Coast Wet Sclerophyll Forests	0.17
Sub-total of PCT 1556					**0.17**
Sub-total of native vegetation					**29.14**
-	Non-Native: Exotic Grasslands	-	-	-	1.60
-	Dams (no Wetland Vegetation)	-	-	-	0.08
-	Excluded (Tracks and Cleared Areas)	-	-	-	1.06
Total Area					**31.89**



Created by: KBlundell
Date: 26/10/2022

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Legend

- Development Site Boundary
- Study Area
- Contours (10m)
- Watercourse
- Riparian Buffer
- Plot Transects

Plant Community Types

Figure: **3**

Ironstone Developments Pty Ltd
Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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Vegetation Zone 1

PCT 1590: Spotted Gum – Broad Leaved Mahogany – Red Ironbark shrubby open forest
(Moderate-Good Condition)



Plate 1: PCT 1590 Spotted Gum – Broad Leaved Mahogany – Red Ironbark (Mod-Good)

PCT 1590: Spotted Gum – Broad Leaved Mahogany – Red Ironbark shrubby open forest (Mod-Good)	
Vegetation Formation & Class	Dry Sclerophyll Forests (Shrub/grass sub-formation) Hunter – Macleay Dry Sclerophyll Forests
Area within Development Site	10.59 ha
Survey Effort	Required: 3 plot/transects. Conducted: 3 plot/transects (Q5, Q6 & Q7).
Floristic description	The canopy of the community is dominated by *Eucalyptus siderophloia* (Grey Ironbark), *Corymbia maculata* (Spotted Gum), *Eucalyptus microcorys* (Tallowwood) and *Eucalyptus acmenoides* (White Mahogany). Other species that occur to a lesser extent include *Eucalyptus canaliculata* (Grey Gum) and *Syncarpia glomulifera* (Turpentine) The mid-storey is dominated by *Allocasuarina torulosa* (Forest Oak) with varying presence of *Jacksonia scoparia* (Dogwood), *Persoonia linearis* (Narrow-leaved Geebung), *Glochidion ferdinandi* (Cheese Tree), *Persoonia linearis* (Narrow-leaved Geebung) and *Alphitonia excelsa* (Red Ash).

PCT 1590: Spotted Gum – Broad Leaved Mahogany – Red Ironbark shrubby open forest (Mod-Good)	
	The ground layer is dominated by Grasses and Rushes with a scattering of forbs and some vines. The most dominant grasses occurring include *Entolasia stricta* (Wiry Panic) and *Themeda triandra* (Kangaroo Grass) with lower abundances of *Aristida vagans* (Three-awn Speargrass) and *Imperata cylindrica* (Blady Grass). The most dominant Rushes were *Lomandra longifolia* (Spiny-headed Mat-rush) and *Lomandra confertifolia* (Mat-rush). Other ground layer species occurring in low densities include *Lepidosperma laterale*, *Pandorea pandorana* (Wonga Wonga vine), *Cheilanthes sieberi subsp. sieberi* (Poison rock fern) and *Desmodium rhytidophyllum*. One weed species (*Lantana camara*) was recorded within the vegetation community at typically low abundances.
Condition within Development Site	The community has a complex vegetation structure with a high diversity of plant species within each stratum. The vegetation is therefore considered to be in a mod-good condition.
Justification for PCT selection	This community is dominated by *Corymbia maculata* (Spotted Gum). There are three Hunter – Macleay Dry Sclerophyll Forests PCTs that occur in the locality (Lower Hunter) which have *Corymbia maculata* in the canopy. These are PCTS 1590, 1592 and 1593 (BioNet VC). All three of these PCTs has *E. fibrosa* in the canopy. PCT 1590 list *E. umbra*; and 1592 lists *E. punctata*. PCT 1593 does not list any other canopy tree and *E. fibrosa* is described as the dominant tree. While *neither E. umbra* or *E. punctata* are prevalent in the zone the similar species *E. acmenoides* is subdominant and *E. canaliculata* occurs as a subdominant species. PCT 1590 is therefore most similar in the canopy signature. PCT 1590 is also more similar in the mid stratum due to the occurrence of *Allocasuarina torulosa* which not listed for PCT 1592.
Status	BC Act: The floristic structure of the vegetation community is not consistent with the diagnostic species supporting the Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions – Endangered Ecological Community (EEC). While *Corymbia maculata* was a dominate overstorey species, *Eucalyptus fibrosa* (Red Ironbark) (a characteristic species of the EEC) (TSSC Final Determination) was not present within the community. *Eucalyptus siderophloia* (Grey Ironbark) was present within the upper stratum of the community, however, this species is infrequently present within the EEC (TSSC Final Determination). **EPBC Act:** Not Listed.
PCT % Cleared	48% (from BioNet Vegetation Classification database).

Vegetation Zone 2

***PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest* (Managed).**



Plate 2: PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Managed).

PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Managed)	
Vegetation Formation & Class	Dry Sclerophyll Forests (Shrub/grass sub-formation) Hunter – Macleay Dry Sclerophyll Forests
Area within Development Site	6.48 ha
Survey Effort	Required: 3 plot/transects. Conducted: 4 plot/transects (Q1, Q8, Q10 & Q16)
Floristic description	The canopy of the community is dominated by *Eucalyptus paniculata* (Grey Ironbark) and *Eucalyptus microcorys* (Tallowwood) and *Eucalyptus acmenoides* (White Mahogany). Other species that occur to a lesser extent include *Eucalyptus canaliculata* (Grey Gum). The mid-storey is largely absent. Shrubs are restricted to unmanaged areas such as around the base of trees. Shrub species include *Daviesia ulicifolia* (Prickly Bush-pea), *Bursaria spinosa* (Black Thorn) and *Pultenaea villosa*.

PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Managed)	
	The ground layer is dominated by exotic grasses such as *Axonopus fissifolius* (Narrow-leaved Carpet Grass) and *Andropogon virginicus* (Whiskey Grass). Native grasses that occur to a lesser extent include *Aristida vagans* (Three-awned Spear Grass), *Eragrostis brownii* (Brown's Lovegrass) and *Panicum simile* (Two-coloured Panic). Native forbs include *Lagenifera stipitata*, *Hypericum gramineum, Ptilothrix deusta, Glycine clandestina, Glycine tabacina, Goodenia paniculata, Gonocarpus teucrioides* and *Lobelia purpurascens*.
Condition within Development Site	This vegetation zone has been managed and lacked a midstorey and shrub layer. The groundcover is dominated by exotic grasses; hence the vegetation zone is considered to be in low condition.
Justification for PCT selection	The vegetation is a managed form of PCT 1590 as indicated by the landscape position and dominant canopy species. Justifications for PCT selection are provided previously for vegetation Zone 1.
Status	BC Act: Not listed EPBC Act: Not Listed.
PCT % Cleared	48% (from BioNet Vegetation Classification database).

Vegetation Zone 3

***PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest* (Regenerating).**



Plate 3 PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Regenerating).

PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest. (Managed).	
Vegetation Formation & Class	Dry Sclerophyll Forests (Shrub/grass sub-formation) Hunter – Macleay Dry Sclerophyll Forests
Area within Development Site	0.62 ha
Survey Effort	Required: 1 plot/transects. Conducted: 1 plot/transects (Q17)
Floristic description	The canopy of the community is dominated by regenerating Corymbia maculata (Spotted Gum), Eucalyptus paniculata (Grey Ironbark), Eucalyptus umbra (Bastard White Mahogany) and *Syncarpia glomulifera* (Turpentine). The mid-storey is dominated by regenerating *Allocasuarina torulosa* (Forest Oak), *Glochidion ferdinandi* (Cheese Tree) and *Bursaria spinosa* (Black Thorn).

PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest. (Managed).	
	The regenerating shrub layer is dominated by *Leptospermum polygalifolium* (Tantoon). Other shrub species include *Daviesia ulicifolia* (Prickly Bush-pea), *Bursaria spinosa* (Black Thorn) and *Pultenaea villosa*. The ground layer is dominated by sedge species such as *Ptilothrix deusta* and *Lepidosperma laterale*. Grass species include *Aristida vagans* (Three-awned Spear Grass), *Eragrostis brownii* (Brown's Lovegrass), and *Imperata cylindrica* (Blady Grass) Native forbs include *Glycine clandestina, Glycine tabacina, Goodenia paniculata, Gonocarpus teucrioides* and *Lobelia purpurascens.*
Condition within Development Site	This vegetation zone contains a large diversity of species in a state of regeneration; hence the vegetation zone is considered to be in moderate condition.
Justification for PCT selection	The vegetation is a regenerating form of PCT 1590 as indicated by the landscape position and dominant plant species. Justifications for PCT selection are provided previously for vegetation Zone 1.
Status	BC Act: Not listed EPBC Act: Not Listed.
PCT % Cleared	48% (from BioNet Vegetation Classification database).

Vegetation Zone 4

***PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest* (Weedy).**



Plate 4: ***PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Weedy).***

PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Weedy).	
Vegetation Formation & Class	Dry Sclerophyll Forests (Shrub/grass sub-formation) Hunter – Macleay Dry Sclerophyll Forests
Area within Development Site	0.72 ha
Survey Effort	Required: 1 plot/transects. Conducted: 1 Plot/transects (Q18).
Floristic description	The canopy of the community is dominated by *Eucalyptus propinqua* (Small-fruited Grey Gum) and *Eucalyptus siderophloia* (Grey Ironbark). The mid-storey is dominated by *Melaleuca nodosa* (Prickly-leaved Paperbark). The ground layer is dominated by exotic species including Lolium rigidum (Wimmera Ryegrass) and *Senecio madagascariensis* (Fireweed). Native grass species include *Aristida vagans*, *Digitaria parviflora, Echinopogon caespitosus, Microlaena stipoides, Oplismenus aemulus* and *Paspalidium distans*. Native forbs include *Arthropodium milleflorum, Hydrocotyle sibthorpioides, Cotula australis,*

PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Weedy).	
	Vernonia cinerea, Pandorea pandorana, Commelina cyanea, Dichondra repens, Glycine tabacina, Geranium solanderi var. solander and *Lobelia purpurascens*.
Condition within Development Site	This vegetation zone contains a large diversity of species in a state of regeneration; hence the vegetation zone is considered to be in a moderate condition state.
Justification for PCT selection	This vegetation zone is largely intact; however, the groundcover is dominated by exotic flora; hence, the vegetation zone is considered to be in moderate condition.
Status	BC Act: Not listed EPBC Act: Not Listed.
PCT % Cleared	48% (from BioNet Vegetation Classification database).

Vegetation Zone 5

PCT – 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands **(Moderate – Good Condition)**



Plate 5: ***PCT – 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands*** **(Mod-Good)**

PCT – 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Mod-good)	
Vegetation Formation & Class	Dry Sclerophyll Forests (Shrubby sub-formation) Sydney Coastal Dry Sclerophyll Forests
Area within Development Site	3.87 ha
Survey Effort	Required: 2 plot/transects. Conducted: 2 plot/transects (Q4 & Q11).
Floristic description	The overstorey layer is dominated by *Angophora costata* (Smooth-bark Apple) and *Corymbia gummifera* (Red Bloodwood), *Eucalyptus capitellata* (Brown Stringybark) is co-dominant in some areas. Sub-dominant species include *Eucalyptus resinifera* subsp. *resinifera* (Red Mahogany), *Eucalyptus eugenioides* (Thin-leaved Stringybark), *Eucalyptus umbra* (Broad-leaved White Mahogany) and *Syncarpia glomulifera* (Turpentine).

PCT – 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Mod-good)	
	The midstorey is dominated by *Allocasuarina torulosa* (Forest Oak) and *Glochidion ferdinandi* (Cheese Tree) with scattered occurrences of *Banksia spinulosa* (Hairpin Bansi), *Persoonia linearis* (Narrow-leaved Geebung), *Lambertia formosa* (Mountain Devil), and *Xylomelum pyriforme* (Native Pear). The ground layer is dominated by *Xanthorrhoea latifolia subsp. latifolia* and native grasses with a diverse but low cover of shrubs. The dominant grasses include *Themeda australis* (Kangaroo Grass), *Entolasia stricta* (Wiry Panic), *Anisopogon avenaceus* (Oat Speargrass). A few exotic species were recorded within the community, but in low abundances, and included *Hypochaeris radicata* (Catsear), *Andropogon virginicus* (Whisky Grass), *Axonopus fissifolius* (Narrow-leaf Carpet Grass) and *Lantana camara* (Lantana).
Condition within Development Site	The vegetation within this zone is in moderate – good condition as its upper stratum consist of large, mature trees supporting a diverse shrub and grass layer with an intact midstorey. A low number of exotic species typically occur within this community in low abundances.
Justification for PCT selection	PCT 1619 is the only PCT that resembles the canopy signature and geographic distribution of this vegetation zone. All three canopy signature species present (*Angophora costata, Corymbia gummifera* and *Eucalyptus capitellata*. Typical midstorey and groundcover species also occur.
Status	BC Act: Not Listed. EPBC Act: Not Listed.
PCT % Cleared	45% (from BioNet Vegetation Classification database).

Vegetation Zone 6

***PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands* (Managed)**



Plate 6: ***PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Managed).***

PCT – 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands. (Managed)	
Vegetation Formation & Class	Dry Sclerophyll Forests (Shrubby sub-formation) Sydney Coastal Dry Sclerophyll Forests
Area within Development Site	1.79 ha
Survey Effort	Required: 1 plot/transect. Conducted: 2 plot/transects (Q3 & Q15).
Floristic description	The overstorey layer is dominated by *Angophora costata* (Smooth-bark Apple) and *Corymbia gummifera* (Red Bloodwood), *Eucalyptus resinifera* subsp. *resinifera* (Red Mahogany) and *Eucalyptus globoidea* (White Stringybark). The midstorey is largely absent. Regenerating *Leptospermum laevigatum* (Woolly Teatree) and *Glochidion ferdinandi* (Cheese Tree).

PCT – 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands. (Managed)	
	The ground layer is dominated by native grasses with a diverse but low cover of shrubs. The dominant grasses include *Themeda australis* (Kangaroo Grass), *Entolasia stricta* (Wiry Panic), *Anisopogon avenaceus* (Oat Speargrass).
Condition within Development Site	This vegetation zone has been managed and lacked a midstorey and shrub later. The groundcover is dominated by exotic grasses; hence the vegetation zone is considered to be in low condition.
Justification for PCT selection	The vegetation is a managed form of PCT 1619 as indicated by the landscape position and dominant canopy species. Justifications for PCT selection are provided previously for vegetation Zone 5.
Status	BC Act: Not Listed. EPBC Act: Not Listed.
PCT % Cleared	45% (from BioNet Vegetation Classification database).

Vegetation Zone 7

PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Regenerating)

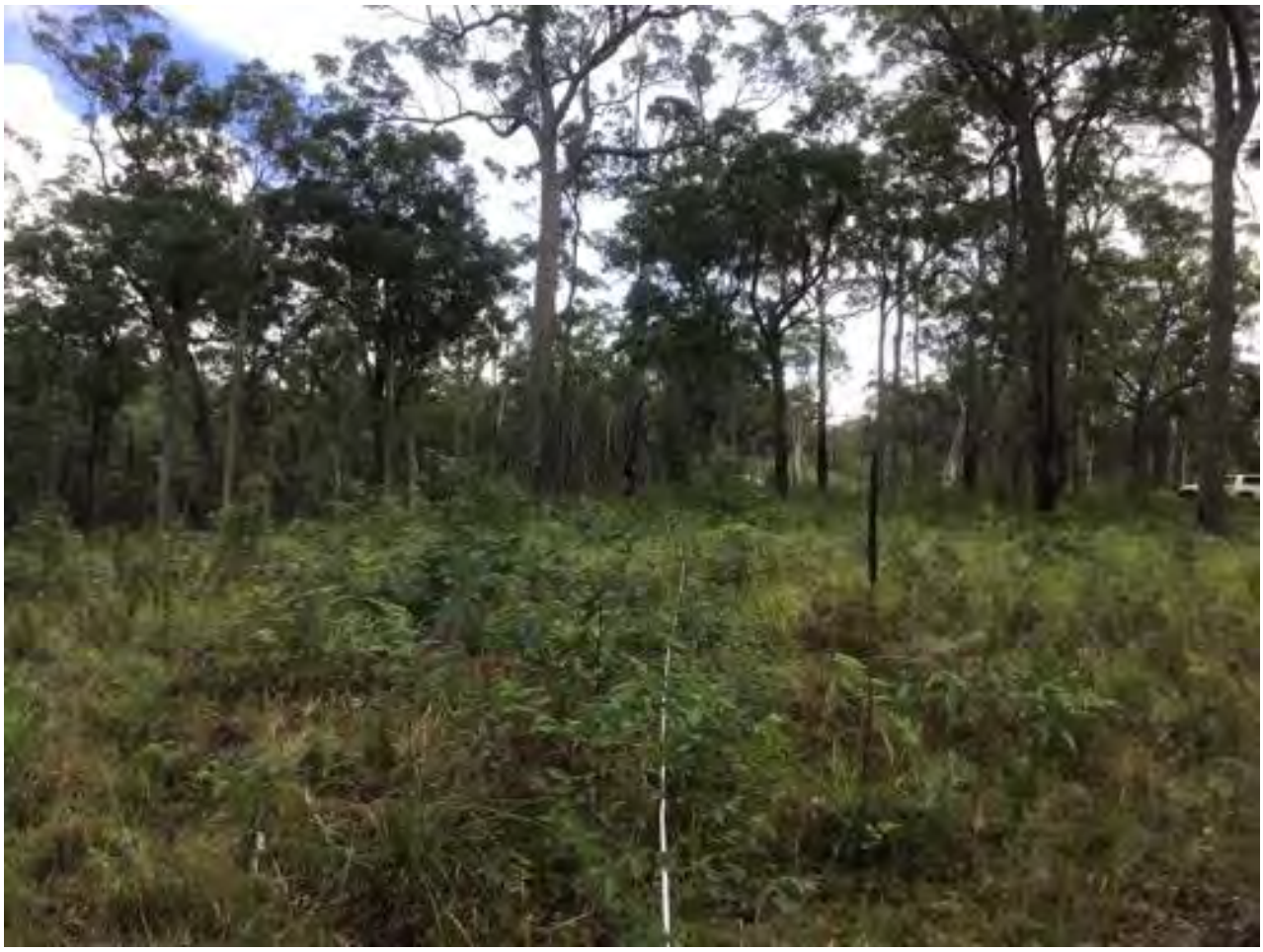


Plate 7 PCT – 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Regenerating)

PCT – 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Regenerating)	
Vegetation Formation & Class	Dry Sclerophyll Forests (Shrubby sub-formation) Sydney Coastal Dry Sclerophyll Forests
Area within Development Site	3.07 ha
Survey Effort	Required: 2 plot/transects. Conducted: 2 plot/transect (Q2, Q12).
Floristic description	The overstorey layer is dominated by *Angophora costata* (Smooth-bark Apple) and *Corymbia gummifera* (Red Bloodwood), *Eucalyptus resinifera* subsp. *resinifera* (Red Mahogany) and *Eucalyptus globoidea* (White Stringybark). The midstorey is largely absent with occasional regenerating *Allocasuarina torulosa* (Forest Oak) Occasional regenerating shrubs include *Lambertia formosa* (Mountain Devil) and *Persoonia linearis* (Narrow-leaved Geebung).

PCT – 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Regenerating)	
	The ground layer is dominated by native grasses with a diverse but low cover of shrubs. The dominant grasses include *Themeda australis* (Kangaroo Grass), *Entolasia stricta* (Wiry Panic), *Anisopogon avenaceus* (Oat Speargrass).
Condition within Development Site	This vegetation zone contains a large diversity of species in a state of regeneration; hence the vegetation zone is considered to be in moderate condition.
Justification for PCT selection	The vegetation is a managed form of PCT 1619 as indicated by the landscape position and dominant canopy species. Justifications for PCT selection are provided previously for vegetation Zone 5.
Status	BC Act: Not Listed. EPBC Act: Not Listed.
PCT % Cleared	45% (from BioNet Vegetation Classification database).

Vegetation Zone 8

PCT 1567: Tallowwood – Brush Box – Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast



Plate 8 ***PCT 1567: Tallowwood – Brush Box – Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast*.**

PCT – 1567: Tallowwood – Brush Box – Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast.	
Vegetation Formation & Class	Wet Sclerophyll Forests North Coast Wet Sclerophyll Forests
Area within Development Site	1.83 ha
Survey Effort	Required: 1 plot/transects. Conducted: 2 plot/ transect (Q13 & Q14).
Floristic description	The overstorey of this vegetation community is typically dominated by *Eucalyptus microcorys* Tallowwood) and *Syncarpia glomulifera* (Turpentine). *Eucalyptus saligna* (Sydney Blue Gum) occurs in wetter areas (gullies) along with *Lophostemon confertus* (Brush Box). The midstorey is a diverse mix of mesic species such as *Synoum glandulosum* subsp. *glandulosum* (Scentless Rosewood) and *Acmena Smithii* (Lilly Pilly).

PCT – 1567: Tallowwood – Brush Box – Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast.	
	The ground layer consists is dominated with a high coverage of sedges and ferns along with some grasses and vines. The dominant species include *Carex longebrachiata, Gahnia melanocarpa, Lomandra longifolia, Oplismenus imbecilis,* and *Christella dentata*.
Condition within Development Site	The vegetation within this zone is in moderate – good condition as its upper stratum consist of large, mature trees supporting a diverse shrub and grass layer with an intact midstorey. A low number of exotic species typically occur within this community in low abundances.
Justification for PCT selection	Key diagnostic canopy species of PCT 1567 are present in the vegetation zone including *Eucalyptus microcorys* (Tallowwood) and *Syncarpia glomulifera* (Turpentine), *Eucalyptus saligna* and *Lophostemon confertus* (Brush Box). Other key diagnostic species in the lower strata include *Synoum glandulosum* subsp. *glandulosum* (Scentless Rosewood), *Gahnia melanocarpa* and *Oplismenus imbecilis*.
Status	BC Act: Not Listed. EPBC Act: Not Listed.
PCT % Cleared	2% (from BioNet Vegetation Classification database).

Vegetation Zone 9

PCT 1556: Tallowwood – Smooth-barked Apple – Blackbutt grass tall open forest of the Central and lower North Coast **(Moderate – Good Condition)**



Plate 9 ***PCT 1556: Tallowwood – Smooth-barked Apple – Blackbutt grass tall open forest of the Central and lower North Coast*** **(Mod-Good)**

PCT – 1556: Tallowwood – Smooth-barked Apple – Blackbutt grass tall open forest of the Central and lower North Coast.	
Vegetation Formation & Class	Wet Sclerophyll Forests Northern Hinterland Wet Sclerophyll Forests
Area within Development Site	0.17 ha
Survey Effort	Required: 1 plot/transects. Conducted: 1 plot/ transect (Q9).
Floristic description	The overstorey of this vegetation community was dominated by *Syncarpia glomulifera* (Turpentine), Eucalyptus microcorys Tallowwood) and *Eucalyptus umbra* (Broad-leaved Mahogany). Other species that occur to a lesser extent include *Corymbia maculata* (Spotted Gum) and *Angophora costata* (Smooth-barked Apple). The most dominant midstorey species were *Allocasuarina torulosa* (Forest Oak) *and Glochidion ferdinandi* (Cheese Tree).

PCT – 1556: Tallowwood – Smooth-barked Apple – Blackbutt grass tall open forest of the Central and lower North Coast.	
	The ground layer was dominated by grasses with an influence of rushes and forbs. The most dominant grasses identified were *Themeda australis* (Kangaroo Grass) and *Entolasia stricta* (Wiry Panic). Other grasses of relative abundance included *Aristida vagans* (Three-awn Speargrass), *Imperata cylindrica* (Blady Grass) and *Eragrostis brownii* (Brown's Lovegrass). *Lomandra confertifolia* (Spiny Mat-rush) was the most dominant rush species followed by *Lomandra obliqua*. Other ground layer species occurring in abundance were *Pullenia gunnii* (Slender tick trefoil) and *Lepidosperma laterale*.
Condition within Development Site	The vegetation within this zone is in moderate – good condition as its upper stratum consist of large, mature trees supporting a diverse shrub and grass layer with an intact midstorey. A low number of exotic species typically occur within this community in low abundances.
Justification for PCT selection	This zone is dominated by *Eucalyptus microcorys* occupying a similar slope position to PCT 1619 and appears to be a moister phase of this community type. Angophora costata occurs as in association with *Eucalyptus microcorys* with *Eucalyptus pilularis* being absent in this case. The descriptive attributes of PCT 1556 cite a canopy dominated by *Eucalyptus microcorys*, occurring in lower north coast upper slopes at mis elevations. The mid-stratum species on site are typical of this PCT.
Status	BC Act: Not listed EPBC Act: Not Listed.
PCT % Cleared	41% (from BioNet Vegetation Classification database).

Exotic Grassland



Plate 10: ***Exotic Grassland***

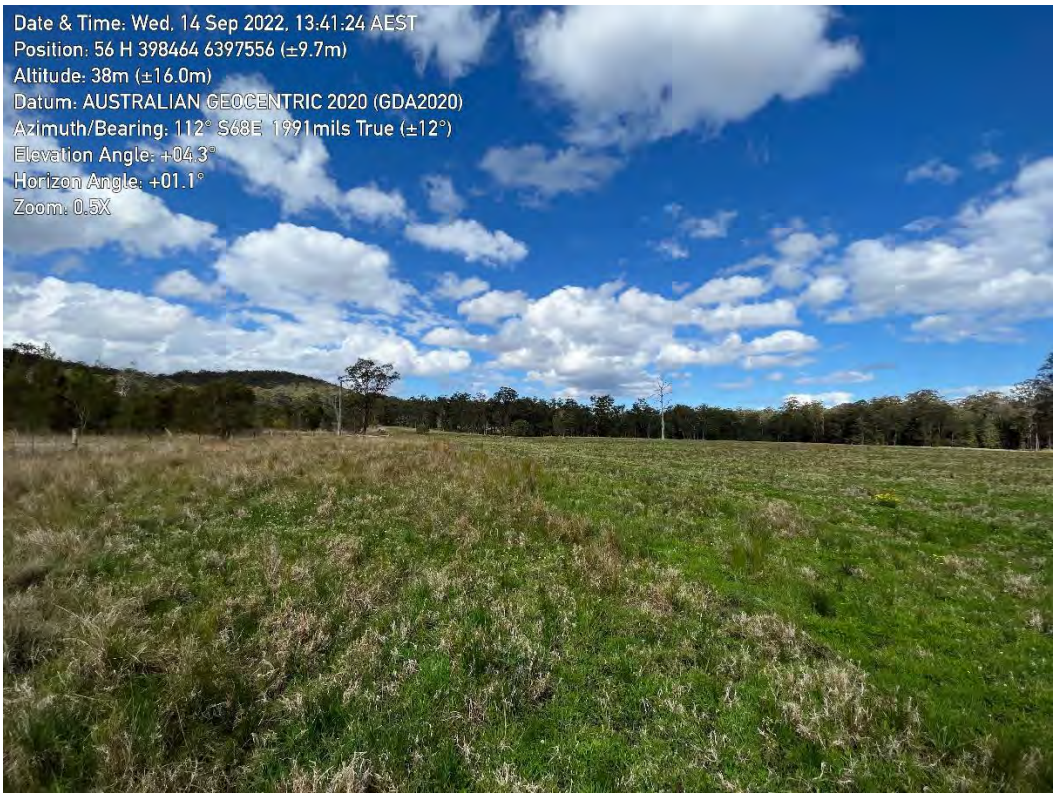


Plate 11: ***Exotic Grassland***

Exotic Grassland	
Vegetation Formation & Class	None
Area within Development Site	1.60 ha
Survey Effort	Required: None Conducted: 2 Plot/transects (Q19 and Q20).
Floristic description	The canopy, mid-storey and shrub layers are absent within this vegetation zone. The ground layer is dominated by exotic species including *Axonopus fissifolius* (Narrow-leafed Carpet Grass),*Juncus cognatus*, *Trifolium repens* (White Clover), and *Senecio madagascariensis* (Fireweed).
Condition within Development Site	This vegetation zone occurs within close proximity to Vegetation Zones 2, 3, 6, and 8 however it is characterised as a highly modified exotic grassland, with very little resemblance with the original vegetation communities that likely occurred within the vegetation zone (PCT 1590 and PCT 1619). The vegetation within this zone is comprised of between 0.04% and 1.04% native species groundcover. As such the vegetation is commensurate with non-native vegetation, low-conservation grasslands, and grasslands permitted to be cleared as defined by the following legislation and guidelines: • *NSW Biodiversity Offset Scheme Grassland Thresholds (2022)* – "In derived plant communities with 100% groundcover that is partially exotic, the area of native vegetation can be calculated to account for the exotic component as follows: a) >75% native is assessed as 100% native, b) between 15-75% native multiply to proportion of native cover by the total area to calculate native vegetation extent, c) **Less than 15% native is excluded as native vegetation extent and assessed as non-native vegetation**" • *Local Land Services Act 2013* – For the purposes of this Part, an area is taken, during the transitional period, to be **low conservation value grasslands** if it comprises only groundcover whose clearing was permitted by section 20 of the Native Vegetation Act 2003, as in force immediately before the repeal of that Act. • *Native Vegetation Act 2003* (Repealed) – "The clearing of native vegetation that comprises only groundcover is permitted if: a) The vegetation comprises less **than 50% of indigenous species of vegetation**, and b) not less than 10% of the area is covered with vegetation (whether dead or alive), and c) those percentages are calculated in accordance with the regulations." • *Land Management (Native Vegetation) Code 2018* – Section 69 Permitted clearing of native vegetation (1) This Division authorises clearing of native vegetation that consists only of groundcover if— a) less than 50% of the vegetation cover in the treatment area is comprised of native species of vegetation, and b) not less than 10% of the treatment area is covered with vegetation (whether dead or alive). As such, the vegetation within this zone was considered representative of exotic grassland/ non-native vegetation. Prescribed impacts and impacts not requiring offsets are considered for this vegetation zone in **Section 5.2.1.3** of the report.
Justification for PCT selection	The vegetation zone is considered exotic/ non-native vegetation in accordance with relevant guidelines and legislation. No PCT could be reasonably assigned to this vegetation zone.
Status	BC Act: Not listed EPBC Act: Not Listed.
PCT % Cleared	Not Applicable

3.2.3 Threatened Ecological Communities

No threatened ecological communities were detected within the Development Site.

3.2.4 Assessment of Patch Size

All vegetation zones have a patch size of >100 ha as they are all zones of native forest vegetation (woody vegetation) which are connected to larger areas of native vegetation (gaps less than 100 m) in the surrounding areas. The patch size for each vegetation zone is outlined in **Table 6**.

3.2.5 Vegetation Integrity Score

Vegetation integrity is a metric-based assessment used to measure the condition of native vegetation against a benchmark, based on survey data collected by the assessor (i.e. composition, structure and function attributes). In accordance with Section 4.3.3 of the BAM 2020, these attributes are assessed within each vegetation zone against benchmark data for the relevant PCT.

Benchmarks used within the BAM Calculator (BAM-C) assume average environmental conditions (e.g. rainfall). Where climatic conditions prior to surveys differ significantly from average conditions the use of BAM-C benchmarks may result in a VI score that is not representative of vegetation condition during more average climatic conditions. For example, during dry periods the vegetation condition is much lower overall and BAM-C benchmark values may be unrealistically high, resulting in an assessment that underestimates the vegetation condition. Alternatively, in very wet conditions, the BAM-C benchmark values may lead to an overestimation of vegetation condition values. These short-term variations in VI may result in an assessment of VI that does not accurately represent the inherent biodiversity values of the site.

Section 1.4.2(3.) of the BAM and the document *Guidance for assessors and decision-makers in applying modified benchmarks to assessments of vegetation integrity* (DPIE 2020) provides that assessors may use benchmark data in the BioNet Vegetation Classification (Veg-C) that reflect seasonal or climatic variation in the benchmark values for a PCT as more appropriate local data (wet or dry benchmarks). The appropriateness of the use of wet or dry benchmarks is determined when the rainfall total for 12 months prior to the assessment exceeds the vegetation class/IBRA bioregion rainfall threshold for a wet or dry rainfall year. Wet or dry rainfall year thresholds are based on the long-term average rainfall data and are assigned to vegetation classes within each IBRA bioregion.

Wet and dry benchmarks are predicted for vegetation classes in each IBRA bioregion according to the following metrics:

dry benchmarks are predicted for rainfall periods that fall below the 20th percentile of the annual totals in long-term rainfall records, referred to as a dry rainfall year

average benchmarks are predicted for rainfall periods that fall between the 20th percentile and the 80th percentile of the annual totals in long-term rainfall records, referred to as an average rainfall year, and

wet benchmarks are predicted for 12-month rainfall periods that reach above the 80th percentile of the annual totals in long-term rainfall records, referred to as a wet rainfall year.

In accordance with the Guideline **Table 4** provides an outline of each 12-month period throughout the assessment period.

Table 4: 12-month cumulative rainfall and Vegetation Class thresholds for the Subject Site

Veg Zone	Plant Community Type (PCT)	Vegetation Class	Benchmark Thresholds (rainfall) (mm)			Cumulative Rainfall Records (12-month periods) (mm) (16th April – 15th April)			
			Dry	Average	Wet	April 2018 – April 2019	April 2019 – April 2020	April 2020 – April 2021	April 2021 – April 2022
1	*PCT 1590: Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest*	**Hunter – Macleay Dry Sclerophyll Forests**	< 844	844 – 1264	> 1264	864.8	790.2	1443.4	1520
2			< 844	844 – 1264	> 1264	864.8	790.2	1443.4	1520
3			< 844	844 – 1264	> 1264	864.8	790.2	1443.4	1520
4			< 844	844 – 1264	> 1264	864.8	790.2	1443.4	1520
5	*PCT 1619: Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands*	**Sydney Coastal Dry Sclerophyll Forests**	< 936	936 – 1364	> 1364	864.8	790.2	1443.4	1520
6			< 936	936 – 1364	> 1364	864.8	790.2	1443.4	1520
7			< 936	936 – 1364	> 1364	864.8	790.2	1443.4	1520
8	*PCT 1567: Tallowwood – Brush Box – Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast*	**North Coast Wet Sclerophyll Forests**	< 1037	1037 – 1598	> 1598	864.8	790.2	1443.4	1520
9	*PCT 1556: Tallowwood – Smooth-barked Apple – Blackbutt grass tall open forest of the Central and lower North Coast*	**Northern Hinterland Wet Sclerophyll Forests**	< 953	953 – 1454	> 1454	864.8	790.2	1443.4	1520

*Colour cells indicate where cumulative rainfall over a 12-month period met vegetation class benchmark thresholds for ***dry*** (orange), ***average*** (green), and ***wet*** (blue) years. Rainfall data from Stroud Post Office weather station (61071).

Vegetation surveys (including the completion of vegetation integrity plots) where completed on 16 April 2019. The cumulative rainfall records for the Subject Site indicates that the preceding 12-months received 864.8 mm (see **Table 4**). This total is below average rainfall, and below the *dry* conditions benchmark threshold for three (3) vegetation classes occurring within the Subject Site; *Sydney Coastal Dry Sclerophyll Forests, North Coast Wet Sclerophyll Forests,* and *Northern Hinterland Wet Sclerophyll Forests*. One (1) vegetation class was considered to be within *average* rainfall conditions; *Hunter – Macleay Dry Sclerophyll Forests*. Benchmarks used for each vegetation zone is detailed in **Table 5**.

Table 5: Benchmark vegetation integrity data applied to the Subject Site

Vegetation Class and Zones	Bench-mark	Benchmarks Applied*															
		Tree		Shrub		GG		Forb		Fern		Other		Function			
		R	C	R	C	R	C	R	C	R	C	R	C	Logs	Litter	No. Large Trees	Large Tree Thrs
Hunter – Macleay Dry Sclerophyll Forests (Zones 1, 2, 3, 4)	***Average***	7	67	10	22	12	100	12	8	2	1	6	6	45	70	3	50
Sydney Coastal Dry Sclerophyll Forests (Zones 5, 6, 7)	***Dry***	9	62	21	45	9	57	8	5	2	1	5	5	65	62	6	50
North Coast Wet Sclerophyll Forests (Zone 8)	***Dry***	12	92	13	32	5	12	8	4	5	12	12	25	59	80	3	80
Northern Hinterland Wet Sclerophyll Forests (Zone 9)	***Dry***	9	79	10	19	9	65	11	9	3	2	9	12	75	70	1	80

*R= species richness, C = cover, Thrs = Threshold

The current vegetation integrity score of the vegetation zones are outlined in Table 6.

Table 6 Current vegetation integrity score for the vegetation zone

Zone	PCT & Class	Area (ha)	Patch Size	Condition scores (Current Score)			Vegetation integrity score
				Composition	Structure	Function	
1	1590: Mod_Good	10.59	>100	97.6	35.4	50.4	55.8
2	1590: Managed	6.48	>100	84.9	18.4	20.6	31.8
3	1590: Regenerating	0.62	>100	97.5	62.4	44.1	64.5
4	1590: Weedy	0.72	>100	57.9	10.6	34.8	27.7
5	1619: Mod_Good	3.87	>100	94.1	45.2	60.1	63.5
6	1619: Managed	1.79	>100	17.7	19.7	15.0	17.4
7	1619: Regenerating	3.07	>100	93.7	45	37	53.8
8	1567: Mod_Good	1.83	>100	94.6	64.7	71.9	76.1
9	1556: Mod_Good	0.17	>100	94.1	49.8	96.5	76.8

4. THREATENED SPECIES

4.1 ASSESSING HABITAT SUITABILITY

To inform the assessment of suitable habitat for threatened species and populations within the Study Area, a database search of the NSW DPIE BioNet Atlas and the DAWE PMST and a literature review for key threatened species were conducted. Discussion of threatened species habitat suitability is provided below, a Likelihood of Occurrence assessment based on the results of desktop searches (BioNet and PMST) is provided in **Appendix 1**.

4.1.1 Habitat Assessment

4.1.1.1 Flora

The habitat for candidate threatened flora species within the Study Area is of varying quality due to historical and current disturbances including vegetation clearing and cattle grazing (Figure 4). Higher quality flora habitat occurs within areas of the study area where intact native vegetation occurs (i.e. Vegetation Zones 1, 5, 8 and 9). These areas contain multiple vegetation strata (i.e. canopy, midstorey, shrub and groundcover layers) and have a moderate to high floristic diversity.

Lower quality flora habitat occurs in areas of the site that have been cleared or managed (i.e. Vegetation Zones 2, 3, 4, 6, and 7). Disturbance in these areas has allowed the encroachment of weeds and exotic perennial grasses. In more open areas, these species tend to outcompete native plant species and reduce floristic diversity. The management of vegetation to establish tracks and open areas within the study area has also facilitated edge effects and the encroachment of weeds such as Lantana camara (Lantana) in better quality flora habitat.

The occurrence of threatened plant species and associated habitat within the Study Area is discussed in **Section 4.2.1**.

4.1.1.2 Fauna

The Study Area contains varying qualities of habitat for fauna species as determined by historical disturbances, including vegetation clearing and cattle grazing (**Figure 4**). Higher quality fauna habitat occurs in less disturbed areas where denser native forest vegetation occurs or where multiple strata layers are present. These areas contain key habitat features for native fauna species, including food resources (i.e. seeds, nectar and pollen), potential breeding habitat (i.e. hollow-bearing trees), and habitat refugia (i.e. dense vegetation, leaf litter, logs and rocks).

Exotic Grasslands within the Study Area may provide a foraging resource for native fauna species; however, these areas are not considered to be important to the long-term survival of threatened species in the locality. In areas where vegetation clearing has occurred, such as in the eastern portion of the Study Area, isolated trees/dead stags may provide hollows for fauna species. Small scatterings of woody debris/fallen timber may also provide refuge for reptile and small mammal species.

Eight man-made dams occur within the Study Area. These areas are likely to provide a source of water for local fauna species. Dams with emergent or aquatic vegetation may also provide breeding habitat for amphibian species. These areas may also provide foraging habitat for bird species such as waders and bats that predate on aquatic prey.

The vegetated riparian corridor of Deep Creek is located within portions of the Study Area and more broadly fringes the eastern side of the Study Area (excepting the access road). Deep Creek is largely ephemeral in nature and is typically incised meandering though the vegetated riparian corridor. It contains frequent deeper pools of water that remain between rain events with varying degrees of permanence.

No derelict man-made structures that represent potential bat habitat (i.e., concrete dwellings or sheds) or culverts occur within or adjacent to the Study Area.

Hollow-bearing Tree Assessment

A survey of trees within the Study Area was undertaken on 12, 14, 15, 19, 20, 22, 26 and 27 August 2019 to locate hollow-bearing trees, and dead standing stags (**Figure 4**). Hollow sizes were defined as small (<5 cm diameter), medium (5 – 20 cm diameter) and large (>20 cm diameter). Additionally, specific hollow attributes were also recorded to assess the suitability of hollows for Large Forest Owls and Cockatoos, including, height from ground, hollow diameter and type of hollows (e.g. upright spout, trunk hollow or brank hollow). The location of Habitat Trees and the type of feature it contained was recorded using a handheld GPS.

A total of 360 habitat trees (comprised of 228 hollow-bearing trees and 132 dead stags) were identified during the surveys within the Study Area. Of these, 128 habitat trees occur within the Development Site, including 90 hollow-bearing trees (HBTs) and 38 dead stags (**Table 7**).

Table 7: Habitat Trees within the Development Site.

Habitat Tree Type	Number of Trees	Small Hollows (<5 cm diameter)	Medium Hollows (5-20 cm)	Large Hollows (>20 cm diameter)
Hollow-bearing Tree (Live)	90	**99**	62	29
Dead Stag (with hollows)	38	**45**	37	22
Total	**128**	**144**	**99**	**51**
		294 Hollows		

Hollows were assessed as either potentially suitable for Large Forest Owls and Cockatoos, or not suitable due to hollow diameter, height of hollow or hollow type. Potentially suitable hollows were stag-watched as part of nocturnal surveys (**Section 4.2.2.1**). A number of nests were also identified during the field surveys; however, none of these nests were consistent with those built by birds of prey.

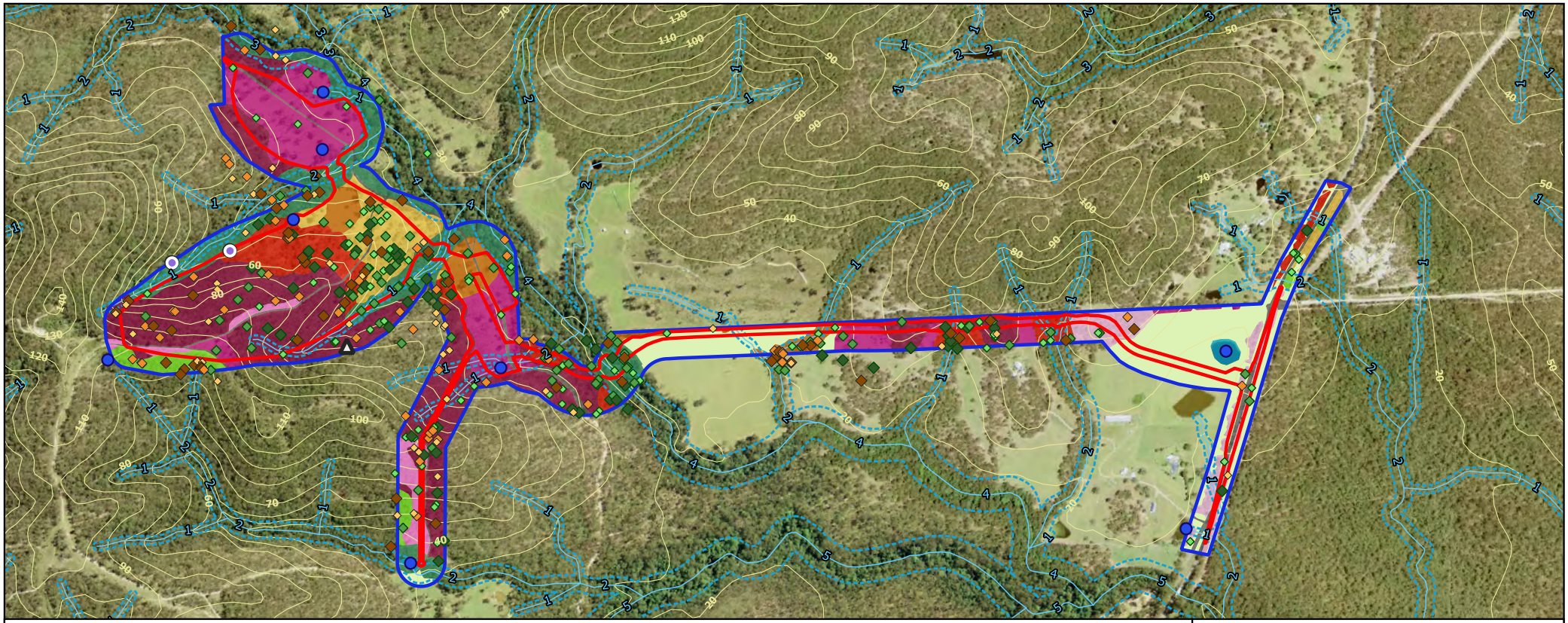
One (1) rock den was noted as occurring within the Development Site. An inspection of this potential habitat feature found that it only consisted of an outcrop of rocks, potentially representing habitat for locally occurring reptiles and small mammals.



Plate 12: Man-made dam and exotic grassland



Plate 13: Previously marked "Rock Den" site representing a small rocky outcrop



Plant Community Types and Vegetation Zones **(Vegetation Zones apply within the Development Site only)**

- Zone 1 – PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Moderate/Good Condition)
- Zone 2 – PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Managed)
- Zone 3 – PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Regenerating)
- Zone 4 – PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Weedy)
- Zone 5 – PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Good Condition)
- Zone 6 – PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Regenerating)
- Zone 7 – PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Managed)
- Zone 8 – PCT 1567: Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast (Moderate/Good Condition)
- Zone 9 – PCT 1556: Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast (Moderate/Good Condition)
- Zone 10 – Exotic Grassland
- Dam
- Roads/Tracks

~Habitat features~

Hollow Bearing Tree
- Large Hollow
- Medium Hollow
- Small Hollow

Dead Stags
- Large Hollow
- Medium Hollow
- Small Hollow

Other
- Nest
- Water feature
- Rocky Outcrop

200 400 600 800
metres

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Legend
- Development Site Boundary
- Study Area
- Watercourse
- Riparian Buffer
- Contours (10m)

Habitat Features

Figure: **4**

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N

Koala (*Phascolarctos cinereus*) Habitat

Habitat for the Koala (*Phascolarctos cinereus*) is highly variable across the species' broad geographic range spanning coastal and inland areas from far-north Queensland to the south-east corner of South Australia. Koala habitat suitability is regionally variable and influenced by the availability and nutritional quality of food trees, presence of suitable resting trees and microclimates, age structure of habitat, management history, and barriers to dispersal (DAWE 2021). An assessment of koala habitat suitability within the Study Area and broader locality is provided below.

Foraging Habitat

The koala is a specialist herbivore feeding almost entirely on the leaves of eucalypts, across a variety of vegetation types ranging from tropical forests to semi-arid woodlands throughout their geographic range. In New South Wales (NSW) alone, koalas have been recorded to use 66 eucalypt species and seven (7) non-eucalypts (DECC 2008, Phillips 2000). However, species selection is highly dependent on the region, with koalas in any one area feeding almost exclusively on a small number of preferred species (preferred food trees). Koalas are also known to use a number of tree and shrub species for purposes other than primary food species, including supplementary food species and shelter. *The Review of Koala Tree Use Across New South Wales* (OEH 2018) provides a summary of koala use species including 'regional high use', 'local high use', 'significant use', 'irregular use', and 'low use' species, for each Koala Management Area (KMA).

An assessment of the koala resource availability within each vegetation community identified at the Subject Site was based on the availability/dominance of the abovementioned koala use tree categories (OEH 2018) for the North Coast KMA and ranked as High, Moderate, or Low resource availability accordingly. Site-specific resource availability ranks used for this KPoM are described below:

- **High –** A dominance of 'Regionally High Use' tree species,
- **Moderate –** A dominance of 'Locally High Use' and/or 'Significant Use' tree species,
- **Low –** Dominance of 'Irregular Use' tree species or highly reduced koala habitat
- **None –** No existing habitat for koalas

Koala resource availability within each vegetation community is summarised in **Table 8** and mapped across the Development Site and surrounds in **Figure 5**.

Table 8: Koala Habitat Suitability and Resource Availability within the Subject Site.

Plant Community Type (PCT)	Koala Resource Availability	Resource Availability	Area within Development Site
PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Co-dominance of 'significant use' species *E. siderophloia, E. acmenoides* and *Syncarpia glomulifera* Sub-dominance of 'regional high use' species *Eucalyptus microcorys* Occurrence of 'irregular use' species *Corymbia maculata* and *E. canaliculata*	**Moderate**	18.42 ha

Plant Community Type (PCT)	Koala Resource Availability	Resource Availability	Area within Development Site
PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Dominance of a 'local high use' (*Angophora* costata) and 'significant use' species (*Corymbia maculata*) Occurrence of a 'local high use' species (*Eucalyptus resinifera* subsp. *resinifera*) Occurrence of 'significant use' species *Eucalyptus eugenioides* and *Syncarpia glomulifera* Occurrence of 'irregular use' species *Corymbia maculata* and *E. capitellata* Occurrence of 'low use' species *Eucalyptus umbra*	**Low**	8.74 ha
PCT 1567: Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast	Dominance of 'regional high use' species *Eucalyptus microcorys* Co-dominance 'significant use' species *Syncarpia glomulifera* Occurrence of 'significant use' species *Eucalyptus saligna* Occurrence of 'irregular use' species	**High**	1.83 ha
PCT 1556: Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast.	Dominance of 'regional high use' species *Eucalyptus microcorys* Co-dominance 'significant use' species *E. siderophloia, E. acmenoides* and *Syncarpia glomulifera* Occurrence of 'irregular use' species *Lophostemon confertus*		0.17 ha

Koala Habitat (Other Factors)

Koala habitat suitability is a product of several factors in addition to that of preferred feed tree occurrence with the core drivers of habitat suitability varying at different scales, including at the site level (e.g. food, shelter, breeding needs), to the broader landscape (e.g. climate, habitat connectivity). The Koala Habitat Information Base (DPIE 2019) provides a series of spatial datasets detailing koala habitat suitability and occupancy across New South Wales. The Koala Habitat Information Base datasets reviewed in relation to koala habitat within the Subject Site are presented in **Appendix 4** and include the following:

- The Koala Habitat Suitability Model (KHSM)
- The Koala Tree Index (KTI)
- Koala Likelihood Map (1999 – 2018)
- Areas of regional koala significance (ARKS)

The Koala Habitat Suitability Model

The Koala Habitat Suitability Model (KHSM) provides a measure of koala habitat suitability at any location. The model predicts the likelihood of finding habitat that is ecologically similar to where koalas have been observed over the past 40 years. The model predicts the spatial distribution of potential koala habitat across NSW using a value between 0 and 1 (i.e. a higher value represents a higher probability that a specific location will contain habitat suitable for koalas). The Koala Habitat Suitability Model (**Figure A1** in **Appendix 4**) indicates that the development site comprises

vegetation with koala habitat suitability ranging from 0.21 to 0.85. Areas of higher habitat suitability occur to the south of the proposed quarry pit, with the majority of the Development Site mapped as between 0.3 and 0.55. This indicates that whilst the vegetation within the Study Area is mapped as containing highly suitable koala habitat, the higher suitability habitat occurs outside of the proposed development site.

The Koala Tree Index

The Koala Tree Index (KTI) provides a measure of the probability of finding a tree species that koalas are known to prefer for food or shelter. The Koala Tree Suitability Index (**Figure A2**) indicates the development site comprises vegetation within tree suitability ranging from 0.31 to 0.9.

Koala Likelihood Map (1999 – 2018)

The Koala Likelihood Map (KLM) provides the likelihood of koalas occurring across a 10-square-kilometre grid covering NSW, based on available arboreal mammal records from the past 20 years. The Koala Likelihood Map and Koala Likelihood Confidence Map (**Figure A3**) indicates that the likelihood of koala of finding a koala within the development site ranges between 0.26 to 0.50 (within a moderate confidence area).

Areas of regional koala significance (ARKS)

This dataset provides mapping of regions that have high known koala occurrence using analysis of koala observation densities. The Subject Site is within Wang Wauk State Forest ARKS (**Figure A4**) which identifies regions mapped as having key koala populations with potential for long-term viability. The ARKS extends from Hexham in the south to Nabiac in the north and has an area of 174,864 ha. Proportionally, the ARKS is comprised of 32% high functional habitat, 35% moderate function habitat, 24% low functional habitat and 9% very low functional habitat. The ARKS is noted to have moderate resilience, high fragmentation risk, high wildlife risk, moderate vehicle strike risk, moderate heat stress risk, moderate disease risk, high dog attack risk and moderate climate change risk. In total, there are 418 koala records from within the ARKS.

Koala Habitat (SEPP 2020)

An Assessment of koala habitat under the Koala SEPP 2020 was completed within the BDAR (Kleinfelder 2021) regarding the presence of 'Potential Koala Habitat' and 'Core Koala Habitat' the following conclusions were made:

Potential Koala Habitat

Potential Koala Habitat: means areas of native vegetation where trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. All PCTs within the Development Site are dominated by Koala Feed tree species listed under Schedule 2 of the Koala SEPP. These species constitute over 15% of the total number of trees within each Vegetation Zone. As such, the vegetation within the Development Site constitutes "Potential Koala Habitat" as defined under the SEPP.

Core Koala Habitat

Core Koala Habitat: means 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. Evidence of Koalas were recorded at six locations in four areas within the

Subject Site, an additional 39 Koala records occur within a 5 km of the Subject Site. As such, the vegetation within the Development Site constitutes “Core Koala Habitat” as defined by the SEPP.

Critical Koala Habitat (EPBC Act)

To further assess the habitat value of the Development Site for the Koala, the habitat assessment criteria within the EPBC Act Referral Guidelines for the Vulnerable Koala (DotE 2014) was reviewed. The guideline aims to provide guidance on whether habitat is critical to the survival of the Koala and on how to determine whether an Action is likely to have an adverse impact on critical habitat. The assessment involves scoring various attributes of the site to calculate a total score. A total score of 5 or more using the habitat assessment tool is considered highly likely to constitute critical Koala habitat.

An assessment using the habitat assessment tool resulted in a habitat score of eight (8). This indicates that the Development Site contains habitat that is **critical to the survival of the Koala** (**Table 9**).

Table 9 Koala habitat assessment

Attribute	Score	Discussion
Koala Occurrence	+2	• This species was detected within the Study Area utilising remote cameras in March 2019. • There are 39 NSW BioNet records of the species within 5 km of the Study Area. Of these, 14 are from within the past five years.
Vegetation Composition	+2	All vegetation types within the Study Area were assessed as Koala Habitat, with all having at least two species of Koala feed trees present. PCT 1567 contains *Angophora costata*, *Eucalyptus canaliculata*, *E. microcorys*, *E. resinifera* subsp. *resinifera* and *E. saligna*. PCT 1556 contains *A. costata* and *E. microcorys*. PCT 1590 contains *E. canaliculata* and *E. microcorys*. PCT 1619 contains *A. costata*, *E. microcorys*, *E. resinifera*, and *E. resinifera* subsp. *resinifera*.
Habitat Connectivity	+2	The vegetation within the Study Area is part of a larger patch of vegetation which is over 500 ha. There are expanses of vegetation in all directions from the Site.
Key Existing Threats	+2	Little or no evidence of koala mortality from vehicle strike or dog attack at present.
Recovery Value	+1	Uncertain whether the habitat is important for achieving the interim recovery objectives, as it is not known if the habitat is: • Free of disease or have low incidence of disease, or • Breeding.

Attribute	Score	Discussion
Total Score	**8**	**As such the Study Area is classified as habitat critical to the survival of the species.**

Regional Koala Population

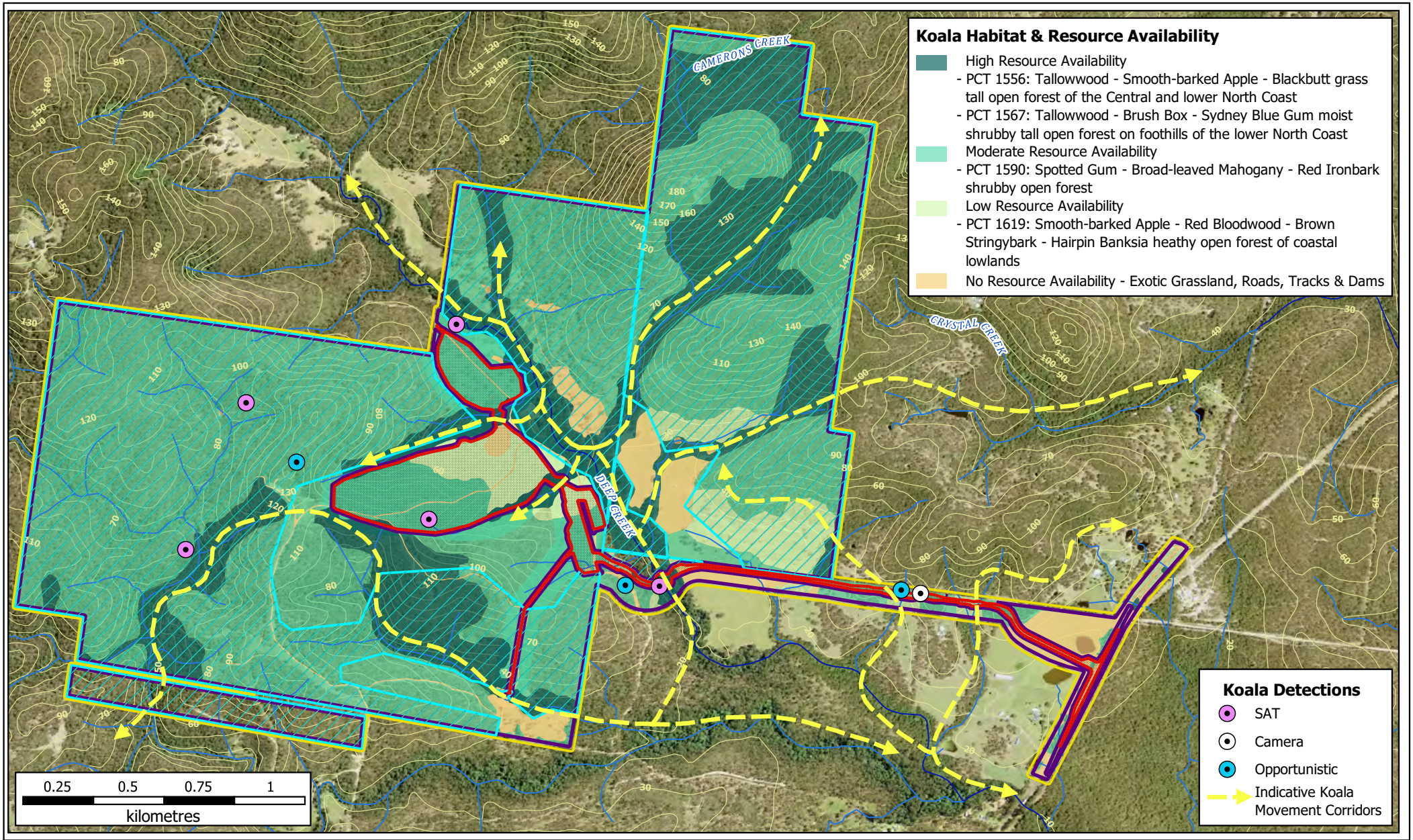
Review of the NSW BioNet Atlas (DPIE 2021) shows that 40 records of Koala exist within 5 kms of the Subject Site, 32 of these records are considered to be recent (<18 years old), eight (8) are historic records (>18 years).

Population Connectivity

A review of the distribution of koala records within the locality and within the Subject Site, and habitat suitability modelling have allowed for the identification of several potential koala movement corridors within the vicinity of the Subject Site. These corridors are primarily within intact vegetation alongside watercourses (see **Figure 5**). Three (3) potential koala corridors intersect the Subject Site at creek locations associated with koala records.

Koala Habitat Use

Through consideration of the above it was determined that the Study Area represents suitable habitat for the koala. Vegetation adjacent to creeks and Tallowwood forests within the broader Study Area were considered to be the most suitable habitat for the species owing to the high concentration of Koala Feed Trees (KFTs) and alluvial soils (conducive to higher nutrient feed), the distribution of this higher suitability koala habitat is illustrated in **Figure 5**. Surveys for the koala were conducted in accordance with best practice and in accordance with the BAM (see **Section 4.2.2.1**). Records (discussed in **Section 4.3**) allow us to determine that this habitat is currently occupied by a population of koalas. Further assessment by Biolink (see discussion in **Section 4.3**) confirmed that higher activity levels were recorded to the south of the proposed quarry pit area and that vegetation within the Development Site is representative of '*transient'* habitat for the koala.



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Legend

- Subject Site
- Proposed Stewardship Site
- Development Site Boundary
- Retained Vegetation
- Major watercourse
- Minor watercourse
- Contours (10m)

Koala Habitat and Resource Availability

Figure: **5**

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New Holland Mouse (*Pseudomys novaehollandiae*) Habitat

The New Holland Mouse (*Pseudomys novaehollandiae*) was recorded within the Study Area (see **Section 5.2.1** for discussion on detections and impacts to species habitat). The following provides a summary of New Holland Mouse habitat suitability within the Development Site and broader Project Application Area.

Key habitat and behavioural factors characteristic of the species include the following:

- **The species is an opportunistic omnivore -** this is supported by Norton (1987), which found that the species had a general diet. The species was found to consume considerable amounts of dicotyledon leaf (27%), fungi (19%), invertebrate (17%) and seed (14%). Also found to consume small amounts of flowers, pollen and root material.
- **Diet varied seasonally -** The diet of the New Holland Mouse was found to differ seasonally, with occurrence of fungi the highest in winter (26%), very low in other seasons (3-4%), dicot leaf material was highest in summer (45%), while it declined in autumn ((2%) and again in winter (14%) (Wilson and Bradtke 1999):
    - Summer = dicot leaf material (41%), and seed (16%)
    - Autumn = dicot leaf material (22%), invertebrate (21%), and seed (18%), followed by stem (14%) and root (11%).
    - Winter = fungi (26%), invertebrate (19%) and dicot leaf

  Cockburn (1980) and Thomson (1980) found the species was predominantly granivorous (diet of predominantly seeds [45-97% and 76% respectively]). Although both Cockburn (1980) and Thomson (1980) found that seed consumption declined by 20% in winter (with increased amount of fungi, plant material, and insects). Wilson and Bradtke (1999) found that variation in diet based on seasonality was likely the result of seasonal changes in resource availability with for example fungi varying throughout the year, with peaks during the wettest times of years, and low abundance during the driest times (autumn, winter and early spring).
- **Burrowing habitat requires complex groundcover structure –** the species is known to construct burrows 30 – 60 mm in diameter (Wilson et al 2005). Burrows were located in open areas while others were well hidden under fallen material, or particularly hidden under leaf litter, with the presence of New Holland Mouse being directly related to vegetation structure rather than floristic groups. In particular **vegetation density at 20-30cm and 60-70cm**, and total vegetation cover (Wilson et al 2005). Wilson et al (2005) also suggests that fallen and dead vegetation and logs provide shelter from predators and important sites for burrows. Lazenby et al. (2008) found that one radio-tracked individual was nesting under low *Xanthorhoea spp.* plants.
- **Species range is up to 400m from burrow sites –** Wilson et al. (2008) found that distances between burrows and capture sites were between 1m and 400m.
- **The species is known to maintain burrows in sub-optimal habitat and forage into nearby preferred foraging habitat –** Lazenby et al. (2008) found that radio tracking showed that two individuals continued to use a burrow after a fire, yet they foraged in areas adjacent to the patch burn. This suggests that they may maintain a burrow in sub-optimal habitat and commute to nearby preferred foraging areas.

Based on the results of the literature review above a habitat assessment was completed at eight (8) New Holland Mouse trapping sites (six [6] presence and two [2] absence sites) (see **Section 4.2.2.2**

and **Section 5.2.1** for discussion of targeted species surveys and impact assessment). The results of the habitat assessment confirmed the following key factors characterising positive capture sites, and therefore suitable habitat within the Study Area:

- Open forest with an open midstorey.
- Shrub layer is variable across sites, with patchiness considered important
- Diverse grassy groundlayer
- Soft soil (loam, sandy loams) – not clay/clay loams (especially if waterlogged)
- Shelter including tussocks (structural including Poaceae species, *Lomandra* spp., and *Xanthorhoea* spp.), rocks, logs for burrowing underneath

The results of this habitat assessment were used to inform the locations for further targeted surveys completed by BioLink (see **Section 4.2.2.1** for discussion of additional survey methods, and **Section 4.2.2.2**.



Plate 14: Suitable habitat for New Holland Mouse at a positive trapping location

Glossy Black-Cockatoo Habitat

A foraging habitat assessment for the Glossy Black-Cockatoo (*Calyptorhynchus lathami*) was completed following a request by Mid Coast Council "*The extent of the foraging habitat and range of the glossy black-cockatoo population of the Study Area. There has not been a comprehensive analysis of the presence of foraging habitat and an analysis of feeding trees and their locations*"" (Mid Coast Council 2022). Targeted surveys required to assess potential breeding habitat were completed in accordance with the BAM and detailed in **Section 4.2.2.1**.

The foraging habitat assessment completed within the Subject Site followed the methods used by Robinson and Paull (2009). The method uses the abundance of chewed *Allocasuarina* spp cone fragments (i.e. 'foraging sign') and *Allocasuarina* stem-density as an index of foraging habitat utility.

Availability of potential feed trees

The availability of potential feed trees (Stem density) was estimated for each vegetation zone within the Development Site and broader Subject Site using data collected within 18 20 m x 20 m BAM vegetation integrity plots undertaken to inform the BDAR. Cover and abundance scores for *Allocasuarina torulosa* were used to estimate density of potential feed trees within the vegetation zone. Note that these cover and abundance scores do not exclude non-cone bearing trees, as such should only be used as a comparative guide of potential feed tree availability within each zone.

Vegetation Zones 1, 5 and 8 contained the highest densities of *Allocasuarina* trees within the Subject Site (see **Table 10**). As such, comparable remnant areas of PCT 1590, PCT 1619 and PCT 1567 within the broader Subject Site were mapped as containing a moderate density of potential feed trees (see **Figure 6**).

Distribution of Feed Trees

Abundance of 'foraging signs' was used an index of foraging tree use across the Development Site. Glossy Black-Cockatoos forage almost exclusively on the woody cones of *Allocasuarina* spp. and are known to favour particular foraging trees, to which they will often return (Crowley and Garnett 2001; Daly 2001). Selection of particular feed trees is thought to be based on visual cues such as cone yield on the tree and the ratio of seed mass to total cone mass (including seed), known as the 'Clout's Index' (Clout 1989; Pepper et al. 2000). By feeding on trees with a high 'Clout's Index', the cockatoo ensures maximum food returns for effort required to tear open the woody cones. Robinson and Paull (2009) found that the selection of trees often relies on the testing of a number of cones (average 1.8 cones) to determine if the tree is worth the effort. If the tree is found to not be suitable, testing will stop and the cockatoo will move onto another tree. As trees are relatively consistent in seed output, once a suitable feed tree is found cockatoos will often revisit the tree over multiple seasons. Robinson and Paull (2009) used three (3) levels to categorise feed tree preference based on the number of *Allocasuarina* cone fragments found on the ground surrounding cone-bearing trees, these include:

- **Tested but Rejected** – these trees show signs that they were investigated by a cockatoo, however there is not enough feeding evidence to suggest that the tree is a preferred feed tree. These trees will only have the fragments of 'tested' cones, based on the assumption that a cockatoo will consume approximately 1.8 cones to test a tree, a Tested but Rejected tree will have <21 cone fragments.

- **Accepted (Feed Tree)** – these trees show evidence of foraging beyond 'testing'. An Accepted tree is considered a 'Feed Tree' and will have between 21-100 cone fragments.
- **Preferred (Feed Tree) –** these trees are preferred by the local Glossy Black-Cockatoo population. A Preferred Feed Tree will have over 100 cone fragments.

To estimate the location of Feed Trees within the Development Site a total of six (6) Feed Tree Assessments (FTA) were conducted. Each FTA involved inspecting 20 cone-bearing *Allocasuarina* trees from a central point (recorded), with each tree inspected for cone fragments for one (1) person minute. Following the inspection, each tree was assigned to one of the tree abovementioned preference categories. The proportion of cone-bearing trees being Feed Trees (Accepted and Preferred Trees) was used to estimate foraging habitat use.

A total of 120 cone-bearing trees were inspected across six (6) FTAs, of which 110 trees were recorded as Tested but Rejected, six (6) were Accepted, and four (4) were Preferred Glossy Black-Cockatoo Feed Trees. FTAs 2, 3, and 4 recorded 15%, 20%, and 15% occurrence of Feed Trees respectively. The remaining FTA sites recorded none. The location of each FTA site is illustrated on **Figure 6**. The occurrence of higher proportions of Feed Trees at 2, 3, and 4 indicate a preference for sheltered sites (gullies, southern slopes and tall forests on alluvial soils). Cameron (2007) found that higher evaporation rates reduce moisture available to *Allocasuarina* spp. trees and resulted in a diminished cone crop. Based on this, it seems likely that sheltered areas within the Subject Site, within the moderate-high resource availability PCTs (PCT 1590, PCT 1619 and PCT 1567) likely represent the highest quality Glossy Black-Cockatoo foraging habitat within the Subject Site.

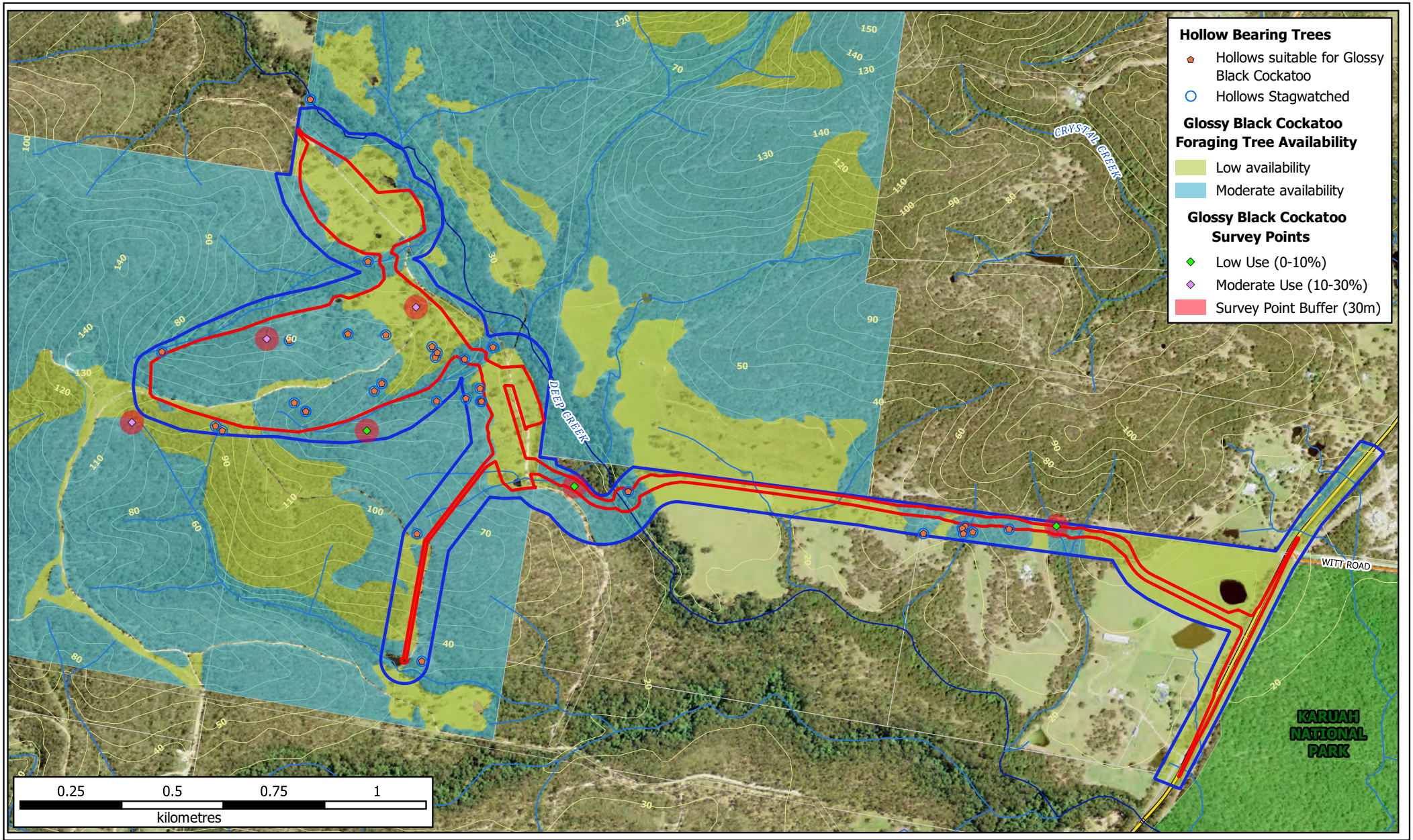
Table 10: Glossy Black-Cockatoo *Allocasuarina* spp. tree availability within the Subject Site.

Plant Community Type (PCT)	Veg Zone	Glossy Black-Cockatoo Foraging Resource Availability			Resource Availability	Area within Development Site
		Cover	Abundance	Density (stem/ha)		
PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Zone 1	7.3%	14.3	**357.5 / ha**	**Moderate**	10.59 ha
	Zone 2	0.1%	2.0	50 / ha	Low	6.48 ha
	Zone 3	0%	0	0 / ha	Low	0.62 ha
	Zone 4	0%	0	0 / ha	Low	0.72 ha
PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Zone 5	8.5%	7.0	**175 / ha**	**Moderate**	3.87 ha
	Zone 6	0%	0	0 / ha	Low	1.79 ha
	Zone 7	0.1%	1.0	25 / ha	Low	3.07 ha
PCT 1567: Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast	Zone 8	2.5%	4.0	**100 / ha**	**Moderate**	1.83 ha

Plant Community Type (PCT)	Veg Zone	Glossy Black-Cockatoo Foraging Resource Availability			Resource Availability	Area within Development Site
		Cover	Abundance	Density (stem/ha)		
PCT 1556: Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast.	Zone 9	0.5%	2.0	50 / ha	Low	0.17 ha



Plate 15: High 'foraging sign' occurrence at FTA 4 – Preferred Feed Tree



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Legend

- Development Site Boundary
- Study Area
- Cadastre
- National Park
- Major watercourse
- Minor watercourse
- Arterial Road
- Local Road
- Contours (10m)
- Suitable Hollows
- Hollows Stagwatched

Glossy Black Cockatoo Foraging Habitat & Suitable Hollows

Figure: **6**

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Threatened Forest Owls

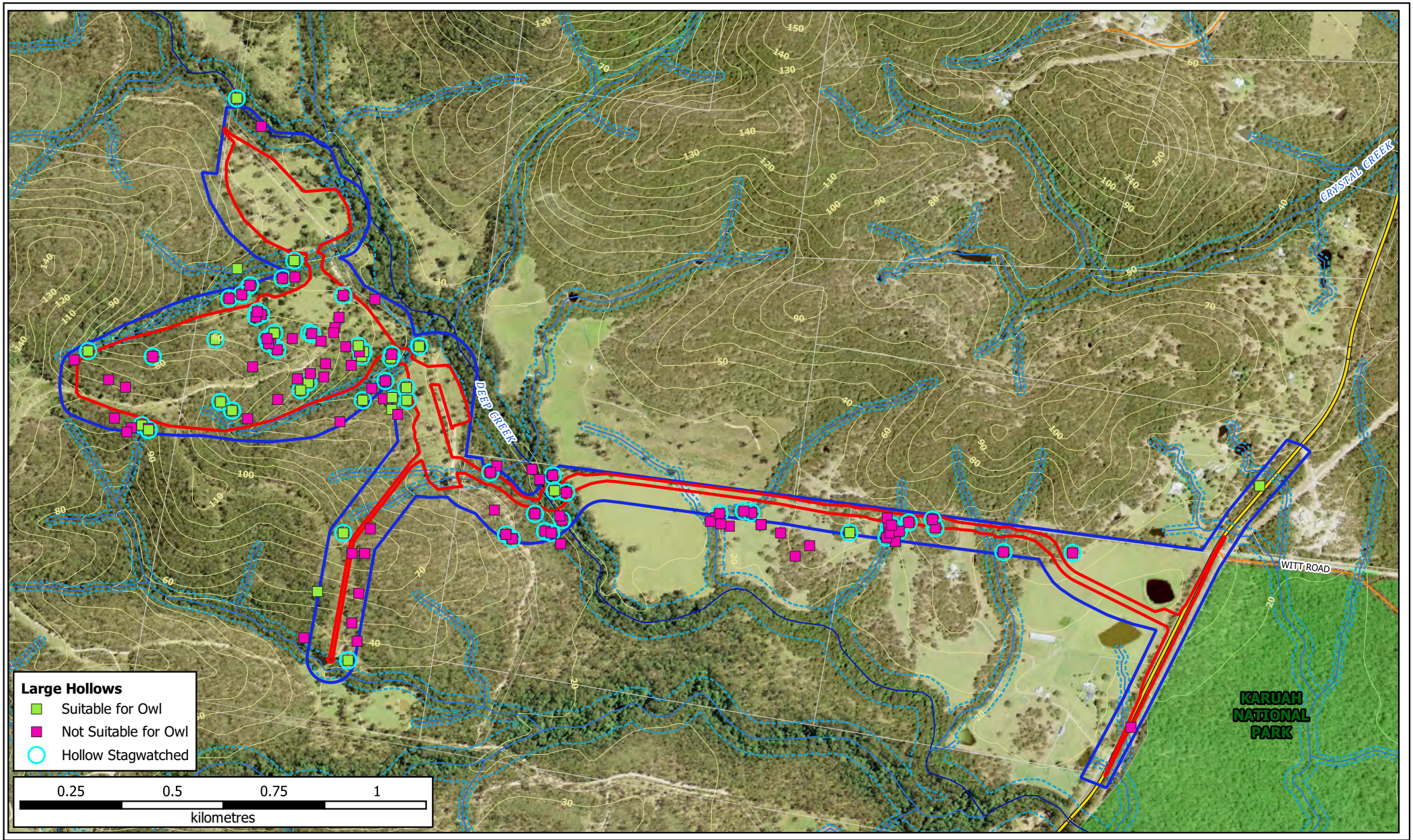
Large forest owls including Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*) were recorded during targeted surveys within the Development Site (see **Section 4.2.2**). As such, the Development Site likely represents foraging habitat for the species. The following is a consideration of the presence and condition of breeding habitat within the Study Area. Potential breeding habitat availability within the Study Area for each species is described below in **Table 11**.

A total of 32 potentially suitable hollowing-bearing trees were recorded within the Study Area.

Targeted surveys for each species was completed in accordance with relevant guidelines and detailed in **Section 4.2.2** and **Appendix 5**.

Table 11: Suitable Breeding Habitat / Habitat Constraints – Threatened Forest Owls.

Species	Habitat Constraints (TBDC)	Lake Macquarie Interim Large Forest Owl Planning and Management Guidelines (LMCC 2014)	Number of HBTs total	Number of Potentially Suitable HBTs	Number of Potentially Suitable Hollows Stagwatched
Barking Owl *Ninox connivens*	Living or dead trees with hollows >20cm diameter	– Nesting and roosting tends to occur near watercourses or wetlands in dense foliage including rainforests, Casuarina, Allocasuarina, Angophora, Melaleuca and Eucalypt species particularly red gum species. They typically breed in hollows of large eucalypts or paperbarks.	128	32	32
Powerful Owl *Ninox strenua*	Living or dead trees with hollows >20cm diameter	Hollows have been approximately 15–20 metres high in the tree, of approx. 30–50cm internal diametre and approx. 1–5+ metres deep. Nest trees have also tended to be within 100 metres of creeklines.		32	32
Sooty Owl *Tyto tenebricosa*	Caves or cliff lines / ledges Living or dead trees with hollows >20cm diameter	Hollows have been approx. 12 metres high in the tree, of approx. 35–50cm internal diametre and approx. 1–3+ metres deep in a main branch close to the trunk.		32	32
Masked Owl *Tyto novaehollandiae*	Living or dead trees with hollows >20cm diameter	Hollows have been approx. 12–20 metres high in the tree, of approx. 35–50cm internal diametre and approx. 1–5+ metres deep		32	32



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Legend

- Development Site Boundary
- Study Area
- Cadastre
- National Park
- ArterialRoad
- LocalRoad
- Contours (10m)
- Major watercourse
- Minor watercourse
- Riparian Buffer

Threatened Forest Owl Habitat

Figure: **7**

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Threatened Migratory and Nomadic Birds

Swift Parrot Habitat

The Swift Parrot breeds in Tasmania during summer, migrating north to South-eastern mainland Australia for winter. Breeding habitat for the species is largely restricted to Blue Gum (*Eucalyptus globulus*) and Black Gum (*Eucalyptus ovata*) (Webb *et al.* 2014) forests along the east and southeast coasts of Tasmania, with scarce and fragmented breeding habitat also likely to occur within the state's northwest.

The Swift Parrot is nomadic on the mainland, occurring within south-eastern Australia during winter, and depending on a network of different foraging locations, of which they exploit at different times depending on environmental conditions. The Swift Parrot is known to forage on nectar and lerps in eucalypt forests and woodlands throughout coastal and western slopes regions. Coastal environments are considered to support larger numbers of birds, especially when inland habitats are subject to drought (Saunders and Tzaros 2011). Important foraging habitat in coastal New South Wales (NSW) is characterised by the presence of key nectar feed tree species, including Swamp Mahogany (*Eucalyptus robusta*), Forest Red Gum (*Eucalyptus tereticornis*), Blackbutt (*Eucalyptus pilularis*), and Spotted Gum (*Corymbia maculata*). Saunders and Heinsohn (2008) found that each of the abovementioned tree species were also relied on for lerps, with the addition of three (3) key lerp (only) feed trees (for coastal NSW) including Red Bloodwood (*Corymbia gummifera*), Coastal Grey Box (*Eucalyptus moluccana*), and Rough-barked Apple (*Angophora subvelutina*). Within these habitats, Swift Parrots have been found to preferentially forage in large, mature trees (Kennedy 2000; Kennedy and Overs 2001; Kennedy and Tzaros 2005) that provide more reliable foraging resources than younger trees (Wilson and Bennett 1999; Law *et al.* 2000). The species has been known to occur within a wider range of habitats than those mentioned above (including planted vegetation), however these are largely opportunistic or as supplementary foraging habitat, rather than providing a reliable quantity and quality resource for which the species can depend on (Saunders and Tzaros 2011).

Key foraging trees within the region include those that the species depends on nectar (see 'key nectar feed trees) and lerps (see 'key lerp feed trees') in **Table 12**.

Table 12: Recognised Swift Parrot Feed Trees – Coastal NSW (Nectar and Lerp feed trees)

Common Name	Scientific Name	Resource*
Swamp Mahogany	*Eucalyptus robusta*	Nectar and Lerps
Forest Red Gum	*Eucalyptus tereticornis*	Nectar and Lerps
Blackbutt	*Eucalyptus pilularis*	Nectar and Lerps
Spotted Gum	*Corymbia maculata*	Nectar and Lerps
Red Ironbark	*Eucalyptus fibrosa*	Nectar and Lerps**
Caley's ironbark	*Eucalyptus caleyi*	Nectar and Lerps**
Red Bloodwood	*Corymbia gummifera*	Lerps
Coastal Grey Box	*Eucalyptus moluccana*	Lerps
Rough-barked Apple	*Angophora subvelutina*	Lerps
Grey Gum	*Eucalyptus punctata*	Lerps**

*As per Saunders and Heinsohn 2008. ** Ross Crates per comms.

A total of two (2) known Swift Parrot feed trees occur within the Study Area, *Corymbia maculata* (Spotted Gum), and *Corymbia gummifera* (Red Bloodwood). These species are largely absent from the Study Area, or occur at low to very densities, i.e. within Vegetation Zone 1, 2, 6, 6, 7, and 9 (see **Table 13**). As such, the vegetation on site is not considered highly suitable foraging habitat for the Swift Parrot.

The Study Area is not mapped as Important Habitat for the Swift Parrot.

Table 13: Swift Parrot Feed Trees availability within the Subject Site.

Plant Community Type (PCT)	Veg Zone	Swift Parrot Foraging Resource Availability			Feed Species Present	Area within Development Site (ha)
		Cover	Abundance	Density (stem/ha)		
PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Zone 1	8.3% (n=3)	8.3 (n=3)	207.5 / ha	*Corymbia maculata*	10.59
	Zone 2	1.7% (n=3)	8.3 (n=3)	207.5 / ha	*Corymbia maculata*	6.48
	Zone 3	0%	0	0 / ha	None	0.62
	Zone 4	0%	0	0 / ha	None	0.72
PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Zone 5	10% (n=2)	6.0 (n=2)	150 / ha	*Corymbia gummifera*	3.87
	Zone 6	0.05% (n=2)	0.5 (n=2)	12.5 / ha	*Corymbia gummifera*	1.79
	Zone 7	21% (n=2)	15 (n=2)	375 / ha	*Corymbia gummifera*	3.07
PCT 1567: Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast	Zone 8	0%	0	0 / ha	None	1.83
PCT 1556: Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast.	Zone 9	1%	1	25 / ha	*Corymbia maculata*	0.17

Regent Honeyeater Habitat

The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalypt species include Mugga Ironbark, *Eucalyptus melliodora* (Yellow Box), *Eucalyptus albens* (White Box) and *Eucalyptus robusta* (Swamp Mahogany). Other tree species may be regionally important. For example the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events. Flowering of associated species such as *Eucalyptus eugenioides* (Thin-leaved Stringybark) and other Stringybark species, and *Eucalyptus fibrosa* (Broad-leaved Ironbark) can also contribute important nectar flows at times. Nectar and fruit from the mistletoes *Amyema miquelii*, *A. pendula* and *A. cambagei* are also utilised. When nectar is scarce lerp and honeydew can comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings.

The vegetation within the Study Area is not mapped as Important Habitat for the Regent Honeyeater, the vegetation also contains a low density of preferred feed trees. As such, the vegetation within the Study Area is not considered to represent suitable foraging habitat for the species.

A full list of Regent Honeyeater feed trees is provided in **Table 15**.

Table 14: Regent Honeyeater Feed Trees

Common Name	Scientific Name	Common Name	Scientific Name
Wallum Banksia	*Banksia aemula*	Grey Ironbark	*Eucalyptus placita*
Heath-leaved Banksia	*Banksia ericifolia*	Bastard Tallowwood	*Eucalyptus planchoniana*
Coast Banksia	*Banksia integrifolia*	Swamp Mahogany	*Eucalyptus robusta*
Old-man Banksia	*Banksia serrata*	Rudder's Box	*Eucalyptus rudderi*
Hairpin Banksia	*Banksia spinulosa*	Steel Box	*Eucalyptus rummeryi*
Pink Bloodwood	*Corymbia intermedia*	Grey Ironbark	*Eucalyptus siderophloia*
Red Bloodwood	*Corymbia gummifera*	Black Sally	*Eucalyptus stellulata*
Red Ironbark	*Eucalyptus fibrosa*	Forest Red Gum	*Eucalyptus tereticornis*
Yellow Box	*Eucalyptus melliodora*	Broad-leaved White Mahogany	*Eucalyptus umbra*
Grey Box	*Eucalyptus moluccana*	Broad-leaved Paperbark	*Melaleuca quinquenervia*
Grey Ironbark	*Eucalyptus paniculata*		

Table 15: Regent Honeyeater Feed Trees availability within the Subject Site.

Plant Community Type (PCT)	Veg Zone	Glossy Black-Cockatoo Foraging Resource Availability			Feed Species Present	Area within Development Site (ha)
		Cover	Abundance	Density (stem/ha)		
PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Zone 1	13.3% (n=3)	4.3 (n=3)	107.5 / ha	*Eucalyptus siderophloia*	10.59
	Zone 2	0.57% (n=3)	1.7 (n=3)	42.5/ ha	None	6.48
	Zone 3	0%	0	0 / ha	None	0.62
	Zone 4	0%	0	0 / ha	None	0.72
PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Zone 5	16.2% (n=2)	10 (n=2)	250 / ha	*Eucalyptus eugenioides, Eucalyptus umbra,* and *Corymbia gummifera*	3.87
	Zone 6	0.05% (n=2)	0.5 (n=2)	12.5 / ha	*Corymbia gummifera*	1.79
	Zone 7	21.25% (n=2)	17 (n=2)	375 / ha	*Corymbia gummifera,* and *Banksia spinulosa var. collina*	3.07
PCT 1567: Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast	Zone 8	10% (n=2)	1 (n=2)	25 / ha	Eucalyptus siderophloia	1.83
PCT 1556: Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast.	Zone 9	0%	0	0 / ha	None	0.17

4.1.2 Ecosystem Credit Species

The following assessment of habitat suitability for ecosystem credit species was conducted in accordance with Section 5.2 of the BAM (DPIE 2020).

Step 1: Identify threatened species for assessment

Step 2: Assessment of the habitat constraints and vagrant species on the subject land

A list of predicted ecosystem credit species for the Development Site was reviewed and assessed according to species specific habitat requirements. The predicted species report is provided in Appendix 4.

4.1.3 Species Credit Species

The following assessment of habitat suitability for species credit species was conducted in accordance with Section 5.2 of the BAM (DPIE 2020).

Step 1: Identify threatened species for assessment

A list of predicted Species Credit Species for the Development Site was reviewed in the BAM calculator and is provided in Appendix 4.

Step 2: Assessment of the habitat constraints and vagrant species on the subject land

The potential for identified Species Credit species to occur within the Disturbance Footprint was assessed according to species specific habitat requirements. The following species were excluded from further assessment based on Habitat Constraints or Geographic Limitations in accordance with the BAM:

- Regent Honeyeater (*Anthochaera phrygia*) (Breeding) – **Habitat Constraints** – Study Area is not within areas of mapped important habitat (DPIE, 2021).
- Large-eared Pied Bat (*Chalinolobus dwyeri*) – **Habitat Constraints** – Study Area is not within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels.
- *Diuris praecox* (Rough Doubletail) –**Geographic Limitations** - The Study Area does not occur "within the Parish boundaries of Forster, Eurunderee, Fens, Tomaree, Stowell and Stockton"
- Large-eared Pied Bat (*Chalinolobus dwyeri*) – **Habitat Constraints** – Study Area is not within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels.
- Pale-headed Snake (*Hoplocephalus bitorquatus*) – **Vagrancy -** The Study Area occurs within the Karuah Manning Subregion where this species has not been previously recorded. The species is therefore considered to be vagrant.
- Swift Parrot (*Lathamus discolor*) (Breeding) – **Habitat Constraints** – Study Area is not within areas of mapped important habitat (DPIE, 2021).
- Little Bentwing-bat (*Miniopterus australis*) (Breeding) – **Habitat Constraints** – Study Area does not contain caves, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet.
- Large Bentwing-bat (*Miniopterus orianae oceanensis*) (Breeding) – **Habitat Constraints** – Study Area does not contain caves, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet.

- Brush-tailed Rock-wallaby (*Petrogale penicillata*) – **Geographic Limitations –** Study Area is not within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines.
- Eastern Cave Bat (*Vespadelus troughtoni*) – **Habitat Constraints** – Study Area does not contain caves or is within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds.

A discussion of potential habitat within the Study Area and the potential for impacts to these species is discussed in Section 7.1.

Step 3: Further assessment of candidate species credit species

A number of Species Credit species were excluded as candidate species due to their geographic or habitat constraints not being met by the Study Area, and no further assessment of these species was required. A full list of Candidate Threatened Species Credit Species for further assessment, and justification for exclusion is provided in **Table 16** below.

Table 16: Species Credit species and justification for inclusion as candidate species.

Scientific name	Common name	Confirmed Candidate Species	Sensitivity to Gain	Justification
Flora				
Allocasuarina defungens	Dwarf Heath Casuarina	**No**	High	**Geographic Limitation:** Not "North of Bulahdelah"
Angophora inopina	Charmhaven Apple	Yes	High	-
Asperula asthenes	Trailing Woodruff	Yes	High	-
Callistemon linearifolius	Netted Bottle Brush	Yes	Moderate	-
Cryptostylis hunteriana	Leafless Tongue Orchid	Yes	Moderate	-
Cynanchum elegans	White-flowered Wax Plant	Yes	High	-
Diuris flavescens	Pale Yellow Doubletail	Yes	Moderate	-
Diuris praecox	Rough Doubletail	**No**	Moderate	**Geographic Limitation:** Not "*within the Parish boundaries of Forster, Eurunderee, Fens, Tomaree, Stowell and Stockton*"
Eucalyptus glaucina	Slaty Red Gum	Yes	High	-
Grevillea guthrieana	Guthrie's Grevillea	Yes	High	-
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Yes	High	-
Melaleuca biconvexa	Biconvex Paperbark	Yes	High	-

Scientific name	Common name	Confirmed Candidate Species	Sensitivity to Gain	Justification
Melaleuca groveana	Grove's Paperbark	Yes	High	-
Pomaderris queenslandica	Scant Pomaderris	Yes	High	-
Pterostylis chaetophora		Yes	Moderate	-
Rhizanthella slateri	Rhizanthella slateri (Rupp) M.A. Clem. & Cribb in the Great Lakes local government area	Yes	High	-
Rhodamnia rubescens	Scrub Turpentine	Yes	Very High	-
Rhodomyrtus psidioides	Native Guava	Yes	Very High	-
Senna acclinis	Rainforest Cassia	Yes	High	-
Solanum sulphureum	Manning Yellow Solanum	Yes	Moderate	-
Tetratheca juncea	Black-eyed Susan	Yes	High	-
Thesium australe	Austral Toadflax	Yes	Moderate	-
Mammals				
Aepyprymnus rufescens	Rufous Bettong	**No**	High	**Geographic Limitation:** Not "*North of Gloucester*"
Cercartetus nanus	Eastern Pygmy-possum	Yes	High	-
Chalinolobus dwyeri	Large-eared Pied Bat	**No**	Very High	**Habitat Constraints:** No "*Caves*" OR "*Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels*"
Macropus parma	Parma Wallaby	Yes	High	-
Miniopterus australis	Little Bent-winged Bat	**No**	Very High	**Habitat Constraints:** No "*Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'*"

Scientific name	Common name	Confirmed Candidate Species	Sensitivity to Gain	Justification
Miniopterus orianae oceanensis	Large Bent-winged Bat	**No**	Very High	**Habitat Constraints:** No "*Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'*"
Myotis macropus	Southern Myotis	Yes	High	-
Petauroides volans	Greater Glider	Yes	High	-
Petaurus norfolcensis	Squirrel Glider	Yes	High	-
Petrogale penicillata	Brush-tailed Rock-wallaby	**No**	Very High	**Habitat Constraints:** Not "*Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines*"
Phascogale tapoatafa	Brush-tailed Phascogale	Yes	High	-
Phascolarctos cinereus	*Koala*	Yes	High	-
Planigale maculata	Common Planigale	Yes	High	-
Potorous tridactylus	Long-nosed Potoroo	Yes	High	-
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	Yes	High	-
Vespadelus troughtoni	Eastern Cave Bat	**No**	Very High	**Habitat Constraints:** Not "Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds.""
Birds				
Anthochaera phrygia	Regent Honeyeater (Breeding)	**No**	High	**Habitat Constraints:** Not within Important Habitat Mapping Area
Burhinus grallarius	Bush Stone-curlew	Yes	High	-
Callocephalon fimbriatum	Gang-gang Cockatoo (Breeding)	Yes	High	-

Scientific name	Common name	Confirmed Candidate Species	Sensitivity to Gain	Justification
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	Yes	High	-
Dromaius novaehollandiae	Emu (Endangered Population)	Yes	High	-
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	Yes	High	-
Hieraaetus morphnoides	Little Eagle (Breeding)	Yes	Moderate	-
Lathamus discolor	Swift Parrot (Breeding)	**No**	Moderate	**Habitat Constraints:** Not within Important Habitat Mapping Area
Lophoictinia isura	Square-tailed Kite (Breeding)	Yes	High	-
Ninox connivens	Barking Owl (Breeding)	Yes	High	-
Ninox strenua	Powerful Owl (Breeding)	Yes	High	-
Pandion cristatus	Eastern Osprey	Yes	Moderate	-
Turnix maculosus	Red-backed Button-quail	Yes	High	-
Tyto tenebricosa	Sooty Owl (Breeding)	Yes	High	-
Tyto novaehollandiae	Masked Owl (Breeding)	Yes	Very High	-
Amphibians				
Crinia tinnula	Wallum Froglet	Yes	Moderate	-
Litoria aurea	Green and Golden Bell Frog	Yes	High	-
Litoria brevipalmata	Green-thighed Frog	Yes	Moderate	-
Mixophyes balbus	Stuttering Frog	Yes	Very High	-
Mixophyes iteratus	Giant Barred Frog	Yes	Moderate	-
Uperoleia mahonyi	Mahony's Toadlet	Yes	High	-

4.2 THREATENED SPECIES SURVEYS

Step 4: Determine the presence of a candidate species credit species

4.2.1 Candidate Threatened Flora

4.2.1.1 Survey Methodology

The candidate threatened flora species were surveyed in accordance with the *Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method* (DPIE 2020h). All surveys were conducted using systematic parallel transects. Parallel field traverses were separated by 5 to 10 m for orchids, herbs and forbs, 10 to 15 m for sub-shrubs, and 10 to 20 m for species in all other life forms (shrubs and trees). Justification for transect separation distances utilized within the Subject Site for each species is provided in **Table 17**.

Survey Timing

The following candidate threatened flora species (**Table 17**) were surveyed across the Study Area by suitably qualified ecologists. Known reference populations were inspected prior to surveys being undertaken (see **Table 18**). Survey tracks for each round of targeted surveys are shown **on Figure 8**, **Figure 9**, **Figure 10** and **Figure 11**.

Table 17: Survey of requirements and timing conducted for candidate flora species

Scientific name	Survey Requirements		Surveys within the Study Area	
	Method/Conditions	Timing	Effort	Timing
Allocasuarina defungens Dwarf Heath Casuarina	Not Applicable	All Year	10 metre wide parallel transects within suitable habitat.	14-18 October 2019 5-7 November 2019 26-29 November & 3-4 December 2019
Angophora inopina Charmhaven Apple	Not Applicable	All Year	10 metre wide parallel transects within suitable habitat.	14-18 October 2019 5-7 November 2019 26-29 November & 3-4 December 2019
Asperula asthenes Trailing Woodruff	*Use fruiting material to identify, as easily confused with Galium genera. Frost sensitive and may disappear above ground until both soil moisture (after about 25mm of rain) and warmer weather return.*	October-December	5 metre wide parallel transects within intact vegetation, 10 metre wide parallel transects within areas with sparse canopy, shrub and groundcover (high visibility).	14-18 October 2019 5-7 November 2019 26-29 November & 3-4 December 2019

Scientific name	Survey Requirements		Surveys within the Study Area	
	Method/Conditions	Timing	Effort	Timing
Callistemon linearifolius Netted Bottle Brush	*Use flowers to identify. Survey Oct - Jan. If not observed in flower, return to site for re-survey later in the survey period. Check nearest possible reference site (within 20km) at similar altitude.*	October to January	10 metre wide parallel transects	14-18 October 2019 5-7 November 2019 26-29 November & 3-4 December 2019
Cryptostylis hunteriana Leafless Tongue Orchid	*Unlikely to flower after a low winter rainfall. Survey northern populations Nov - Dec. Survey southern populations Dec - Jan. Species will not flower under dense vegetation.*	November to January	5 metre wide parallel transects within intact vegetation, 10 metre wide parallel transects within areas with sparse canopy, shrub and groundcover (high visibility).	5-7 November 2019
Cynanchum elegans White-flowered Wax Plant	Not Applicable	All year	5 metre wide parallel transects within suitable habitat	5-7 November 2019 26-29 November 3-4 December 2019
Diuris flavescens Pale Yellow Doubletail	*Survey mid-Sep to early Oct.*	September to October.	5 metre wide parallel transects within intact vegetation, 10 metre wide parallel transects within areas with sparse canopy, shrub and groundcover (high visibility).	14-18 October 2019

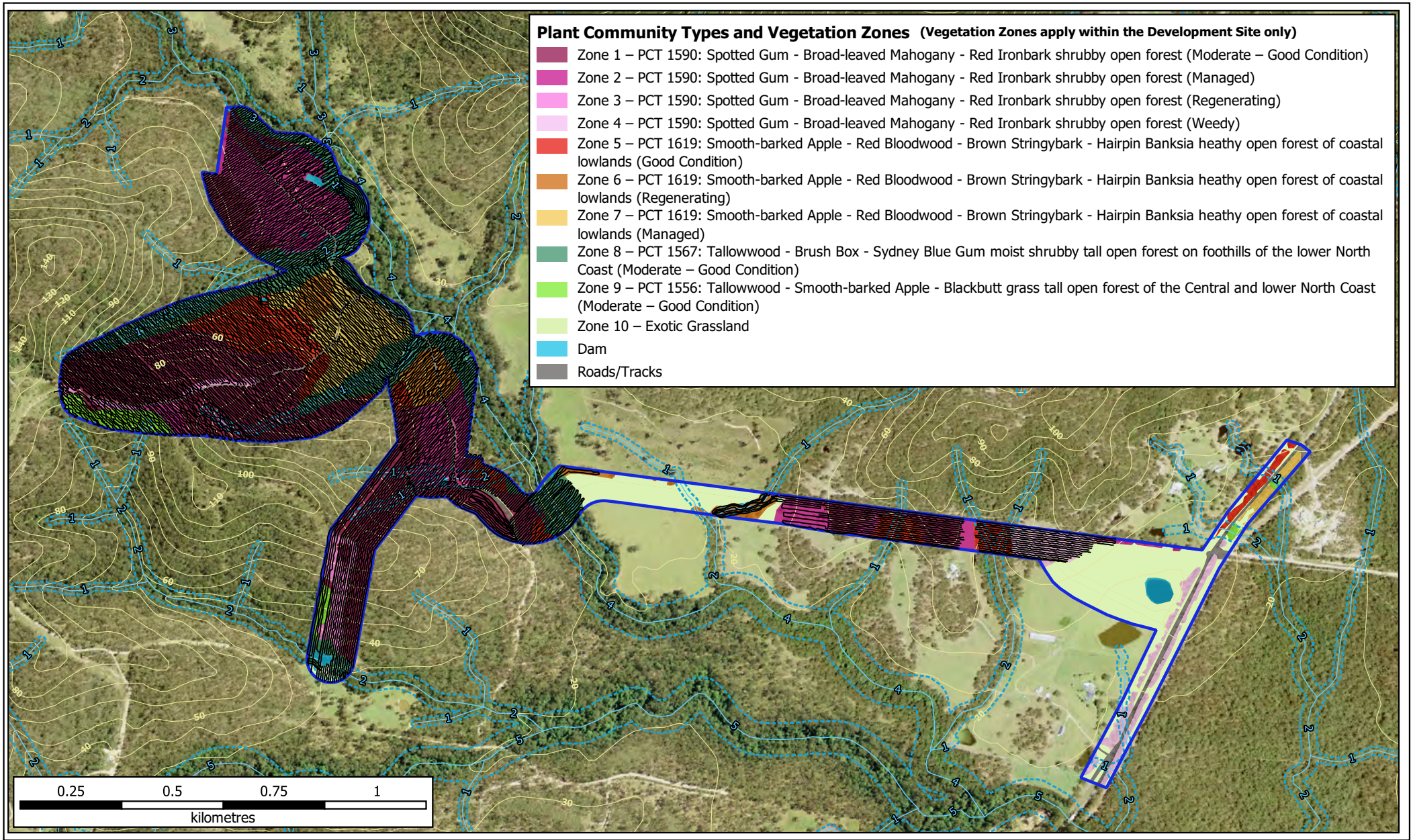
Scientific name	Survey Requirements		Surveys within the Study Area	
	Method/Conditions	Timing	Effort	Timing
Eucalyptus glaucina Slaty Red Gum	*Use buds and/or juvenile growth to detect and identify.*	All Year	10 metre wide parallel transects within suitable habitat.	15, 16, 21, 28, 29 August 2019 5-7 November 2019 26-29 November 3-4 December 2019
Grevillea guthrieana Guthrie's Grevillea	Not Applicable	All Year	5 metre wide parallel transects within suitable habitat.	15, 16, 21, 28, 29 August 2019 5-7 November 2019 26-29 November 3-4 December 2019
Grevillea parviflora subsp. parviflora Small-flower Grevillea	*Use flowers to identify, as easily confused with G. humilis. Will also flower sporadically throughout the year.*	August to November	5 metre wide parallel transects within suitable habitat.	15, 16, 21, 28, 29 August 2019 5-7 November 2019 26-29 November
Melaleuca biconvexa Biconvex Paperbark	Not Applicable	All Year	10 metre wide parallel transects within suitable habitat.	15, 16, 21, 28, 29 August 2019 5-7 November 2019 26-29 November 2019 3-4 December 2019
Melaleuca groveana Grove's Paperbark	Not Applicable	All Year	10 metre wide parallel transects within suitable habitat.	15, 16, 21, 28, 29 August 2019 5-7 November 2019 26-29 November 2019 3-4 December 2019
Pomaderris queenslandica Scant Pomaderris	*Flowers are useful to identify, as easily confused with P. intermedia, however species can be distinguished by leaf morphology - P. intermedia generally has a much larger leaf compared to P. queenslandica.*	All Year	5 metre wide parallel transects within suitable habitat.	15, 16, 21, 28, 29 August 2019 5-7 November 2019 26-29 November 2019 3-4 December 2019

Scientific name	Survey Requirements		Surveys within the Study Area	
	Method/Conditions	Timing	Effort	Timing
Pterostylis chaetophora	*Use flowering material to identify to species. Flowers Sep - early Nov.*	September to November	5 metre wide parallel transects within intact vegetation, 10 metre wide parallel transects within areas with sparse canopy, shrub and groundcover (high visibility).	14-18 October 2019
Rhizanthella slateri Eastern Australian Underground Orchid	*Use buds, flowers and/or fruit to identify to species.*	September to November	5 metre wide parallel transects within suitable habitat.	14-18 October 2019 5-7 November 2019 26-29 November 2019
Rhodamnia rubescens Scrub Turpentine	Not Applicable	All Year	5 metre wide parallel transects within intact vegetation, 10 metre wide parallel transects within areas with sparse canopy, shrub and groundcover (high visibility).	15, 16, 21, 28, 29 August 2019 5-7 November 2019 26-29 November 3-4 December 2019
Rhodomyrtus psidioides Native Guava	Not Applicable	All Year	5 metre wide parallel transects within intact vegetation, 10 metre wide parallel transects within areas with sparse canopy, shrub and groundcover (high visibility).	5-7 November 2019 26-29 November 3-4 December 2019

Scientific name	Survey Requirements		Surveys within the Study Area	
	Method/Conditions	Timing	Effort	Timing
Senna acclinis Rainforest Cassia	*Use seed pods and leaves to identify, as often mis-identified as Senna pendula var. glabrata.*	All Year	5 metre wide parallel transects within intact vegetation, 10 metre wide parallel transects within areas with sparse canopy, shrub and groundcover (high visibility).	14-18 October 2019 5-7 November 2019 26-29 November 3-4 December 2019
Solanum sulphureum Manning Yellow Solanum	Not Applicable	All Year	5 metre wide parallel transects within intact vegetation, 10 metre wide parallel transects within areas with sparse canopy, shrub and groundcover (high visibility).	14-18 October 2019 5-7 November 2019 26-29 November 3-4 December 2019
Tetratheca juncea Black-eyed Susan	*Peak flowering Sep - Oct, though will flower sporadically at other times throughout the year.*	September to October	5 metre wide parallel transects within suitable habitat.	14-18 October 2019
Thesium australe Austral Toadflax	Not Applicable	November to February	5 metre wide parallel transects within suitable habitat.	5-7 November 2019

Table 18: Reference Population Inspections – Threatened Flora

Species	Survey Requirements	Survey Timing	Date of Reference Population Inspection	Location of Reference Population	Confirmed Species Flowering at Location
Cryptostylis hunteriana **Leafless Tongue Orchid**	**November to January** *Unlikely to flower after a low winter rainfall. Survey northern populations Nov - Dec. Survey southern populations Dec - Jan. Species will not flower under dense vegetation.*	5-7/11/2019	In the week of 4/11/2019	Lake Munmorah, NSW	Yes
Pterostylis chaetophora	**September to November** *Use flowering material to identify to species. Flowers Sep - early Nov.*	14-18/10/2019	14/10/2019	Columbey National Park, Clarence Town, NSW	Yes



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Legend

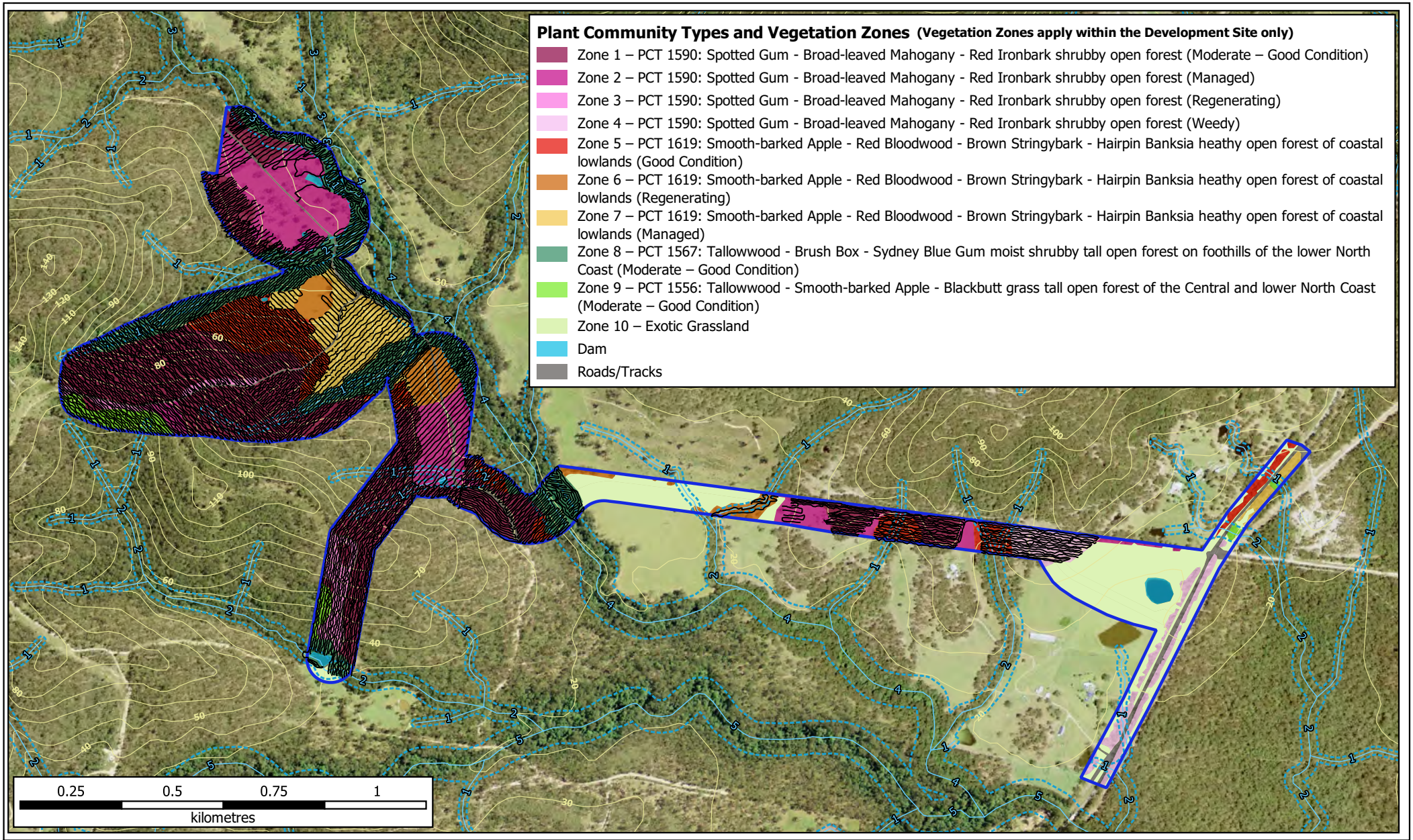
- Development Site Boundary
- Study Area
- Targeted Threatened Flora Search Tracks (15, 16, 21, 28, 29 August 2019)
- Contours (10m)
- Watercourse
- Riparian Buffer

Targeted Threatened Flora Search (15, 16, 21, 28, 29 August 2019)

Figure: **8**

Ironstone Developments Pty Ltd
Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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Legend

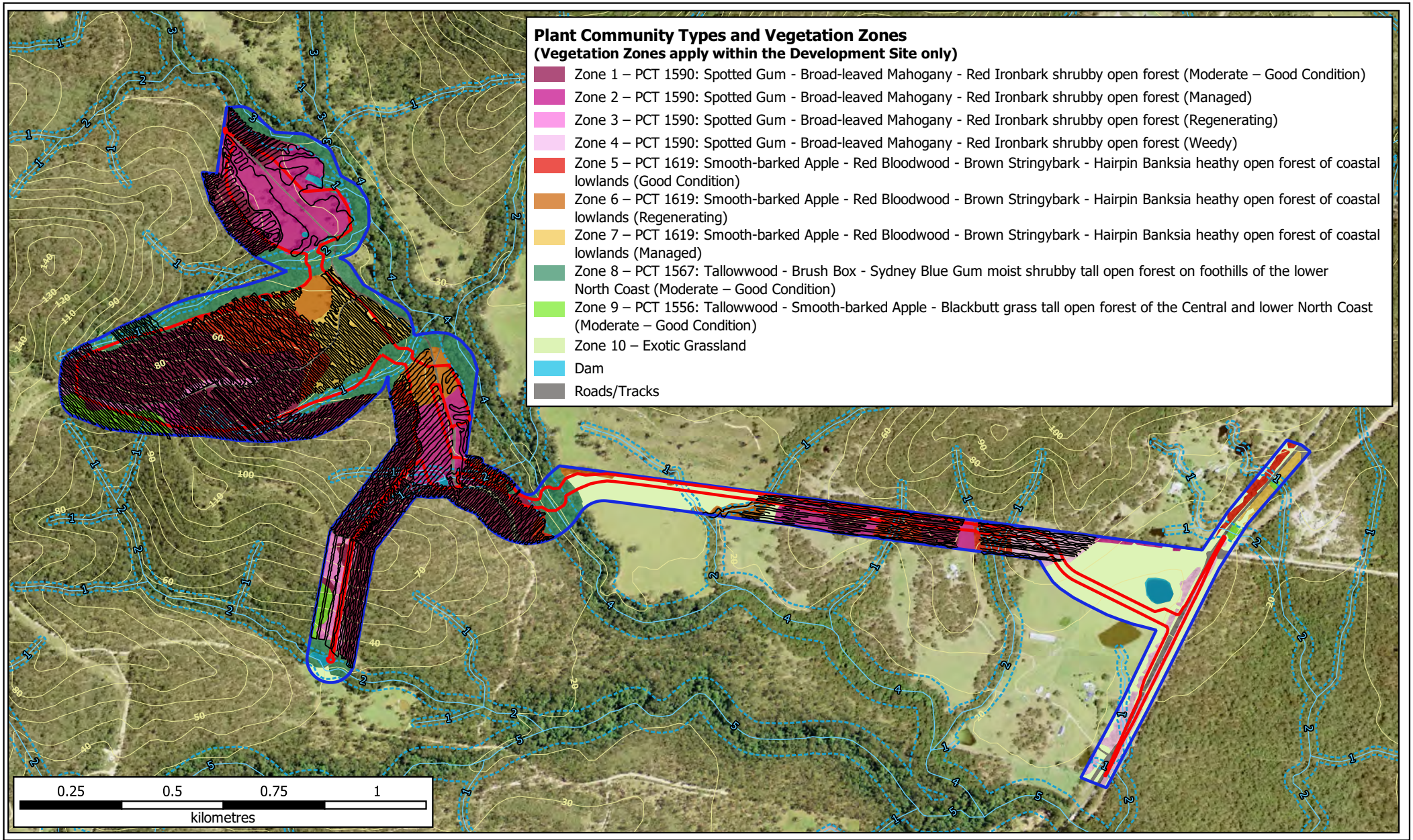
- Development Site Boundary
- Study Area
- Targeted Threatened Flora Search Tracks (14-18 October 2019)
- Contours (10m)
- Watercourse
- Riparian Buffer

Targeted Threatened Flora Search (14-18 October 2019)

Figure: **9**

Ironstone Developments Pty Ltd
Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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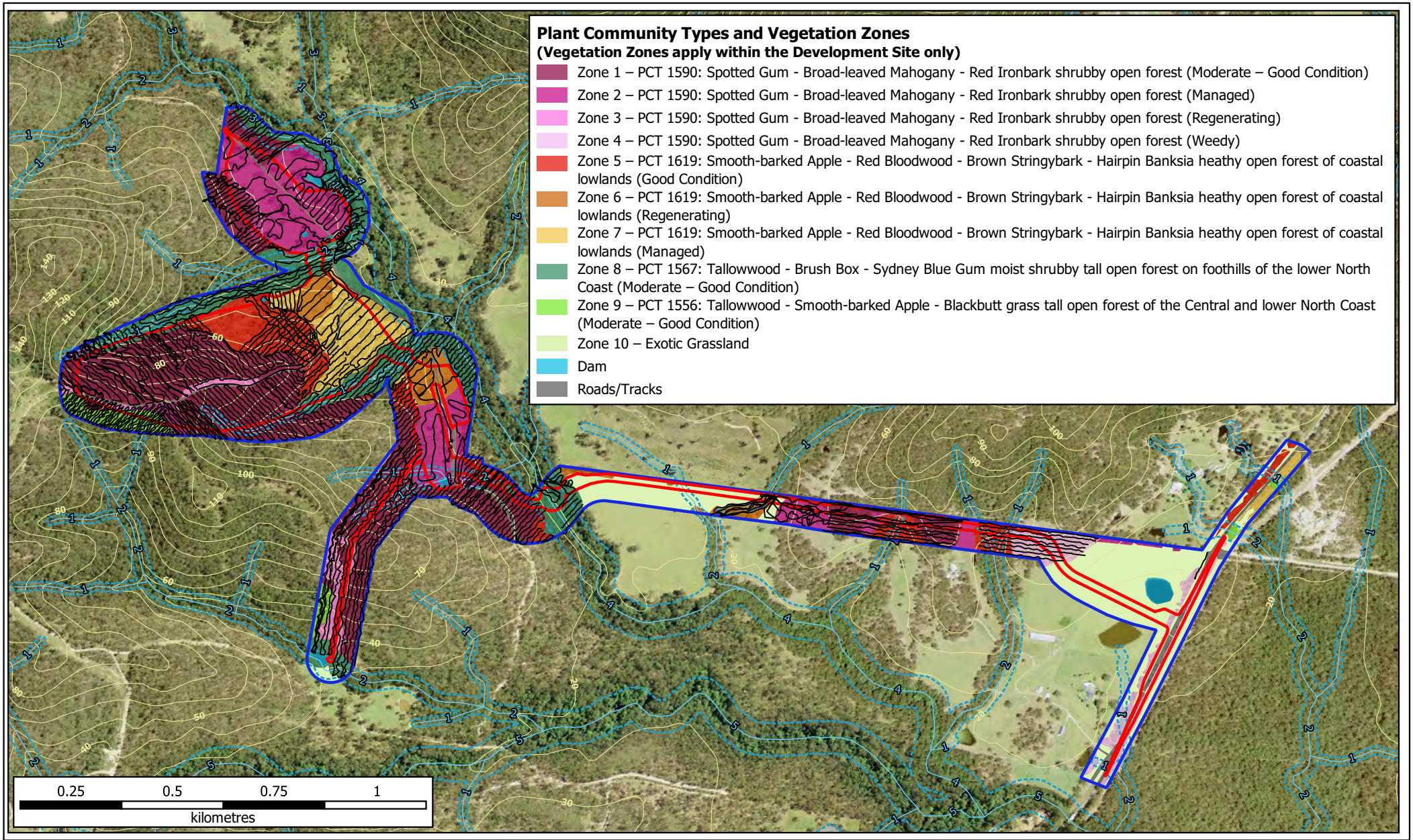
- Development Site Boundary
- Study Area
- Targeted Threatened Flora Search Tracks (5-7 November 2019)
- Contours (10m)
- Watercourse
- Riparian Buffer

Targeted Threatened Flora Search (5-7 November 2019)

Figure: **10**

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Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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Legend

- Development Site Boundary
- Study Area
- Targeted Threatened Flora Search Tracks (26-29 November & 3-4 December 2019)
- Contours (10m)
- Watercourse
- Riparian Buffer

Targeted Threatened Flora Search (26-29 November & 3-4 December 2019)

Figure: **11**

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Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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4.2.1.2 Flora Survey Results

A total of 235 flora species were identified during field surveys. Twenty-four of these species are considered exotic, of which one species (Lantana) is listed under the *Biosecurity Act 2015* (NSW). A summary of the number of species identified within each plant growth form group as defined by the BAM is as follows:

- 9 Fern species
- 38 Forb species
- 33 Grass and "Grass like" species
- 29 "Other" species (mainly vines)
- 65 Shrub species
- 29 Tree species

Two threatened flora species; *Callistemon linearifolius* (Netted Bottlebrush) and *Tetratheca juncea* (Black-eyed Susan) were detected within the Development Site (Section 4.3).

A list of the flora species identified within the Study Area is provided in Appendix 2.

4.2.2 Candidate Threatened Fauna

4.2.2.1 Survey Methodology

The following sub-sections outline the methods for all fauna surveys conducted across the Study Area. A summary of the Fauna Survey Effort and comparison against the Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft) (DEC, 2004) and DAWE Guidelines is provided in Appendix 5.

Survey Timing

The following candidate threatened fauna species were surveyed in the appropriate season as per the BAM (Table 19).

Table 19 Survey of threatened fauna species

Scientific name	Common name	Survey Requirements	Survey Timing & Type
Amphibians			
Crinia tinnula	Wallum Froglet	All Year	9 and 12 March 2020, and 3 March and 24 March 2022 Targeted waterbody surveys
Litoria aurea	Green and Golden Bell Frog	November to March	9 and 12 March 2020, and 3 March and 24 March 2022 Targeted waterbody surveys
Litoria brevipalmata	Green-thighed Frog	October to March	9 and 12 March 2020, and 3 March and 24 March 2022 Targeted waterbody surveys
Mixophyes balbus	Stuttering Frog	September to March	9 and 12 March 2020, and 3 March and 24 March 2022 Targeted waterbody surveys
Mixophyes iteratus	Giant Barred Frog	October to March	9 and 12 March 2020, and 3 March and 24 March 2022 Targeted waterbody surveys

Scientific name	Common name	Survey Requirements	Survey Timing & Type
Uperoleia mahonyi	Mahony's Toadlet	October to March	9 and 12 March 2020, and 3 March and 24 March 2022 Targeted waterbody surveys
Birds			
Burhinus grallarius	Bush Stone-curlew	All year	12 – 15, 19 ,20 and 22 August 2019 Call Playback 17 and 19 March 2019 Spotlighting
Callocephalon fimbriatum	Gang-gang Cockatoo (Breeding)	October to January	27 and 28 November 2019 Dusk Bird Surveys 27 November 2019 and 7-8 January 2020 Hollow/Nest Searches
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	April to August	12,14-15,19-20, 22 and 26-27 August 2019 Hollow/Nest Surveys 12-13, 20-21, 23 August 2019, 20 – 23 June, 4, 15 and 16 August 2022 Stag Watching
Dromaius novaehollandiae	Emu (Endangered Population)	All Year	12,14-15,19-20, 22 and 26-27 August 2019
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	July to December	12,14-15,19-20, 22 and 26-27 August 2019 Hollow/Nest Surveys 27 November 2019 and 7-8 January 2020 Hollow/Nest Searches
Hieraaetus morphnoides	Little Eagle (Breeding)	August to October	
Lophoictinia isura	Square-tailed Kite (Breeding)	September to January	
Pandion cristatus	Eastern Osprey	April to November	
Ninox connivens	Barking Owl (Breeding)	May to December	12 – 15,19,20 and 22 August 2019 Owl Call-playback 12-13, 20-21, 23 August 2019, 20 – 23 June, 4, 15 and 16 August 2022 Stag Watching
Ninox strenua	Powerful Owl (Breeding)	May to August	
Tyto tenebricosa	Sooty Owl (Breeding)	May to August	
Tyto novaehollandiae	Masked Owl (Breeding)	May to August	
Turnix maculosus	Red-backed Button-quail	All Year	12,14-15,19-20, 22 and 26-27 August 2019 Diurnal surveys
Mammals			
Aepyprymnus rufescens	Rufous Bettong	All Year	11 March – 2 April 2019 and 19 – 26 March 2020 Remote Camara Trapping 6-10 January 2020 Cage Traps and Ground Cameras

Scientific name	Common name	Survey Requirements	Survey Timing & Type
Cercartetus nanus	Eastern Pygmy-possum	October to March	11 March – 2 April 2019 and 19 – 26 March 2020 Remote Camara Trapping
Macropus parma	Parma Wallaby	All Year	11 March – 2 April 2019 and 19 – 26 March 2020 Remote Camara Trapping
Myotis macropus	Southern Myotis	October to March	9 – 13 March 2020 Harp trapping and Anabat Survey over/near water
Petaurus norfolcensis	Squirrel Glider	All Year	26 February to 11 March 2019 Camera Trapping 11-15 March 2019 Arboreal Elliot Trapping 17 and 19 March 2020 Spotlighting
Phascogale tapoatafa	Brush-tailed Phascogale	December to June	26 February to 11 March 2019 Camera Trapping 11-15 March 2019 Arboreal Elliot Trapping 17 and 19 March 2020 Spotlighting
Phascolarctos cinereus	*Koala*	All Year	26 February to 11 March 2019 Camera Trapping 17 and 19 March 2020 Spotlighting SAT Tests 27 April 2022 – 01 May 2022 (Biolink SATs)
Planigale maculata	Common Planigale	All Year	11-15 March 2019 Terrestrial Elliot Trapping 17 and 19 March 2020 Spotlighting 6-10 June 2022 Pitfall Traps
Potorous tridactylus	Long-nosed Potoroo	All Year	6-10 January 2020 Cage Traps and Ground Cameras
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	October to December	27 November 2019 Searches for camps Conducted during all other surveys while traversing the site during October to December.
Vespadelus troughtoni	Eastern Cave Bat	November to January	26 February to 11 March 2019 Anabat

Scientific name	Common name	Survey Requirements	Survey Timing & Type
Reptiles			
Hoplocephalus bitorquatus	Pale-headed Snake	November to March	17 and 19 March 2020 Spotlighting
Hoplocephalus stephensii	Stephen's Banded Snake	October to March	17 and 19 March 2020 Spotlighting

Arboreal Mammals

Ten Elliott B traps were placed in trees at heights of 3 m, along four transects (40 traps in total) for a period of four nights in March 2019. Traps were baited with a mixture of rolled oats, honey, peanut butter and treacle. The trunks of trees containing the traps were sprayed with a mixture of honey and water. Traps were checked daily for arboreal species over the four nights.

A total of 27 Reconyx HyperfireTM remote trigger cameras were installed arboreally (at heights of 3 m or 1 m). Cameras installed at 3 m, targeted Brush-tailed Phascogale, Koala and Squirrel Gliders between 26 February and 11 March 2019. Cameras installed at 1 m, targeted Eastern Pygmy Possum (between 26 February and 11 March 2019 and between 19 – 26 March 2020).

Cameras were active onsite for 14 consecutive nights in 2019 and for seven consecutive nights in 2020. Cameras were baited with an oats, peanut butter, treacle, vanilla essence and truffle oil mixture in a mesh canister, and the surrounding area (including the tree trunk) was sprayed with honey water. Cameras were re-baited twice during the survey period. Images were analysed to identify species captured on camera.

A total of 58 Boly Guard remote trigger cameras were installed arboreally (at heights of 3 m or higher). Cameras installed targeted Brush-tailed Phascogale, Koala and Squirrel Gliders from the 10 May to the 21 June 2022 and were rebaited after 2 weeks.

Cameras were active onsite for 42 consecutive nights in 2022 and for seven consecutive nights in 2020. Cameras were baited with an oats, peanut butter, treacle, vanilla essence and truffle oil mixture in a mesh canister, and the surrounding area (including the tree trunk) was sprayed with honey water. Cameras were re-baited twice during the survey period. Images were analysed to identify species captured on camera.

Spotlighting surveys were conducted on 17 and 19 March 2020 using high-powered headtorches to search for all types of nocturnal fauna. Spotlighting was undertaken via random meanders for 60-minutes on two separate nights at four separate locations (transect locations). Call playback for Koalas was also conducted to incite a response following spot lighting on the nights of 12 – 15, 19, 20 and 22 August 2019.

Ten Spot Assessment Technique (SAT) surveys (Phillips and Callaghan, 2011) were conducted within vegetation dominated by Koala Feed Trees *Eucalyptus canaliculata* (Grey Gum), *Eucalyptus microcorys* (Tallowwood), *Eucalyptus resinifera* (Red Mahogany), *Eucalyptus saligna* (Sydney Blue Gum) and *Angophora costata* (Smooth-barked Apple) on the 26 March and 17 April 2020. This technique involves the selection of a centre tree (survey point) that is selected according to the following criteria:

- A tree of any species beneath which one or more Koala faecal pellets have been observed; and/or

- A tree in which a Koala is observed; and/or
- Any other tree known or considered to be potentially important for Koalas, or for other assessment purposes.

For each SAT survey, a minimum of 30 trees (including the centre tree) with a DBH of 100 mm, or greater, are then surveyed for Koala scats. Surveys involve the inspection of the ground surface within 100 centimetres from the base of the tree. If faecal scats are identified, the survey concludes, and the surveyor moves to the next closest tree until the 30 trees are surveyed.

Terrestrial Mammals

Twenty-five Elliott A traps were placed along four transects at regular intervals targeting the Common Planigale and the New Holland Mouse. Traps were baited with a mix of rolled oats, honey, peanut butter and treacle and set for four consecutive nights from 11-15 March 2019 with checks for captures occurring each morning.

Ten Reconyx HyperfireTM remote trigger cameras were installed at a height below 1 m and 11 wire cage traps targeting the Rufous Bettong and Long-nosed Potoroo. Cameras and cage traps were baited with an oats, peanut butter, treacle, vanilla essence and truffle oil mixture in a mesh canister, and the surrounding area was sprayed with honey water. Cameras and cage traps were active onsite for four consecutive night/days from 6 - 10 January 2020. Images from the cameras were analysed to identify species captured on camera.

A total of 13 pitfall traps were placed within the 200m of the ecotonal boundary of adjoining PCTs targeting Common Planigale. Each Pitfall trap consisted of a 10m drift fence with a 20l bucket at both ends. The traps were set for a total of 4 nights (52 trap nights) from 6-10 June 2022 .

Spotlighting surveys were conducted on 17 and 19 March 2020 using high-powered headtorches to search for all types of nocturnal fauna. Spotlighting was undertaken via random meanders for 60-minutes on two separate nights at four separate locations (transect locations).

Bats

Four Harp traps and four AnabatTM bat-call detectors were used to detect Microchiropteran bats within the Study Area. Surveys for Microchiropteran bats were targeting the Southern Myotis, with paired harp traps and Anabats placed at suitable waterbodies for four consecutive nights; 9 – 13 March 2020. Another four Anabat were put out on each transect location for 14 consecutive nights; 26 February to 11 March 2019. Nocturnal searches of blossoming trees were also undertaken during spotlighting to detect Megachiropteran bats.

Diurnal Birds

Opportunistic visual and auditory bird surveys were conducted throughout the Study Area periodically from 12 July 2019 to 8 January 2020 in conjunction with other surveys. Surveys targeting the breeding habitat of woodland bird species were conducted at dusk. Breeding habitat was identified through habitat assessments such as hollow bearing tree surveys. Surveys targeted waterbodies and hollow-bearing trees suitable for Glossy-black Cockatoos and Gang-gang Cockatoos and were conducted between 4:30 pm – 8:00 pm at three separate waters bodies on two separate afternoons on the 27 and 28 November 2020.

Justification for targeting waterbodies for Glossy-black Cockatoos and Gang-gang Cockatoos were based on knowledge that these species visit waterbodies to drink in the early morning or late afternoon. Species were identified visually with the aid of binoculars or aurally from call identification.

All opportunistic sightings were noted through all other surveys conducted onsite. Stag-watching was also undertaken to determine if threatened Cockatoos were nesting within the Development Site (12 – 15, 19, 20 and 22 August 2019) additional nights include 20 – 23 June, 4, 15 and 16 August 2022. Further Stag watching and evening surveys were conducted onsite to determine if breeding habitat was present for the Glossy Black Cockatoo with stag watching and quiet listening.

A survey for trees containing nests was undertaken within the Development Site and a 100 m buffer (where this occurred within the property boundary) on 12 – 23 August, 27 November 2019 and 7 – 8 January 2020. These surveys were undertaken to identify potential breeding habitat of candidate birds of prey.

Nocturnal Birds

Within the Study Area, stag-watching and owl call-playback was conducted over seven nights on 12 – 15, 19, 20 and 22 August 2019. During these surveys, hollows identified as being potentially suitable for Large Forest Owls were stag watched from dusk (30-minutes prior to last light) for a period of 1-hour. After stag watching was completed, owl call-playback was conducted. Calls of large forest owls (Powerful Owl, Masked Owl, Barking Owl and Sooty Owl) and the Bush Stone-curlew were broadcast through a megaphone to attract individuals or to incite a response. After an initial listening period of 15-minutes, recorded calls of threatened species were broadcast for 5-minutes each, followed by 1-2 minutes of stationary spotlighting. Directly after the final broadcast, a quiet listening period of 5 minutes was conducted followed by a 30-minute spotlighting survey.

Additional stag watching surveys were completed on the 20 – 23 June, 4, 15 and 16 August 2022 with multiple people onsite each night. During these surveys, hollows identified as being potentially suitable for Large Forest Owls were stag watched from dusk (30-minutes prior to last light) for a period of 1-hour (**Figure 12**)

Amphibians

Amphibian surveys (transect searches) were undertaken in four locations covering dams and creeks with suitable frog habitat. Nocturnal surveys involved quiet listening periods where species were identified through aural detection of species-specific calls along with spotlighting searches within emergent vegetation around the edge of the waterbodies. Adult frogs encountered were identified by visual confirmation or by their distinct advertisement calls. Surveys at each dam were conducted for 30 min on two separate nights (total one-person hour per water body). Surveys for amphibians were conducted in March after rainfall (16mm on the 7 March and 26mm on the 10 March) over two days on the 9 and 12 March. Further surveys were conducted in 2022 on the 3 and 24 March after substantial rainfall (5 days prior to the 3 March was 40.4mm with 81.4mm falling on the day of the survey with 29mm falling on the day of the 24 March 2022)

Reptiles

Spotlighting surveys were conducted on 17 and 19 March 2020 using high-powered headtorches to search for all types of nocturnal fauna. Spotlighting was undertaken via random meanders for 60-minutes on two separate nights at four separate locations (transect locations).

Biolink Surveys

To survey the Extent of Occurrence (EoO), occupancy and population density for the New Holland Mouse (NHM) a grid based survey design was deployed over two sampling events. Further details of the survey methodology can be seen in the Biolink report (Biolink 2022).

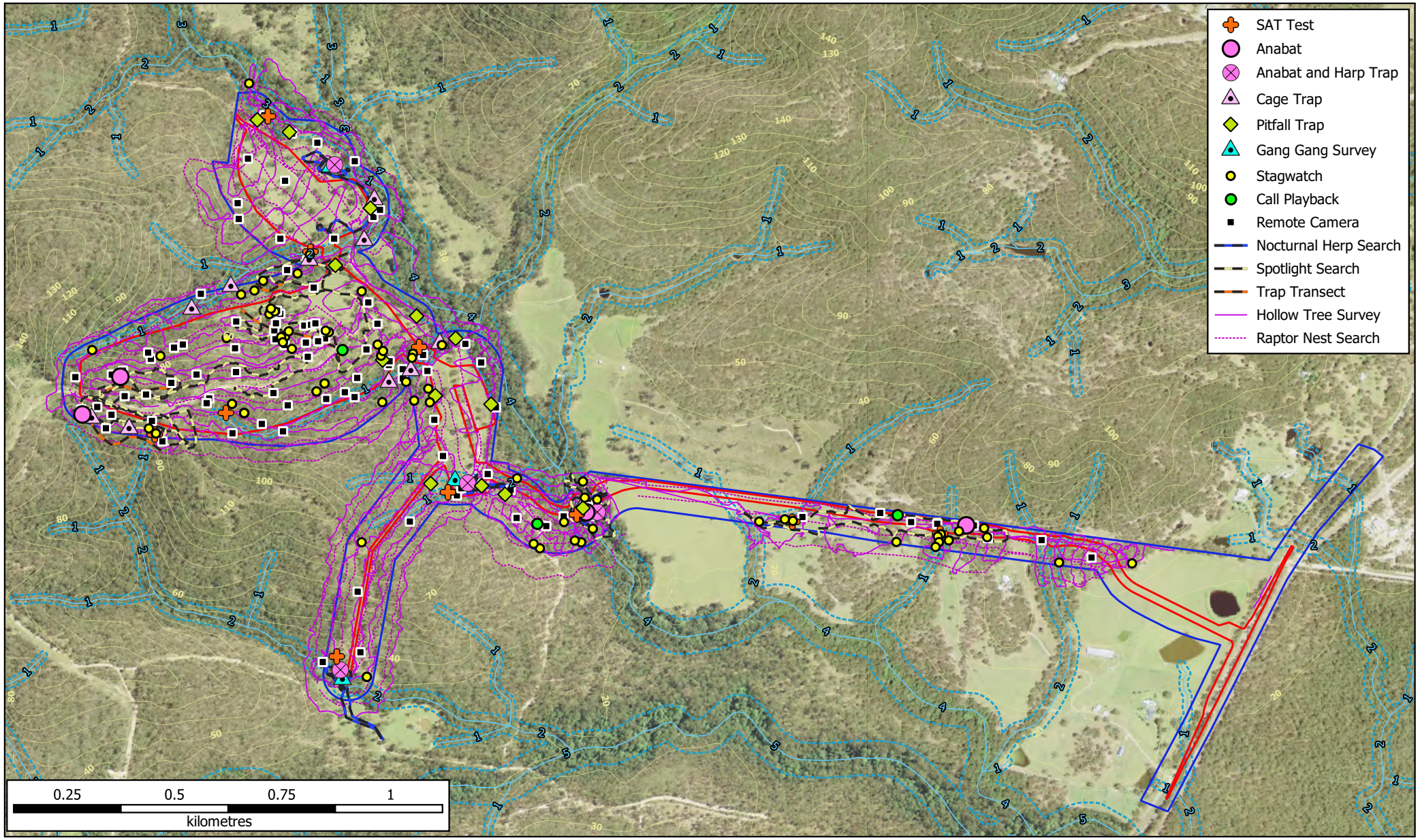
Further koala surveys were conducted within the use of the Spot Assessment Technique (SAT) sampling of Phillips and Callaghan (2011) at 250m intervals across the proposed quarry pit and immediately adjoining areas of habitat to assess the extent of habitat utilization by koalas. Further detail can be found within the Biolink report (Biolink 2022).

Weather Data

Temperature and rainfall data for the survey period is summarised per month in **Table 20**. Temperature data is from Nelsons Bay (BOM: 061054) and rainfall data is from the Clarence Town weather station (BOM: 061010).

Table 20 Weather Data

Month	Temperature (°C)				Rain (mm) BOM	
	Min	Max	Min (Avg)	Max (avg)	Recorded	Monthly Long-term Mean
February 2019	15.1	34.7	20.6	27.9	73.6	111.6
March 2019	14.3	30.5	20.1	26.5	152.0	126.2
April 2019	12.9	32.4	18.1	24.9	53.8	99.9
May 2019	8.42	25.8	13.4	22.1	36.0	86.4
June 2019	7.8	24.6	11.1	18.2	77.6	100.7
July 2019	8.0	24.6	11.0	18.9	16.8	69.7
August 2019	7.7	23.5	10.5	19.3	36.0	60.2
September 2019	7.3	28.5	12.9	21.3	85.0	62.3
October 2019	11.5	32.1	14.8	23.4	19.6	69.1
November 2019	6.7	34.4	16.3	25.8	21.0	79.2
December 2019	13.2	32.1	18.3	26.6	3.0	99.7
January 2020	15.7	33.8	20.5	28.3	78.0	104.9
February 2020	17.1	39.1	19.9	27.5	274.0	111.6
March 2020	15.9	36.3	18.4	25.7	110.0	126.2
January 2022	17.9	30.1	19.9	27.0	85.0	104.9
February 2022	17.1	30.5	19.4	26.5	94.6	111.6
March 2022	15.4	29.4	19.1	25.2	307.4	126.2
April 2022	14.6	26.9	17.2	23.6	104.6	99.9
May 2022	9.2	26.0	13.8	20.5	82.0	86.4
June 2022	7.7	20.5	10.1	16.9	19.2	100.7
July 2022	7.7	22.2	10.9	17.1	282.8	69.7
August 2022	8.1	22.9	11.7	18.6	163.6	60.2



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Legend

- Development Site Boundary
- Study Area
- Watercourse
- Riparian Buffer
- Contours (10m)

Fauna Survey Effort

Figure: **12**

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4.2.2.2 Fauna Survey Results

A total of 78 species of fauna were detected within the Study Area during field surveys (Appendix 2). These comprised six amphibian, 37 bird, 31 mammal, two reptile, one fish and one crustacean species. All species detected were native species except the Red Fox (*Vulpes vulpes*), which is an introduced species.

Four (4) bird and thirteen mammal species detected within the Study Area are listed as Vulnerable under the BC Act and/or the EPBC Act:

Birds

- Glossy Black-Cockatoo (*Calyptorhynchus lathami*) was observed flying over the Study Area (outside the Development Site) during bird surveys. No evidence of breeding was detected within the Development Site.
- Little Lorikeet (*Glossopsitta pusilla*) was identified flying over the Study Area during bird surveys; however, no individuals were seen to perch within the Development Site.
- Masked Owl (*Tyto novaehollandiae*) was detected during nocturnal surveys (heard calling offsite – northwest of access track). No evidence of breeding was detected within the Development Site.
- Sooty Owl (*Tyto tenebricosa*) was detected during nocturnal surveys (heard calling offsite – west of Study Area). No evidence of breeding was detected within the Development Site.

Microbats

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) was identified via Anabat recordings.
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) was identified via Anabat recordings.
- Little Bent-winged Bat (*Miniopterus australis*) was identified via Anabat recordings
- Southern Myotis (*Myotis macropus*) was identified via Anabat recordings.
- Golden Tipped Bat (*Phoniscus papuensis*) was identified via Anabat recordings and captured using a harp trap.
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) was identified via Anabat recordings
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) was identified via Anabat recordings.
- Eastern Cave Bat (*Vespadelus troughtoni*) was identified via Anabat recordings.
- Large-eared Pied Bat (*Chalinolobus dwyeri*) was identified via Anabat recordings.

Other Mammals

- Grey-headed Flying-fox (*Pteropus poliocephalus*) was detected foraging within the site; however, no camps were detected.
- Koala (*Phascolarctos cinereus*) was detected within the Development Site via remote cameras and via Koala SATs.
- New Holland Mouse (*Pseudomys novaehollandiae*) was detected within the Development Site during terrestrial trapping surveys (EPBC Act listed only).
- Squirrel Gliders (*Petaurus norfolcensis*) was detected during remote camera surveys in 2022.

The Glossy Black-Cockatoo, Little Bent-winged Bat and Eastern Cave Bat are “Dual Credit Species", which are Species Credit Species for breeding habitat and ecosystem credit species for foraging habitat. The habitat constraints for each of these species is as follows:

- Glossy Black-Cockatoo
    - Hollow bearing trees - Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground where breeding individuals are observed using the hollow.
- Little Bent-winged Bat
    - Caves
    - Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code ‘IC – in cave’
    - Observation type code ‘E nest-roost’
    - With numbers of individuals >500
    - Or from the scientific literature
- Eastern Cave Bat
    - Caves
    - Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds."

Given that no evidence of breeding of the above listed species was found within the Development Site and breeding habitat was absent from the locality, these species were confirmed as ecosystem species only. In accordance with the BAM (DPIE 2020), impacts to foraging habitat for these species will be offset via ecosystem credits only. No further assessment for these species is required.

The Little Lorikeet, Masked Owl, Sooty Owl, Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Golden Tipped Bat, Yellow-bellied Sheathtail-bat, and Greater Broad-nosed Bat are all ecosystem credit species, as such, no further assessment for these species is required.

The Southern Myotis, and Koala, species credits have been further assessed in the following section.

4.3 IDENTIFIED THREATENED SPECIES

Step 5: Determine the area or count, and location of suitable habitat for species credit species & Step 6: Determine the habitat condition within the species polygon for species assessed by area

***Callistemon linearifolius* (Netted Bottle Brush)**

A total of 573 individuals of *Callistemon linearifolius* (Netted Bottlebrush) were detected within the Study Area during the assessment (Figure 13). A total of 60 individuals occur within the Development Site.

In accordance with the BAM, the unit of measurement for the species polygon for *C. linearifolius* is “count” of individuals. The total number of individuals within the Development Site within each vegetation zone is as follows:

- 3 individuals within Vegetation Zone 1 (PCT 1590– Mod-Good)
- 15 individuals within Vegetation Zone 2 (PCT 1590_Managed)
- 9 individuals within Vegetation Zone 5 (PCT 1619_Mod-Good)
- 33 individuals within Vegetation Zone 8 (PCT 1567 -Mod-Good).

***Tetratheca juncea* (Black-eyed Susan)**

A total of 1,830 *Tetratheca juncea* individuals were identified during survey, forming two separate populations. The larger population is comprised of 1,828 individuals, of which 586 individuals are within the Development Site, 19 individuals are within the Study Area (outside of the Development Site) and 1,225 individuals are within the remaining landholdings (that have been surveyed) and will not be impacted. The second smaller population of 2 individuals was identified on the access road and will be impacted. In accordance with the BAM, the unit of measurement for the species polygon for *T. juncea* is "area" of habitat, which is defined by the extent of the Vegetation Zone in which the species is detected.

The total area of the species polygon for *T. juncea* within the Development Site was determined to be 19.36 ha as shown in **Figure 14**, including:

- 10.59 ha (containing 27 individual plants) within Vegetation Zone 1 (PCT 1590_Mod-Good).
- 3.87 ha (containing 457 individual plants) within Vegetation Zone 5 (PCT 1619 – Mod-Good).
- 3.07 ha (containing 95 individual plants) within Vegetation Zone 7 (PCT 1619 – Regenerating).
- 1.83 ha (containing 17 individual plants) within Vegetation Zone 8 (PCT 1567_Mod-Good).

All other vegetation zones are considered to be too degraded or unsuitable habitat (PCT 1556 and PCT 1567) for *T. juncea*.

Koala (*Phascolarctos cinereus*)

The Koala was recorded in four areas within the Study Area from six detections through Koala SAT assessment or remote camera surveys. The four areas included; 1) mid-way along the access road (SAT and camera); 2) near Deep Creek crossing (SAT and camera); 3) in a gully near the southern side of the quarry pit (SAT); and 4) within the riparian corridor below the main stockpile area (SAT). All tended to be within the lower slopes and gullies, with two records in the Development Site (Figure 15).

Targeted surveys completed by Biolink (2022) who characterised the koala population and location and extent of koala habitat on site as the following:

- Seven (7) Spot Assessment Technique (SAT) sites were assessed (five within the quarry pit footprint, two within the buffer).
- The presence of *Corymbia maculata* (Spotted Gum) and *Corymbia gummifera* (Red Bloodwood) allowed Biolink to characterise the greater portion of the quarry pit area as having a 'low nutrient soil landscape'.
- Four (4) of the seven (7) SAT sites contained Preferred Koala Feed Trees (PKFTs)
- Two (2) of the seven (7) SAT sites contained evidence of habitat utilization by koalas (faecal pellets). Both sites returned measures of habitat utilization indicative of *transient use* (i.e.

both returned koala activity levels of less than 10%) based on the activity thresholds in Table 2 of Phillips and Callaghan (2011).

- Higher koala habitat suitability and use outside of the development footprint, within vegetation to the south of the proposed quarry pit area: *"The presence of a south-easterly trending koala activity gradient implied the likelihood of significant levels of habitat use by resident animals immediately to the south of the peripheral buffer area adjoining the quarry pit in the south"* (Biolink 2022) (see **Plate 16**)
- A sparse distribution of PKFTs within the proposed haul road

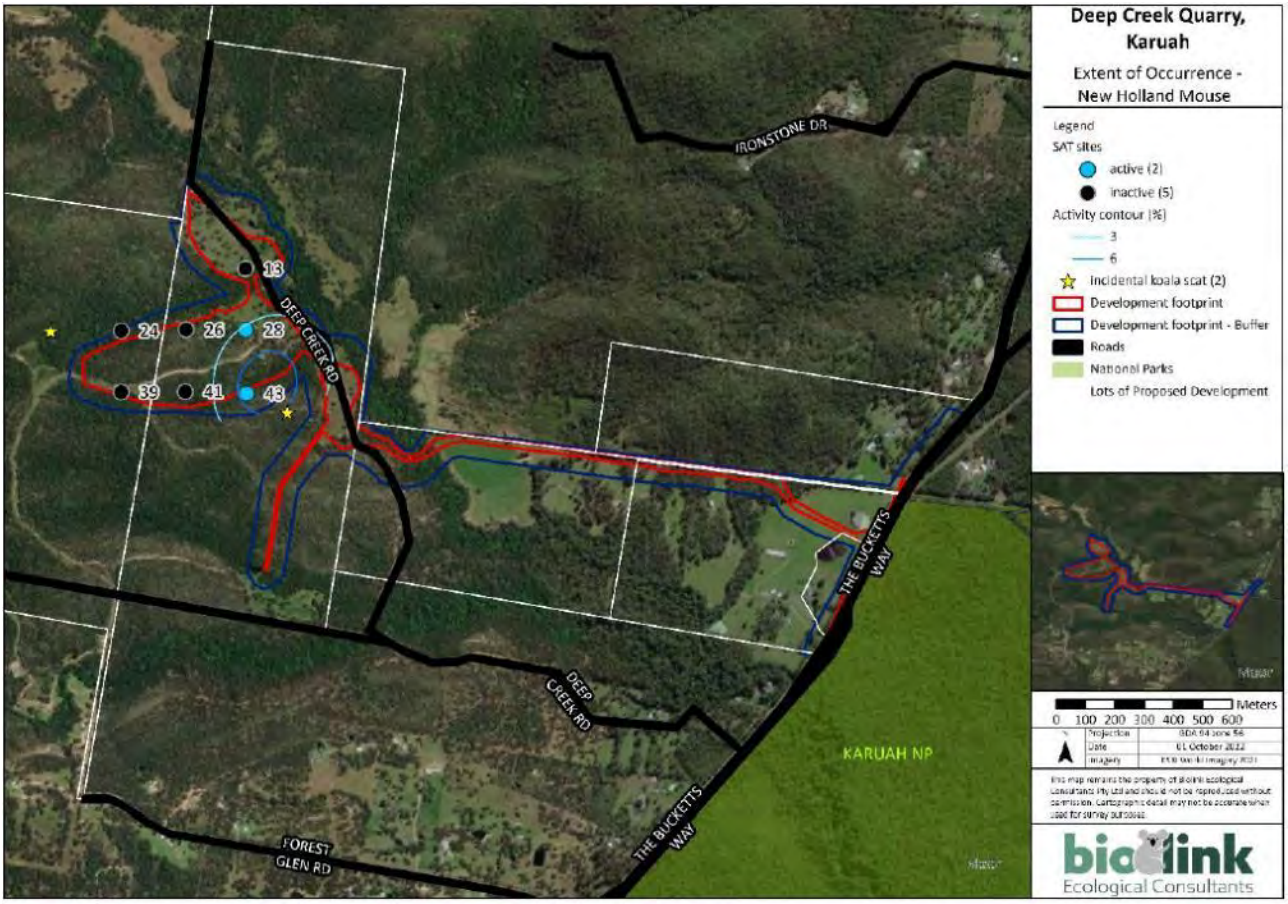


Plate 16: Biolink SAT survey results and indicative koala population activity.
Inactive SAT sites (black circles) (n=5), Active SAT sites (blue circles) (n=2) based on the presence of koala faecal scats. Interpolated activity contours illustrate increasing activity to the south of the proposed quarry pit area (blue lines, darker colour indicative of increasing activity).

The results from Biolink surveys indicate that koala activity within the development site is largely ***"transient"*** in nature and concentrated to the south of the proposed quarry pit area. The report also highlights the importance of areas of higher PKFT concentrations on alluvial soils located primarily at haul road creek crossings. These conclusions support the koala habitat mapping shown in **Figure 5**, which illustrates higher koala resource availability and koala movement corridors within Vegetation Zones 8 and 9. Measures for avoiding and minimizing impacts to higher value koala habitat within the Study Area is detailed in **Section 5.1**.

For the purposes of determining the location of koala habitat and a suitable species polygon koala habitat was defined as each vegetation zone where Koala Feed Tree Species were present (see Section 4.1.1.3).

The total area of the species polygon for the Koala is 29.15 ha (**Figure 16**), including:

- 10.59 ha within Vegetation Zone 1 (PCT 1590– Mod-Good).
- 6.48 ha within Vegetation Zone 2 (PCT 1590_Managed).
- 0.62 ha within Vegetation Zone 3 (PCT 1590_Regenerating).
- 0.72 ha within Vegetation Zone 4 (PCT 1590_Weedy).
- 3.87 ha within Vegetation Zone 5 (PCT 1619_Mod-Good).
- 1.79 ha within Vegetation Zone 6 (PCT 1619_Managed).
- 3.07 ha within Vegetation Zone 7 (PCT 1619_Regenerating).
- 1.83 ha within Vegetation Zone 8 (PCT 1567_Mod-Good).
- 0.17 ha within Vegetation Zone 9 (PCT 1556_Mod-Good).

Southern Myotis (*Myotis macropus*)

Southern Myotis was identified via Anabat recordings. Habitat for the species has been assessed as all PCTs which the species is associated with under the Threatened Biodiversity Data Collection that occur within 200 m of the foraging habitat – waterbodies greater than 3 m wide (both within the Study Area and within 200 m of the Development Site). The total area of the species polygon for the Southern Myotis is 17.65 ha (**Figure 16**), including:

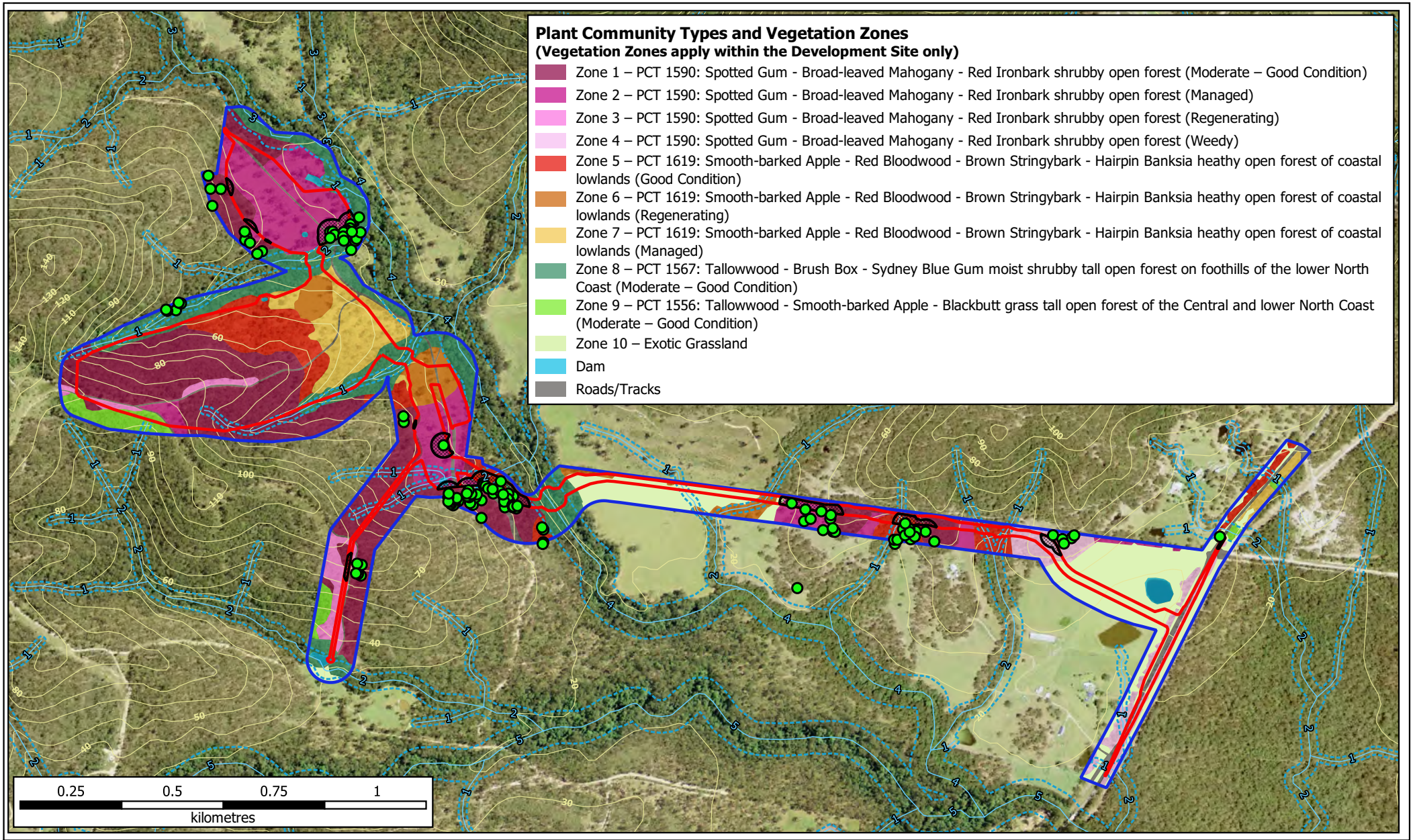
- 2.72 ha within Vegetation Zone 1 (PCT 1590– Mod-Good).
- 5.83 ha within Vegetation Zone 2 (PCT 1590_Managed).
- 0.17 ha within Vegetation Zone 3 (PCT 1590_Regenerating).
- 0.39 ha within Vegetation Zone 4 (PCT 1590_Weedy).
- 3.17 ha within Vegetation Zone 5 (PCT 1619_Mod-Good).
- 1.70 ha within Vegetation Zone 6 (PCT 1619_Managed).
- 2.52 ha within Vegetation Zone 7 (PCT 1619_Regenerating).
- 1.21 ha within Vegetation Zone 8 (PCT 1567_Mod-Good).

Squirrel Glider (*Petaurus norfolcensis*)

Squirrel Glider was identified via remote cameras. Habitat for the species has been assessed as all PCTs which the species is associated with under the Threatened Biodiversity Data Collection. The total area of the species polygon for the Squirrel Glider is 29.15 ha (**Figure 17**), including:

- 10.59 ha within Vegetation Zone 1 (PCT 1590– Mod-Good).
- 6.48 ha within Vegetation Zone 2 (PCT 1590_Managed).
- 0.62 ha within Vegetation Zone 3 (PCT 1590_Regenerating).
- 0.72 ha within Vegetation Zone 4 (PCT 1590_Weedy).
- 3.87 ha within Vegetation Zone 5 (PCT 1619_Mod-Good).

- 1.79 ha within Vegetation Zone 6 (PCT 1619_Managed).
- 3.07 ha within Vegetation Zone 7 (PCT 1619_Regenerating).
- 1.83 ha within Vegetation Zone 8 (PCT 1567_Mod-Good).
- 0.17 ha within Vegetation Zone 9 (PCT 1556_Mod-Good).



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Legend

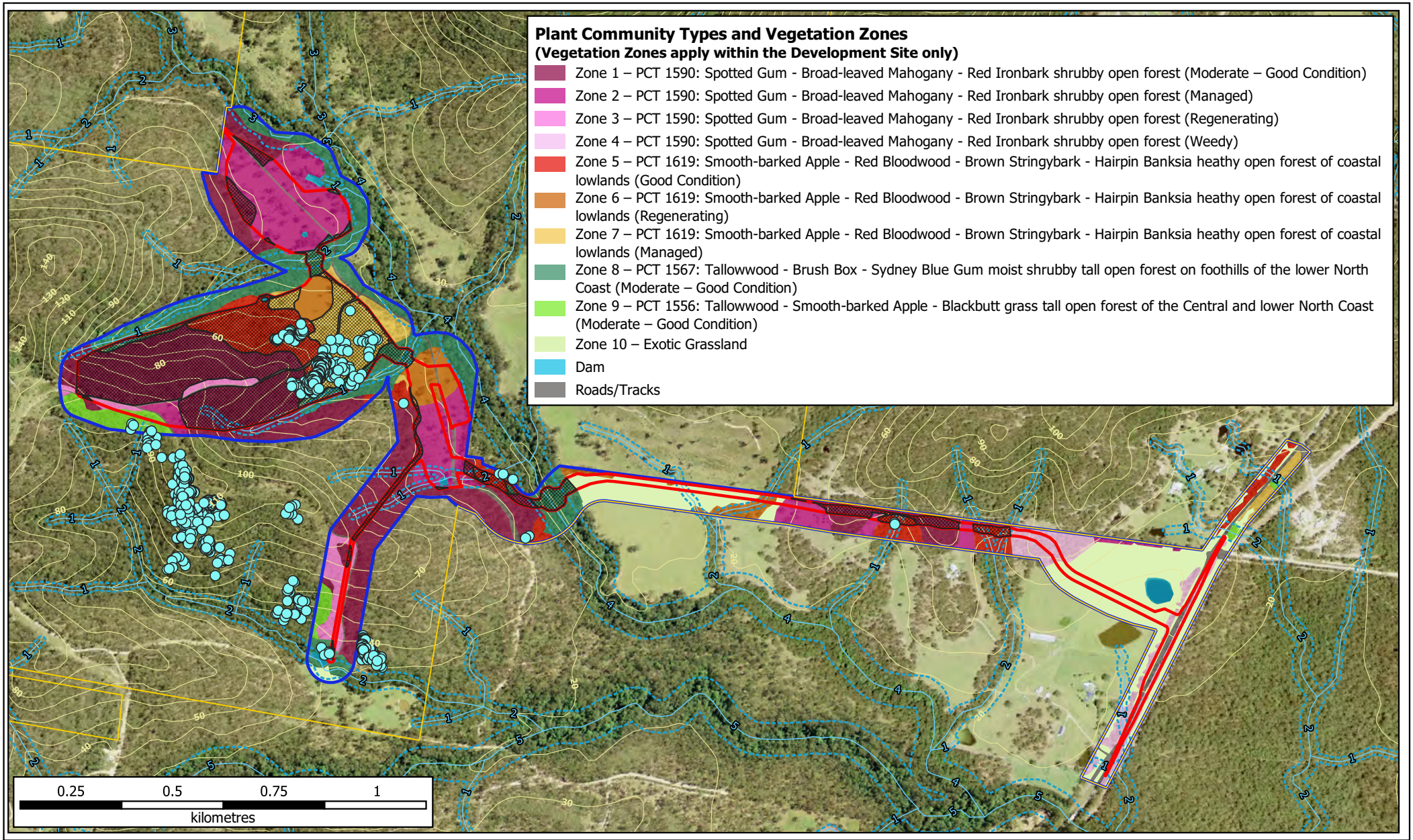
- Development Site Boundary
- Study Area
- Contours (10m)
- Watercourse
- Riparian Buffer
- *Callistemon linearifolius* presence
- *Callistemon linearifolius* Species Polygon

Callistemon linearifolius **Presence and Species Polygon**

Figure: **13**

Ironstone Developments Pty Ltd
Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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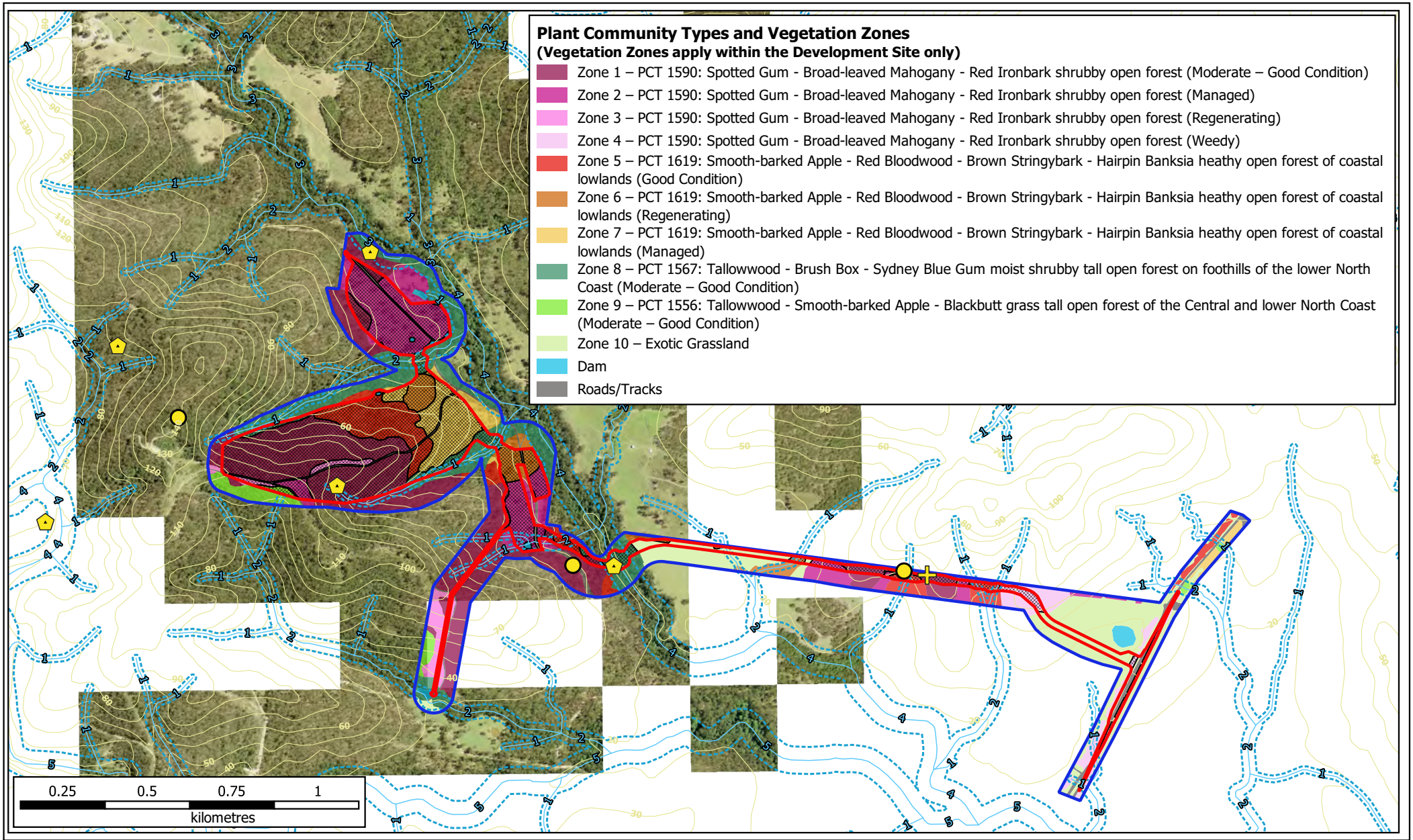
- Development Site Boundary
- Study Area
- Contours (10m)
- Watercourse
- Riparian Buffer
- *Tetratheca juncea* detected
- *Tetratheca juncea* Species Polygon

Tetratheca juncea
(Black-eyed Susan)
Presence and Species Polygon

Figure: **14**

Ironstone Developments Pty Ltd
Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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Legend

- Development Site Boundary
- Study Area
- Contours (10m)
- Watercourse
- Riparian Buffer
- *Phascolarctos cinereus* Species Polygon

***Phascolarctos cinereus* (Koala) Detections**

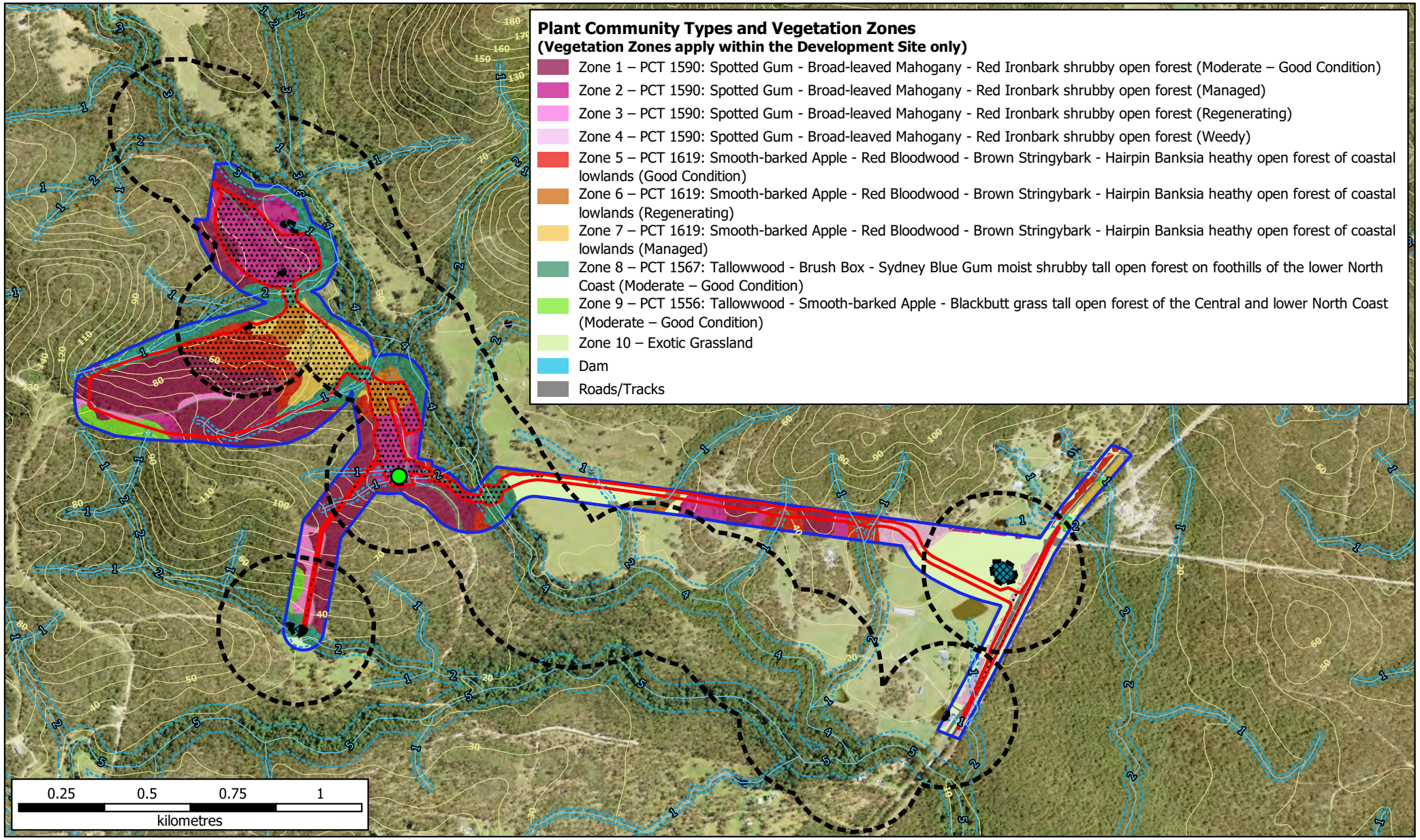
- Remote Camera
- Opportunistic Sighting
- SAT Assessment

Phascolarctos cinereus (Koala) Presence and Species Polygon

Figure: **15**

Ironstone Developments Pty Ltd
Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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Legend

- Development Site Boundary
- Study Area
- Contours (10m)
- Watercourse
- Riparian Buffer
- *Myotis macropus* (Southern Myotis) presence

***Myotis macropus* (Southern Myotis) Habitat**

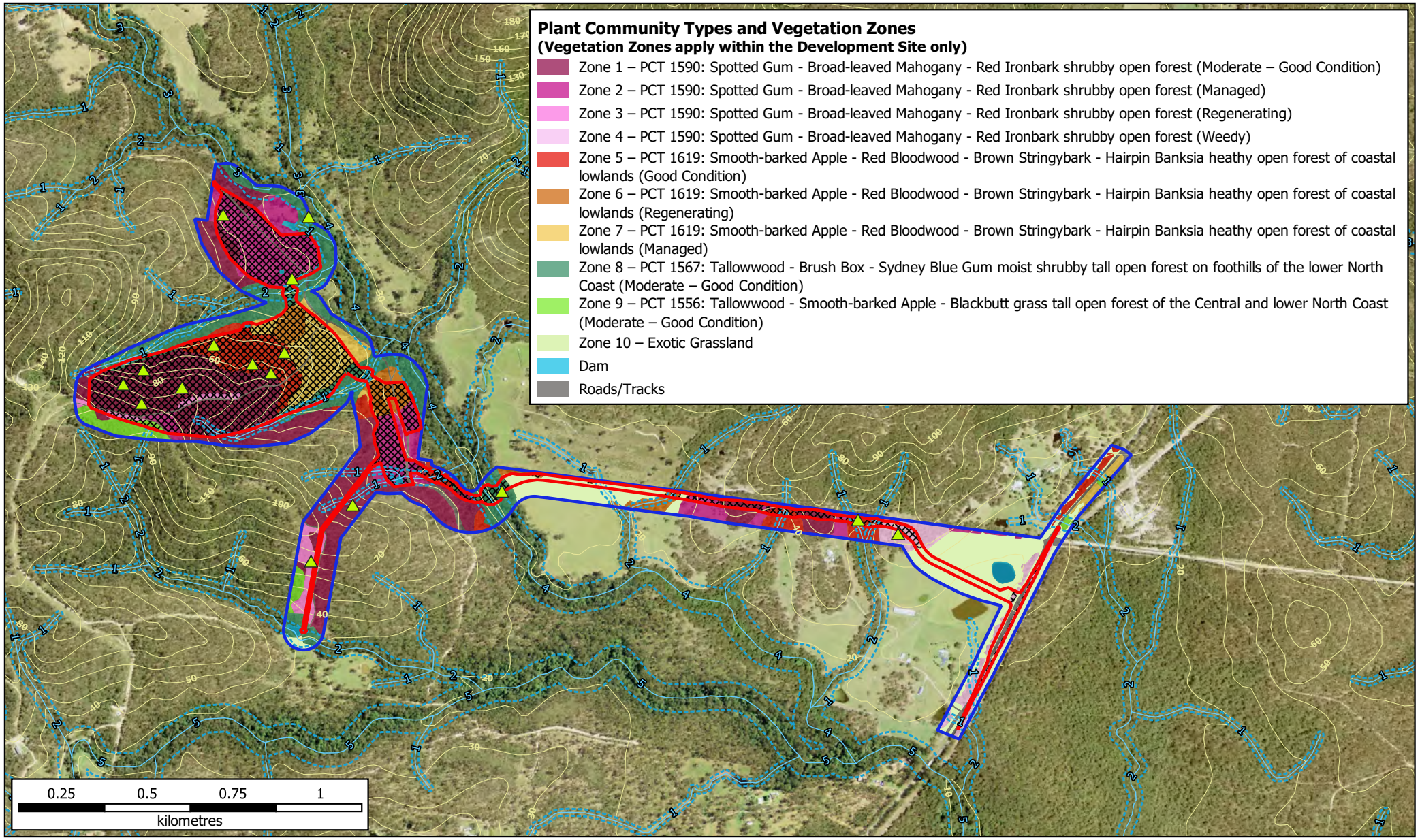
- Species Polygon
- Foraging Area
- Foraging Area Buffer (200m)

***Myotis macropus* (Southern Myotis) Presence and Species Polygon**

Figure: **16**

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Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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Legend

- Development Site Boundary
- Study Area
- Contours (10m)
- Watercourse
- Riparian Buffer
- *Petaurus norfolcensis* (Squirrel Glider) detected
- *Petaurus norfolcensis* (Squirrel Glider) Species Polygon

***Petaurus norfolcensis* (Squirrel Glider) Presence and Species Polygon**

Figure: **17**

Ironstone Developments Pty Ltd
Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

N

5. IMPACT ASSESSMENT

5.1 AVOIDING AND MINIMISING IMPACTS

5.1.1 Avoid and Minimising Impacts on Native Vegetation and Habitat

Avoidance and minimisation measures considered during the planning stages of the Project in relation to site selection, project design and alternative technologies are outlined in the following sections. Avoidance and minimization measures provided aimed to first avoid impacts, and then if required, minimize and offset the loss of biodiversity values in accordance with the avoidance and minimization hierarchy pursuant to section 6.4(1) of the Biodiversity Conservation Act 2016, Preston CJ in Denoci Pty Ltd v Liverpool City Council [2020] NSWLEC 102 (Denoci judgement) at [27], and IRM Property Group (No. 2) Pty Ltd v Blacktown City Council [2021] NSWLEC 1306 (IRM). Residual impacts to biodiversity following mitigation, offsets will be implemented in accordance with the NSW Biodiversity Offsets Scheme (see **Section 6**).

5.1.1.1 Avoidance and minimisation requirements

The Biodiversity Conservation Act 2016 (the BC Act)

Section 6.4 (1) of the BC Act describes the hierarchy of Avoidance and Minimisation, stating that measures to offset and compensate for impacts to biodiversity values are only appropriate following initial consideration of steps to avoid or minimise impacts.

The Environment Planning and Assessment Act 1979 (the EP&A Act)

EPA Act describes in Section1.3(b), the requirement to seek '*to facilitate ecologically sustainable development by integrating relevant* ***economic****,* ***environmental*** *and* ***social considerations*** *in decision-making about environmental planning and assessment*'.

IRM Property Group (No. 2) Pty Ltd v Blacktown City Council [2021] NSWLEC 1306 (IRM)

The New South Wales Land and Environment Court (LEC) judgment associated with IRM Property Group (No. 2) Pty Ltd v Blacktown City Council [2021] NSWLEC 1306 determined that:

- The proposed development did not firstly take the necessary steps to avoid or minimise impact on biodiversity values on the site, as required in s 6.4 of the BC Act.
- The proposed development did not sufficiently consider environmental impacts in accordance with Section 4.15(1)(b) of the EPA Act.

Key contentions of this LEC case included:

- The proposed development did not sufficiently avoid or minimise impacts to native vegetation with mapped biodiversity values located in the southern portion of the site. The vegetation on site was identified as Cumberland Shale Hills Woodland (CSHW), Cumberland Shale Plains Woodland (CSPW) and Cumberland River Flat Forest.
- The future Biodiversity Stewardship Site (BSS) is not an appropriate avoidance strategy to offset the loss of Biodiversity values that will result from the clearing on the site.
- Council considered that there were better alternative lot design options that would protect vegetation mapped with biodiversity values, particularly associated with proposed Lot 17

- Whilst the proponent considered economic aspects of the proposed development, there was insufficient consideration of environmental impacts, which is not consistent with facilitating ecologically sustainable development in accordance with the EP&A Act.
- Pursuant to s 6.4(1) of the BC Act, the court considered that the applicant must firstly demonstrate appropriate and sufficient steps have been taken to avoid or minimise impact to areas with vegetation mapped with biodiversity values, and only then if satisfied that this is achieved, the relevant biodiversity conservation measures should be considered to offset or compensate any impacts such as from clearing.

Conclusions

- After consideration of the evidence before the Court in assessment of the DA under appeal, we are not satisfied that the amended DA sufficiently addresses the relevant jurisdictional requirements established in the BC Act and the EPA Act.
- The proposed development does not firstly take the necessary steps to avoid or minimise impact on biodiversity values on the site, as required in s 6.4 of the BC Act. We find there is a likely impact from the proposed development on the natural environment, therefore we cannot be satisfied that s 4.15(1)(b) of the EPA Act is achieved
- The appeal for DA 19-01184 as amended is refused, pursuant to s 4.16(1)(b) of the EPA Act.

Tomasic v Port Stephens Council [2021] NSWLEC 56 (Tomasic)

The New South Wales Land and Environment Court (LEC) judgment associated with *Tomasic v Port Stephens Council [2021] NSWLEC 56 (Tomasic)* determined that:

- The proposed subdivision did not avoid or mitigate to an acceptable degree the adverse effects of the subdivision on the EEC (i.e. *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast bioregions*) and preferred koala habitat on the site. A different subdivision layout could have avoided and mitigated those adverse effects to a greater extent.

In finding that the proposed subdivision would have unacceptable impacts on the EEC, Preston CJ set out the regulatory framework created by the BC Act and stated that:

169.*The biodiversity mitigation hierarchy requires, in order, avoiding impacts, minimising impacts and only then offsetting or compensating for residual impacts that remain after all steps are taken to avoid or minimise these impacts. The proposed subdivision fails to take all appropriate avoidance and minimisation measures.*

Planners North v Ballina Shire Council [2021] NSWLEC 120 (Planners North)

The New South Wales Land and Environment Court (LEC) judgment associated with *Planners North v Ballina Shire Council [2021] NSWLEC 120 (Planners North)* determined that:

- The non-development of land subject to a Biobanking Agreement (BBA) and mapped under the Coastal Management SEPP was not considered to be *avoidance* because the Manufactured Home Estates SEPP prevented consent being granted on such land owing to its status as a mapped wetland.

5.1.1.2 Key avoidance and minimisation considerations

Key **ecological**, **economic** and **social** considerations (all of which are considered as per the EP&A Act) for impact avoidance and minimisation include the following:

- **Native Vegetation Impacts (Area) –** The Subject Site contains four (4) vegetation communities of variable condition states, areas exotic (managed) grassland, and no listed Threatened Ecological Communities (TECs).
- **Higher Condition Vegetation Zones -** The Subject Site contains a total of nine (9) vegetation zones. Vegetation Zones 1, 5, 8, and 9 contain moderate – good condition intact vegetation representative of PCT 1590, PCT 1619, PCT 1567, and PCT 1556 respectively. The remainder vegetation zones are characterized as 'regenerating' 'managed', or 'weedy' and are of lower condition.
- **Areas of High Biodiversity Value –** Two (2) areas of biodiversity value are identified on the *Biodiversity Values Map and Threshold Tool* as occurring within the Subject Site, including: mapped '*Biodiverse riparian land'* and '*Identified Old Growth Forest'*. These areas are associated with the riparian vegetation occurring in close proximity to Deep Creek

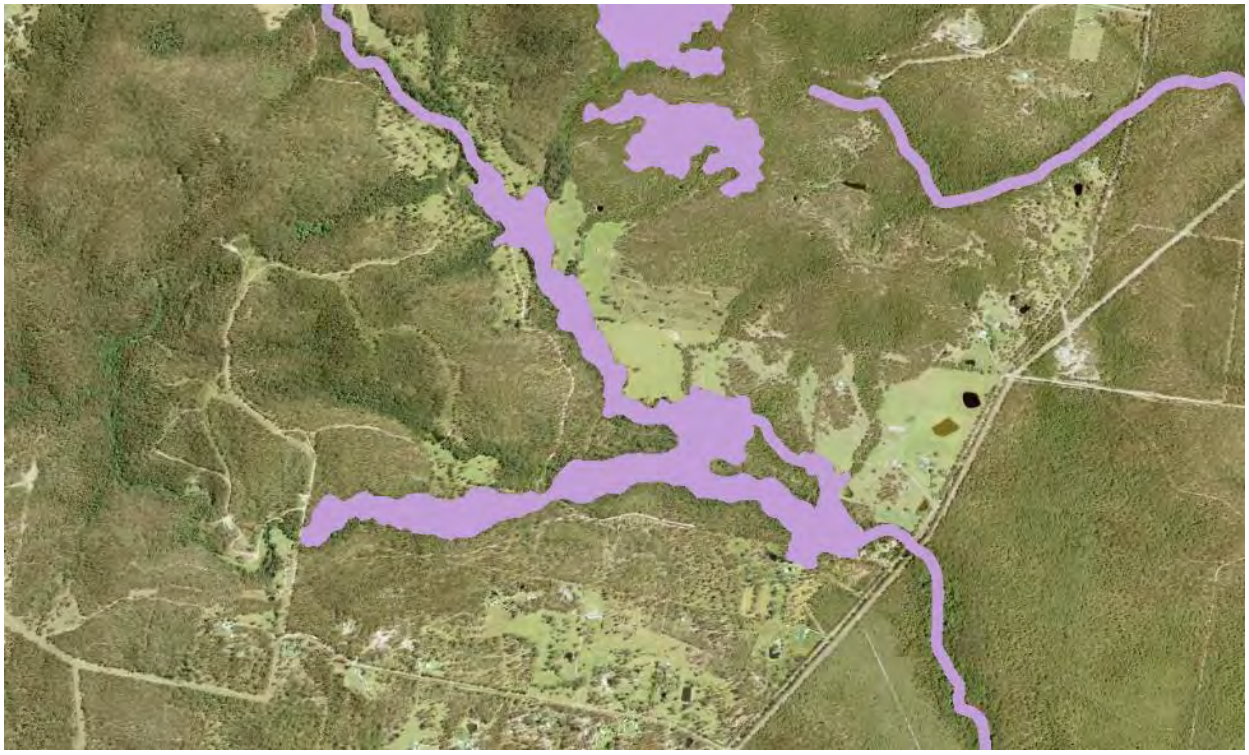


Plate 17: Mapped Biodiversity Values on the NSW *Biodiversity Values Map and Threshold Tool*

- **Fauna Habitat Features –** A total of 360 habitat trees (comprised of 228 hollow-bearing trees and 132 dead stags) were identified during the surveys within the Study Area (**Figure 4**)
- **Threatened Species Habitat –**
    - o *Callistemon linearifolius* (Netted Bottlebrush) - A total of 573 individuals of the species were detected within the Study Area during the assessment.

- *Tetratheca juncea* (Black-eyed Susan) – A total of 1,462 Tetratheca juncea individuals were identified during survey, forming two separate populations
- Koala (*Phascolarctos cinereus*) – A total of six (6) detections of koala were made throughout the Study Area. The majority of the broader Subject Site is considered foraging habitat for the species. Vegetation within the proposed quarry footprint is considered of '*transient'* use by the species with higher activity occurring to the south of the quarry footprint (Biolink 2022). Areas of higher resource availability for the species occur adjacent to watercourses and gullies, associated with Vegetation Zones 8 and 9 (see **Figure 5** and **Plate 16**).
- New Holland Mouse (*Pseudomys novaehollandiae*) – Targeted surveys completed by Biolink confirmed that the species occurs within the Subject Site with an Extent of Occurrence of 77.02 ha and estimated population of 1156.07 (95% CI: 784.06 – 1528.85) individuals (Biolink 2022) (see **Plate 18**).
- Squirrel Glider (*Petaurus norfolcensis*) – Squirrel Glider was identified via remote cameras.
- Southern Myotis (*Myotis macropus*) – Southern Myotis was identified via Anabat recordings. Habitat for the species has been assessed as all PCTs which the species is associated with under the Threatened Biodiversity Data Collection that occur within 200 m of the foraging habitat. Foraging habitat includes areas with >3m of open water.

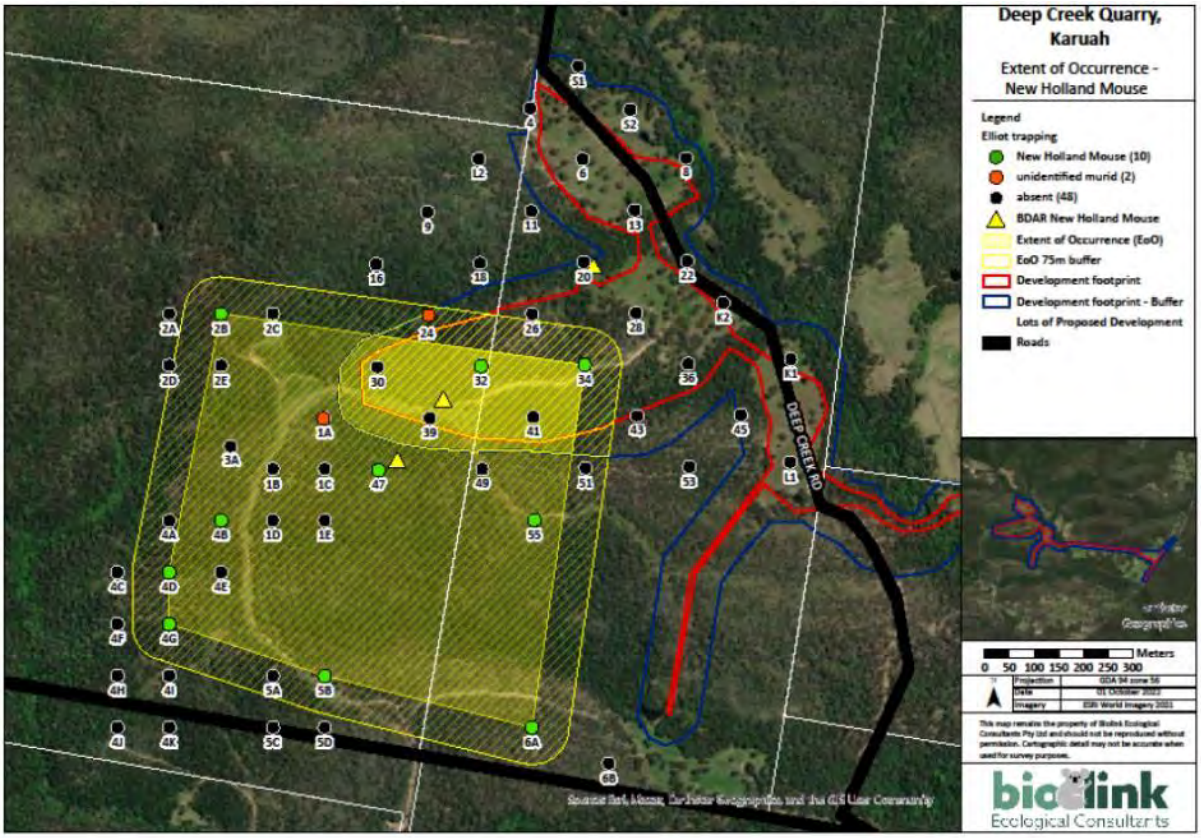


Plate 18: Biolink New Holland Mouse (NHM) trapping results (Biolink 2022)
coded as NHM absent (black circles) (n =50) or present (green circles) (n = 10). The NHM Extent of Occurrence (yellow polygon) and associated buffer (yellow hatching) based on the two survey events is indicated. NHM records reported by the BDAR (yellow triangles) of Kleinfelder (2021) are also illustrated for context.

- **Hydrological Impacts –** A number of first order streams occur within the broader Subject Site, all of which are tributaries of Deep Creek, which itself is a tributary to the Karuah River located to the east of the Subject Site.
- **Resource Quality –** The proposed development seeks to develop the high value rhyolite product located within the site.
- **Dust and Noise Impacts (Social) –** The proposed development seeks to minimise visual impacts to adjoining landowners and public roads and noise and dust impacts to dwellings (and broader environment) to the west, south, east and north of the quarry.
- **Services (Electricity) –** Initially electricity supplies for the quarry were to be drawn from the mains network along The Bucketts Way

Key Recommendations from Biolink

The following avoidance recommendations were proposed by BioLink with regard to the Koala:

Koala (*Phascolarctos cinereus*)

- Stadia-metric survey of PKFTs along the proposed alignment of the haul road (i.e., currently proposed alignment and 20 m either side) should be provided so as to demonstrate that the loss of PKFTs > 300 mm DBH on non-alluvial soils, and all PKFTs > 100 mm DBH on alluvial soils has been minimised. Any unavoidable loss of PKFTs should be addressed via revegetation.
- PKFTs represent a finite food resource for free-ranging koalas. As such, we recommend addressing the reduction in carrying capacity of the landscape which will result from the loss of PKFTs within the development area by focusing on increasing the extent of PCT 1567. This PCT has a higher carrying capacity than other PCTs, especially in alluvial landscapes.

5.1.1.3 Key avoidance and minimisation measures

The proposed action has been the subject of an extensive project design process since it was first considered in 2013. The key steps in the design process has been as follows:

Avoidance measures

The proposed action has been the subject of an extensive project design process since it was first considered in 2013. Section 1.5.3 of the EIS provided an outline of the key alternatives that were considered in the development of the Project. Further consideration of the avoidance measures contained within the project alternatives is provided below, highlighting the ecological value of the project design elements.

- **Resource Area**: Resource evaluations of the property identified a potential quarry resource in excess of 90 ha (with access and facility areas in addition to this area). This resource comprised a thick high quality rhyolite material located near the centre of the adopted pit shell, along with other rhyolite and arenite (a hardened sandstone) quarry materials across the site. From this total resource area the following amendments were made:
  - Consideration of surrounding ridge lines and risk of noise propagation reduced the western and northern extent of the adopted resource boundary. This removed approximately 20 ha from the pit extent and avoided impacts in that catchment.
  - *Tetratheca Juncea* populations identified during initial investigations resulted in the contraction of the southern boundary of the quarry, which also retained a ridge line that would

limit noise propagation to the south. This removed a further 34 ha of pit extent (remaining resource area of 36 ha).

- Additional *Tetratheca juncea* individuals located mid-slope in the current pit shell were then avoided that removed a further 7 ha from the pit extent. While this avoided direct impacts, it would have resulted in a change in the hydrological conditions of those plants, with uncertain outcomes. This avoidance resulted in the loss of higher quality rhyolite resource and changed the direction of quarrying activities and introduced more complex highwalls.
- With further resource evaluation, a decision was made to consolidate and simplify the quarry extent to focus on the highest quality resource onsite. This resulted in the avoidance of 18 ha of native vegetation to the south of the current pit shell and impacts to a first order creek, however the 7 ha previously avoided (albeit hydrologically modified) was now directly impacted. This resulted in a final quarry pit area of approximately 18 ha.
- The eastern extent of the pit shell plays an important part in ensuring adequate resource can be extracted, while maintaining a more free-draining final landform (i.e. as opposed to a void pit).

- **Hydrology:** Hydrological impacts of the quarry have been avoided through the following:
  - The western boundary of the quarry has been positioned near the crest of a hill to minimise disturbance to adjacent catchments.
  - Adjustment of the northern and southern boundaries to avoid the majority of first order drainage lines.
  - The eastern boundary avoiding Deep Creek and the associated riparian vegetation.
  - The quarry floor being positioned above where the hydraulic head of a lower quality groundwater has been measured below the quarry floor.
- **Visual**: The quarry location and extraction plan has been developed to avoid visual impacts to adjoining land owners and public roads and noise impacts to dwellings to the south east and west of the quarry.
- **Access**: The following access considerations were evaluated:
  - Forest Glen Road, while a legal access road to the property was avoided due to the greater number of dwellings in proximity to the haulage route in conjunction with steeper grades to access the quarry. To establish a better grade would have resulted in more extensive clearing and disturbance.
  - Deep Creek Road, while a legal access road has a disjointed alignment and is heavily constrained by vegetation requiring widening of the existing cleared area, that would also impact on threatened species (*Callistemon Linearifolius and Tetratheca juncea*). Use of Deep Creek Road would have also resulted in high noise impacts to a dwelling located less than 20m from the legal alignment.
  - The proposed alignment was developed in consultation with neighbouring land owners, and enables a straighter and more energy efficient haulage road for the quarry. The alignment follows the fence line and access easement for the neighbouring property. Additional discussions with a neighbouring land owner (R30) resulted in further amendment to the proposed road corridor shifting the eastern section of the road south to minimize impacts on dwelling R30 to north of the access road.

- The implementation of speed restrictions and limit of haulage operations from 6am to 6pm (i.e. essentially daylight hours) will avoid impacts to nocturnal species.
- Surveys of large hollow bearing trees within the gully lines guided the placement of the internal access roads and the new quarry access road. Within the Deep Creek section of the access road, the alignment avoided very large trees on the east and west of the creek line, including a Tallowwood with a diameter at breast height of over 2m) was also avoided.
- Changes in the location of the tarping bay, east of Deep Creek to avoid large preferred koala feed trees.
- In addition to the above, the section of the access road crossing of Deep Creek included the following considerations:
  - As the road caters for large heavy vehicles, the curvature, or horizontal alignment required to maintain a safe and practical road reduces the ability to avoid trees.
  - The location of cadastral boundaries provides a restricted window to the placement of the road.
  - The alignment sort to avoid compromising better quality grazing land on the alluvial flats east of Deep Creek.
  - The western extent of the alignment needs to intersect the existing Deep Creek Road and the office area at a suitable angle to maintain a safe intersection.
  - The topography of the area helps dictate the best location in terms of optimum cut and fill requirements.
  - The need to maintain suitable grades for heavy vehicles prevented pushing the road further west into the hill as the extent of cut (and disturbance area) increases considerably.
  - The alignment ideally approaches the creek at a near perpendicular angle to the flow within Deep Creek.

- **Infrastructure areas**: While strategically beneficial due to the lower slopes, the stockpile area and the office and workshop areas have been positioned within the cleared areas west of Deep Creek.

As evident from the above design considerations, significant avoidance has been incorporated into the presented quarry design, this is likely to include avoidance of the following ecological values:

- Over 72 ha of native vegetation (and the associated habitat for a broad range of threatened fauna).
- More than 1,225 *Tetratheca juncea* individuals.
- More than 200 individuals of *Callistemon Linearifolius*.
- Numerous hollow bearing trees.
- Avoidance of potential ecological impacts by limiting the affected catchments and direct impacts to 1st order drainage lines from the quarry pit.

Implementation of Biolink recommendations

Stadia-metric survey of PKFTs along the proposed alignment of the haul road

A koala tree survey was completed on 4 and 17 August 2022 recording the location of all Preferred Koala Feed Trees (PKFTs) (Tallowwood [*Eucalyptus microcorys*] and Grey Gum [*Eucalyptus punctata*]) within the proposed haul road and access road (and buffer). These trees were defined by species, size class (<300mm or >300mm dbh) and location on alluvial soil or non-alluvial soil in accordance with Biolink recommendations (Biolink 2022). PKFs of highest value included PKFTs of any size on alluvial soils, and PKFTs >300mm on non-alluvial soils.

As the proposed haul road and access road is largely within disturbed areas and existing tracks impacts to PKFTs were predominantly avoided. Maps outlining the occurrence of PKFTs along the Haul Road are provided in **Appendix 9**.

Reduction in impacts on PCT 1567 as it has a higher carrying capacity

The Development Site will impact on a total of 1.83 ha of PCT 1567. Measures to reduce impacts have been taken where possible and impacts to the is PCT are only proposed for creek crossings. Due to the location of the resources, creek crossings are required for access. Where possible existing crossings have been utilised and crossings have been designed in such way to minimise clearing. As outlined above PFKTs in these areas were avoided where possible.

Consideration of other Planning Instruments and Initiatives

The Tops to Lakes Initiative

The Tops to Lakes (T2L) Initiative is a long-term strategic program that seeks to deliver, through Council vision and action and community and agency partnerships, coordinated decision-making that achieves:

1. The protection and reinstatement of environmental services functions within the natural landscape (including, but not limited to, the provision of water flows and water quality protection and improvement),
2. The conservation and re-establishment of biodiversity and habitat resilience and connectivity across the Great Lakes
3. The recognition of the importance of natural areas for their cultural significance and for their contribution to recreational opportunities and spiritual wellbeing

The vision for the Tops to Lakes initiative is: *The ecosystems of the Great Lakes area, from Barrington Tops to the coast and the coastal lakes, are healthy, functional and connected. This is achieved in a manner that conserves and restores natural landscapes and populations of native plants and animals, preserves and reinstates environmental services functions and contributes to the longterm economic, social, cultural and spiritual well-being of our communities.*

The Karuah NR – Black Bulga SCA connection is relevant to the proposed development. As such, the proposed development aims to protect environmental services functions and the conservation of important linkages through the area through the following:

- Avoidance of impacts to watercourses and riparian vegetation areas
- Maintenance of movement corridors north/south and along watercourses through the accommodation of fauna underpasses in the design of culverts.

- The conservation of surrounding lands and the establishment of BSAs to protect these areas in perpetuity.

The Great Eastern Ranges Initiative

The aim of the Great Eastern Ranges Initiative is to protect and connect native ecosystems along the 3600 kilometres of the Great Dividing Range and Eastern Escarpment from central Victoria to far north Queensland. The Great Eastern Ranges Initiative aims to reconnect fragmented habitats across land uses and complement the conservation work done in formal protected areas in order to respond to climate change threats.

The proposed development aims to support the goals of the Great Eastern Ranges initiative through the following:

- Maintenance of movement corridors north/south and along watercourses through the accommodation of fauna underpasses in the design of culverts.
- The conservation of surrounding lands and the establishment of BSAs to protect these areas in perpetuity.
- Provide supplementary KFT plantings within the broader site.

Further Impact Minimisation Measures

- The implementation of speed restrictions and limit of haulage operations to 6 am to 6 pm (i.e. essentially daylight hours) will avoid impacts to nocturnal species.
- Initial electricity supplies for the quarry were to be drawn from the mains network along The Bucketts Way and along a corridor parallel with the new access road. The required designs and associated easements means further widening in the clearing along the access road corridor. On the basis of the high installation costs and the increased vegetation clearing the preferred option was to provide electricity to the quarry via solar power and diesel generators.
- Other avoidance has included consideration of large hollow bearing trees in the placement of access roads, and while strategically beneficial, the placement of infrastructure areas on the lower slopes and cleared areas west of Deep Creek.

Avoidance measures in accordance with BC Act and Case Law requirements

Mid-Coast Council (MCC) requested consideration of key avoidance requirements including the New South Wales Land and Environment Court (LEC) judgments on *IRM Property Group (No. 2) Pty Ltd v Blacktown City Council [2021] NSWLEC 1306 (IRM)* and other relevant case law relevant to the proposed development, these are summarized in **Table 21** below.

Table 21 Key Avoidance and Minimisation Requirements

Relevant Case	Conclusion	Consideration within this Proposal
IRM Property Group (No. 2) Pty Ltd v Blacktown City Council [2021] NSWLEC 1306 (IRM)	The applicant must firstly demonstrate appropriate and sufficient steps have been taken to avoid or minimise impact to areas with vegetation mapped with biodiversity values, and only then if satisfied that this is achieved, the relevant biodiversity conservation measures should be considered to offset or compensate any impacts such as from clearing.	The proposed development has shown steps to avoid and minimise impacts to biodiversity values in **Section 5.1.1.3**. Residual impacts will be offset through the purchase of suitable credits. The proposal also includes the creation of

Relevant Case	Conclusion	Consideration within this Proposal
	The BDAR proposed the establishment of a Biodiversity Stewardship Site (BSS) in the southern portion of the site, rather than firstly taking the necessary steps to avoid or minimise the impact to biodiversity values as required in s 6.4 of the BC Act. The appeal for DA 19-01184 as amended is refused, pursuant to s 4.16(1)(b) of the EPA Act.	Biodiversity Stewardship Sites (BSS) within the broader subject site. These BSS are additional to the listed avoidance and minimisation steps and offsetting of residual impacts.
Tomasic v Port Stephens Council [2021] NSWLEC 56 (Tomasic)	The proposed subdivision did not avoid or mitigate to an acceptable degree the adverse effects of the subdivision on the EEC (i.e. *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast bioregions*) and preferred koala habitat on the site. A different subdivision layout could have avoided and mitigated those adverse effects to a greater extent.	The proposed development has shown steps to avoid and minimise impacts to biodiversity values in **Section 5.1.1.3**.
Planners North v Ballina Shire Council [2021] NSWLEC 120 (Planners North)	The non-development of land subject to a Biobanking Agreement (BBA) and mapped under the Coastal Management SEPP was not considered to be *avoidance* because the Manufactured Home Estates SEPP prevented consent being granted on such land owing to its status as a mapped wetland.	The proposed development has shown steps to avoid and minimise impacts to biodiversity values in **Section 5.1.1.3**. The Manufactured Home Estates SEPP is not relevant to the proposed development.

5.1.2 Avoid and Minimise Impacts on Prescribed Biodiversity Impacts

The following are prescribed impacts which need to be considered as per Section 7.2 of the BAM (DPIE 2020).

Impact of development on the habitat of threatened species or ecological communities associated with significant geological features, human made structure or non-native vegetation.

No significant geological features (e.g. caves, rock overhangs), human made structures (e.g. bridges) or non-native vegetation associated with threatened species habitat or ecological communities occur within the Study Area.

Impacts of the development on the connectivity of different habitat which facilitates movement of threatened species

A large portion of the Development Site has been located within areas that are already disturbed and impose only limited width breaks (e.g. the access road corridor) within the general north-west to south east corridor (i.e. generally along the direction of Deep Creek).. Due to the large extent of forest vegetation surrounding the Development Site, the location of the quarry between two gullies, and the limited disturbance within gully lines where existing connectivity is highest, impacts to connectivity and movement of threatened species within the locality are likely to be minor.

Impact of the development on the movement of threatened species that maintains their life cycle

As outlined above, the Development Site has been positioned to utilised cleared areas within the Study Area and retain areas of better quality habitat that may be important to the movement of

threatened species. Habitat connectivity will be maintained within dense native vegetation to the north, west and south. Habitat connectivity will also be maintained within the riparian forest vegetation associated with Deep Creek to the east. Due to these avoidance measures, impacts of the development on the movement of threatened species within the Study Area and locality have been minimised and are unlikely to affect their life cycles.

Impacts of the development on water quality, bodies and hydrological processes that sustain threatened species or ecological communities.

In the absence of the implementation of suitable controls potential unmitigated impacts to surface water during construction, and operations to a lesser extent, have been assessed as a result of removal of vegetation, stripping of topsoil, excavation, stockpiling, concreting, instream works, transportation of cut and fill and accidental spills and leaks.

- The subsequent impact to water quality could be increased turbidity, suspended solids, nutrients and contaminants from mobilisation of soils, which in turn could lead to increased weed growth and algal blooms and smothering of aquatic organisms. Oily films, increased alkalinity and pH, and elevated concentrations of toxicants from concreting works and accidental leaks and spills could result in reduced health of aquatic organisms.
- Operational water discharges to Deep Creek will be required to meet quality criteria, failure to adhere to these criteria could result in similar impacts to those noted above.
- Waterways at greatest risk are those directly impacted (instream works) or located in close proximity to construction works such as Deep Creek.

The project will be required to operate in accordance with a Soil and Water Management Plan and Environmental Protection Licence that will guide and regulate the quarry and the potential impacts on water. With implementation of this management plan and the EPL, impacts on surface water quality will be minimal.

Impact of wind turbine strikes on protected animals

Not applicable to the current application.

Impacts of vehicle strikes on threatened species or on animals that are part of a TEC

Vehicle and machinery movements are necessary during the construction and operational phases of the Project. The quarry itself has relatively short travel distances and will operate within a broader cleared area. The access road is approximately 1.6km and runs near perpendicular to the general north-west to south east vegetated corridors. The construction and operational times are limited to generally daylight hours that will limit the potential for vehicle strikes. As such impacts from vehicle strikes is not anticipated to be a significant impact from the Project. Measures to minimise any potential impacts would be through the implementation of reduced vehicle speeds within construction zones and operationally for all traffic.

5.2 ASSESSMENT OF IMPACTS

5.2.1 Impacts on Native Vegetation, Threatened Ecological Communities and Threatened Species Habitat

5.2.1.1 Direct Impacts

Direct impacts of the Project are expected to occur during clearing works. This will be highest during construction and will then increase progressively during operations until the maximum extent is cleared. Within the Development Site, the Project will equate to the complete removal of all native vegetation (total 29.02 ha of native vegetation). Each vegetation zone equates to one management zone; and the future value of each attribute (composition, structure, and function) will be zero. As such the vegetation integrity score for all management zones within the Development Site following development will be zero. The change in the Vegetation Integrity Score of each Vegetation Zone and Threatened Species Habitat Polygon is provided in **Table 22**.

Table 22 Change in Vegetation Integrity Scores within the Development Site.

Zone	PCT & Class / Species	Area (ha)	Current Vegetation Integrity Score	Future Vegetation Integrity Score	Change in Vegetation Integrity Score
Vegetation Zones					
1	1590: Mod_Good	10.59	55.8	0	-55.8
2	1590: Managed	6.48	31.8	0	-31.8
3	1590: Regenerating	0.62	64.5	0	-64.5
4	1590: Weedy	0.72	27.7	0	-27.7
5	1619: Mod_Good	3.87	63.5	0	-63.5
6	1619: Managed	1.79	17.4	0	-17.4
7	1619: Regenerating	3.07	53.8	0	-53.8
8	1567: Mod_Good	1.83	76.1	0	-76.1
9	1556: Mod_Good	0.17	76.8	0	-76.8
Callistemon linearifolius					
1	1590: Mod_Good	3	55.8	0	-55.8
2	1590: Managed	15	31.8	0	-31.8
5	1619: Mod_Good	9	63.5	0	-63.5
8	1567: Mod_Good	33	76.1	0	-76.1
Tetratheca juncea					
1	1590: Mod_Good	10.59	55.8	0	-55.8
5	1619: Mod_Good	3.87	63.5	0	-63.5
7	1619: Regenerating	3.07	53.8	0	-53.8
Koala					
1	1590: Mod_Good	10.59	55.8	0	-55.8
2	1590: Managed	6.48	31.8	0	-31.8
3	1590: Regenerating	0.62	64.5	0	-64.5

Zone	PCT & Class / Species	Area (ha)	Current Vegetation Integrity Score	Future Vegetation Integrity Score	Change in Vegetation Integrity Score
4	1590: Weedy	0.72	27.7	0	-27.7
5	1619: Mod_Good	3.87	63.5	0	-63.5
6	1619: Managed	1.79	17.4	0	-17.4
7	1619: Regenerating	3.07	53.8	0	-53.8
8	1567: Mod_Good	1.83	76.1	0	-76.1
9	1556: Mod_Good	0.17	76.8	0	-76.8
Southern Myotis					
1	1590: Mod_Good	2.72	55.8	0	-55.8
2	1590: Managed	5.83	31.8	0	-31.8
3	1590: Regenerating	0.17	64.5	0	-64.5
4	1590: Weedy	0.39	27.7	0	-27.7
5	1619: Mod_Good	3.17	63.5	0	-63.5
6	1619: Managed	1.70	17.4	0	-17.4
7	1619: Regenerating	2.52	53.8	0	-53.8
8	1567: Mod_Good	1.21	76.1	0	-76.1
Squirrel Glider					
1	1590: Mod_Good	10.59	55.8	0	-55.8
2	1590: Managed	6.48	31.8	0	-31.8
3	1590: Regenerating	0.62	64.5	0	-64.5
4	1590: Weedy	0.72	27.7	0	-27.7
5	1619: Mod_Good	3.87	63.5	0	-63.5
6	1619: Managed	1.79	17.4	0	-17.4
7	1619: Regenerating	3.07	53.8	0	-53.8
8	1567: Mod_Good	1.83	76.1	0	-76.1
9	1556: Mod_Good	0.17	76.8	0	-76.8

5.2.1.2 Indirect Impacts

The Project has the potential to cause the following indirect impacts on land adjacent to the Development Site during construction and operations (see Section 5.3):

- Increased levels of dust.
- Increased levels of noise. Operations are limited largely to daytime hours (6am -6pm), so increased light levels would be minimal.
- Erosion of soils within and adjoining the disturbance area and the associated sedimentation down gradient if controls are not in place.
- Downstream modification of hydrology and vegetation downstream of the impact area (addressed in prescribed impacts).

- Transfer of weeds and pathogens.

5.2.1.3 Prescribed Impacts

An assessment of the Project on Prescribed Impacts is summarized in **Table 23**. Where required, a detailed assessment is provided in the sections following the table below.

Table 23 Assessment of the Project on Prescribed Impacts

Prescribed Impact	Impact of the Proposal
Impact of development on the habitat of threatened species or ecological communities associated with significant geological features, human made structure or non-native vegetation.	No significant geological features, human made structures or non-native vegetation associated with threatened species habitat or ecological communities occur within the Study Area.
Impacts of the development on the connectivity of different habitat which facilitates movement of threatened species.	Some minor impacts not assessed as significant. Discussed further below.
Impact of the development on movement of threatened species that maintains their life cycle.	Some minor impacts not assessed as significant. Discussed further below.
Impacts of the development on water quality, bodies and hydrological processes that sustain threatened species or ecological communities.	Some minor impacts not assessed as significant. Discussed further below.
Impact of wind turbine strikes on protected animals	Not applicable to the current application.
Impacts of vehicle strikes on threatened species or on animals that are part of a TEC	Vehicle and machinery activity would be increased during the construction and operational phases of the Project. Limited vehicle speeds within works area would be enforced which would limit the potential for impacts from vehicle strikes.

Impacts of the development on the connectivity of different habitat which facilitates movement of threatened species

Vegetation removal will be limited to areas that have already been subject to vegetation clearing or areas of forest vegetation on the edge of larger patches of vegetation, which are continuous within the locality. As such, impacts to these areas of vegetation is unlikely to impact on the movement of fauna in the local area.

Impact of the development on movement of threatened species that maintains their life cycle

As discussed above, the Project would have limited impacts on the movement of threatened species in the local area. While areas of native vegetation would be removed, movement corridors within the local area would be maintained, or interrupted by only narrow cleared corridors associated with the quarry access road.

On this basis, the Project will not cause the fragmentation of the local landscape, such that areas of habitat for threatened species would become isolated and the life cycle of a local population would be placed at the risk of extinction.

Impacts of the development on water quality, bodies and hydrological processes that sustain threatened species or ecological communities.

The Development Site has been positioned to minimize direct impacts on drainage channels such as Deep Creek to the north; however, there is some potential for indirect impacts to water quality downstream through sedimentation and changes in water quality. Implementation of appropriate erosion and sedimentation control measures and discharge licence requirements as part of the

Project will be required to minimize the potential and extent of these impacts (see Section 5.3 – Mitigation Measures).

5.2.1.4 Cumulative Impacts

The impact assessments provided for this quarry have considered the effects of the Project on various aspects of the environment taking into account impacts on local flora and fauna populations and the local community.

The considerations on local flora and fauna populations all include consideration of whether the project places the local population at risk of extinction, in all cases, the connectivity and extent of the population shows there is no risk of local extinction, so cumulatively, assuming the considerations at other quarries are of similar equivalence, the impacts on these same flora and fauna over a more regional area are also unlikely to have a significant impact on the population. It is also noted that inherent in ecological assessments is the consideration of the existing impacts that the State and Federal government have assigned to flora and fauna populations through the designated conservation status.

5.3 MITIGATING AND MANAGING IMPACTS ON BIODIVERSITY VALUES

A site-specific Biodiversity Management Plan (or similar) will be prepared prior to commencement of any clearing or construction works to ensure that impacts are minimised. This would include the measures outlined in **Table 24**.

The following recommendations from the BioLink report have been incorporated in the mitigation measures and will form part of the statement of commitments for the project:

Koala:

- Any unavoidable loss of PKFTs should be addressed via revegetation.
- Infrastructure along any final haul road alignment should include fauna exclusion fencing along the vegetated section of the straight road which is anticipated to run from the Bucketts Way to the base of the incline within the development footprint (between approx. UTH coordinates 398783 / 6397533 and 399673 / 6397416). This exclusion fencing should incorporate koala-grids at fence ends to enforce the exclusion area and the use of three dry box-culverts of sufficient dimensions (minimum 1.2 m x 1.2 m) to facilitate the under-road passage of koalas and other wildlife. Planting PKFT either side of the underpasses will enhance their long-term utility. Fencing, underpass and koala-grid specifications are provided in Appendix 4. The remainder of the straight road, which runs through cuttings in the vegetation, should be fenced with rural fencing at a minimum. It is anticipated that the section of road which follows the steep incline / decline in the development footprint is unlikely to sustain vehicles travelling at high speeds and therefore requires rural fencing at a minimum and the incorporation of wide speed humps and fauna signage.

New Holland Mouse

- Prior to any construction work within 100m of the NHM EoO buffer, an approved onsite relocation or offset translocation plans should be prepared as an appropriate response to longer-term management and monitoring of NHM on the site.
- High-resolution floristic / pedological and landscape data from the 10 NHM capture sites should be used to develop an optimum NHM habitat model to assist identification of potential sites for relocation / translocation.

Table 24 Summary mitigation and management measures for the Project

Impact	Action and Outcome	Responsibility	Timing
Direct impact / prescribed impact – General			
Clearing of native vegetation	• Avoid and minimise clearing impacts to native vegetation where practicable. • Clearly delineate the boundaries of the Development Site to ensure no accidental incursions within retained vegetation. • Ensure vehicle and equipment parking areas and stockpile areas are identified and sited to avoid areas containing ecological value wherever practicable. • Appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' should be installed. • Identify and communicate the location of any 'No Go Zones' in site inductions. • Further mitigation measures to reduce the potential for impacts to Koalas are presented in the KPoM (Kleinfelder 2021).	Construction / Quarry Manager	Prior to and during vegetation clearing.
Removal of hollow-bearing trees / habitat trees, resulting in fauna injury and mortality.	• Limit removal of trees to that required within the Development Site. • A pre-clearing protocol will be implemented during clearing works, as follows: o Pre-clearance surveys will be undertaken to determine if any inhabiting fauna are present. o A suitably qualified and trained fauna handler will be present during hollow-bearing tree clearing to rescue and relocate displaced fauna.	Construction / Quarry Manager, and suitably qualified/trained fauna handler.	Prior to and during tree clearing.
Impacts to surface and groundwater quality and quantity due to sediment run-off and/or contaminant runoff into adjacent watercourses	• Source controls such as sediment fences, mulching and jute matting will be utilised where appropriate. • Site-based vehicles will carry spill kits. • A Soil and Water Management Plan will be required prior to disturbance activities that includes: o An Erosion and Sediment Control Plan for each stage of development. o A Groundwater Management Plan. o A Surface Water Management Plan. • Limit the use of pesticides in the Development Site where possible to avoid the risk of contamination of nearby watercourses/wetland areas.	Construction / Quarry Manager	During vegetation clearing, construction and operation.
Vehicle collision with fauna	• Speed limits within the Development Site will be limited to 40 km/hr. • This speed limit should be communicated in site inductions and through onsite signage. • Staff and contractor awareness of increased animal activity during dawn and dusk should be communicated in site inductions and through appropriate onsite signage. • Mitigation measures to reduce the potential for vehicle strikes to Koalas are presented in the KPoM (Wedgetail 2022).	Construction / Quarry Manager	During construction and operation
Direct impact / prescribed impact – Koala habitat			

Impact	Action and Outcome	Responsibility	Timing
Impacts on Koala habitat	• Preferred Koala Feed Tree (PKFT) Planting Offsets. A total of 450 PFFTs will be planted on a 2:1 offset ratio (loss of 225 PKFTs) across an area of 2.8 ha. • The implementation of a weed control program before and during operations. Monitoring program to be established to monitor vegetation conditions adjacent to the operation areas.	Construction / Quarry Manager	Prior to construction
Direct impact / prescribed impact – New holland Mouse			
	• The proponent proposes the completion of a New Holland Mouse species management plan to further detail management of the species during construction and operation of the quarry. Which will include relocation / translocation of individuals from the Development Site, and habitat assessments to identify optimum habitat for relocation / translocation sites.	Construction / Quarry Manager	Prior to construction within 100 m of the NHM EoO buffer.
Indirect impact - General			
Transfer of weeds and pathogens to and from site.	Fungal pathogens, including Phytophora cinnamomi and Myrtle Rust (Puccinia psidii), and invasive weeds can have devastating impacts on native plant communities and inhabiting fauna if not managed. Key measures are recommended to include: • Earth moving equipment and off road vehicles will be required to enter the site clean, free of loose dirt and vegetation matter. • Weed infestations within the construction footprint are to be identified and mapped prior to construction. • Ensure soil and seed material is not transferred between weedy and weed free areas onsite. • A Plan of Management for the control of noxious weeds is to be included in the Biodiversity Management Plan. This is to include weed control works to be conducted throughout the construction phase of the Project, and follow-up weed control within the Development Site post construction.	Construction / Quarry Manager	During vegetation clearing and construction.
Noise, vibration, waste and air pollution impacts to adjacent sensitive habitat areas.	Increased human activity (from workers and traffic levels) directly adjacent to sensitive habitat areas may cause disturbance to flora and fauna species in adjoining habitat. Impacts from operational activities, such as disturbance to an animal's normal behaviour patterns due to noise, vibration, and dust may cause areas of previously suitable habitat to become sub-optimal and may cause fauna species to vacate areas of previously suitable habitat. Management Plans for the Quarry will consider measures to mitigate impacts on flora and fauna from noise, vibration, waste, and air pollution such as: • Traffic Management Plan that will include measures to improve driver behaviour, that will be communicated through inductions and a Drivers Code of Conduct applicable to all haulage contractors. Key measures to be included are:	Construction / Quarry Manager	During construction and operation.

Impact	Action and Outcome	Responsibility	Timing
	o Speed limits within the Development Site will be limited to 40 km/hr. o Speed limit signage. o Staff and contractor awareness of increased animal activity during dawn and dusk should be communicated in site inductions and through appropriate onsite signage. • Enforce 'carry-in, carry-out' policy regarding rubbish and waste materials generated on site to avoid waste materials entering adjacent vegetation. • Restriction of public access and associated impacts from domestic pets, waste dumping and damage to adjoining vegetation must be enforced pre, during and post construction. • Fence sensitive areas to delineate 'no go' zones. • Noise and vibration minimization practices should be included in the Noise and Vibration Management Plan for the quarry. • Dust control measures will be implemented through the Quarry's Air Quality Management Plan, this should include covering loads where required; amending operations under excessive wind conditions including ceasing operations if required; use of water carts and static sprays as required to control dust; rehabilitation or stabilisation of exposed surfaces; and, other dust minimisation measures as become evident during works.		
Indirect impact – Koala			
Potential vehicle strikes	• The installation of exclusion fencing and koala underpasses at key movement corridors within the Study Area (see KPoM for detailed plan of locations) are to be installed to reduce the risk of vehicle strike. Quarry operation times will further reduce the risk of animal injury/fatalities. • Monitoring program for feral dogs, cats and foxes. If present within the Study Area baiting programs to follow to control feral species.	Construction / Quarry Manager	Post-clearing

6. IMPACT SUMMARY

6.1 SERIOUS AND IRREVERSIBLE IMPACTS

No Serious and Irreversible Impacts (SAIIs) were identified within the Development Site.

6.2 IDENTIFICATION OF IMPACTS REQUIRING OFFSETS

This section provides an assessment of the impacts requiring offsetting in accordance with Section 10 of the BAM (DPIE 2020).

6.2.1 Impacts on Native Vegetation

A summary of the impacts within the Development Site on native vegetation and the required ecosystem credit is provided in **Table 25**. The Biodiversity Credit Report is provided in Appendix 6.

Table 25 Summary of ecosystem credit requirements

Zone	PCT & Class / Species	Area (ha) No.	Current Vegetation Integrity Score	Future Vegetation Integrity Score	Credits Required
Vegetation Zones					
1	1590: Mod_Good	10.59	55.8	0	222
2	1590: Managed	6.48	31.8	0	77
3	1590: Regenerating	0.62	64.5	0	15
4	1590: Weedy	0.72	27.7	0	7
				Subtotal	**321**
5	1619: Mod_Good	3.87	63.5	0	92
6	1619: Managed	1.79	17.4	0	12
7	1619: Regenerating	3.07	53.8	0	62
				Subtotal	**166**
8	1567: Mod_Good	1.83	76.1	0	52
				Subtotal	**52**
9	1556: Mod_Good	0.17	76.8	0	5
				Subtotal	**5**
				Total	**544**

6.2.2 Impacts on Threatened Species

A summary of the impacts on threatened species and the required species credit species is provided in **Table 26**. The Biodiversity Credit Reports are provided in **Appendix 7**.

Table 26 Summary of species credit requirements

Zone	PCT & Class / Species	Area (ha) No.	Current Vegetation Integrity Score	Future Vegetation Integrity Score	Credits Required
Callistemon linearifolius					
1	1590: Mod_Good	3	55.8	0	5
2	1590: Managed	15	31.8	0	23
5	1619: Mod_Good	9	69.0	0	14
8	1567: Mod_Good	33	75.0	0	50
				Total	92
Tetratheca juncea					
1	1590: Mod_Good	10.59	55.8	0	297
5	1619: Mod_Good	3.87	69.0	0	134
7	1619: Regenerating	2.97	58.3	0	87
8	1567: Mod_Good	1.57	75.0	0	59
				Total	**577**
Koala					
1	1590: Mod_Good	10.59	55.8	0	297
2	1590: Managed	6.48	31.8	0	107
3	1590: Regenerating	0.62	64.5	0	20
4	1590: Weedy	0.72	27.7	0	10
5	1619: Mod_Good	3.87	69.0	0	134
6	1619: Managed	1.76	16.9	0	15
7	1619: Regenerating	2.97	58.3	0	87
8	1567: Mod_Good	1.57	75.0	0	59
9	1556: Mod_Good	0.17	77.8	0	7
				Total	**736**
Southern Myotis					
1	1590: Mod_Good	2.72	55.8	0	76
2	1590: Managed	5.83	31.8	0	93
3	1590: Regenerating	0.17	64.5	0	5
4	1590: Weedy	0.39	27.7	0	5
5	1619: Mod_Good	3.17	69.0	0	101
6	1619: Managed	1.70	16.9	0	15
7	1619: Regenerating	2.52	58.3	0	68

Zone	PCT & Class / Species	Area (ha) No.	Current Vegetation Integrity Score	Future Vegetation Integrity Score	Credits Required
8	1567: Mod_Good	1.21	75.0	0	46
				Total	409
Squirrel Glider					
1	1590: Mod_Good	10.59	55.8	0	296
2	1590: Managed	6.48	31.8	0	103
3	1590: Regenerating	0.62	64.5	0	20
4	1590: Weedy	0.72	27.7	0	10
5	1619: Mod_Good	3.87	69.0	0	123
6	1619: Managed	1.76	16.9	0	15
7	1619: Regenerating	2.97	58.3	0	80
8	1567: Mod_Good	1.57	75.0	0	60
9	1556: Mod_Good	0.17	77.8	0	7
				Total	714

6.3 IMPACTS NOT REQUIRING FURTHER ASSESSMENT

Areas not requiring further assessment in accordance with Section 9.3 of the BAM (DPIE 2020) within the Development Site include:

- Existing roads.
- Non-native vegetation (exotic grasslands).
- Existing infrastructure areas.

6.4 SECURING THE OFFSET OBLIGATION

If approved the proponent is committed to fulfilling the offset obligation in accordance with the Biodiversity Offset Scheme (BOS) and will retire all biodiversity credits required prior to the commencement of clearing.

The proponent is committed to securing approximately 235 ha of land to the west of the Development Site under a Biodiversity Stewardship Agreement (BSA). Like-for-like credits generated at the BSA Site would be used to fulfil, in-part, the obligation for the proposal. Where there is a credit shortfall, the proponent is committed to securing other like-for-like credits in accordance with the BOS. Additional credits may be generated through the establishment of additional BSA Sites on land owned by the proponent, or credits will be purchased from the market, or if required payment into the Biodiversity Conservation Fund (BCF) will be made.

In the event that like-for-like biodiversity offsets cannot be achieved prior to the commencement of works, the variation rules would be sought. However, it is not anticipated that the variation rules would be required.

7. ASSESSMENT OF BIODIVERSITY LEGISLATION

7.1 ENVIRONMENT AND BIODIVERSITY CONSERVATION ACT 1999

7.1.1 Assessment Requirements

The EPBC Act requires that developments or undertakings that are likely to have a significant impact on MNES be referred for a determination as to whether they are a controlled action which requires approval under the EPBC Act (Section 1.5.1). Of the nine MNES listed under the Act, those considered relevant to the Study Area are potential impacts on listed threatened species or communities and potential impacts on migratory species listed under international agreements. The results of a search of the relevant threatened species database and an assessment of the likelihood of occurrence of threatened and migratory species is provided in **Appendix 1**.

A delegate of the Commonwealth Minister for the Environment determined that the project is a controlled action under the EPBC Act (EPBC 2020/8823). The EPBC Act controlling provisions for the proposed action are listed threatened species and communities (sections 18 and 18A). The project will be assessed under the Bilateral Agreement (Amending Agreement No.1, 2020) between the Commonwealth and NSW Governments.

The BDAR has prepared in accordance with the assessment requirements provided by DAWE. A summary of these requirements is presented in **Table 27**.

Table 27 Assessment Requirements (DAWE)

Requirement	Location that this is addressed
Introduction	
1. On 7 December 2020, a delegate of the Federal Minister for the Commonwealth Department of Agriculture, Water and the Environment (DAWE) (formerly the Department of Environment and Energy), determined that the Deep Creek Quarry project is a controlled action under section 75 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The EPBC Act controlling provisions for the proposed action are: i. Listed threatened species and communities (sections 18 and 18A).	The BDAR has been prepared in accordance with the EPBC Act controlling provisions.
2. The proposed action will be assessed in accordance with the bilateral assessment agreement between the Australian and NSW governments (Amending Agreement No.1, 2020). The assessment documentation must include: i. an assessment of all impacts that the action is likely to have on each matter protected by a provision of Part 3 of the EPBC Act; ii. enough information about the proposal and its relevant impacts to allow the Federal Minister to make an informed decision on whether or not to approve; and iii. information addressing the matters outlined in Schedule 4 of the Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations).	See below for breakdown of how each point is addressed.
3. The Applicant must undertake an assessment of all protected matters that may be impacted by the development under the controlling provisions identified in paragraph 1. DAWE considers that there is likely to be a significant impact on the following:	The Biodiversity Development Assessment Report has been prepared in accordance with the Biodiversity Assessment Method and addresses impacts to relevant threatened and ecological communities.

Requirement	Location that this is addressed
a) Black-eyed Susan (*Tetratheca juncea*) listed as Vulnerable under the EPBC Act; b) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (Phascolarctos cinereus) listed as Vulnerable under the EPBC Act; and c) Grey-headed Flying-fox (*Pteropus poliocephalus*) listed as Vulnerable under the EPBC Act..	An assessment of potential impacts for each of the relevant EPBC listed species which was assessed as being potentially impacted on due to the proposal (see **Appendix 1**) has been addressed in accordance with the Significant Impact Guidelines 1.1 –Matters of National Environmental Significance (DoE, 2013) Refer to **Appendix 7**.
4. Based on the information in the referral documentation, the location of the action, species records and likely habitat present in the area, DAWE considers that there are likely to be significant impacts to: a) Large-eared Pied Bat (*Chalinolobus dwyeri*) listed as Vulnerable under the EPBC Act; b) New Holland Mouse (*Pseudomys novaehollandiae*) listed as Vulnerable under the EPBC Act; c) Green and Golden Bell Frog (*Litoria aurea*) listed as Vulnerable under the EPBC Act; d) Swift Parrot (*Lathamus discolour*) listed as Critically Endangered under the EPBC Act; and e) Regent Honeyeater (*Anthochaera phrygia*) listed as Critically Endangered under the EPBC Act. These species require further assessment, surveys and analysis to determine whether they are likely to be significantly impacted.	The Biodiversity Development Assessment Report has been prepared in accordance with the Biodiversity Assessment Method and addresses impacts to relevant threatened and ecological communities. An assessment of potential impacts for each of the relevant EPBC listed species which was assessed as being potentially impacted on due to the proposal (see **Appendix 1**) has been addressed in accordance with the Significant Impact Guidelines 1.1 –Matters of National Environmental Significance (DoE, 2013) Refer to **Appendix 7**. Additional surveys for the Green and Golden Bell Frog were conducted and the species were not identified within the Study Area. Additionally, habitat was assessed as marginal for these species, as such, no further assessment was conducted.
5. The Applicant must consider each of the protected matters under the triggered controlling provisions that may be impacted by the action. Note that this may not be a complete list and it is the responsibility of the Applicant to undertake an analysis of the significance of the relevant impacts and ensure that all protected matters that are likely to be significantly impacted are assessed for the Commonwealth Minister's consideration.	Additional species for which habitat was identified within the development site have also been addressed in accordance with the Significant Impact Guidelines 1.1 –Matters of National Environmental Significance (DoE, 2013). Refer to **Appendix 7**.
General Requirements	
6. The Environmental Impact Statement (EIS) must address the matters outlined in Schedule 4 of the EPBC Regulations and the matters outlined below in relation to the controlling provisions.	Refer to the EIS.
7. The title of the action, background of the action and current status.	The title of the action and background information of the action is briefly summarised in **Section 1** of the BDAR. The status of developments associated with approvals to be surrendered is provided in the EIS.
8. The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on Matters of National Environmental Significance (MNES).	The location of the action is described in **Figure 1** and **Figure 2** of the BDAR. Further detail pertaining to elements of the action are presented in the EIS.
9. How the action relates to any other actions that have been or are being taken in the region affected by the action.	The action is not related to any other action proposed or being undertaken in the region. The controlling provisions impacted by the action are considered likely to be cumulative to other actions occurring in the region.

Requirement	Location that this is addressed
10. How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES.	Refer to EIS.
11. The EIS must include an assessment of the relevant impacts of the action on the matters protected by the controlling provisions, including: i. a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long-term relevant impacts; ii. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible; iii. analysis of the significance of the relevant impacts; and iv. any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	Refer to **Appendix 7** of the BDAR.
Avoidance, mitigation and offsetting 12. For each of the relevant matters protected that are likely to be significantly impacted by the action, the EIS must provide information on proposed avoidance and mitigation measures to manage the relevant impacts of the action including: i. a description, and an assessment of the expected or predicted effectiveness of the mitigation measures, ii. any statutory policy basis for the mitigation measures, iii. the cost of the mitigation measures; iv. an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing v. the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	Refer to **Section 5** of the BDAR.
13. Where a significant residual adverse impact to a relevant protected matter is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy.	A biodiversity credit obligation for impacts to biodiversity is presented in Section 6 of the BDAR. The offset strategy is to be developed in accordance the NSW Biodiversity Offset System requirements.
14. For each of the relevant matters likely to be impacted by the action the EIS must provide reference to, and consideration of, relevant Commonwealth guidelines and policy statements including any: i. conservation advice or recovery plan for the species or community; ii. relevant threat abatement plan for a process that threatens the species or community; iii. wildlife conservation plan for the species; and iv. any strategic assessment.	Refer to **Appendix 7** of the BDAR
Key Issues **Biodiversity (threatened species and communities and migratory species)**	
15.For each of the EPBC Act listed species predicted to occur in the project site, and each of the EPBC Act listed ecological communities likely to be significantly impacted, the EIS/Biodiversity Development Assessment Report (BDAR) must provide:	a) Survey methods and results for threatened species (including EPBC listed species) are presented in **Section 4** of the BDAR.

Requirement	Location that this is addressed
a) survey results, including details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Commonwealth guidelines and policy statements and/or the NSW Biodiversity Assessment Method (BAM); b) a description and quantification of habitat in the study area (including suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advices, conservation advices and recovery plans, threat abatement plans and wildlife conservation plans; and c) maps displaying the above information (specific to each EPBC protected matter) overlaid with the proposed action. Note: it is acceptable, where possible, to use the mapping and assessment of Plant Community Types (PCTs) and the species surveys prescribed by the BAM as the basis for identifying EPBC Act-listed species and communities. The EIS/BDAR must clearly identify which PCTs are considered to align with habitat for the relevant EPBC Act listed species or community, and provide individual maps for each species or community.	b) A discussion of available habitat for threatened species is presented in **Section 4** of the BDAR. An EPBC Impact Assessment is also presented in **Appendix 7** and further summarised in **Table 15**. c) Maps are presented in BDAR for all EPBC listed species that were detected during the assessment. The availability of habitat for EPBC listed species that were not detected during the assessment is discussed in **Appendix 7** and summarised in **Table 15**.
16. The EIS/BDAR must describe the nature, geographic extent, magnitude, timing and duration of any likely direct, indirect and consequential impacts on any relevant EPBC Act listed species and communities. It must clearly identify the location and quantify the extent of all impact areas to each relevant EPBC Act listed species or community. 17. For each of the EPBC Act listed species and communities likely to be impacted by the development, the EIS/BDAR must provide information on proposed avoidance and mitigation measures to deal with the impacts of the action, and a description of the predicted effectiveness and outcomes that the avoidance and mitigation measures will achieve. 18. The EIS/BDAR must identify each EPBC Act listed species and community likely to be significantly impacted by the proposed action. Where a significant impact is likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit, how offsets will be secured, and timing of protection. Note: not all of the offset options under the NSW Biodiversity Conservation Act 2016 are endorsed under the EPBC Act for approval purposes. It is a requirement that offsets directly contribute to the ongoing viability of the specific protected matter impacted by a proposed action i.e. 'like for like'. Like-for-like includes protection of native vegetation that is the same EEC or habitat being impacted, or funding to provide a direct benefit to the matter being impacted i.e. threat abatement, breeding and propagation programs or other relevant conservation measures.	The BDAR has been prepared in consideration of all of the assessment requirements listed. This includes survey results, habitat mapping for relevant threatened biota and a detailed discussion of potential impacts (**Appendix 7**).
Other approvals and conditions	
19. Information in relation to any other approvals or conditions required must include the information prescribed in Schedule 4 Clause 5 (a) (b) (c) and (d) of the EPBC Regulations.	Refer to the EIS

Requirement	Location that this is addressed
Environmental Record of person proposing to take the action	
21. Information in relation to the environmental record of a person proposing to take the action must include details as prescribed in Schedule 4 Clause 6 of the EPBC Regulations.	Refer to the EIS
Information Sources	
22. For information given in an EIS, the EIS must state the source of the information, how recent the information is, how the reliability of the information was tested; and what uncertainties (if any) are in the information.	Refer to the EIS

7.1.1.1 Summary of Impacts

Key issues and other information required to address potential impacts to threatened species, ecological communities and migratory species have been addressed in assessments of significance in **Appendix 8**. A summary of impacts to habitat for each of the above listed biota is presented in **Table 28**.

Table 28 Impact Assessment Summary – EPBC listed threatened and migratory species

Threatened Species	Description
Tetratheca juncea (Black-eyed Susan)	*Tetratheca juncea* is confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. It is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover (DPIE 2020). A total of 1,830 *Tetratheca juncea* individuals were identified during survey, forming two separate populations. The larger population is comprised of 1,830 individuals, of which 586 individuals are within the Development Site, 19 individuals are within the Study Area (outside of the Development Site) and 1,225 individuals are within the remaining landholdings (that have been surveyed) and will not be impacted. The second smaller population of 2 individuals was identified on the access road and will be impacted. The extent of habitat that will be impacted within the Development Site was determined to be 19.05 ha as shown in Figure 11. Given that the population of plant clumps is greater than 1000, the larger *T. juncea* population is considered to meet the definition of an 'Important Population' in accordance with the criteria listed in the EPBC Act Referral Guidelines for the Vulnerable Black-eyed Susan, *Tetratheca Juncea* (DSEWPaC, 2011). An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.
Koala (*Phascolarctos cinereus*)	The Koala generally occurs from the Townsville district in northern Queensland, south along the coast and ranges into Victoria and part of South Australia. Within NSW this distribution extends into the western slopes and plains. The habitat mapped within the Study Area meets the definition of habitat critical to the survival of the species in accordance with the assessment criteria provided in the *EPBC Act Referral Guidelines for the Vulnerable Koala* (DotE, 2014). Approximately 235 hectares of native vegetation will be retained within the property boundary, outside the proposed Development Site. Vegetation mapping determined that the majority of this area is comprised of "Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590)". This PCT is dominated by Koala feed trees such as *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Broad-

Threatened Species	Description
	leaved Ironbark) and *Eucalyptus umbra* (Bastard White Mahogany). These areas are therefore likely to represent suitable Koala habitat. An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Grey-headed Flying-fox individuals were observed flying over the Study Area during survey. No roost sites / camps for the species were detected within the Study Area despite targeted surveys undertaken in accordance with the *Survey Guidelines for Australia's Threatened Bats* (DEWHA, 2010). Large areas of potential foraging habitat occurs within the Study Area, of which 29.02 ha is within the Development Site and is to be removed as part of the proposed action. The Grey-headed Flying-fox is a highly mobile species and utilises a variety of forested habitats within or near coastal areas of south-eastern Australia. Although canopy trees within the indicative disturbance footprint have the potential to provide foraging habitat for Grey-headed Flying-fox when in flower, roosting habitat is not present. The closest Nationally Important Flying-fox Camp is located approximately 10 km west of the Study Area at Glenn William (identification number 241). The individuals recorded traversing the Study Area do not form part of an important population in accordance with the criteria specified in the EPBC Act Significant Impact Guideline: Matters of National Environmental Significance (DEWHA, 2013). An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.
Large-eared Pied Bat (*Chalinolobus dwyeri*)	The preferred foraging habitat of the species is comprised of well-timbered areas containing gullies where it forages for small, flying insects below the forest canopy. The Large-eared Pied Bat was detected by AnabatTM bat-call detectors on the proposed access road of the Development Site Individuals detected during the survey are likely to utilise the foraging habitats associated with drainage channels such as Deep Creek. The majority of this habitat will be retained within and outside the property boundary to the north, east and south of the proposed Development Site. The Large-eared Pied Bat roosts and breeds 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. No known roost sites have been identified within the Study Area; hence it is unlikely that breeding habitat will be impacted. An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.
New Holland Mouse (*Pseudomys novaehollandiae*)	The species is largely restricted to the coast of central and northern NSW, with one inland occurrence near Parkes (ACT Environment and Sustainable Development Directorate 2013). The New Holland Mouse has been found from coastal areas and up to 100 km inland on sandstone country (Wilson and Laidlaw 2003). The New Holland Mouse was recorded at 13 locations within the Study Area and surrounds, three of which occurs within the Development Site. A total of 43.06 ha of potential New Holland Mouse habitat occurs within the Study Area, of which 17.45 ha occurs within the Development Site. Individuals were recorded in PCT 1556, PCT 1567 and PCT 1590, during survey. All woody vegetation in high to moderate condition has been considered as potential habitat for the species.

Threatened Species	Description
	An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.
Swift Parrot (*Lathamus discolour*)	This species breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. The species was not detected during the assessment; however, suitable foraging habitat was identified. An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.
Regent Honeyeater (*Anthochaera phrygia*)	The Regent Honeyeater (*Anthochaera phrygia*) is a nomadic feeder and can be found throughout its range where there is suitable blossom occurring (Franklin et al., 1989). This species is mostly recorded in box-ironbark eucalypt associations. They prefer the wettest, most fertile sites within these associations, such as along creek flats, broad river valleys and foothills. The species was not detected during the assessment and there are no records of the species in the locality. The Study Area represents potential foraging habitat for the species, with no breeding being recorded in the region. A total of 29.02 ha of potential foraging habitat occurs within the Development Site. Approximately 235 hectares of suitable habitat for the species will be retained within the property boundary, outside the proposed Development Site. An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.
Fork- tailed Swift (*Apus pacificus*)	The Fork- tailed swift is found in a wide range of climatic zones and habitats. It breeds in sheltered locations such as caves, natural rock crevices or under the roofs of houses. The species breeds in eastern Asia. It is strongly migratory, spending the northern hemisphere's winter in Southeast Asia and Australia (Barret et al. 2003; DSEWPC 2013). The species forages in high open spaces over varied habitat types. mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. The species was not detected during the assessment; however, suitable foraging habitat was identified. An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.
White-throated Needletail (*Hirundapus caudacutus*)	The species is a migratory bird, breeding in Central Asia and southern Siberia, and wintering south in the Indian Subcontinent, Southeast Asia and Australia (Chantler 1999). They build their nests in rock crevices in cliffs or hollow trees (Higgns 1999). The species was not detected during the assessment; however, suitable foraging habitat was identified. An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.
Satin Flycatcher (*Myiagra cyanoleuca*)	The Satin Flycatcher is found in Australia, Indonesia, and Papua New Guinea (Blakers et al. 1984). Its natural habitats are temperate forests and subtropical or tropical moist lowland forests. It breeds mostly in south-eastern Tasmania and Australia. It is

Threatened Species	Description
	declining throughout the eastern seaboard due to predation from the introduced Red Fox and habitat loss. The species was not detected during the assessment; however, suitable foraging habitat was identified. An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.
Black-faced Monarch (*Monarcha melanopsis*)	The species is found along the eastern seaboard of Australia, and also New Guinea where most birds migrate to during the austral winter (May to August). The preferred habitat is rainforest and wet forest (Barret et al. 2003). The species was not detected during the assessment; however, suitable foraging habitat was identified. An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.
Rufous Fantail (*Rhipidura rufifrons*)	This species is found in Australia, Indonesia, Micronesia, New Guinea and the Solomon Islands. They are migratory, travelling to south-eastern Australia in the spring to breed, and then north in the autumn (Barret et al. 2003). The species tends to feed on small insects in the lower parts of the canopy. The species was not detected during the assessment; however, suitable foraging habitat was identified. An Impact Assessment in accordance with the guidelines (DSEWPaC 2011) has been prepared for the species in Appendix 7. This assessment determined that the Activity is unlikely to have a significant impact on the species.

Timing of Impacts to Matters of National Environmental Significance

Table 29: Timing of impacts to MNES

EPBC Act listed entity	Nature and Consequence of Impact (direct & indirect)	Duration of Impact (e.g. construction, operation, life of project)	Quantum of Impact	Consequence of Impact (local, state and national scales)	Impact requires offsetting? (significant or not)
Tetratheca juncea (Black-eyed Susan)	Direct impact to individuals and habitat	Construction	Total 586 individuals (32% of subpopulation)	Local Population Scale	Yes (Species Credits)
Koala (*Phascolarctos cinereus*)	Direct impact to habitat, indirect impact along access track (Truck movements)	Direct impacts during construction, indirect impacts for the life of the project	29.15 ha of suitable habitat	Local Population Scale	Yes (Species Credits)
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Direct impact to foraging habitat	Construction	29.15 ha of foraging habitat	Local Population Scale	No. Impacts to the species foraging habitat will be offset through the retirement of Ecosystem Credits.

EPBC Act listed entity	Nature and Consequence of Impact (direct & indirect)	Duration of Impact (e.g. construction, operation, life of project)	Quantum of Impact	Consequence of Impact (local, state and national scales)	Impact requires offsetting? (significant or not)
Large-eared Pied Bat (Chalinolobus dwyeri)	Direct impact to foraging habitat	Construction	29.15 ha of foraging habitat	Local Population Scale	No. Impacts to the species foraging habitat will be offset through the retirement of Ecosystem Credits.
New Holland Mouse (*Pseudomys novaehollandiae*)	Direct impact to habitat	Construction	29.15 ha of suitable habitat	Local Population Scale	Yes (Ecosystem Credit retirement will fulfil the requirement for offsets for this species. The 235 ha offset area will also provide local offsets for the species)
Swift Parrot (*Lathamus discolour*)	Direct impact to potential foraging habitat	Construction	29.15 ha of low suitability potential foraging habitat	Local Population Scale	No. Impacts to the species foraging habitat will be offset through the retirement of Ecosystem Credits.
Regent Honeyeater (*Anthochaera phrygia*)	Direct impact to potential foraging habitat	Construction	29.15 ha of low suitability potential foraging habitat	Local Population Scale	No. Impacts to the species foraging habitat will be offset through the retirement of Ecosystem Credits.
Fork- tailed Swift (*Apus pacificus*)	Direct impact to potential foraging habitat	Construction	29.15 ha of potential foraging habitat	Local Population Scale	No. Impacts to the species foraging habitat will be offset through the retirement of Ecosystem Credits.
White-throated Needletail (*Hirundapus caudacutus*)	Direct impact to potential foraging habitat	Construction	29.15 ha of potential foraging habitat	Local Population Scale	No. Impacts to the species foraging habitat will be offset through the retirement of Ecosystem Credits.

EPBC Act listed entity	Nature and Consequence of Impact (direct & indirect)	Duration of Impact (e.g. construction, operation, life of project)	Quantum of Impact	Consequence of Impact (local, state and national scales)	Impact requires offsetting? (significant or not)
Satin Flycatcher (*Myiagra cyanoleuca*)	Direct impact to potential foraging habitat	Construction	1.99 ha of potential foraging habitat	s	No. Impacts to the species foraging habitat will be offset through the retirement of Ecosystem Credits.
Black-faced Monarch (*Monarcha melanopsis*)	Direct impact to potential foraging habitat	Construction	1.99 ha of potential foraging habitat	Local Population Scale	No. Impacts to the species foraging habitat will be offset through the retirement of Ecosystem Credits.
Rufus Fantail (*Rhipidura rufifrons*)	Direct impact to potential foraging habitat	Construction	1.99 ha of potential foraging habitat	Local Population Scale	No. Impacts to the species foraging habitat will be offset through the retirement of Ecosystem Credits.

Table 30 Summary of species credit requirements

EPBC Act listed entity	Vegetation Zones Associated with the Species	Area of Impact	Credits Required	Credits Type
Tetratheca juncea (Black-eyed Susan)	**Veg Zone 1** PCT 1590 (Mod_Good)	10.59	296	Species Credits
	Veg Zone 5 PCT 1619 (Mod_Good)	3.87	123	
	Veg Zone 7 PCT 1619 (Regenerating)	3.07	83	
	Veg Zone 8 PCT 1567 (Mod_Good)	1.83	70	
Koala (*Phascolarctos cinereus*)	**Veg Zone 1** PCT 1590 (Mod_Good)	10.64	296	Species Credits
	Veg Zone 2 PCT 1590 (Managed)	6.70	103	
	Veg Zone 3 PCT 1590 (Regenerating)	0.62	20	
	Veg Zone 4 PCT 1590 (Weedy)	0.72	10	
	Veg Zone 5 PCT 1619 (Mod_Good)	3.87	123	
	Veg Zone 6 PCT 1619 (Managed)	1.76	16	
	Veg Zone 7 PCT 1619 (Regenerating)	2.97	83	
	Veg Zone 8 PCT 1567 (Mod_Good)	1.57	70	
	Veg Zone 9 PCT 1556 (Mod_Good)	0.17	7	
	Veg Zone 7 PCT 1619 (Regenerating)	2.97	62	

EPBC Act listed entity	Vegetation Zones Associated with the Species	Area of Impact	Credits Required	Credits Type
	Veg Zone 8 PCT 1567 (Mod_Good)	1.57	52	
	Veg Zone 9 PCT 1556 (Mod_Good)	0.17	5	
New Holland Mouse (*Pseudomys novaehollandiae*)	**Veg Zone 1** PCT 1590 (Mod_Good)	10.64	297	Ecosystem Credits
	Veg Zone 4 PCT 1590 (Weedy)	0.72	10	
	Veg Zone 5 PCT 1619 (Mod_Good)	3.87	134	
	Veg Zone 8 PCT 1567 (Mod_Good)	1.57	59	
	Veg Zone 9 PCT 1556 (Mod_Good)	0.17	7	
	Veg Zone 2 PCT 1590 (Managed)	6.70	77	
	Veg Zone 3 PCT 1590 (Regenerating)	0.62	15	
	Veg Zone 4 PCT 1590 (Weedy)	0.72	7	
	Veg Zone 5 PCT 1619 (Mod_Good)	3.87	92	
	Veg Zone 6 PCT 1619 (Managed)	1.76	12	
	Veg Zone 7 PCT 1619 (Regenerating)	2.97	62	
	Veg Zone 8 PCT 1567 (Mod_Good)	1.57	52	
	Veg Zone 9 PCT 1556 (Mod_Good)	0.17	5	

7.2 BIOSECURITY ACT 2015

Species which require control to ensure they are not spread due to works prior to and post construction of the Development Site include species identified as priority weeds in the Hunter; *Senecio madagascariensis* (Fireweed), and *Lantana camara* (Lantana). Additionally, these species are listed as Weeds of National Significance (WoNS).

Mitigation measures to prevent the spread of weeds within the Study Area are presented in **Section 5.3.**

7.3 SEPP (KOALA HABITAT PROTECTION) 2020

The Study Area is located within Mid-Coast LGA, which is listed within Schedule 1 of the Koala SEPP 2020 and is zoned Rural Land. The Koala SEPP 2020 was therefore deemed applicable for the Development Site. As such, an assessment of Koala habitat suitability was conducted in accordance with the SEPP including the determination of Potential Koala Habitat (Step 1) or Core Koala Habitat (Step 2) within the Subject Site. These terms are defined as the following:

- Potential Koala Habitat: means areas of native vegetation where trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.
- Core Koala Habitat: means 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.

The presence of Potential Koala Habitat or Core Koala Habitat within the Subject Site, as defined by the SEPP, are considered below.

Step 1 - Potential Koala Habitat

All Plant Community Types within the Development Site are dominated by Koala Feed tree species listed under Schedule 2 of the Koala SEPP. These species constitute over 15% of the total number of trees within each Vegetation Zone. As such, the vegetation within the Development Site constitutes “Potential Koala Habitat” as defined under the SEPP.

Step 2 - Core Koala Habitat

The Koala was recorded at six locations in four areas within the Study Area from via opportunistic sighting, remote camera and via SAT Assessment. The four areas included: 1) mid-way along the access road (opportunistic sighting and camera); 2) near Deep Creek crossing (opportunistic sighting and SAT Assessment); 3) in a gully near the southern side of the quarry pit (SAT Assessment); and 4) within the riparian corridor below the main stockpile area (SAT Assessment). All detections tended to be within the lower slopes and gullies. Two Koala detections occurred within the Development Site. A total of 39 Koala records occur within a 5 km of the Subject Site. As such, the vegetation within the Development Site constitutes “Core Koala Habitat” as defined by the SEPP.

In accordance with the SEPP, a Koala Plan of Management (KPoM) has been prepared for the project (Kleinfelder 2021).

8. REFERENCES

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APPENDIX 1: THREATENED SPECIES DATABASE SEARCH

A list of threatened species, populations and ecological communities that have been reported or modelled to occur from within a five-kilometre radius of the Study Area was obtained from the following databases:

- NSW Office of Environment and Heritage (OEH) BioNet Atlas: (http://www.bionet.nsw.gov.au/) (25/11/2022)
- Department of Environment and Energy (DoEE) Protected Matters search tool: (www.environment.gov.au/erin/ert/epbc/index.html).

Note: Pelagic and shorebird species have not been included in the list due to the lack of potential habitat within the Study Area.

An assessment was then made of the likelihood of the threatened species, populations, and / or ecological communities reported or modelled to occur in the locality occurring within the Study Area or using the habitat within the Study Area as an essential part of a foraging range.

The table below summarises the likelihood of threatened species and EPBC Act listed migratory species occurring within the Study Area based on the habitat requirements of each species. A brief definition of the likelihood of occurrence criteria is provided below:

- Known – species identified within the site during surveys.
- High – species known from the area (OEH Wildlife Atlas records), suitable habitat (such as roosting and foraging habitat) present within the site.
- Moderate – species may be known from the area, potential habitat is present within the site.
- Low – species not known from the area and/or marginal habitat is present within the site.
- Nil – habitat requirements not met for this species within the site.

An assessment of the likelihood of threatened species, populations and ecological communities occurring within the Study Area

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
Flora								
1.	*Allocasuarina defungens* Dwarf Heath Casuarina	E	E	2	BioNet Atlas	Dwarf Heath Casuarina is found only in NSW from the Nabiac area, north-west of Forster, to Byron Bay on the NSW north coast. This species grows mainly in tall heath on sand but can also occur on clay soils and sandstone. The species also extends onto exposed nearby-coastal hills or headlands adjacent to sandplains. **The Study Area is outside of the known distribution for this species.** **Species not detected during targeted surveys within the study area.**	Nil	No
2.	*Angophora inopina* Charmhaven Apple	V	V	13	BioNet Atlas, PMST	Occurs most frequently in four main vegetation communities: *Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina* woodland/forest; *Hakea teretifolia–Banksia oblongifolia* wet heath; *Eucalyptus resinifera–Melaleuca sieberi–Angophora inopina* sedge woodland; *Eucalyptus capitellata–Corymbia gummifera–Angophora inopina* woodland/forest. **Species not detected during targeted surveys within the study area.**	Nil	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
3.	*Arthraxon hispidus* Hairy-joint Grass	V	V	-	PMST	This species occurs as far south as Kempsey, and west to Glen Innes, NSW. Moisture and shade-loving grass, found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps. **The Study Area is outside of the known distribution for this species.**	Nil	No
4.	*Asperula asthenes* Trailing Woodruff	V	V	-	PMST	Inhabits damp areas, often along riverbanks. **Suitable habitat present within the study area. Species not detected during targeted surveys within the study area.**	Low	No
5.	*Caladenia tessellata* Thick Lip Spider Orchid	E	V	-	PMST	In NSW this species is found sporadically on the coast from Swansea and extends onto the Tablelands further south. *Caladenia tessellata* is normally found on clay or sandy soils in grassy sclerophyll woodlands, although it has been recorded on stony soil. The species is now known with certainty from only two populations on the NSW Southern Tablelands. **No suitable habitat (soil and vegetation formation) and no records in the locality.**	Nil	No
6.	*Callistemon linearifolius* Netted Bottle Brush	V	-	15	BioNet Atlas	This shrub grows up to 3-4 m tall, with red flowers that are clustered into the typical "bottlebrushes". The species grows in dry sclerophyll forest on the coast and adjacent ranges. **Suitable habitat present within the Study Area. Targeted surveys onsite detected this species.**	Known	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
7.	*Cryptostylis hunteriana* Leafless Tongue-orchid	V	V	-	PMST	In New South Wales the species occupies a variety of habitats. The larger populations typically occur in woodland dominated by *Eucalyptus sclerophylla* (Scribbly Gum), *E. sieberi* (Silvertop Ash), *Corymbia gummifera* (Red Bloodwood) and *Allocasuarina littoralis* (Black Sheoak). The species grows most often on the flat plains close to the coast, favouring moist soils. **Low habitat suitability within the study area. Species not detected during targeted surveys within the study area.**	Low	No
8.	*Cynanchum elegans* White- flowered Wax Plant	E	E	-	PMST	Occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum – Banksia integrifolia* subsp. *integrifolia* (Coastal Banksia) coastal scrub; *Eucalyptus tereticornis* (Forest Red Gum) aligned open forest and woodland; *Corymbia maculata* (Spotted Gum) aligned open forest and woodland; and *Melaleuca armillaris* (Bracelet Honeymyrtle) scrub to open scrub. **Suitable habitat present within the study area. Species not detected during targeted surveys within the study area.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
9.	*Dichanthium setosum* Bluegrass	V	V	-	PMST	Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. It is often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched. **Suitable habitat present within the Study Area. However, no known records within locality.**	Low	No
10.	*Diuris flavescens* Pale Yellow Doubletail	CE	CE	-	BAM	Known only from the Wingham-Tinonee - Burrell Creek area, incl. Kiwarrak State Forest; on the mid north coast of New South Wales. Endemic to this area. Grows in grassy tall eucalypt forest with Kangaroo Grass and Bladey Grass on brown clay soil. **Study Area is not within the known distribution of this species. No known records within locality.**	Nil	No
11.	*Diuris praecox* *Newcastle Doubletail*	V	V	-	PMST	Grows in grassy open forest between Ourimbah and Nelsons Bay in NSW. **Suitable habitat present within Study Area. However, no known records within locality. Species not detected during targeted surveys within the Study Area.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
12.	*Eucalyptus glaucina* Slaty Red Gum	V	V	-	PMST, BAM	Observed in a variety of habitats: shallow soils or stony hillsides, but not on poor sandstones; grassy woodlands on deep, moderately fertile and well-watered soil; gentle slopes near drainage lines in alluvial and clayey soils. Associated with the following vegetation classes: Hunter-Macleay Dry Sclerophyll Forests; Northern Gorge Dry Sclerophyll Forests; North Coast Dry Sclerophyll Forests; Sydney Sand Flats Dry Sclerophyll Forests; Western Slopes Grasslands; Coastal Valley Grassy Woodlands; Northern Hinterland Wet Sclerophyll Forests; North Coast Wet Sclerophyll Forests. **Suitable habitat present within the Study Area. However, no known records within locality.** **Species not detected during targeted surveys within the study area.**	Low	No
13.	*Euphrasia arguta*	CE	CE	-	PMST	Could be found in grassy areas near rivers at elevations up to 700 m above sea level, with an annual rainfall of 600 mm. **Suitable habitat present within the study area. However, no known records within locality.**	Low	No
14.	*Grevillea guthrieana*	E	E	-	PMST, BAM	Known from the north coast of NSW, at Booral near Bulahdelah and on the Carrai Plateau, south-west of Kempsey. Grows along creeks and cliff lines in eucalypt forest, on granitic or sedimentary soil. **Study Area is not within the known distribution of this species. No known records within locality.** **Species not detected during targeted surveys within the study area.**	Nil	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
15.	*Grevillea parviflora* subsp. *parviflora* Small-flower Grevillea	V	V	-	PMST, BAM	The species occurs in heath and shrubby woodland, in sandy or lightly clay soils usually over thin shales. **Suitable habitat present within the Study Area. However, no known records within locality.** **Species not detected during targeted surveys within the study area.**	Low	No
16.	*Melaleuca biconvexa* Biconvex Paperbark	V	V	-	PMST, BAM	The species is most commonly found in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects, along freshwater watercourses and in association with *Eucalyptus saligna* (Sydney Blue Gum) or *Eucalyptus robusta* (Swamp Mahogany). **Marginal suitable habitat present within the Study Area. However, no known records within the locality.** **Species not detected during targeted surveys within the study area.**	Low	No
17.	*Melaleuca groveana* Grove's Paperbark	V	-	-	BAM	Grove's Paperbark grows in heath and shrubland, often in exposed sites, in low coastal hills, escarpment ranges and tablelands on outcropping granite, rhyolite and sandstone on rocky outcrops and cliffs. It also occurs in dry srubby open forest and woodlands. **Marginal suitable habitat present within the Study Area. However, no known records within the locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
18.	*Persicaria elatior* Tall Knotweed	V	V	-	PMST	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. **Suitable habitat present within the Study Area. However, no known records within the locality.**	Low	No
19.	*Phaius australis* Lesser Swamp-orchid	E	E	-	PMST	Occurs in Queensland and north-east NSW as far south as Coffs Harbour. Historically, it extended farther south, to Port Macquarie. Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas. **The Study Area is not within the known distribution for this species.**	Nil	No
20.	*Pomaderris queenslandica* Scant Pomaderris	E	-	-	BAM	Widely scattered but not common in north-east NSW and in Queensland. It is known from several locations on the NSW north coast and a few locations on the New England Tablelands and North West Slopes, including near Torrington and Coolata. Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.	Nil	No
21.	*Prasophyllum sp. Wybong (C.Phelps ORG 5269)* (EPBC Act) / *Prasophyllum petilum* (BC Act) A Leek-orchid	E	CE	-	PMST	Known from open eucalypt woodland and grassland. **Suitable habitat present within the Study Area, however no known records within the locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
22.	*Pterostylis chaetophora*	V	-	-	BAM	In NSW it is currently known from 18 scattered locations in a relatively small area between Taree and Kurri Kurri, extending to the south-east towards Tea Gardens and west into the Upper Hunter, with additional records near Denman and Wingen. The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. **Suitable habitat present within the Study Area, however no known records within the locality.**	Low	No
23.	*Rhizanthella slateri* Eastern Australian Underground Orchid	V	E	-	BAM	The species grows in eucalypt forest but no informative assessment of the likely preferred habitat for the species is available. Currently known only from 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. **Marginal habitat present within the Study Area. Species not detected during targeted surveys within the study area.**	Low	No
24.	*Rhodamnia rubescens* Scrub Turpentine	CE	CE	2	BAM, BioNet	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. **Marginal habitat present within the Study Area, however only one know record within the locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
25.	*Rhodomyrtus psidioides* Native Guava	CE	CE	1	BAM	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines. **Marginal habitat present within the Study Area, However, no known records from the locality.**	Low	No
26.	*Senna acclinis* Rainforest Cassia	E	-	-	BAM	Occurs in coastal districts and adjacent tablelands of NSW from the Illawarra in NSW to Queensland. Grows on the margins of subtropical, littoral and dry rainforests. **Marginal habitat present within the Study Area, However, no known records from the locality.**	Low	No
27.	*Solanum sulphureum* Manning Yellow Solanum					Restricted to the Taree – Wingham area on the mid north coast of NSW. Inhabits sunlit breaks in rainforest, rainforest regrowth on pasture land or eucalypt forest with rainforest understorey. **No suitable habitat present within the Study Area. No known records within the locality.**	Nil	No
28.	*Syzygium paniculatum* Magenta Lilly Pilly	E	V	1	PMST, BioNet,	Grows on sandy soils in subtropical and littoral rainforest near the coast from Bulahdelah to Jervis Bay. **No suitable habitat present within the Study Area. Only one known record within the locality.**	Nil	No
29.	*Tetratheca juncea* Black-eyed Susan	V	V	15	BioNet Atlas, PMST	Grows in sandy, occasionally swampy heath and in dry sclerophyll forest; chiefly in coastal districts from Bulahdelah to Lake Macquarie. **Suitable habitat present within the Study Area. Targeted surveys onsite detected this species.**	**Known**	**Yes**

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
30.	*Thesium australe* Austral Toadflax	V	V	-	PMST	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. **Suitable habitat present within the Study Area. However, no known records from the locality.**	Low	No
Birds								
1.	*Anthochaera phrygia* Regent Honeyeater	E	CE	-	PMST	Mostly recorded in box-ironbark eucalypt associations. At times of food shortage, the species also uses other woodland types and wet lowland coastal forest dominated by Swamp Mahogany or Spotted Gum. **Suitable foraging habitat onsite within the Spotted-Gum Forest. Study Area not within Regent Honeyeater Important Habitat mapping and no records of the species in the locality**	**Moderate-Low**	**Yes**
2.	*Botaurus poiciloptilus* Australasian Bittern	E	E	-	PMST	Occurs in reeds and marshes in terrestrial freshwater wetlands and, occasionally estuarine habitats. Nests in stands of *Phragmites, Typha*, and rushes (*Juncus, Baumea* spp.). **Low habitat suitability within the Study Area. No known records from the locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
3.	*Burhinus grallarius* *Bush Stone-curlew*	E	-	-	BAM	Scattered distribution across NSW. Inhabits lowland grassy woodland and open forest and, in coastal areas, Casuarina and Melaleuca woodlands, saltmarsh and mangroves. Requires a low, sparse groundcover, some fallen timber and leaf litter, and a general lack of a shrubby understory. **Low habitat suitability within the Study Area. No known records from the locality.**	Low	No
4.	*Calidris canutus* Red Knot	V	E, M	-	PMST	In Australasia, the species typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons. They are occasionally found on exposed reefs or rock platforms, shorelines with mangrove vegetation, ponds in saltworks, at swamps near the coast, saltlakes and non-tidal lagoons. The Red Knot rarely occurs on inland lakes and swamps. **No suitable habitat present within the Study Area. No known records within locality.**	Nil	No
5.	*Calidris ferruginea* Curlew Sandpiper	E	CE	-	PMST	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. **No suitable habitat present within the Study Area. No known records within locality.**	Nil	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
6.	*Callocephalon fimbriatum* Gang-gang Cockatoo	V	E	-	BAM	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. May also occur in sub-alpine Snow Gum (Eucalyptus pauciflora) woodland and occasionally in temperate rainforests. **Suitable habitat present within the Study Area. However, no known records within locality.**	Low	No
7.	*Calyptorhynchus lathami* Glossy Black-Cockatoo	V	-	3	BAM	Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of Allocasuarina species. Prefers woodland and open forests, rarely away from Allocasuarina. Roost in leafy canopy trees, preferably eucalypts, usually <1 km from feeding site. Nests in large (approx. 20 cm) hollows in trees, stumps or limbs, usually in Eucalypts. **Suitable habitat exists within the Study Area. Species recorded during targeted surveys. No breeding present onsite.**	Known	No
8.	*Dasyornis brachypterus* Eastern Bristlebird	E	E	-	PMST	Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW occurs in open forest with tussocky grass understorey; all of these vegetation types are fire prone. **Suitable habitat present within the Study Area. However, no known records within locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
9.	*Dromaius novaehollandiae* Emu (Endangered Population)	E	-	-	BAM	Occur in a range of predominantly open lowland habitats, including grasslands, heathland, shrubland, open and shrubby woodlands, forest, and swamp and sedgeland communities, as well as the ecotones between these habitats. Breeding occurs in late autumn and winter **Low habitat suitability within the Study Area. Species not detected during targeted field surveys.**	Low	No
10.	*Erythrotriorchis radiatus* Red Goshawk	CE	V	-	PMST	This unique Australian endemic raptor is distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, and with scattered records in central Australia. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers. **No suitable habitat present within the Study Area. No known records within locality.**	Nil	No
11.	*Grantiella picta* Painted Honeyeater	V	V	-	PMST	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. The primary food source for this bird is the fruit and flowers of mistletoes in the genus *Amyema*, though it will also take some nectar and insects. **No suitable habitat due to lack of mistletoes at sufficient densities. No known records within locality.**	Nil	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
12.	*Haliaeetus leucogaster* White- bellied Sea-Eagle	V	M	3	BioNet Atlas, BAM	Inhabits coastal areas including offshore islands and hunts over estuaries and waterways. **Low habitat suitability within the Study Area. No large stick nests observed during surveys. Species not detected during targeted field surveys.**	Low	No
13.	*Hieraaetus morphnoides* Little Eagle	V	-	-	BAM	Occurs throughout NSW except most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. **Suitable habitat within the Study Area. No large stick nests observed during surveys. Species not detected during targeted field surveys.**	Low	No
14.	*Hirundapus caudacutus* White-throated Needletail	V	V, M	-	PMST	Forages in high open spaces over varied habitat types although probably recorded most often above wooded or partly wooded areas, including open forest and rainforest, and may also fly between trees or in clearings. **May fly over Study Area however no foraging habitat present and no avian nests recorded during surveys. No known records within the locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
15.	*Lathamus discolor* Swift Parrot	E	CE	2	BioNet Atlas, PMST	This migratory species has been recorded on the mainland from a variety of habitat types including dry and wet sclerophyll forest, forested wetlands, coastal swamp forests and heathlands. **Potential foraging habitat across the Study Area in *Eucalypt* species.**	**Moderate**	**Yes**
16.	*Lophoictinia isura* Square-tailed Kite	V	-	-	BAM	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Breeding is from July to February. **Low habitat suitability within the Study Area. No large stick nests observed during surveys. Species not detected during targeted field surveys.**	Low	No
17.	*Pandion cristatus* Eastern Osprey	V	-	-	BAM	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. **Low habitat suitability within the Study Area. No large stick nests observed during surveys. Species not detected during targeted field surveys.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
18.	*Ninox connivens* Barking Owl	V	-	-	BAM	Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and in the arid zone. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. **Suitable habitat within the Study Area. Species not detected during targeted field surveys. No records within the locality.**	Low	No
19.	*Ninox strenua* Powerful Owl	V				In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. **Suitable habitat within the Study Area. Species not detected during targeted field surveys. No records within the Locality.**	Low	No
20.	*Lophoictinia isura* Square-tailed Kite	V	-	-	BAM	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Breeding is from July to February. **Low habitat suitability within the Study Area. No large stick nests observed during surveys. Species not detected during targeted field surveys.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
21.	*Pandion cristatus* Eastern Osprey	V	-	-	BAM	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. **Low habitat suitability within the Study Area. No large stick nests observed during surveys. Species not detected during targeted field surveys.**	Low	No
22.	*Ninox connivens* Barking Owl	V	-	-	BAM	Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and in the arid zone. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. **Suitable habitat within the Study Area. Species not detected during targeted field surveys. No records within the locality.**	Low	No
23.	*Ninox strenua* Powerful Owl	V				In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. **Suitable habitat within the Study Area. Species not detected during targeted field surveys. No records within the Locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
24.	*Tyto tenebricosa* Sooty Owl	V	-	1	BAM	Occurs in the coastal, escarpment and tablelands regions of NSW. More common in the north and absent from the western tablelands and further west. Inhabits tall, moist eucalypt forests and rainforests, and are strongly associated with sheltered gullies, particularly those with tall rainforest understorey. Roosts in tree hollows, amongst dense foliage in gullies or in caves, recesses or ledges of cliffs or banks. Nest in large (>40cm wide, 100cm deep) tree hollows in unlogged/unburnt gullies within 100m of streams or in caves. **Suitable habitat within the Study Area. Species detected nearby offsite during targeted field surveys. Not detected within the Study Area.**	Low	No
25.	*Tyto novaehollandiae* Masked Owl	V	-	1	BAM	Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken. **Suitable habitat within the Study Area. Species detected nearby offsite during targeted field surveys. Not detected within the Study Area**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
26.	*Turnix maculosus* Red-backed Button-quail	V	-	-	BAM	A small, cryptic ground-dwelling bird, inhabiting grasslands, open and savannah woodlands with grassy ground layer, pastures and crops of warm temperate areas. The species extends discontinuously from along northern and eastern Australia in mainly coastal and subcoastal regions, preferring sites near water. **Suitable habitat within the Study Area. Species not detected during targeted surveys.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
Mammals								
1.	*Aepyprymnus rufescens* Rufous Bettong	V	-	-	BAM	Largely vanished from inland areas but there are sporadic, unconfirmed records from the Pilliga and Torrington districts. The species inhabit a variety of forests from tall, moist eucalypt forest to open woodland, with a tussock grass understorey. A dense cover of tall native grasses is the preferred shelter. **Marginal habitat present within the Study Area. No known records within the locality. Species not recorded during targeted surveys.**	Low	No
2.	*Cercartetus nanus* Eastern Pygmy-possum	V	-	-	BAM	In NSW, has been found in mallee shrubland dominated by either spinifex (Triodia spp.) or with an understorey of tea-tree (Leptospermum spp.) and also in Belah (Casuarina pauper) in a mixed woodland with well-developed understorey of saltbush. In other states is also frequently found in woodlands with dense heath understorey (particularly Proteaceae species such as Banksia and Hakea species). **Suitable habitat present within the Study Area. Species not recorded during targeted field surveys. No records within the Locality**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
3.	*Chalinolobus dwyeri* Large-eared Pied Bat	V	V	-	PMST	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. Found in well-timbered areas containing gullies. **Potential foraging habitat within the Study Area. Species identified via Anabat**	**Known**	**Yes**
4.	*Dasyurus maculatus* Spotted-tailed Quoll	V	E	3	BioNet Atlas, PMST	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. **Suitable habitat present within the Study Area. Species not recorded during targeted field surveys.**	Low	No
5.	*Macropus parma* *Parma Wallaby*	V	-	-	BAM	Moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. Typically feed at night. **Suitable habitat present within the Study Area. Species not recorded within locality.**	Low	No
6.	*Miniopterus australis* Little Bent-winged Bat	V	-	3	BAM	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. **Suitable foraging habitat present within the Study Area. Species recorded during targeted field surveys.**	Known	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
7.	*Miniopterus orianae oceanensis* Large Bent-winged Bat	V	-	1	BAM	Eastern Bentwing-bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Hunt in forested areas, catching moths and other flying insects above the tree tops. **Suitable foraging habitat present within the Study Area. Species not recorded during targeted field surveys.**	Low	No
8.	*Myotis macropus* Southern Myotis	V	-	1	BAM	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. **Suitable habitat present within the Study Area. Species recorded during targeted field surveys.**	Known	No
9.	*Petauroides Volans* Greater Glider	-	V	-	PMST	Open woodland and tall remnant forests where there is suitable eucalypt trees. Rests in hollow trees during the day and feeds at night. Presence and density of Greater Gliders is related to soil fertility, eucalypt tree species, disturbance history and density of suitable tree hollows **Suitable habitat present within the Study Area. Species not recorded within locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
10.	*Petaurus norfolcensis* Squirrel Glider	V	-	1	BioNet Atlas	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. **Suitable habitat exists within the Study Area. Species recorded during targeted surveys.**	Known	No
11.	*Phascogale tapoatafa* Brush-tailed Phascogale	V	-	-	BAM	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Mating occurs May – July. **Suitable habitat exists within the Study Area. Species not recorded during targeted surveys.**	Low	No
12.	*Petrogale penicillata* Brush-tailed Rock-wallaby	E	V	-	PMST	Occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. **No suitable habitat within the Study Area. Species not recorded within locality.**	Nil	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
13.	*Phascolarctos cinereus* Koala	V	V	39	BioNet Atlas, PMST	Found in a variety of forest types with suitable feed tree species. Feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. **Study Area contains suitable Koala feed trees. Koala scat detected during targeted field surveys. Koalas also detected during spotlighting and camera surveys.**	**Known**	**Yes**
14.	*Planigale maculata* Common Planigale	V		-	BAM	Occupies coastal north-eastern NSW, coastal east Queensland and Arnhem Land. The species reaches its confirmed southern distribution limit on the NSW lower north coast. Common Planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water.	Low	No
15.	*Potorous tridactylus tridactylus* Long-nosed Potoroo (SE Mainland Population)	V	V	1	BioNet Atlas, PMST	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. **Study Area potentially contains suitable habitat. However, species not detected during targeted surveys.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
16.	*Pseudomys novaehollandiae* New Holland Mouse	-	V	-	PMST	Inhabits open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. **Suitable habitat present within the Study Area. Species recorded during targeted surveys.**	**Known**	**Yes**
17.	*Pteropus poliocephalus* Grey-headed Flying-fox	V	V	1	BioNet Atlas, PMST	Occurs across a wide range of habitat types along the eastern seaboard of Australia, depending on food availability. Fruit from myrtaceous trees and rainforest trees form the major components of their diet. **Potential foraging within *Eucalypt* and species within Study Area. No roost sites present. Species detected on site during targeted surveys.**	**Known**	**Yes**
18.	*Vespadelus troughtoni* Eastern Cave Bat	V	-	-	BAM	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. **Suitable habitat present within the Study Area. Species recorded during targeted surveys.**	Known	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
Amphibians								
1.	*Crinnia tinnula* Wallum Froglet	V	-	-	BAM	Found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands under leaf litter, vegetation and other debris. In NSW the species extends from north of the Queensland border south to Kurnell. Breeding occurs in colder months. **Unsuitable habitat present within the Study Area. No known records of the species in the locality.**	Low	No
2.	*Heleioporus australiacus* Giant Burrowing Frog	V	V	-	PMST, BAM	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Breeding habitat of this species is generally soaking or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water. **Suitable habitat present within the Study Area. However, no known records of the species in the locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
3.	*Litoria aurea* Green and Golden Bell Frog	E	V	1	PMST, BioNet, BAM	Prefers open water bodies, fringed by reeds and other aquatic vegetation for breeding and foraging purposes. Needs fallen logs and debris for shelter and over-wintering purposes. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). **Low habitat suitability within the Study Area. Only one known record of the species in the locality. Species not identified during field surveys.**	Low	No
4.	*Litoria brevipalmata* Green-thighed Frog	V	-	-	BAM	Occurs north from Gosford to Qld. Breeding occurs in flooded semi-permanent or ephemeral pools, usually in grassy areas and within 100 m of significant stands of native vegetation. Can tolerate some disturbance but not found in >50% cleared grazing land or entirely urban areas. Usually associated with moist forest (swamp forest, wet sclerophyll or rainforest) but often recorded from dry sclerophyll forests in the northern part of its range. **Suitable habitat present within the Study Area. However, no known records of the species in the locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
5.	*Mixophyes balbus* Stuttering Frog	E	V	-	PMST, BAM	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Breed in streams during summer after heavy rain. Eggs are laid on rock shelves or shallow riffles in small, flowing streams. Tadpoles require deep permanent pools and take approximately 12 months to metamorphose. **Suitable habitat present within the Study Area. However, no known records of the species in the locality.**	Low	No
6.	*Mixophyes iteratus* Giant Barred Frog	E	E	-	PMST, BAM	The species is known to occur along freshwater streams with permanent or semi-permanent water. 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. Requires overhanging or steeply sloped banks for egg deposition. **Suitable habitat present within the Study Area. However, no known records of the species in the locality.**	Low	No
7.	*Uperoleia mahonyi* Mahony's Toadlet	E	-	-	BAM	Mahony's Toadlet is endemic to the mid-north coast of New South Wales (NSW) and to date has been found between Kangy Angy and Seal Rocks. Current observations indicate Mahony's Toadlet inhabits ephemeral and semi-permanent swamps and swales on the coastal fringe of its range **Unsuitable habitat present within the Study Area. No known records of the species in the locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
Insects								
1.	*Uperoleia mahonyi* Mahony's Toadlet	E	-	-	BAM	Mahony's Toadlet is endemic to the mid-north coast of New South Wales (NSW) and to date has been found between Kangy Angy and Seal Rocks. Current observations indicate Mahony's Toadlet inhabits ephemeral and semi-permanent swamps and swales on the coastal fringe of its range **Unsuitable habitat present within the Study Area. No known records of the species in the locality.**	Low	No
Fish								
1.	*Epinephelus daemelii* Black Rockcod	-	V	-	PMST	Usually found in caves, gutters and beneath bommies on rocky reefs, from near shore environments to depths of at least 50 m. Small juveniles are often found in coastal rock pools, and larger juveniles around rocky shores in estuaries. **No suitable habitat within the Study Area. Species not recorded within locality.**	Nil	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
Migratory Species								
1.	*Actitis hypoleucos* Common Sandpiper	-	M	-	PMST	Utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. Has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow and may be steep. Often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags. **Low habitat suitability within the Study Area.**	Low	No
2.	*Anous stolidus* Common Noddy	-	M	-	PMST	Found in tropical and sub-tropical seas off the west, north and east coasts of Australia, from the Abrolhos Islands in WA to the islands of the Great Barrier Reef in Qld, as well as Norfolk and Lord Howe Islands. Some are seen almost annually in NSW as far south as Sydney. **No suitable habitat within the Study Area. Species not recorded within locality.**	Nil	No
3.	*Apus pacificus* Fork- tailed Swift	-	M	-	PMST	Forages in high open spaces over varied habitat types. mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. **May forage aerially above the Study Area. However, no known records within locality.**	**Moderate - Low**	**Yes**

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
4.	*Ardea ibis* Cattle Egret	-	M	1	BioNet Atlas	Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. **Low habitat suitability within the Study Area.**	Low	No
5.	*Ardenna grisea* Sooty Shearwater	-	M	-	PMST	The Sooty Shearwater is a pelagic species which breeds mainly on subtropical and sub-Antarctic islands, as well as on the mainland of New Zealand. **No suitable habitat within the Study Area.**	Nil	No
6.	*Calidris acuminata* Sharp-tailed Sandpiper	-	M	-	PMST	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. Also occur in saltworks and sewage farms. Use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. Use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. **No suitable habitat present within the Study Area.**	Nil	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
7.	*Calidris canutus* Red Knot	V	E,M	-	PMST	In Australasia, the species typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons. They are occasionally found on exposed reefs or rock platforms, shorelines with mangrove vegetation, ponds in saltworks, at swamps near the coast, saltlakes and non-tidal lagoons. The Red Knot rarely occurs on inland lakes and swamps. **No suitable habitat present within the Study Area.**	Nil	No
8.	*Calidris ferruginea* Curlew Sandpiper	E	CE, M	-	PMST	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. **No suitable habitat present within the Study Area.**	Nil	No
9.	*Calidris melanotos* Pectoral Sandpiper	-	M	-	PMST	Prefers shallow fresh to saline wetlands. Found in coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. Has also been recorded in swamp overgrown with lignum. Forage in shallow water or soft mud at the edge of wetlands. **No suitable habitat within the Study Area. Species not recorded within locality.**	Nil	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
10.	*Cuculus optatus* Oriental Cuckoo	-	M	-	PMST	Occurs at rainforest edges, leafy trees in paddocks, river flats, roadsides and mangroves. **Low habitat suitability within the Study Area. Species not recorded within locality.**	Low	No
11.	*Gallinago hardwickii* Latham's Snipe	-	M	-	PMST	Often recorded in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration. **Low habitat suitability within the Study Area. Species not recorded within locality.**	Nil	No
12.	*Hirundapus caudacutus* White-throated Needletail	-	M	-	PMST	Forages in high open spaces over varied habitat types although probably recorded most often above wooded or partly wooded areas, including open forest and rainforest, and may also fly between trees or in clearings. **May forage aerially above the Study Area. However, no known records within locality.**	**Moderate-Low**	**Yes**
13.	*Monarcha melanopsis* Black-faced Monarch	-	M	-	PMST	Found in rainforests, moist eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. **Suitable habitat within the Study Area. However, species not recorded within locality.**	**Moderate-Low**	**Yes**
14.	*Monarcha trivirgatus* Spectacled Monarch	-	M	-	PMST	Inhabits the understorey of mountain/lowland rainforests, thickly wooded gullies and waterside vegetation including mangroves. **Marginal habitat within the Study Area. No records from locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
15.	*Motacilla flava* Yellow Wagtail	-	M	-	PMST	Found in a variety of habitats including short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns. **Marginal habitat within the Study Area. No records from locality.**	Low	No
16.	*Myiagra cyanoleuca* Satin Flycatcher	-	M	-	PMST	Found in tall forests, preferring wetter habitats such as heavily forested gullies. **Suitable habitat within the Study Area. However, no records from locality.**	**Moderate - Low**	**Yes**
17.	*Numenius madagascariensis* Eastern Curlew	-	CE, M	-	PMST	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. **No suitable habitat within the Study Area. Species not recorded within locality.**	Nil	No
18.	*Pandion haliaetus* = *Pandion cristatus* Eastern Osprey	V	M	-	PMST	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. **No suitable habitat within the Study Area. Species not recorded within locality.**	Nil	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
19.	*Rhipidura rufifrons* Rufous Fantail	-	M	-	PMST	Found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. **Suitable habitat within the Study Area. Species not recorded within locality.**	**Moderate - Low**	**Yes**
20.	*Tringa nebularia* Common Greenshank	-	M	-	PMST	Found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. Habitats include embayment's, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. Uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. **Low habitat suitability within the Study Area. Species not recorded within locality.**	Low	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
Threatened Ecological Communities								
1.	*Central Hunter Valley eucalypt forest and woodland*		CE	-	PMST	Typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from finer grained sedimentary rocks. Soils typically have a high clay content and are medium in fertility, relative to nearby deep alluvial loam soils—which are more fertile—and to the skeletal soils of the bordering escarpment landscape—which is made up of less fertile, coarser–grained and sandier soils. Does not occur on alluvial flats, river terraces, windblown sands, Triassic sediments, or escarpments. **Unsuitable habitat within the Study Area. Community does not occur within Study Area.**	Nil	No
2.	*Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community*	-	E	-	PMST	Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally, occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reed lands with scattered trees. **Unsuitable habitat within the Study Area. Community does not occur within Study Area.**	Nil	No

	Species	Status*		Records**	Source***	Habitat Preference	Likelihood of Occurrence	Assessment Required (EPBC Act)?
		BC	EPBC					
3.	*Lowland Rainforest of Subtropical Australia*	-	CE		PMST	The Hawkesbury River notionally marks the southern limit of Lowland Rainforest in the NSW North Coast and Sydney Basin bioregions. South of the Sydney metropolitan area, Lowland Rainforest is replaced by Illawarra Subtropical Rainforest of the Sydney Basin Bioregion, which is listed as an endangered ecological community. Milton Ulladulla Subtropical Rainforest is also a related rainforest endangered ecological community that occurs still further south in the South East Corner Bioregion. **Unsuitable habitat within the Study Area. Community does not occur within Study Area.**	Nil	No
4.	*Subtropical and Temperate Coastal Saltmarsh*	-	V	-	PMST	The community is largely restricted to the intertidal zone of the subtropical and temperate coasts of Australia. Substrates of intertidal saltmarsh are Quaternary or recent alluvium and are saline to hypersaline depending on the extent of inundation and tidal flushing. **Unsuitable habitat within the Study Area. Community does not occur within Study Area.**	Nil	No

* Status. *Biodiversity Conservation Act 2016* (BC), *Environment Protection and Biodiversity Conservation Act 1999* (EPBC), M (Migratory), V (Vulnerable), E (Endangered), CE (Critically Endangered), E3 (Endangered Ecological Community), E4B (Critically Endangered Ecological Community)

** Records. # (number of records within locality), P (Predicted), K (known to occur with the locality).

*** Source. Bionet (NSW Department of Planning and Environment (DPE) BioNet Atlas), PMST (Protected matter database search tool).

APPENDIX 2: FLORA AND FAUNA SPECIES LIST

Flora Species List

Family	Scientific Name	Plot ID	Q01		Q02		Q03		Q04		Q05		Q06		Q07		Q08		Q09		Q10		Q11		Q12		Q13		Q14		Q15	
		BAM Growth Form / High Threat Weeds	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab
Acanthaceae	*Brunoniella australis*	Forb (FG)			0.1	30			0.1	30	0.1	50	0.1	30	0.1	100	0.1	20	0.1	20	0.1	20	0.1	50			0.1	5				
Acanthaceae	*Pseuderanthemum variabile*	Forb (FG)																									0.1	50				
Adiantaceae	*Adiantum aethiopicum*	Fern (EG)																									1	100	0.2	20		
Adiantaceae	*Adiantum hispidulum var. hispidulum*	Fern (EG)																											0.1	10		
Adiantaceae	*Cheilanthes sieberi subsp. sieberi*	Fern (EG)									0.1	20	0.1	200	0.2	50	0.1	50			0.3	500					0.1	20				
Anthericaceae	*Arthropodium milleflorum*	Forb (FG)									0.2	15			0.1	1							0.1	5								
Anthericaceae	*Tricoryne simplex*	Forb (FG)					0.1	1			0.1	5																				
Aphanopetalaceae	*Aphanopetalum resinosum*	Other (OG)																											0.1	5		
Apiaceae	*Hydrocotyle laxiflora*	Forb (FG)					0.1	2																								
Apiaceae	*Hydrocotyle pedicellosa*	Forb (FG)																									0	0				
Apocynaceae	*Gomphocarpus fruticosus*	Exotic															0.1	10							0.1	2					0.1	10
Apocynaceae	*Parsonsia straminea*	Other (OG)																					0.1	1			1	20	2	30		
Araliaceae	*Polyscias sambucifolia*	Shrub (SG)													0.1	10							0.1	5								
Asteraceae	*Aster subulatus*	Exotic																													0.1	5
Asteraceae	*Conyza bonariensis*	Exotic					0	5																							0.1	10
Asteraceae	*Conyza* spp.	Exotic															0.1	2														
Asteraceae	*Epaltes australis*	Forb (FG)															0.1	50			0.1	20										
Asteraceae	*Euchiton involucratus*	Forb (FG)					0.1	5																								
Asteraceae	*Gamochaeta americana*	Exotic																													0.1	20

Family	Scientific Name	Plot ID	Q01		Q02		Q03		Q04		Q05		Q06		Q07		Q08		Q09		Q10		Q11		Q12		Q13		Q14		Q15	
		BAM Growth Form / High Threat Weeds	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab
Asteraceae	*Hypochaeris radicata*	Exotic	1	500	0.1	10	1	100	0.1	10							1	500			0.2	50	0.1	1	0.2	100					0.5	100
Asteraceae	*Lagenophora stipitata*	Forb (FG)	0.1	50	0.1	20					0.1	10							0.1	20	0.1	20	0.1	5	0.1	20	0.1	5				
Asteraceae	*Onopordum acanthium*	Exotic																													0.1	20
Asteraceae	*Ozothamnus diosmifolius*	Shrub (SG)																									0.2	3				
Asteraceae	*Senecio madagascariensis*	High Threat	0.1	5			30	1000									0.2	40			0.1	5			0.1	5					1	100
Asteraceae	*Vernonia cinerea var. cinerea*	Forb (FG)									0.1	20	0.1	10					0.1	20			0.1	5	0.1	5					0.1	2
Bignoniaceae	*Pandorea pandorana subsp. pandorana*	Other (OG)									0.5	20					0.1	5	0.2	20	0.1	10					0.1	1	0.1	5		
Blechnaceae	*Blechnum cartilagineum*	Fern (EG)																									0.5	20				
Campanulaceae	*Wahlenbergia gracilis*	Forb (FG)															0.1	10			0.1	10										
Caryophyllaceae	*Cerastium glomeratum*	Exotic																													0.1	10
Casuarinaceae	*Allocasuarina torulosa*	Tree (TG)			0.1	1			2	4	5	20	2	3	15	20			0.5	2	0.1	2	15	10			2	3	3	5		
Celastraceae	*Denhamia celastroides*	Shrub (SG)													0.1	2											0.1	2	0.2	5		
Clusiaceae	*Hypericum gramineum*	Forb (FG)	0.2	50																	0.1	20			0.1	20						
Convolvulaceae	*Dichondra repens*	Forb (FG)									0.1	1															0.2	150	0.1	200	0.1	1
Convolvulaceae	*Polymeria calycina*	Other (OG)																					0.1	5								
Cunoniaceae	*Ceratopetalum apetalum*	Tree (TG)																									2	5				
Cyperaceae	*Carex longebrachiata*	Grass & grasslike (GG)																											2	50		
Cyperaceae	*Cyperus brevifolius*	Exotic					0.1	1																							0.1	2
Cyperaceae	*Cyperus eragrostis*	High Threat																													0.1	1
Cyperaceae	*Gahnia melanocarpa*	Grass & grasslike (GG)																									5	20				
Cyperaceae	*Gahnia* spp.	Grass & grasslike (GG)																					1	20								
Cyperaceae	*Lepidosperma cf. laterale*	Grass & grasslike (GG)																					1	100								
Cyperaceae	*Lepidosperma laterale*	Grass & grasslike (GG)			0.3	30			0.3	20	0.5	20	0.3	40	0.5	20			0.5	100	0.1	10			0.2	10						
Cyperaceae	*Lepidosperma* spp.	Grass & grasslike (GG)																					0.1	20								

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		BAM Growth Form / High Threat Weeds	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab
Cyperaceae	*Ptilothrix deusta*	Grass & grasslike (GG)	1	500	0.5	300			0.5	100													5	1000								
Dennstaedtiaceae	*Pteridium esculentum*	Fern (EG)			3	80			2	50											0.2	5			4	50						
Dilleniaceae	*Hibbertia aspera*	Shrub (SG)	0.5	10	0.2	10			0.1	2	0.1	5	0.3	30	0.5	10	0.1	3	0.2	10	0.2	10	0.1	10			0.2	5			0.1	1
Dilleniaceae	*Hibbertia aspera subsp. aspera*	Shrub (SG)																							0.1	3						
Dilleniaceae	*Hibbertia diffusa*	Shrub (SG)							0.1	10																						
Dilleniaceae	*Hibbertia riparia*	Shrub (SG)																					0.1	1								
Dilleniaceae	*Hibbertia scandens*	Other (OG)																			0.1	3							0.1	2		
Dilleniaceae	*Hibbertia vestita*	Shrub (SG)							0.3	10			0.1	4																		
Dioscoreaceae	*Dioscorea transversa*	Other (OG)																									0.2	50	0.1	50		
Ebenaceae	*Diospyros australis*	Shrub (SG)																											3	5		
Elaeocarpaceae	*Elaeocarpus reticulatus*	Shrub (SG)																											0.1	1		
Elaeocarpaceae	***Tetratheca juncea***	**Shrub (SG)**			0.1	5			0.1	5																						
Ericaceae	*Acrotriche divaricata*	Shrub (SG)							0.3	5	0.1	2	0.4	2	0.1	1			0.5	2			0.1	2	0.1	2	0.1	1				
Ericaceae	*Epacris pulchella*	Shrub (SG)																					0.2	5								
Ericaceae	*Leucopogon juniperinus*	Shrub (SG)			0.1	1			0.3	5			0.2	3	0.2	5			0.5	5	0.1	2	0.2	5								
Ericaceae	*Monotoca scoparia*	Shrub (SG)			0.2	10			0.1	2																						
Ericaceae	*Trochocarpa laurina*	Tree (TG)			0.1	2																										
Eupomatiaceae	*Eupomatia laurina*	Shrub (SG)																									1	20	2	8		
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Shrub (SG)	0.1	5																												
Fabaceae (Faboideae)	*Daviesia ulicifolia subsp. stenophylla*	Shrub (SG)			0.2	30			0.1	1			0.1	1							0.2	5			0.3	10						
Fabaceae (Faboideae)	*Desmodium brachypodum*	Forb (FG)													0.1	5																
Fabaceae (Faboideae)	*Desmodium gunnii*	Forb (FG)									0.1	20					0.1	40	0.1	100	0.1	20			0.1	50						
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*	Forb (FG)			0.1	20			0.1	30	0.2	20	0.1	30	0	10	0.1	20	0.1	20	0.1	50			0.1	30						
Fabaceae (Faboideae)	*Glycine clandestina*	Other (OG)	0.1	10	0.1	50			0.1	20	0.1	10	0.1	20	0.1	20	0.1	50	0.1	20	0.1	50	0.1	10	0.1	50	0.1	2			0.1	5

Family	Scientific Name	Plot ID	Q01		Q02		Q03		Q04		Q05		Q06		Q07		Q08		Q09		Q10		Q11		Q12		Q13		Q14		Q15	
		BAM Growth Form / High Threat Weeds	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab
Fabaceae (Faboideae)	*Glycine tabacina*	Other (OG)	0.1	20			2	500			0.1	10			0.1	5							0.1	1								
Fabaceae (Faboideae)	*Gompholobium pinnatum*	Shrub (SG)							0.1	10													0.1	2	0.1	20						
Fabaceae (Faboideae)	*Hardenbergia violacea*	Other (OG)			0.1	5			0.1	2	0.1	1					0.1	10	0.1	2	0.1	20			0.1	20						
Fabaceae (Faboideae)	*Jacksonia scoparia*	Shrub (SG)											1	10	0.2	2																
Fabaceae (Faboideae)	*Mirbelia rubiifolia*	Shrub (SG)																					0.1	1								
Fabaceae (Faboideae)	*Platylobium formosum*	Fern (EG)							0.1	20																						
Fabaceae (Faboideae)	*Podolobium ilicifolium*	Shrub (SG)			0.3	20			0.1	5	0.1	2							0.2	15	0.1	3	0.1	3								
Fabaceae (Faboideae)	*Pultenaea paleacea*	Shrub (SG)	0.2	20	0.2	40	0.1	1															0.1	2	0.8	100					0.1	3
Fabaceae (Faboideae)	*Pultenaea villosa*	Shrub (SG)	0.1	5	0.1	3			0.2	10	0.1	2	0.1	1	0.1	5	0.2	8	0.1	2	0.4	20			0.1	5					0.1	1
Fabaceae (Faboideae)	*Trifolium repens*	Exotic	0.1	10			0.1	20																							0.1	50
Fabaceae (Mimosoideae)	*Acacia binervata*	Tree (TG)																									0.5	10				
Fabaceae (Mimosoideae)	*Acacia binervia*	Tree (TG)													0.5	5																
Fabaceae (Mimosoideae)	*Acacia falcata*	Shrub (SG)																							0.1	1						
Fabaceae (Mimosoideae)	*Acacia implexa*	Shrub (SG)													0.5	10																
Fabaceae (Mimosoideae)	*Acacia irrorata*	Shrub (SG)																									0.1	3				
Fabaceae (Mimosoideae)	*Acacia irrorata* subsp. *irrorata*	Shrub (SG)																											0.2	3		
Fabaceae (Mimosoideae)	*Acacia maidenii*	Tree (TG)									0.1	2	0.1	3	0.1	5	0.1	2	0.2	5												
Fabaceae (Mimosoideae)	*Acacia myrtifolia*	Shrub (SG)			0.2	5			0.3	8															0.1	2						
Fabaceae (Mimosoideae)	*Acacia* spp.	Shrub (SG)																							0.1	3						
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Shrub (SG)			0.1	3			0.2	5					0.2	2	0.2	5			0.1	3										

Family	Scientific Name	Plot ID	Q01		Q02		Q03		Q04		Q05		Q06		Q07		Q08		Q09		Q10		Q11		Q12		Q13		Q14		Q15	
		BAM Growth Form / High Threat Weeds	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab
Goodeniaceae	*Goodenia heterophylla subsp. heterophylla*	Forb (FG)																			0.1	20										
Goodeniaceae	*Goodenia paniculata*	Forb (FG)	1	500													0.1	20													0.1	50
Goodeniaceae	*Goodenia* spp.	Forb (FG)																							0.1	10						
Haemodoraceae	*Haemodorum planifolium*	Forb (FG)			0.1	2																										
Haloragaceae	*Gonocarpus teucrioides*	Forb (FG)	0.2	50					0.1	30	0.1	5			0.1	10							0.5	100								
Hypoxidaceae	*Hypoxis hygrometrica*	Forb (FG)															0.1	2			0.1	5			0.1	5						
Hypoxidaceae	*Hypoxis* spp.	Forb (FG)																	0.1	5												
Juncaceae	*Juncus cognatus*	Exotic																													0.1	50
Juncaceae	*Juncus usitatus*	Grass & grasslike (GG)					0.1	10																							0.2	50
Lamiaceae	*Clerodendrum tomentosum*	Tree (TG)									0.1	2															0.1	2	0.1	3		
Lamiaceae	*Plectranthus parviflorus*	Forb (FG)									0.1	20	0.1	2																		
Lauraceae	*Cassytha glabella*	Other (OG)											0.1	5																		
Lauraceae	*Cassytha pubescens*	Other (OG)																	0.1	10												
Lauraceae	*Cinnamomum camphora*	High Threat																									0.1	2				
Lobeliaceae	*Pratia purpurascens*	Forb (FG)	0.5	100	0.1	300	5	1000	0.1	100	0.1	20	0.1	200	0.1	50	0.1	200	0.1	20	0.2	500	0.1	50	0.2	200	0.1	50	0.1	100	0.5	100
Loganiaceae	*Logania sp. A*	Shrub (SG)																									0.2	1				
Lomandraceae	*Lomandra confertifolia*	Grass & grasslike (GG)			0.1	2			0.1	5			40	500	10	50	0.1	2	20	100	3	50										
Lomandraceae	*Lomandra filiformis*	Grass & grasslike (GG)									0.2	20																				
Lomandraceae	*Lomandra glauca*	Grass & grasslike (GG)			0.1	30			0.2	50			0.1	50							0.5	100	0.1	5								
Lomandraceae	*Lomandra longifolia*	Grass & grasslike (GG)	1	20							5	50			0.2	5	0.1	1	0.5	10			0.2	10			1	5	0.2	2	1	20
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Grass & grasslike (GG)											0.1	10	0.1	5			1	20	0.1	5										
Lomandraceae	*Lomandra obliqua*	Grass & grasslike (GG)	0	10	2	500			2	500					0.1	1			0.5	100	0.1	30	0.5	100	3	500					0.1	2
Luzuriagaceae	*Eustrephus latifolius*	Other (OG)									0.1	10			0.1	1			0.2	20	0.1	2	0.1	1	0.1	5	0.1	5	0.1	5		

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		BAM Growth Form / High Threat Weeds	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab
Luzuriagaceae	*Geitonoplesium cymosum*	Other (OG)									0.1	5			0.1	10			0.1	10							0.2	20	0.1	10	0.1	1
Malvaceae	*Sida rhombifolia*	Exotic					0.1	20									0.1	3														
Meliaceae	*Synoum glandulosum subsp. glandulosum*	Shrub (SG)																											7	10		
Menispermaceae	*Sarcopetalum harveyanum*	Other (OG)																											0.1	5		
Menispermaceae	*Stephania japonica var. discolor*	Other (OG)																									0.1	2	0.1	20		
Moraceae	*Ficus coronata*	Shrub (SG)																									0.5	1	1	5		
Myrsinaceae	*Anagallis arvensis*	Exotic																													0.1	2
Myrsinaceae	*Myrsine variabilis*	Shrub (SG)													0.1	5													0.4	10		
Myrtaceae	*Acmena smithii*	Tree (TG)																									2	5	5	8		
Myrtaceae	*Angophora costata*	Tree (TG)							5	4									2	2	0.2	2	1	2			5	4			0.1	1
Myrtaceae	*Angophora floribunda*	Tree (TG)																									5	2				
Myrtaceae	*Baeckea crassifolia*	Shrub (SG)	0.1	5																												
Myrtaceae	*Callistemon rigidus*	Shrub (SG)	0.1	1																												
Myrtaceae	*Corymbia gummifera*	Tree (TG)			35	10			10	9													10	3	7	20					0.1	1
Myrtaceae	*Corymbia maculata*	Tree (TG)									5	10	20	15			3	15	1	1	2	10										
Myrtaceae	*Eucalyptus acmenoides*	Tree (TG)									10	5	10	9																		
Myrtaceae	*Eucalyptus canaliculata*	Tree (TG)	0.5	5							2	3			10	5													3	1		
Myrtaceae	*Eucalyptus eugenioides*	Tree (TG)																					10	3								
Myrtaceae	*Eucalyptus globoidea*	Tree (TG)			2	2																			8	5					5	1
Myrtaceae	*Eucalyptus microcorys*	Tree (TG)	1	5							10	3							10	10	10	40			5	1	15	3				
Myrtaceae	*Eucalyptus paniculata*	Tree (TG)	20	20									10	10																		
Myrtaceae	*Eucalyptus resinifera*	Tree (TG)																					5	0							5	0
Myrtaceae	*Eucalyptus resinifera subsp. resinifera*	Tree (TG)							6	1																			5	2		
Myrtaceae	*Eucalyptus saligna*	Tree (TG)																									10	1				

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		BAM Growth Form / High Threat Weeds	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab
Myrtaceae	*Eucalyptus siderophloia*	Tree (TG)									15	3			25	10													20	2		
Myrtaceae	*Eucalyptus umbra*	Tree (TG)															0.7	2	10	5	1	3	2	2								
Myrtaceae	*Leptospermum laevigatum*	Shrub (SG)																													0.2	5
Myrtaceae	*Leptospermum polyanthum*	Shrub (SG)									0.1	1					0.2	2														
Myrtaceae	*Leptospermum polygalifolium*	Shrub (SG)	2	20	0.3	3					0.1	2							0.2	5			2	20	0.5	20						
Myrtaceae	*Leptospermum trinervium*	Shrub (SG)	0.5	5	0.2	5																										
Myrtaceae	*Lophostemon confertus*	Tree (TG)																									5	2				
Myrtaceae	*Melaleuca nodosa*	Shrub (SG)	1	10																												
Myrtaceae	*Syncarpia glomulifera subsp. glomulifera*	Tree (TG)									2	2							20	5			5	3	1	5	15	5	1	1		
Oleaceae	*Notelaea longifolia*	Tree (TG)																	0.1	5												
Oleaceae	*Notelaea longifolia f. intermedia*	Tree (TG)									0.1	1																	0.5	10		
Orchidaceae	*Acianthus fornicatus*	Forb (FG)									0.1	50							0.1	50												
Orchidaceae	*Cymbidium suave*	Other (OG)							0.1	1																						
Other	Euchiton japonicus	Other (OG)															0.1	20							0.1	10						
Other	Halogaris	Other (OG)																													0.1	5
Other	Orchidaceae spp.	Other (OG)																					0.1	2								
Other	Slender parsonsia	Other (OG)																									0.1	1				
Oxalidaceae	*Oxalis perennans*	Forb (FG)															0.1	100			0.1	50					0	0				
Phormiaceae	*Dianella caerulea var. caerulea*	Forb (FG)	0.1	5							0.2	10																				
Phormiaceae	*Dianella caerulea var. producta*	Forb (FG)			0.2	20			0.1	20			0.1	10	0.2	10	0.1	8	0.5	20	0.1	10	0.2	20			0.5	20			0.1	5
Phormiaceae	*Dianella revoluta var. revoluta*	Forb (FG)							0.1	10			0.1	5																		
Phyllanthaceae	*Breynia oblongifolia*	Shrub (SG)			0.1	3			0.1	2	0.1	5	0.1	2	0.1	5			0.1	5	0.1	7	0.5	10	0.1	4	0.5	10	0.5	10		
Phyllanthaceae	*Glochidion ferdinandi var. ferdinandi*	Tree (TG)			0.1	2					0.1	2	0.1	4	5	10			0.1	5			30	50	0.2	10	15	20	50	30	0.1	2
Phyllanthaceae	*Phyllanthus gunnii*	Shrub (SG)																	0.1	10							0.1	1				

Family	Scientific Name	Plot ID	Q01		Q02		Q03		Q04		Q05		Q06		Q07		Q08		Q09		Q10		Q11		Q12		Q13		Q14		Q15	
		BAM Growth Form / High Threat Weeds	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab
Phyllanthaceae	*Phyllanthus hirtellus*	Shrub (SG)			0.2	40			0.2	30			0.3	100	0.1	10	0.1	20	0.1	10	0.5	100	0.1	10	0.4	100						
Pittosporaceae	*Billardiera scandens*	Other (OG)	0.1	1	0.1	10			0.1	20	0.1	10	0.1	20			0.1	10	0.1	5	0.1	20	0.1	20	0.1	20	0.2	5				
Pittosporaceae	*Bursaria spinosa*	Shrub (SG)	0.1	1							0.1	5							0.2	10												
Pittosporaceae	*Pittosporum multiflorum*	Shrub (SG)																									0.1	5				
Pittosporaceae	*Pittosporum revolutum*	Shrub (SG)													0.2	10													0.1	5		
Plantaginaceae	*Plantago lanceolata*	Exotic					0.1	1																								
Poaceae	*Andropogon virginicus*	High Threat	5	500	0.1	10			0.1	5							0.3	20			5	200	0.1	5	0.2	20					0.5	50
Poaceae	*Anisopogon avenaceus*	Grass & grasslike (GG)			0.2	50			0.2	30													1	100								
Poaceae	*Aristida vagans*	Grass & grasslike (GG)	10	1000	0.3	100			0.3	50	2	500	0.3	80	0.5	50	3	200	0.5	100	2	300	0.5	50	5	500					0.1	20
Poaceae	*Axonopus fissifolius*	High Threat	20	1000			1	100									3	300			0.5	200	0.1	1	0.3	50					25	1000
Poaceae	*Cymbopogon refractus*	Grass & grasslike (GG)			0.1	5					0.1	5					0.2	30							0.2	30						
Poaceae	*Cynodon dactylon*	Grass & grasslike (GG)					5	500																							10	0
Poaceae	*Dichelachne micrantha*	Grass & grasslike (GG)			0.2	40					0.1	5					0.2	100	0.2	100	0.1	30			0.2	100					0.1	5
Poaceae	*Digitaria didactyla*																50	1000			2	200										
Poaceae	*Digitaria parviflora*	Grass & grasslike (GG)							0.1	3			0.1	5	0.1	2	0.1	20			2	200	0.1	20								
Poaceae	*Echinopogon caespitosus*	Grass & grasslike (GG)					0.1	10			0.1	20			0.1	5			0.1	10			0.1	20							0.1	10
Poaceae	*Echinopogon caespitosus var. caespitosus*	Grass & grasslike (GG)			0.1	10											0.4	50			0.5	100			0.2	30						
Poaceae	*Entolasia marginata*	Grass & grasslike (GG)													0.5	100					0.2	30					1	500				
Poaceae	*Entolasia stricta*	Grass & grasslike (GG)	0.5	20	3	200			3	200	5	500	4	500	0.5	100	0.5	100	2	500	5	500	5	500	3	100					0.5	100
Poaceae	*Eragrostis brownii*	Grass & grasslike (GG)	5	500															0.2	100												
Poaceae	*Eragrostis leptostachya*	Grass & grasslike (GG)											0.1	10			0.2	100			10	1000			0.3	50					0.1	5
Poaceae	*Imperata cylindrica*	Grass & grasslike (GG)			0.3	50	20	1000			1	100			0.1	20	10	500	0.5	100	15	500	0.1	20	15	1000	0.1	20	0.2	30	2	500

Family	Scientific Name	Plot ID	Q01		Q02		Q03		Q04		Q05		Q06		Q07		Q08		Q09		Q10		Q11		Q12		Q13		Q14		Q15	
		BAM Growth Form / High Threat Weeds	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab
Poaceae	*Microlaena stipoides var. stipoides*	Grass & grasslike (GG)			0.2	50									0.1	20	0.2	50			0.2	50			0.5	100	1	500				
Poaceae	*Oplismenus aemulus*	Grass & grasslike (GG)									0.1	5											0.1	5								
Poaceae	*Oplismenus imbecillis*	Grass & grasslike (GG)													0.1	10			0.2	50			0.1	20			0.5	100	2	200		
Poaceae	*Panicum simile*	Grass & grasslike (GG)	5	500	0.2	20							0.1	20	0.1	10	0.1	20			1	100	0.1	10	0.5	50	0.2	50				
Poaceae	*Paspalidium distans*	Grass & grasslike (GG)			0.1	10			0.1	5	0.5	100	0.2	40	0.1	50	0.2	30	0.1	5	0.3	50	0.5	100	0.3	50			0.1	5	0.1	20
Poaceae	*Paspalum dilatatum*	High Threat	5	100			0.5	20									2	20			1	30									5	100
Poaceae	*Pennisetum clandestinum*	High Threat					50	1000									5	500													25	1000
Poaceae	*Setaria parviflora*	Exotic																													0.5	50
Poaceae	*Sporobolus africanus*	Exotic															2	70													0.1	10
Poaceae	*Sporobolus pyramidalis*	Exotic															0.1	3														
Poaceae	*Stenotaphrum secundatum*	High Threat	5	500																												
Poaceae	*Themeda triandra*	Grass & grasslike (GG)	1	100	5	200			7	300	5	500	1	100	1	100	2	50	5	500	0.2	10	2	500	20	500					1	100
Polygonaceae	*Rumex conglomeratus*	Exotic																													0.1	20
Polypodiaceae	*Platycerium bifurcatum*	Fern (EG)																											0.1	1		
Primulaceae	*Myrsine howittiana*	Shrub (SG)																											0.3	5		
Proteaceae	*Banksia marginata*	Shrub (SG)																	0.1	2			0.2	5								
Proteaceae	*Banksia spinulosa var. collina*	Shrub (SG)			0.5	4			0.4	3																						
Proteaceae	*Grevillea humilis subsp. humilis*	Shrub (SG)							0.1	1																						
Proteaceae	*Isopogon anemonifolius*	Shrub (SG)							0.3	5																						
Proteaceae	*Lambertia formosa*	Shrub (SG)			3	20			4	20															0.3	3						
Proteaceae	*Lomatia silaifolia*	Shrub (SG)			0.5	20			0.5	20									0.2	10			0.1	5	0.2	8						
Proteaceae	*Persoonia levis*	Shrub (SG)			0.1	2																			0.1	1						
Proteaceae	*Persoonia linearis*	Shrub (SG)			2	20			2	20	0.2	4	2	15	2	5	0.1	3	0.5	10	0.1	5	0.5	10	0.2	2						
Proteaceae	*Xylomelum pyriforme*	Shrub (SG)							0.3	5																						

Family	Scientific Name	Plot ID	Q01		Q02		Q03		Q04		Q05		Q06		Q07		Q08		Q09		Q10		Q11		Q12		Q13		Q14		Q15	
		BAM Growth Form / High Threat Weeds	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab
Ranunculaceae	*Clematis aristata*	Other (OG)																	0.1	1							0.5	10	0.1	2		
Rhamnaceae	*Alphitonia excelsa*	Tree (TG)									0.1	1															0.1	1	0.5	2		
Rosaceae	*Rubus moluccanus var. moluccanus*	Shrub (SG)																									0.1	1				
Rosaceae	*Rubus moluccanus var. trilobus*	Shrub (SG)																											0.1	5		
Rosaceae	*Rubus parvifolius*	Shrub (SG)																	0.1	1												
Rubiaceae	*Galium australe*	Forb (FG)									0.1	5																				
Rubiaceae	*Morinda jasminoides*	Other (OG)																									2	10	2	50		
Rubiaceae	*Opercularia diphylla*	Forb (FG)	0.1	20	0.1	10			0.1	50			0.1	20			0.1	50			0.1	30			0.1	50						
Rubiaceae	*Opercularia* spp.	Forb (FG)	0.1	20																			0.1	20								
Rubiaceae	*Pomax umbellata*	Forb (FG)			0.1	100			0.2	200			0.1	50			0.1	30	0.1	5	0.2	200			0.5	500						
Rubiaceae	*Psychotria loniceroides*	Shrub (SG)																											0.2	4		
Rubiaceae	*Richardia brasiliensis*	Exotic	0.5	20			0.5	50																								
Rubiaceae	*Richardia humistrata*	Exotic															0.4	40			0.2	20			0.1	10						
Rutaceae	*Boronia polygalifolia*	Forb (FG)	0.1	5	0.1	20													0.1	2			0.1	2								
Rutaceae	*Zieria smithii*	Shrub (SG)																									5	20				
Schizaeaceae	*Schizaea bifida*	Fern (EG)			0.1	2																										
Scrophulariaceae	*Veronica plebeia*	Forb (FG)															0.1	5														
Smilacaceae	*Smilax australis*	Other (OG)													0.1	1											0.2	5	0.1	3		
Smilacaceae	*Smilax glyciphylla*	Other (OG)																									0.2	5				
Solanaceae	*Duboisia myoporoides*	Shrub (SG)																									2	5				
Stylidiaceae	*Stylidium graminifolium*	Forb (FG)							0.1	10	0.1	5													0.1	10						
Thelypteridaceae	*Christella dentata*	Fern (EG)																											0.2	10		
Thymelaeaceae	*Pimelea linifolia subsp. linifolia*	Shrub (SG)			0.1	5			1	3													0.1	10	0.1	10						
Verbenaceae	*Lantana camara var. camara*	Exotic			0.1	1							0.2	3	2	20			0.1	5	0.2	2	1	20			5	20	15	50		
Verbenaceae	*Verbena bonariensis*	Exotic	0.1	5			0.1	10																							1	50

Family	Scientific Name	Plot ID	Q01		Q02		Q03		Q04		Q05		Q06		Q07		Q08		Q09		Q10		Q11		Q12		Q13		Q14		Q15	
		BAM Growth Form / High Threat Weeds	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab	C	Ab
Verbenaceae	*Verbena rigida*	Exotic																													0.1	10
Verbenaceae	*Verbena rigida var. rigida*	Exotic															0.1	3														
Violaceae	*Viola hederacea*	Forb (FG)																											0.2	500		
Vitaceae	*Cissus antarctica*	Other (OG)																									0.2	2	0.2	10		
Vitaceae	*Cissus hypoglauca*	Other (OG)																					0.1	1			1	5	0.1	2		
Xanthorrhoeaceae	*Xanthorrhoea latifolia subsp. latifolia*	Other (OG)			10	70			15	50													5	50	5	30						
Xanthorrhoeaceae	*Xanthorrhoea macronema*	Other (OG)									0.5	5							1	10												
Zamiaceae	*Macrozamia flexuosa*	Other (OG)																					0.1	5								

Grassland Plots

Family	Scientific Name	Common Name	Plot ID	Q19		Q20	
			BAM Growth Form / High Threat Weeds	C	Ab	C	Ab
Asteraceae	Hypochaeris radicata	Catsear	Exotic	0.1	20		
Asteraceae	Senecio madagascariensis	Fireweed	Exotic	0.2	20	0.1	10
Caryophyllaceae	Stellaria media	Common Chickweed	Exotic	0.2	30	0.2	30
Fabaceae (Faboideae)	Trifolium repens	White Clover	Exotic	5	1000	1	100
Gentianaceae	Centaurium erythraea	Common Centaury	Exotic	0.1	20		
Juncaceae	Juncus cognatus	-	Exotic	5	1000	1	50
Juncaceae	Juncus usitatus	-	Grass & grasslike (GG)			5	100
Onagraceae	Ludwigia peploides subsp. montevidensis	Water Primrose	Forb (FG)	0.2	30	0.2	20
Poaceae	Axonopus fissifolius	Narrow-leafed Carpet Grass	HTW	40	1000	90	1000
Poaceae	Briza minor	Shivery Grass	Exotic	1	1000		
Poaceae	Cenchrus clandestinus	Kikuyu Grass	Exotic	20	1000		
Poaceae	Poa annua	Winter Grass	Exotic	15	1000		
Poaceae	Sporobolus africanus	Parramatta Grass	Exotic	1	50		
Verbenaceae	Verbena bonariensis	Purpletop	Exotic	0.1	3		

Fauna Species List

No.	Scientific Name	Common Name	Status
	Amphibians		
1.	*Crinia Signifera*	Common Eastern Froglet	
2.	*Limnodynastes peronii*	Striped Marsh Frog	
3.	*Litoria dentata*	Bleating Tree Frog	
4.	*Litoria Fallax*	Eastern Dwarf Tree Frog	
5.	*Litoria latopalamata*	Broad-palmed Frog	
6.	*Pseudophryne coriacea*	Red-backed Toadlet	
	Birds		
1.	*Acanthiza lineata*	Striated Thornbill	
2.	*Acanthorhynchus tenuirostris*	Eastern Spinebill	
3.	*Alisterus scapularis*	King Parrot	
4.	*Cacomantis flabelliformis*	Fantail Cuckoo	
5.	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo	
6.	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	Vulnerable (BC Act)
7.	*Centropus phasianinus*	Pheasant Coucal	
8.	*Colluricincla harmonica*	Grey Shrike-thrush	
9.	*Coracina tenuirostris*	Cicadabird	
10.	*Cormobates leucophaea*	White-throated Treecreeper	
11.	*Corvus coronoides*	Australian Raven	
12.	*Cracticus tibicen*	Australian Magpie	
13.	*Dacelo novaeguineae*	Laughing Kookaburra	
14.	*Eolophus roseicapilla*	Galah	
15.	*Eopsaltria australis*	Eastern Yellow Robin	
16.	*Eurostopodus mystacalis*	White-throated Nightjar	

No.	Scientific Name	Common Name	Status
17.	*Glossopsitta concinna*	Musk Lorikeet	
18.	*Glossopsitta pusilla*	Little Lorikeet	Vulnerable (BC Act)
19.	*Leucosarcia melanoleuca*	Wonga Pigeon	
20.	*Lichenostomus chrysops*	Yellow-faced Honeyeater	
21.	*Malurus cyaneus*	Superb Fairy Wren	
22.	*Meliphaga lewinii*	Lewin's Honeyeater	
23.	*Melithreptus lunatus*	White-naped Honeyeater	
24.	*Ninox boobook*	Southern Boobook	
25.	*Pachycephala pectoralis*	Golden Whistler	
26.	*Pardalotus punctatus*	Spotted Pardalote	
27.	*Philemon corniculatus*	Noisy Friarbird	
28.	*Podargus strigoides*	Tawny Frogmouth	
29.	*Rhipidura albiscapa*	Grey Fantail	
30.	*Rhipidura rufifrons*	Rufous Fantail	Migratory (EPBC Act)
31.	*Strepera graculina*	Pied Currawong	
32.	*Trichoglossus chlorolepidotus*	Scaly-breasted Lorikeet	
33.	*Trichoglossus moluccanus*	Rainbow Lorikeet	
34.	*Tyto novaehollandiae*	Masked Owl	Vulnerable (BC Act)
35.	*Tyto tenebricosa*	Sooty Owl	Vulnerable (BC Act)
36.	*Vanellus miles*	Masked Lapwing	
37.	*Zosterops lateralis*	Silvereye	
	Mammals		
1.	*Acrobates pygmaeus*	Feathertail Glider	
2.	*Antechinus stuartii*	Brown Antechinus	
3.	*Austronomus australis*	White-striped Freetail-Bat	

No.	Scientific Name	Common Name	Status
4.	*Chalinolobus dwyeri*	Large-eared Pied Bat	Vulnerable (BC Act and EPBC Act)
5.	*Chalinolobus gouldii*	Gould's Wattled Bat	
6.	*Chalinolobus morio*	Chocolate Wattled Bat	
7.	*Falsistrellus tasmaniensis #*	Eastern False Pipistrelle	Vulnerable (BC Act)
8.	*Micronomus norfolkensis #*	Eastern Coastal Free-tailed Bat	Vulnerable (BC Act)
9.	*Miniopterus australis #*	Little Bent-winged Bat	Vulnerable (BC Act)
10.	*Mormopterus planiceps*	South-eastern Freetail Bat	
11.	*Mormopterus ridei*	Ride's Free-tailed Bat	
12.	*Myotis macropus #*	Southern Myotis	Vulnerable (BC Act)
13.	*Nyctophilus sp.*	Long-eared Bat	
14.	*Petaurus breviceps*	Sugar Glider	
15.	*Petaurus norfolcensis #*	Squirrel Glider	Vulnerable (BC Act)
16.	*Phascolarctos cinereus*	Koala	Vulnerable (BC Act and EPBC Act)
17.	*Phoniscus papuensis #*	Golden-tipped Bat	Vulnerable (BC Act)
18.	*Pseudomys novaehollandiae*	New Holland Mouse	Vulnerable (EPBC Act)
19.	*Pteropus poliocephalus*	Grey-headed Flying-fox	Vulnerable (BC Act and EPBC Act)
20.	*Rhinolophus megaphyllus*	Eastern Horseshoe-bat	
21.	*Saccolaimus flaviventris #*	Yellow-bellied Sheathtail-bat	Vulnerable (BC Act)
22.	*Scoteanax rueppellii #*	Greater Broad-nosed Bat	Vulnerable (BC Act)
23.	*Scotorepens balstoni*	Inland Broad-nosed Bat	
24.	*Scotorepens orion*	Broad-nosed Bat sp.	
25.	*Tachyglossus aculeatus*	Short-beaked Echidna	
26.	*Trichosurus vulpecula*	Common Brushtail Possum	

No.	Scientific Name	Common Name	Status
27.	*Vespadelus darlingtoni*	Large Forest Bat	
28.	*Vespadelus pumilus*	Eastern Forest Bat	
29.	*Vespadelus regulus*	Southern Forest Bat	
30.	*Vespadelus troughtonii #*	Eastern Cave Bat	Vulnerable (BC Act)
31.	*Vespadelus vulturnus*	Little Forest Bat	
32.	*Vulpes vulpes**	Red Fox	Feral
33.	*Wallabia bicolor*	Swamp Wallaby	
	Reptiles		
1.	*Pseudonaja textilis*	Eastern Brown Snake	
2.	*Varanus varius*	Lace Monitor	
	Fish		
1.	*Anguilla australis*	Short-finned Eel	
	Crustacean		
1.	*Cherax destructor*	Common Yabby	

APPENDIX 3: PHOTOGRAPHS (BIODIVERSITY AND HABITAT VALUES)



Golden Tipped Bat (*Phoniscus papuensis*), Vulnerable BC Act. This individual was captured within the Development Site using a harp trap.



Koala (*Phascolarctos cinereus*), vulnerable BC Act and EPBC Act. This individual was detected within the Development Site using a remote camera.



New Holland Mouse (*Pseudomys novaehollandiae*), Vulnerable EPBC Act. This individual was captured within the Development Site using an Elliot Trap.



Hollow bearing tree (*Corymbia maculata* Spotted Gum) within the Development Site.

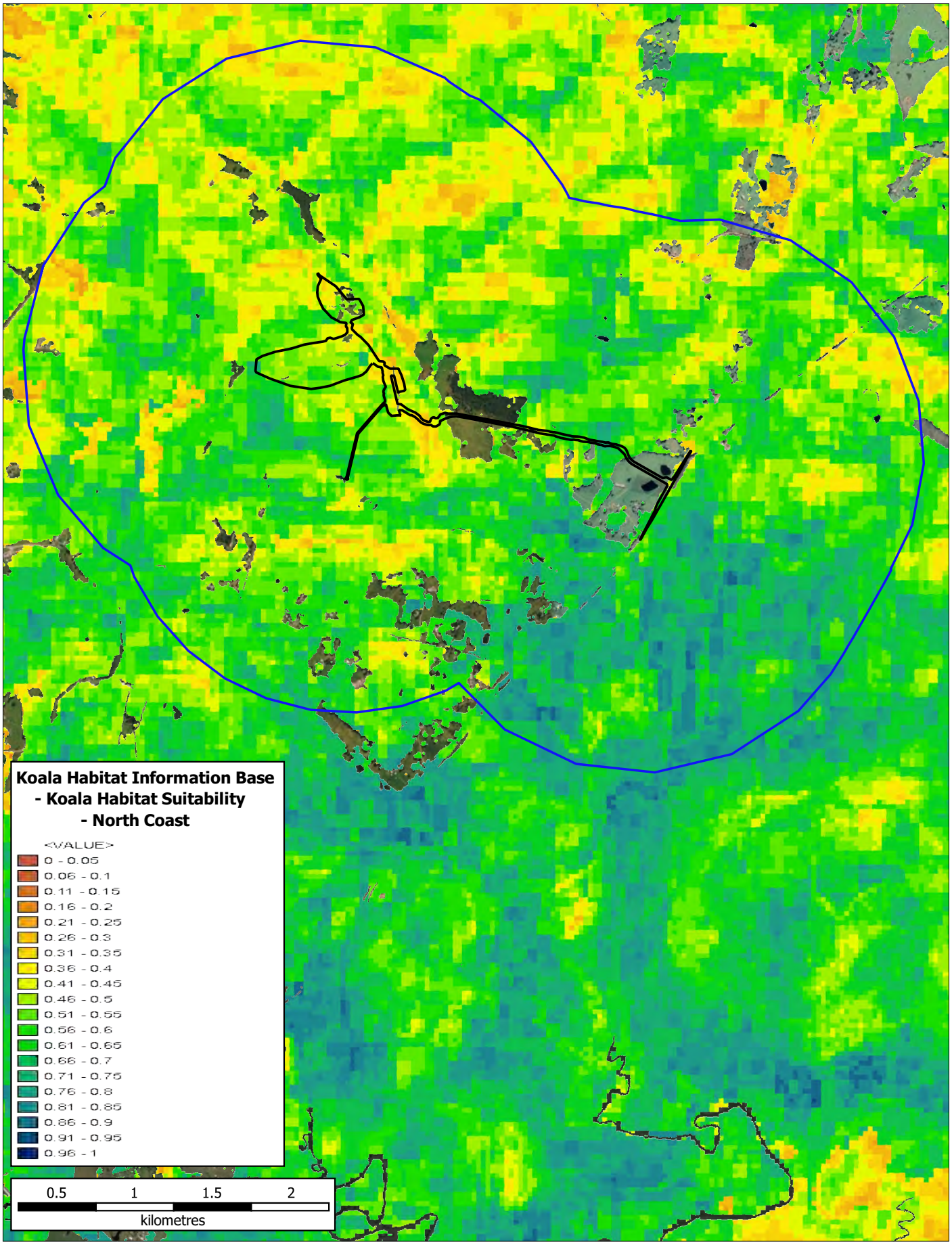


Dry Creek bed associated with Deep Creek (ephemeral waterway).



Constructed Dam in the southern portion of the Study Area surrounded by forest vegetation.

APPENDIX 4: KOALA HABITAT MAPPING



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Date: 08/12/2022

WEDGETAIL
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Legend

Development Site Boundary

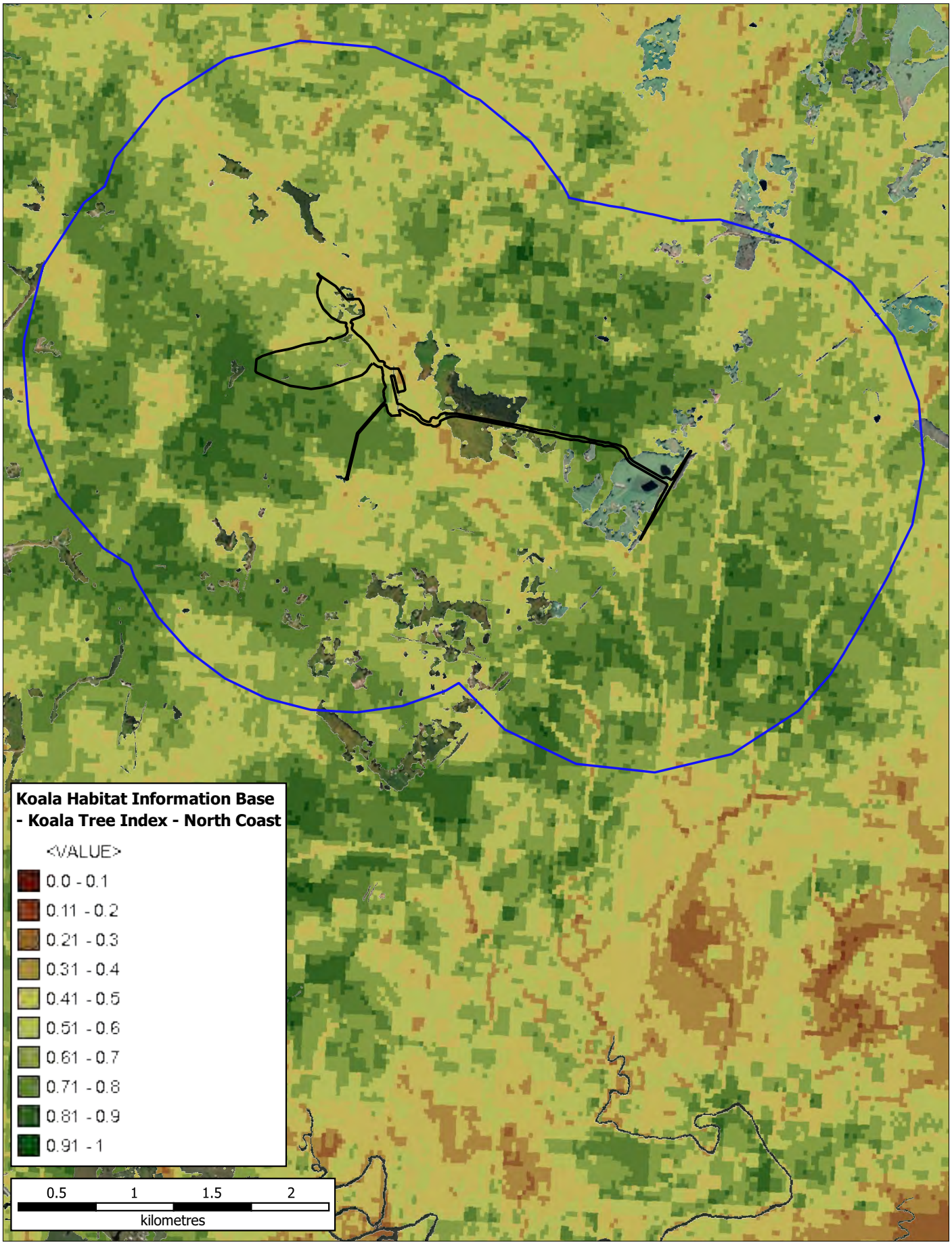
1500m Buffer

Koala Habitat Suitability Model

Figure:
A1

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Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek, NSW 2324

N



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Date: 08/12/2022

WEDGETAIL
PROJECT CONSULTING PTY LTD

https://wedgetail.com.au

Legend

Development Site Boundary

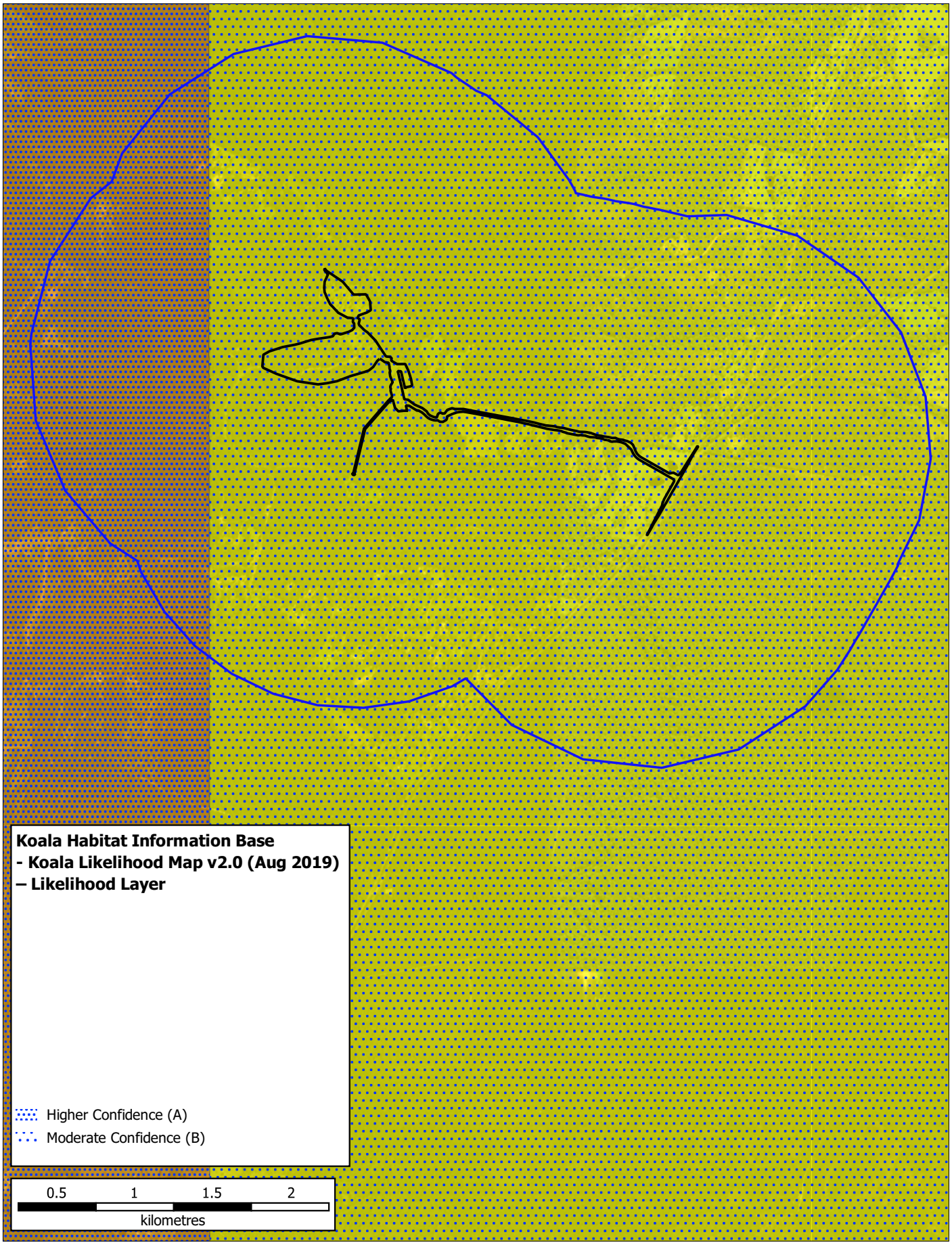
1500m Buffer

Koala Tree Suitability Index

Figure:
A2

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N



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Date: 08/12/2022

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Legend

Development Site Boundary

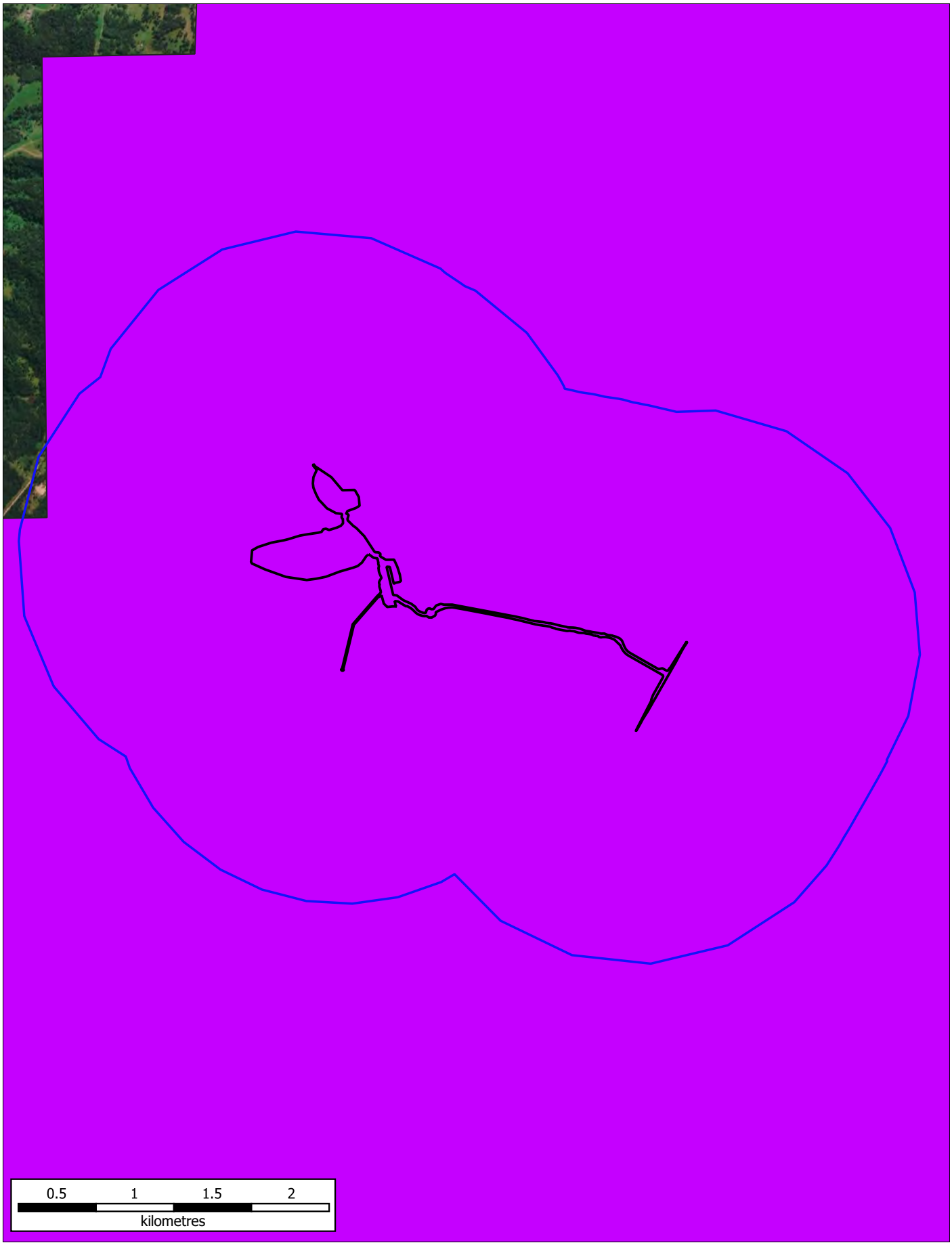
1500m Buffer

Koala Likelihood Map

Figure:
A3

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Legend

- Development Site Boundary
- 1500m Buffer
- Wang Wauk SF ARKS

Areas of Regional Koala Significane (ARKS)

Figure:
A4

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Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek, NSW 2324

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APPENDIX 5: PREDICTED AND CANDIDATE SPECIES REPORTS

BAM Candidate Species Report

Proposal Details

Assessment Id 00022618/BAAS21021/20/00022619	Proposal Name Deep Creek Quarry	BAM data last updated * 19/12/2022
Assessor Name Gilbert Whyte	Report Created 23/12/2022	BAM Data version * 56
Assessor Number BAAS18041	Assessment Type Major Projects	BAM Case Status Finalised
Assessment Revision 3	Date Finalised 23/12/2022	

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

List of Species Requiring Survey

Name	Presence	Survey Months
Aepyprymnus rufescens Rufous Bettong	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☑ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Allocasuarina defungens Dwarf Heath Casuarina	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Angophora inopina Charmhaven Apple	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?

Asperula asthenes Trailing Woodruff	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Burhinus grallarius Bush Stone-curlew	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Callistemon linearifolius Netted Bottle Brush	Yes (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Callocephalon fimbriatum Gang-gang Cockatoo	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?
Calyptorhynchus lathami Glossy Black-Cockatoo	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☑ May ☑ Jun ☐ Jul ☑ Aug ☑ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Cercartetus nanus Eastern Pygmy-possum	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Crinia tinnula Wallum Froglet	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Cryptostylis hunteriana Leafless Tongue Orchid	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Cynanchum elegans White-flowered Wax Plant	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Diuris flavescens Pale Yellow Doubletail	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Dromaius novaehollandiae - endangered population Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus camfieldii Camfield's Stringybark	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?

Eucalyptus glaucina Slaty Red Gum	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Grevillea guthrieana Guthrie's Grevillea	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Grevillea parviflora subsp. parviflora Small-flower Grevillea	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?
Haliaeetus leucogaster White-bellied Sea-Eagle	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?
Hieraaetus morphnoides Little Eagle	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Hoplocephalus stephensii Stephens' Banded Snake	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Litoria aurea Green and Golden Bell Frog	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Litoria brevipalmata Green-thighed Frog	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Lophoictinia isura Square-tailed Kite	No (surveyed)	☑ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?
Macropus parma Parma Wallaby	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☑ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Melaleuca biconvexa Biconvex Paperbark	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Melaleuca groveana Grove's Paperbark	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?

Mixophyes balbus Stuttering Frog	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Mixophyes iteratus Giant Barred Frog	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Myotis macropus Southern Myotis	Yes (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Ninox connivens Barking Owl	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Ninox strenua Powerful Owl	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pandion cristatus Eastern Osprey	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Petauroides volans Greater Glider	No (surveyed)	☐ Jan ☑ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Petaurus norfolcensis Squirrel Glider	Yes (surveyed)	☐ Jan ☑ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Phascogale tapoatafa Brush-tailed Phascogale	No (surveyed)	☐ Jan ☑ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Phascolarctos cinereus Koala	Yes (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Planigale maculata Common Planigale	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pomaderris queenslandica Scant Pomaderris	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?

Potorous tridactylus Long-nosed Potoroo	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pteropus poliocephalus Grey-headed Flying-fox	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?
Pterostylis chaetophora Pterostylis chaetophora	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?
Rhizanthella slateri Eastern Australian Underground Orchid	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?
Rhodamnia rubescens Scrub Turpentine	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Rhodomyrtus psidioides Native Guava	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?

Senna acclinis Rainforest Cassia	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☑ Nov ☐ Dec ☐ Survey month outside the specified months?
Solanum sulphureum Manning Yellow Solanum	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☑ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Tetratheca juncea Black-eyed Susan	Yes (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Thesium australe Austral Toadflax	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☑ Nov ☑ Dec ☐ Survey month outside the specified months?
Turnix maculosus Red-backed Button-quail	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Tyto novaehollandiae Masked Owl	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Tyto tenebricosa Sooty Owl	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☑ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Uperoleia mahonyi Mahony's Toadlet	No (surveyed)	☐ Jan ☐ Feb ☑ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Brush-tailed Rock-wallaby	Petrogale penicillata	Habitat constraints
Eastern Cave Bat	Vespadelus troughtoni	Habitat constraints
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Large-eared Pied Bat	Chalinolobus dwyeri	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
Pale-headed Snake	Hoplocephalus bitorquatus	Species is vagrant
Regent Honeyeater	Anthochaera phrygia	Habitat constraints
Rough Doubletail	Diuris praecox	Refer to BAR
Swift Parrot	Lathamus discolor	Habitat constraints

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022618/BAAS21021/20/00022619	Deep Creek Quarry	19/12/2022
Assessor Name	Report Created	BAM Data version *
Gilbert Whyte	23/12/2022	56
Assessor Number	Assessment Type	BAM Case Status
BAAS18041	Major Projects	Finalised
Assessment Revision		Date Finalised
3		23/12/2022

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

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

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Diamond Firetail	Stagonopleura guttata	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest

Eastern Chestnut Mouse	Pseudomys gracilicaudatus	1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Eastern False Pipistrelle	Falsistrellus tasmaniensis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Eastern Osprey	Pandion cristatus	1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Gang-gang Cockatoo	Callocephalon fimbriatum	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Glossy Black-Cockatoo	Calyptorhynchus lathami	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest

Glossy Black-Cockatoo	Calyptorhynchus lathami	1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Golden-tipped Bat	Phoniscus papuensis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Greater Broad-nosed Bat	Scoteanax rueppellii	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Grey-crowned Babbler (eastern subspecies)	Pomatostomus temporalis temporalis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Grey-headed Flying-fox	Pteropus poliocephalus	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast

Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Large Bent-winged Bat	Miniopterus orianae oceanensis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Little Bent-winged Bat	Miniopterus australis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Little Eagle	Hieraaetus morphnoides	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Little Lorikeet	Glossopsitta pusilla	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Masked Owl	Tyto novaehollandiae	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest

Masked Owl	Tyto novaehollandiae	1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Powerful Owl	Ninox strenua	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Red-legged Pademelon	Thylogale stigmatica	1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Regent Honeyeater	Anthochaera phrygia	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
Rose-crowned Fruit-Dove	Ptilinopus regina	1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Scarlet Robin	Petroica boodang	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
Sooty Owl	Tyto tenebricosa	1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Speckled Warbler	Chthonicola sagittata	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Spotted-tailed Quoll	Dasyurus maculatus	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest

Spotted-tailed Quoll	Dasyurus maculatus	1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Square-tailed Kite	Lophoictinia isura	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
Superb Fruit-Dove	Ptilinopus superbus	1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Swift Parrot	Lathamus discolor	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
Turquoise Parrot	Neophema pulchella	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
Varied Sittella	Daphoenositta chrysoptera	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast

White-bellied Sea-Eagle	Haliaeetus leucogaster	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
White-throated Needletail	Hirundapus caudacutus	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Wompoo Fruit-Dove	Ptilinopus magnificus	1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Yellow-bellied Glider	Petaurus australis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
		1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
		1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast

Threatened species Manually Added

None added

BAM Predicted Species Report

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C

APPENDIX 6: FAUNA SURVEY EFFORT WITHIN THE STUDY AREA

Detailed comparison of fauna trapping effort against relevant guidelines

Fauna Transect	Trap type	No.	Nights/ Days	Total nights/days	Totals for all Formations
Transect 1: PCT – 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (EEC)					
	Elliott A	25	4	80	320
	Elliott B arboreal	10	4	40	160
	SAT Test (Koala)	3			10
	Harp Trap	2	4	8	16
	Anabat	1	14	14	72
	Anabat (Over Water)	2	4	8	72
	Camera Trap (3m)	4	16	64	256
	Camera Trap (1m)	3	7	21	189
Transect 2: PCT – 1567: Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast.					
	Elliott A	25	4	80	80
	Elliott B arboreal	10	4	40	40
	SAT Test (Koala)	4			10
	Anabat	1	14	14	72
	Anabat (Over Water)	2	4	8	72
	Camera Trap (3m)	4	16	64	256
	Camera Trap (1m)	3	7	21	189
	Camera Trap (Ground)	8	4	32	40
	Cage Traps	9	4	36	36

Fauna Transect	Trap type	No.	Nights/ Days	Total nights/days	Totals for all Formations
Transect 3: PCT – 1556: Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast (EEC)					
	Elliott A	25	4	80	80
	Elliott B arboreal	10	4	40	40
	SAT Test (Koala)	1			10
	Harp Trap	2	4	8	8
	Anabat	1	14	14	14
	Camera Trap (3m)	4	16	64	256
	Camera Trap (1m)	3	7	21	189
	Camera Trap (Ground)	2	4	8	40
	Cage Traps	2	4	8	8
Transect 4: PCT – 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands					
	Elliott A	25	4	80	80
	Elliott B arboreal	10	4	40	40
	SAT Test (Koala)	2			10
	Anabat	1	14	14	72
	Camera Trap (3m)	4	16	64	256
	Camera Trap (1m)	9	14	126	189

Candidate fauna species survey requirements

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
Amphibians								
Crinia tinnula **Wallum Froglet**	*Aural-visual surveys*	**All year** after flooding rains (i.e. " *recent flooding of the target waterbodies*")	480 mins	4	*4x Aural-visual surveys*	120 person minutes (2 ecologists)	09/03/2020	20.6 mm in previous 48hrs
						120 person minutes (2 ecologists)	12/03/2020	1.8 mm in previous 48hrs
	Acoustic recorder	**All year** after flooding rains (i.e. " *recent flooding of the target waterbodies*")	154 recorder days	1 x 14 days		120 person minutes (2 ecologists)	03/03/2022	43.2 mm in previous 48hrs
						120 person minutes (2 ecologists)	24/03/2022	3.2 mm in previous 48hrs
Litoria aurea **Green and Golden Bell Frog**	*Aural-visual surveys*	**Nov. – March**	480 mins	4	*4x Aural-visual surveys*	120 person minutes (2 ecologists)	09/03/2020	20.6 mm in previous 48hrs
						120 person minutes (2 ecologists)	12/03/2020	1.8 mm in previous 48hrs
	Acoustic recorder	**Nov. – March**	154 recorder days	1 x 14 days		120 person minutes (2 ecologists)	03/03/2022	43.2 mm in previous 48hrs
	Tadpole search	**Nov. – March**	10 mins /50 m2 of surface area	Up to 2		120 person minutes (2 ecologists)	24/03/2022	3.2 mm in previous 48hrs

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
Litoria brevipalmata **Green-thighed Frog**	*Aural-visual surveys*	Spring – autumn after flooding rains (i.e. "*recent flooding of the target waterbodies*")	240 mins	2	*4x Aural-visual surveys*	120 person minutes (2 ecologists)	09/03/2020	20.6 mm in previous 48hrs
						120 person minutes (2 ecologists)	12/03/2020	1.8 mm in previous 48hrs
	Tadpole search	Spring – autumn after flooding rains (i.e. "*recent flooding of the target waterbodies*")	10 mins /50 m2 of surface area	2		120 person minutes (2 ecologists)	03/03/2022	43.2 mm in previous 48hrs – site was flooded at the time of surveys owing to high volume of rainfall over previous 30 days. *L. brevipalmata* reference population (Central Coast) active
						120 person minutes (2 ecologists)	24/03/2022	3.2 mm in previous 48 hrs – site was flooded at the time of surveys owing to high volume of rainfall over previous 30 days. *L. brevipalmata* reference population (Central Coast) active
Mixophyes balbus **Stuttering Frog**	*Aural-visual surveys*	Sept. – March	480 mins	4	*4x Aural-visual surveys*	120 person minutes (2 ecologists)	09/03/2020	20.6 mm in previous 48hrs
						120 person minutes (2 ecologists)	12/03/2020	1.8 mm in previous 48hrs

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
	Acoustic recorder	Sept. – March	154 recorder days	1 x 14 days		120 person minutes (2 ecologists)	03/03/2022	43.2 mm in previous 48hrs
						120 person minutes (2 ecologists)	24/03/2022	3.2 mm in previous 48hrs
Mixophyes iteratus **Giant Barred Frog**	*Aural-visual surveys*	Oct. – March	480 mins	4	*4x Aural-visual surveys*	120 person minutes (2 ecologists)	09/03/2020	20.6 mm in previous 48hrs
						120 person minutes (2 ecologists)	12/03/2020	1.8 mm in previous 48hrs
						120 person minutes (2 ecologists)	03/03/2022	43.2 mm in previous 48hrs
						120 person minutes (2 ecologists)	24/03/2022	3.2 mm in previous 48hrs
Uperoleia mahonyi **Mahony's Toadlet**	*Aural-visual surveys*	Oct. – March	480 mins	4	*4x Aural-visual surveys*	120 person minutes (2 ecologists)	09/03/2020	20.6 mm in previous 48hrs
						120 person minutes (2 ecologists)	12/03/2020	1.8 mm in previous 48hrs
						120 person minutes (2 ecologists)	03/03/2022	43.2 mm in previous 48hrs

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
						120 person minutes (2 ecologists)	24/03/2022	3.2 mm in previous 48hrs
Birds								
Burhinus grallarius **Bush Stone-curlew**	Not Applicable	All Year	N/A	N/A	Nocturnal Surveys and Call Playback	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable
Callocephalon fimbriatum **Gang-gang Cockatoo**	Gang-gang Cockatoo Breeding Habitat Assessment [see detailed assessment requirements below]	October to January	N/A	N/A	Habitat Assessment (Hollows) and Diurnal Surveys	12,14-15,19-20, 22 and 26-27 August 2019, and 22 September 2022		Suitable
					Dusk Surveys	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable
Calyptorhynchus lathami **Glossy Black-Cockatoo**	Glossy Black-Cockatoo Breeding Habitat Assessment [see detailed assessment requirements below]	Jan – Sept	N/A	N/A	Habitat Assessment (Hollows) and Diurnal Surveys	12,14-15,19-20, 22 and 26-27 August 2019, and 22 September 2022		Suitable
					Dusk Surveys	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
Dromaius novaehollandiae **Emu (Endangered Population)**	Survey using camera traps or to identify tracks, scats and feathers.	All Year	N/A	N/A	Diurnal Surveys	12,14-15,19-20, 22 and 26-27 August 2019		Suitable
					Remote Cameras	11 March – 2 April 2019 and 19 – 26 March 2020		
Haliaeetus leucogaster **White-bellied Sea-Eagle (Breeding Habitat)**	Habitat Assessment (Nests)	July to December	N/A	N/A	Habitat Assessments (Nest Search)	12,14-15,19-20, 22 and 26-27 August 2019, 27 November 2019, and 7-8 January 2020, and 22 September 2022		Suitable
Hieraaetus morphnoides **Little Eagle (Breeding Habitat)**	Habitat Assessment (Nests)	August to October	N/A	N/A	Habitat Assessments (Nest Search)	12,14-15,19-20, 22 and 26-27 August 2019, 27 November 2019, and 7-8 January 2020, and 22 September 2022		Suitable
Lophoictinia isura **Square-tailed Kite (Breeding Habitat)**	Habitat Assessment (Nests)	September to January	N/A	N/A	Habitat Assessments (Nest Search)	12,14-15,19-20, 22 and 26-27 August 2019, 27 November 2019, and 7-8 January 2020, and 22 September 2022		Suitable
Pandion cristatus **Eastern Osprey (Breeding Habitat)**	Habitat Assessment (Nests)	September to January	N/A	N/A	Habitat Assessments (Nest Search)	12,14-15,19-20, 22 and 26-27 August 2019, 27 November 2019, and 7-8 January 2020, and 22 September 2022		Suitable
Ninox connivens **Barking Owl**	Habitat Assessment (Hollows),	May to December	N/A	N/A	Habitat Assessment (Hollows)	12,14-15,19-20, 22 and 26-27 August 2019,		Suitable

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
(Breeding Habitat)	Stagwatching [see detailed assessment requirements below]					27 November 2019, 7-8 January 2020, and 22 September 2022		
					Nocturnal Surveys and Call Playback	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable
					Stagwatching			Suitable
Ninox strenua **Powerful Owl (Breeding Habitat)**	Habitat Assessment (Hollows), Stagwatching [see detailed assessment requirements below]	May to August	N/A	N/A	Habitat Assessment (Hollows)	12,14-15,19-20, 22 and 26-27 August 2019, 27 November 2019, 7-8 January 2020, and 22 September 2022		Suitable
					Nocturnal Surveys and Call Playback	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable
					Stagwatching			Suitable
Tyto tenebricosa **Sooty Owl (Breeding Habitat)**	Habitat Assessment (Hollows), Stagwatching [see detailed assessment requirements below]	May to August	N/A	N/A	Habitat Assessment (Hollows)	12,14-15,19-20, 22 and 26-27 August 2019, 27 November 2019, 7-8 January 2020, and 22 September 2022		Suitable
					Nocturnal Surveys and			Suitable

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
					Call Playback	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		
					Stagwatching			Suitable
Tyto novaehollandiae **Masked Owl (Breeding Habitat)**	Habitat Assessment (Hollows), Stagwatching [see detailed assessment requirements below]	May to August	N/A	N/A	Habitat Assessment (Hollows)	12,14-15,19-20, 22 and 26-27 August 2019, 27 November 2019, 7-8 January 2020, and 22 September 2022		Suitable
					Nocturnal Surveys and Call Playback	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable
					Stagwatching			Suitable
Turnix maculosus **Red-backed Button-quail**	Nocturnal Surveys	All Year	N/A	N/A	Nocturnal Surveys	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable
Mammals								
Aepyprymnus rufescens **Rufous Bettong**	Terrestrial Remote Cameras	All Year	N/A	N/A	Terrestrial Remote Cameras	10 Remote Cameras <1m height (4 nights) – 40 trap nights total	6 - 10 January 2020	Suitable

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
					Wire Cage Traps	11 Wire Cage Traps (4 nights) – 44 trap nights	6 - 10 January 2020	Suitable
Cercartetus nanus **Eastern Pygmy-possum**	N/A	Oct - March	N/A	N/A	Remote Cameras	27 Remote Cameras (1-3m height) (13 nights)	26 February and 11 March 2019, and 19 – 26 March 2020	Suitable
					Nocturnal Surveys	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		
Chalinolobus dwyeri **Large-eared Pied Bat**	Harp trap or mist net***	Mid Nov.- end Jan	16 trap nights	Min 4 nights	Harp trap	4 Harp Traps, 4 nights (16 trap nights)	9 – 13 March 2020	Suitable
	Acoustic detection***	Mid Nov.- end Jan.	16 trap nights	Min 4 nights	Acoustic detection (Anabats Detectors)	4 Anabats, 18 nights (72 trap nights)	9 – 13 March 2020, and 26 February to 11 March 2019	Suitable

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
	Radio tracking/roost search***	Mid Nov.- end Jan.	As required		Habitat Assessment (roosting sites)	12,14-15,19-20, 22 and 26-27 August 2019, 27 November 2019, 7-8 January 2020, and 22 September 2022		Suitable
Macropus parma **Parma Wallaby**	Not Applicable	All Year	N/A	N/A	Diurnal Surveys	12,14-15,19-20, 22 and 26-27 August 2019		Suitable
					Terrestrial Remote Cameras	10 Remote Cameras <1m height (4 nights) – 40 trap nights total	6 - 10 January 2020	Suitable
					Nocturnal Surveys	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable
Miniopterus australis **Little Bent-winged Bat**	Harp trap***	Dec. to Feb.	8 trap nights	Min 4 nights	Harp trap	4 Harp Traps, 4 nights (16 trap nights)	9 – 13 March 2020	Suitable
					Acoustic detection (Anabats Detectors)	4 Anabats, 18 nights (72 trap nights)	9 – 13 March 2020, and 26 February to 11 March 2019	Suitable
					Habitat Assessment	12,14-15,19-20, 22 and 26-27 August 2019,		Suitable

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
					(roosting sites)	27 November 2019, 7-8 January 2020, and 22 September 2022		
Miniopterus orianae oceanensis **Large Bent-winged Bat**	Harp trap***	Dec. to Feb.	8 trap nights	Min 4 nights	Harp trap	4 Harp Traps, 4 nights (16 trap nights)	9 – 13 March 2020	Suitable
					Acoustic detection (Anabats Detectors)	4 Anabats, 18 nights (72 trap nights)	9 – 13 March 2020, and 26 February to 11 March 2019	Suitable
					Habitat Assessment (roosting sites)	12,14-15,19-20, 22 and 26-27 August 2019, 27 November 2019, 7-8 January 2020, and 22 September 2022		Suitable
Myotis macropus **Southern Myotis**	Harp trap or mist net***	Oct. to March	16 trap nights	Min 4 nights	Harp trap	4 Harp Traps, 4 nights (16 trap nights)	9 – 13 March 2020	Suitable
	Roost Search (buildings, bridges etc.)***	Oct. to March	1 per structure	30 mins per feature	Roost search	Not Applicable – no suitable roost sites within the Subject Site.		
	Acoustic detection***	Oct. to March	16 trap nights	Min 4 nights	Acoustic detection (Anabats Detectors)	4 Anabats, 18 nights (72 trap nights)	9 – 13 March 2020, and 26 February	Suitable

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
							to 11 March 2019	
Petaurus norfolcensis **Squirrel Glider**	Not Detailed	All Year	Not Detailed	Not Detailed	Arboreal Remote Cameras	27 Remote Cameras (3 weeks)	26 February and 11 March 2019 and between 19 – 26 March 2020	Suitable
						58 Remote Cameras (4 weeks)	10 May to the 21 June 2022	Suitable
					Elliot B Trapping	40 traps (4 nights)	19 – 26 March 2020	Suitable
					Nocturnal Surveys	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable
Phascogale tapoatafa **Brush-tailed Phascogale**	Remote Camera Surveys	Dec. to June	[See detailed assessment requirements below]		Remote Camera Surveys (Modified Survey Approach)	58 Remote Cameras (4 weeks)	10 May to the 21 June 2022	Suitable

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
	Remote Camera Surveys (Modified Survey Approach)	Dec. to June	[See detailed assessment requirements below]		Nocturnal Surveys	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable
Phascolarctos cinereus **Koala**	Not Detailed at the time of assessment. New Koala Survey Guidelines published following submission.				SAT Surveys	10 SATs	26 March and 17 April 2020	Suitable
					Remote Cameras	27 Remote Cameras (3 weeks)	26 February and 11 March 2019 and between 19 – 26 March 2020	Suitable
						58 Remote Cameras (4 weeks)	10 May to the 21 June 2022	Suitable
					Nocturnal Surveys	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable
Aepyprymnus rufescens **Rufous Bettong**	Remote Cameras	All Year	Not Detailed		Terrestrial Remote Cameras	10 Remote Cameras <1m height (4 nights) – 40 trap nights total	6 - 10 January 2020	Suitable
Planigale maculata **Common Planigale**	Pitfall Traps	[See detailed assessment requirements below]			Pitfall Trap	13 traps (4 nights) – 52 trap nights	6-10 June 2022	Suitable

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
Potorous tridactylus **Long-nosed Potoroo**	Remote Cameras	All Year	At least 14 nights	Not Detailed	Terrestrial Remote Cameras	10 Remote Cameras <1m height (4 nights) – 40 trap nights total	6 - 10 January 2020	Suitable
					Wire Cage Traps	11 Wire Cage Traps (4 nights) – 44 trap nights	6 - 10 January 2020	Suitable
Pteropus poliocephalus **Grey-headed Flying-fox**	Daytime camp survey	Oct.- Dec	6hrs (two hours/day)	3 (one per month)	Habitat Assessment (roosting sites)	12,14-15,19-20, 22 and 26-27 August 2019, 27 November 2019, 7-8 January 2020, and 22 September 2022		Suitable
Vespadelus troughtoni **Eastern Cave Bat**	Harp trap or mist net***	Nov. to end Jan.	16	4	Harp trap	4 Harp Traps, 4 nights (16 trap nights)	9 – 13 March 2020	Suitable
	Roost Search (buildings, bridges etc.)***	Nov. to end Jan.	1 per structure	N/A				
	Acoustic detection***	Nov. to end Jan.	16	4	Acoustic detection (Anabats Detectors)	4 Anabats, 18 nights (72 trap nights)	9 – 13 March 2020, and 26 February to 11 March 2019	Suitable
	Radio tracking/roost search***	Nov. to end Jan.	As required	-				

Species	Requirements (TBDC/BAM Guidelines)				Completed			
	Survey Method	Survey Period	Survey Effort	Survey Replicates	Survey Method	Survey Effort / Replicates	Survey Timing	Survey Conditions
Reptiles								
Hoplocephalus bitorquatus **Pale-headed Snake**	Not Detailed at the time of assessment. New Threatened Reptile Survey Guidelines published following submission.				Nocturnal Surveys	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable
Hoplocephalus stephensii **Stephens' Banded Snake**	Not Detailed at the time of assessment. New Threatened Reptile Survey Guidelines published following submission.				Nocturnal Surveys	12 – 15,19,20 and 22 August 2019, 11 May 2022, and 22-23 June 2022		Suitable

*** 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method Detailed Survey Guidelines

Species	Detailed Survey Requirements	Completed
Calyptorhynchus lathami **Glossy Black-Cockatoo** **(Breeding Habitat)**	The identification of breeding habitat will require survey or an expert report. The following method is recommended for the identification of breeding habitat (TBDC):	
	1. **Identify Signs of Breeding –** the assessor should identify signs of breeding including the following: a) *begging birds of any age or sex*, b) *lone adult males during breeding season (April to August)*, or c) *an occupied nest.* If **Signs of Breeding** are identified on site go to part 2.	Signs of breeding recorded within the Study Area.
	2. **Potential Nest Trees –** should be identified if signs of breeding are present on site. *Potential nest trees contain hollows that are; (i) at least 8 m above the ground; and (ii) in stems with a diameter of at least 30 cm; and (iii) hollow diameter is at least 15 cm; and (iv) stem angle is at least 45 degrees, and may be near-vertical or vertical.*	A total of 32 suitable hollow-bearing trees (potential nest trees) were stag-watched. Stag-watching was undertaken within the Development Site between 12 – 15, 19, 20 and 22 August 2019, 20 – 23 June, and 4, 15 and 16 August 2022. Dusk fauna surveys were completed in conjunction with the aforementioned nocturnal surveys. **No actual nest trees were recorded during the assessment.**
	3. Actual Nest Trees - *Where potential nest trees are identified on site, monitor for this species during the breeding season (Apr – Aug) to confirm the presence of any **Actual Nest Trees** on site. Assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys.*	

Species	Detailed Survey Requirements	Completed
Callocephalon fimbriatum **Gang-gang Cockatoo (Breeding Habitat)**	The identification of breeding habitat will require survey or an expert report. The following method is recommended for the identification of breeding habitat (TBDC):	
	1. Identify Signs of Breeding – the assessor should identify signs of breeding including the following: a) lone adult males during breeding season (October to January); or (b) an occupied nest. If breeding is presumed present, progress to Step 3	Opportunistic visual and auditory bird surveys were conducted throughout the Study Area periodically from 12 July 2019 to 8 January 2020 in conjunction with other surveys. **No signs of breeding was recorded within the Study Area.**
	2. Potential Nest Trees – should be identified if signs of breeding are present on site. Potential nest trees are forest and woodland eucalypts containing hollows that are; (i) at least 9 m above the ground; and (ii) with hollow diameter of 10 cm or larger.	A total of 32 suitable hollow-bearing trees (potential nest trees) were stag-watched. Stag-watching was undertaken within the Development Site between 12 – 15, 19, 20 and 22 August 2019, 20 – 23 June, and 4, 15 and 16 August 2022. Dusk fauna surveys were completed in conjunction with the aforementioned nocturnal surveys. **No actual nest trees were recorded during the assessment.**
	3. Actual Nest Trees - Where potential nest trees are identified on site, monitor for this species during the breeding season (Oct. - Jan) to confirm the presence of any Actual Nest Trees on site. Assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys.	
Ninox connivens **Barking Owl (Breeding Habitat)**	The identification of breeding habitat will require survey or an expert report. The following method is recommended for the identification of breeding habitat (TBDC):	
	1. Identify Signs of Breeding – *the assessor should identify signs of breeding including suitable habitat AND (a) presence of male and female OR (b) calling to each other (duetting) OR (c) find nest. Note that this species does not respond as well to call-play-back and could require stagwatching and other evidence of nesting.*	**No signs of breeding was recorded within the Study Area.**
	2. Potential Nest Trees – *should be identified if signs of breeding are present on site. Potential nest trees are living or dead trees with hollows greater than 20 cm diameter.*	A total of 32 suitable hollow-bearing trees (potential nest trees) were stag-watched. Stag-watching was undertaken within the Development Site between 12 – 15, 19, 20 and 22 August 2019, 20 – 23 June, and 4, 15 and 16 August 2022. Call playback and nocturnal surveys were completed on the 12 – 15, 19, 20 and 22 August 2019. **No actual nest trees were recorded during the assessment.**
	3. Actual Nest Trees - *Where potential nest trees are identified on site, night monitoring at the identified potential nest locations for a minimum of 2 nights should be undertaken to detect the presence of any owl of this species using a potential nest tree or demonstrating behaviour focussed on a potential nest tree (e.g. investigating the hollow or roosting within 10*	

Species	Detailed Survey Requirements	Completed
	m). Assessors must undertake species surveys using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements).	
Ninox strenua **Powerful Owl (Breeding Habitat)**	The identification of breeding habitat will require survey or an expert report. The following method is recommended for the identification of breeding habitat (TBDC):	
	1. **Identify Signs of Breeding –** *the assessor should identify signs of breeding including suitable habitat AND (a) presence of male and female OR (b) calling to each other (duetting) OR (c) find nest. Note that this species does not respond as well to call-play-back and could require stagwatching and other evidence of nesting.*	**No signs of breeding was recorded within the Study Area.**
	2. **Potential Nest Trees –** *should be identified if signs of breeding are present on site. Potential nest trees are living or dead trees with hollows greater than 20 cm diameter.*	A total of 32 suitable hollow-bearing trees (potential nest trees) were stag-watched. Stag-watching was undertaken within the Development Site between 12 – 15, 19, 20 and 22 August 2019, 20 – 23 June, and 4, 15 and 16 August 2022. Call playback and nocturnal surveys were completed on the 12 – 15, 19, 20 and 22 August 2019. **No actual nest trees were recorded during the assessment.**
	3. **Actual Nest Trees -** *Where potential nest trees are identified on site, night monitoring at the identified potential nest locations for a minimum of 2 nights should be undertaken to detect the presence of any owl of this species using a potential nest tree or demonstrating behaviour focussed on a potential nest tree (e.g. investigating the hollow or roosting within 10 m). Assessors must undertake species surveys using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements).*	
Tyto tenebricosa **Sooty Owl (Breeding Habitat)**	The identification of breeding habitat will require survey or an expert report. There are no detailed survey methods for the species within the TBDC, as such the following details the survey requirements for other threatened forest owls for the identification of breeding habitat (TBDC):	
	1. **Identify Signs of Breeding –** *the assessor should identify signs of breeding including suitable habitat AND (a) presence of male and female OR (b) calling to each other (duetting) OR (c) find nest. Note that this species does not respond as well to call-play-back and could require stagwatching and other evidence of nesting.*	**One (1) Sooty Owl was recorded calling from offsite during nocturnal surveys, however no individuals were recorded within the Study Area and no signs of breeding were recorded within the Study Area.**

Species	Detailed Survey Requirements	Completed
	2. **Potential Nest Trees –** *should be identified if signs of breeding are present on site. Potential nest trees are living or dead trees with hollows greater than 20 cm diameter.*	A total of 32 suitable hollow-bearing trees (potential nest trees) were stag-watched. Stag-watching was undertaken within the Development Site between 12 – 15, 19, 20 and 22 August 2019, 20 – 23 June, and 4, 15 and 16 August 2022. Call playback and nocturnal surveys were completed on the 12 – 15, 19, 20 and 22 August 2019. **No actual nest trees were recorded during the assessment.**
	3. **Actual Nest Trees -** *Where potential nest trees are identified on site, night monitoring at the identified potential nest locations for a minimum of 2 nights should be undertaken to detect the presence of any owl of this species using a potential nest tree or demonstrating behaviour focussed on a potential nest tree (e.g. investigating the hollow or roosting within 10 m). Assessors must undertake species surveys using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements).*	
Tyto novaehollandiae **Masked Owl (Breeding Habitat)**	The identification of breeding habitat will require survey or an expert report. There are no detailed survey methods for the species within the TBDC, as such the following details the survey requirements for other threatened forest owls for the identification of breeding habitat (TBDC):	
	1. **Identify Signs of Breeding –** *the assessor should identify signs of breeding including suitable habitat AND (a) presence of male and female OR (b) calling to each other (duetting) OR (c) find nest. Note that this species does not respond as well to call-play-back and could require stagwatching and other evidence of nesting.*	**One (1) Masked Owl was recorded calling from offsite during nocturnal surveys, however no individuals were recorded within the Study Area and no signs of breeding were recorded within the Study Area.**
	2. **Potential Nest Trees –** *should be identified if signs of breeding are present on site. Potential nest trees are living or dead trees with hollows greater than 20 cm diameter.*	A total of 32 suitable hollow-bearing trees (potential nest trees) were stag-watched. Stag-watching was undertaken within the Development Site between 12 – 15, 19, 20 and 22 August 2019, 20 – 23 June, and 4, 15 and 16 August 2022. Call playback and nocturnal surveys were completed on the 12 – 15, 19, 20 and 22 August 2019. **No actual nest trees were recorded during the assessment.**
	3. **Actual Nest Trees -** *Where potential nest trees are identified on site, night monitoring at the identified potential nest locations for a minimum of 2 nights should be undertaken to detect the presence of any owl of this species using a potential nest tree or demonstrating behaviour focussed on a potential nest tree (e.g. investigating the hollow or roosting within 10 m). Assessors must undertake species surveys using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements).*	

Species	Detailed Survey Requirements	Completed
Chalinolobus dwyeri **Large-eared Pied Bat**	**Survey methods: see below**	
	Harp trap *(or mist net) placed in areas of potential breeding habitat on the subject land. The survey may use harp traps or a combination of harp traps and mist nets. Age, sex and reproductive status of captured bats must be assessed and recorded.*	**Complete** - four (4) harp traps were installed over 4 consecutive nights
	Acoustic detectors *may be used; however, this method does not allow for reproductive status to be identified. If acoustic detectors are the only survey method used and the target species is detected, breeding must be assumed and mapped in accordance with Table 2 (Bat Survey Guidelines).*	**Complete** – four (4) Anabats were installed over 18 nights between 9 – 13 March 2020, and 26 February to 11 March 2019
	Radio tracking *or 'other' (roost) searches are optional methods that may be used to pinpoint the breeding site and refine the species polygon when recommended survey confirms the presence of breeding habitat. However, these methods cannot be used to demonstrate the species is absent from the subject land.*	Habitat Assessment did not identify any suitable roosting habitat within the Study Area or surrounds. **Species excluded.**
	Potential breeding habitat: *The PCTs associated with the species (as per the TBDC) within 100m of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. Traps should be set in woodlands, valley floors, riparian areas and relatively fertile parts of the subject land where possible*	
Miniopterus australis **Little Bent-winged Bat**	**Survey methods:** *Harp traps should be placed close to exits of caves, mines or tunnels identified as survey habitat. Care should be taken to monitor traps to avoid overcrowding. Age, sex and reproductive status of captured bats must be assessed and recorded. At a minimum of two traps per night over two nights, repeated at least two weeks later is required.*	No suitable roosting habitat was identified within the Study Area or surrounds. As such, four (4) harp traps and four (4) Anabats were installed within appropriate fly ways. **Species excluded**
	Potential breeding habitat: *Caves, tunnels, mines or other structures known or suspected to be used by M. australis including species records in the NSW BioNet Atlas with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature.*	
Miniopterus orianae oceanensis	**Survey methods:** *Harp traps should be placed close to exits of caves, mines or tunnels identified as survey habitat. Care should be taken to monitor traps to avoid overcrowding. Age, sex and reproductive status of*	No suitable roosting habitat was identified within the Study Area or surrounds. As such, four (4) harp traps and four (4)

Species	Detailed Survey Requirements	Completed
Large Bent-winged Bat (Breeding Habitat)	*captured bats must be assessed and recorded. At a minimum of two traps per night over two nights, repeated at least two weeks later is required.*	Anabats were installed within appropriate fly ways. **Species excluded**
	Potential breeding habitat: *Caves, tunnels, mines or other structures known or suspected to be used by M. australis including species records in the NSW BioNet Atlas with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature.*	
Myotis macropus **Southern Myotis**	**Survey methods:** see below	No suitable roosting habitat was identified within the Study Area or surrounds. As such, four (4) harp traps and four (4) Anabats were installed within appropriate fly ways.
	Harp trap *or mist net placed in areas of potential habitat. For larger water bodies mist nets may be necessary. Traps or nets should be set beside or preferably over pools of water along creeks or rivers, particularly in flat or areas of low relief if present. Traps can be set under bridges or culverts, or overhanging branches. The survey may use only mist nets, or a combination of harp traps and mist nets.*	
	Roost search: *Any bridges, tunnels, culverts or other structures identified as potential breeding habitat should be searched for bats or signs of bats (guano etc). A torch should be used and attention paid to inspecting cracks or seams in the roof. A handheld bat detector can alert the searcher to ultrasonic calls. If bats or signs of bats are observed, the bats may need to be captured to identify species and breeding status using traps, nets or other methods.*	
	Potential habitat: *The range of PCTs associated with the species (as per the TBDC) within 200 meters of any medium to large permanent creeks, rivers, lakes or other waterways (i.e. with pools/ stretches 3m or wider) (Anderson et al. 2005).*	
Phascogale tapoatafa **Brush-tailed Phascogale**	**Remote Camera Surveys -** *Survey must be undertaken using baited cameras. The bait type used must remain as an effective attractant until replaced. Honeyed oat balls will need to be replaced daily. Other effective baiting methods include using a baited canister with small holes and capped at either end, to limit bait theft by other species, or honey-water, sprayed very liberally in front of each camera. The baited canister and honey-water will require less frequent replenishment of the bait compared to a bait ball.*	**Complete -** A total of 58 Remote Cameras were installed over a period of 4 weeks, baits replaced after 2 weeks.

Species	Detailed Survey Requirements	Completed
	Cameras should be set at head height, or above, facing the branch or tree trunk where a honey-based bait has been placed. Cameras must remain in place for a minimum of 4 weeks with cameras checked and baits replaced after 2 weeks. A minimum of 4 cameras, independent of the size of the subject land, must be used for sites up to 1 ha, then an additional 2 cameras for every ha of suitable habitat thereafter. Cameras must be evenly spaced across the site. Where potential habitat is disconnected by gaps of 50 m or more, each habitat patch should have a minimum of 4 cameras for the first ha, and 2 cameras for every ha thereafter. Malfunctioning cameras must be replaced and additional cameras and time must be invested to address the lost survey effort. That is, at least 22 working, baited, evenly spaced camera traps are required for the first 10 ha of suitable habitat. *Where the subject land is >10ha, contact the BOS Helpdesk providing a camera survey approach for review by species experts. Include a map (or maps) of the subject land showing:* • *Suggested camera placements,* • *PCTs within the subject land, including each vegetation zone and its condition, and* • *Records of the species within, and within 50 km of, the subject land*. **At 29 ha of native vegetation within the Subject Site this requires the install of 60 Remote Cameras.**	
	Remote Camera Surveys (Modified Survey Approach) - Recommended by subject matter expert: "*22 baited cameras for the first 10 hectares; then 1 baited camera for every 2 additional hectares of suitable habitat*. *This equates to 31 baited camera traps.*"	
Planigale maculata **Common Planigale**	**Pitfall Traps -** *Survey must be undertaken using pitfall traps where the substrate allows. Occasionally, the substrate may be too rocky, hard or inundated to allow the use of pitfall traps. In these circumstances, we strongly advise that an expert report should be obtained. Survey should be delayed if heavy precipitation is forecast, to prevent the drowning of this, and other species, caught in the traps.*	**Complete -** Suitable habitat was calculated as the area within 200 m of the ecotone between 'wet' and 'dry' vegetation types. A total of 13 pitfall traps were installed and inspected over a period of 4 nights.

Species	Detailed Survey Requirements	Completed
	Pitfall trap design: Ideally, each pitfall trap array should comprise 10 m of drift-fence with a 20 L or larger bucket with a lid at either end. The lid should be elevated 2 to 3 cm (using sticks) above the lip of the bucket and be black in colour to encourage animals to move under it. Leaf litter and small twigs should be placed in the bottom of each bucket to provide shelter for trapped animals. *Survey placement: Target the placement of traps in suitable habitat within about 200 m of the ecotonal boundary of adjoining PCTs, in or adjacent to dense grass cover, deep leaf litter and/or abundant logs where Planigales would be expected to be present under the prevailing conditions (upslope of the ecotone in wet conditions and downslope in dry conditions). Traps must remain in place for a minimum of four consecutive nights.* *Pitfall traps need to be checked as soon as possible after first light (to reduce exposure and predation) and ideally, during the night as well, especially in the event of unforeseen rainfall events (to prevent drowning).* *Survey effort: A minimum of three pitfall trap arrays must be used for an area of suitable habitat up to 1 ha. For suitable habitat >1 ha – 10 ha, one additional pitfall trap array must be used for every additional hectare, with a maximum of 10 pitfall trap arrays for any one patch of suitable habitat. Where suitable habitat patches are separated by 200 m or greater, the same survey effort must be applied in each patch. If the combined mapped areas of suitable habitat on the subject land is >10 ha, contact the Department for a modified survey approach.*	
	Pitfall Traps (modified survey approach) – *Target the placement of traps in suitable habitat within about 200 m of the ecotonal boundary of adjoining PCTs, in or adjacent to dense grass cover, deep leaf litter and/or abundant logs where Planigales would be expected to be present under the prevailing conditions (upslope of the ecotone in wet conditions and downslope in dry conditions). The ecotonal zone is the boundary between a 'wet' PCT and a 'dry' PCT. Under drier conditions, the species moves into the lower elevation 'wet' PCT, and under wetter conditions*	

Species	Detailed Survey Requirements	Completed
	it moves upslope to the higher elevation 'dry' PCT. Habitat includes hollow logs, under bark, rocks, cracks in soil, grass tussocks or building debris. Where possible, sample suitable habitat in varying ages post fire or other disturbance. *Where the total area of suitable habitat is above 10 ha, the following number of pitfall trap arrays are required:* • *total suitable habitat >10 – 50 ha: 10 arrays + three additional for every 10 ha of suitable habitat above 10 ha. For example, 20 ha of suitable habitat will require 13 arrays.* • *total suitable habitat > 50 ha: 22 arrays plus one additional for every 10 ha of suitable habitat above 10 ha. For example, 60 ha of suitable habitat will require 23 arrays.* *The pitfall trap arrays must be evenly distributed across the suitable habitat.* While the TBDC currently recommends use of Elliott trapping to detect the Yellow-footed Antechinus as an indication of Common Planigale presence, this is not required under the Biodiversity Assessment Method (BAM). Presence of Yellow-footed Antechinus alone (in the absence of targeted survey or expert report for Common Planigale) cannot be used to determine Common Planigale absent from the site.	
Vespadelus troughtoni **Eastern Cave Bat**	**Survey methods:** *Harp traps should be placed close to exits of caves, mines or tunnels identified as survey habitat. Care should be taken to monitor traps to avoid overcrowding. Age, sex and reproductive status of captured bats must be assessed and recorded. At a minimum of two traps per night over two nights, repeated at least two weeks later is required.*	No suitable roosting habitat was identified within the Study Area or surrounds. As such, four (4) harp traps and four (4) Anabats were installed within appropriate fly ways.
	Potential breeding habitat: *Caves, tunnels, mines or other structures known or suspected to be used by M. australis including species records in the NSW BioNet Atlas with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature.*	

EPBC Act threatened species survey requirements

Species	Completed	Requirements
Litoria aurea Green and Golden Bell Frog	Nocturnal surveys over 4 nights in 8 separate locations. Totalling 8 hours.	Using a combination of call detection, call playback and spotlight surveys over a minimum of 4 nights. Accompanied by a habitat assessment.
Anthochaera phrygia Regent Honeyeater	Bird census around water bodies for 1 hour at dusk on 2 separate days. Totalling 6 hours.	Area searches for 20 hours over 2 days and Targeted searches for 20 hours of 5 days.
Lathamus discolor Swift Parrot	Bird census around water bodies for 1 hour at dusk on 2 separate days. Totalling 6 hours.	Area searches or transect surveys for 20hours over 8 days and targeted surveys for 20 hours over 8 days.
Chalinolobus dwyeri Large-eared Pied Bat	Harp traps and anabats were placed at 4 locations over 4 full nights Totalling 16 nights for each method.	Anabat detectors for 16 detectors nights Harp traps for 16 trap nights.
Dasyurus maculatus Spotted-tailed Quoll	Daytime habitat searches have been completed throughout the entire site.	Daytime searches for suitable habitat resources. Daytime searches for signs of activity i.e. scates and latrines. Hair funnel traps for a minimum of 14 consecutive nights. Remote camera traps for minimum of three weeks with 10 per hectare.
Pteropus poliocephalus Grey-headed Flying-fox	Nocturnal surveys over 2 nights in March 2020 Totalling 8 hours Searches for camps were conducted over the entire subject area.	Seek information about the location of historic camps from DECC (NSW). A comprehensive vegetation survey has been completed for the area and an assessment of the food plants with the Project area in relation to the broader area.

Hollow-bearing Tree Assessment Results – Owl Suitable Hollows

Tree ID	HBT Details	Number of Hollows			Owl Suitable	Comments	Stagwatched
		Large	Med	Small			
2	HBT	1	-	-	Suitable	-	Yes
3	HBT	1	-	-	Suitable	-	Yes
10	Dead Stag	2	-	-	Suitable	-	Yes
17	HBT	1	-	-	Suitable	Only 8m of the ground	Yes
18	HBT	1	-	-	Suitable	-	Yes
24	HBT	1	-	-	Suitable	-	Yes
57	Hollow-bearing Tree	1	0	0	Suitable	-	Yes
70	Dead Stag	1	0	0	Suitable	-	Yes
74	Dead Stag	1	1	0	Suitable	-	Yes
103	Dead Stag	2	0	0	Marginal	-	Yes
117	Dead Stag	1	3	0	Suitable	-	Yes
118	Hollow-bearing Tree	2	1	1	Suitable	-	Yes
128	Hollow-bearing Tree	1	0	1	Suitable	-	Yes
129	Hollow-bearing Tree	1	0	0	Suitable	-	Yes
131	Hollow-bearing Tree	1	0	0	Suitable	-	Yes
217	Hollow-bearing Tree	1	0	0	Suitable	-	Yes
226	Hollow-bearing Tree	1	0	0	Suitable	-	Yes
227	Hollow-bearing Tree	2	0	0	Suitable	-	Yes
228	Dead Stag	1	0	0	Marginal	Only 10m high	Yes
231	Hollow-bearing Tree	2	0	0	Suitable	-	Yes
238	Hollow-bearing Tree	1	0	0	Suitable	-	Yes
240	Hollow-bearing Tree	3	0	0	Suitable	12m high	Yes
251	Dead Stag	1	0	0	Suitable	-	Yes
252	Dead Stag	1	1	0	Suitable	-	Yes
267	Hollow-bearing Tree	1	0	0	Suitable	-	Yes
288	Hollow-bearing Tree	1	1	0	Suitable	-	Yes
353	Hollow-bearing Tree	1	0	0	Suitable	-	Yes
113	Hollow-bearing Tree	1	2	0	Suitable	-	Yes
154	Dead Stag	2	2	2	Suitable	-	Yes
188	Hollow-bearing Tree	0	2	3	Suitable	-	Yes
335	Hollow-bearing Tree	1	2	1	Suitable	-	Yes
1	Hollow-bearing Tree	1	2	2	Suitable	Suitable for owls, stag watched 20/06/2022	Yes

APPENDIX 7: BIODIVERSITY CREDIT REPORT

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00022618/BAAS21021/20/00022619

Proposal Name
Deep Creek Quarry

BAM data last updated *
19/12/2022

Assessor Name
Gilbert Whyte

Assessor Number
BAAS18041

BAM Data version *
56

Proponent Names

Report Created
23/12/2022

BAM Case Status
Finalised

Assessment Revision
3

Assessment Type
Major Projects

Date Finalised
23/12/2022

* 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.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Not a TEC	18.4	222	99	321
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Not a TEC	8.7	154	12	166
1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast	Not a TEC	0.2	5	0	5
1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast	Not a TEC	1.8	52	0	52

1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

	Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914	Northern Hinterland Wet Sclerophyll Forests <50%	1556_VZ9_Mod_Good	Yes	5	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	North Coast Wet Sclerophyll Forests This includes PCT's: 487, 613, 661, 684, 686, 692, 693, 694, 695, 699, 747, 748, 752, 812, 826, 827, 1073, 1208, 1217, 1222, 1237, 1244, 1245, 1257, 1259, 1260, 1261, 1265, 1266, 1282, 1284, 1285, 1504, 1561, 1562, 1563, 1566, 1567, 1568, 1569, 1572, 1573, 1575, 1579, 1841, 1843, 1915	North Coast Wet Sclerophyll Forests <50%	1567_VZ8_Mod_Good	Yes	52	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748	Hunter-Macleay Dry Sclerophyll Forests <50%	1590_VZ2_Managed	No	77	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748	Hunter-Macleay Dry Sclerophyll Forests <50%	1590_VZ1_Mod_Good	Yes	222	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748	Hunter-Macleay Dry Sclerophyll Forests <50%	1590_VZ3_Regenerating	No	15	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748	Hunter-Macleay Dry Sclerophyll Forests <50%	1590_VZ4_Weedy	No	7	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Sydney Coastal Dry Sclerophyll Forests <50%	1619_VZ7_Regenerating	Yes	62	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Sydney Coastal Dry Sclerophyll Forests <50%	1619_VZ6_Managed	No	12	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Sydney Coastal Dry Sclerophyll Forests <50%	1619_VZ5_Mod_Good	Yes	92	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Callistemon linearifolius / Netted Bottle Brush	**1590_VZ2_Managed, 1619_VZ5_Mod_Good, 1590_VZ1_Mod_Good, 1567_VZ8_Mod_Good**	60.0	92.00
Myotis macropus / Southern Myotis	**1590_VZ2_Managed, 1619_VZ7_Regenerating, 1619_VZ6_Managed, 1619_VZ5_Mod_Good, 1590_VZ1_Mod_Good, 1567_VZ8_Mod_Good, 1590_VZ3_Regenerating, 1590_VZ4_Weedy**	17.7	409.00
Petaurus norfolcensis / Squirrel Glider	**1590_VZ2_Managed, 1619_VZ7_Regenerating, 1619_VZ6_Managed, 1619_VZ5_Mod_Good, 1590_VZ1_Mod_Good, 1556_VZ9_Mod_Good, 1567_VZ8_Mod_Good, 1590_VZ3_Regenerating, 1590_VZ4_Weedy**	28.8	714.00

Phascolarctos cinereus / Koala	**1590_VZ2_Managed, 1619_VZ7_Regenerating, 1619_VZ6_Managed, 1619_VZ5_Mod_Good, 1590_VZ1_Mod_Good, 1556_VZ9_Mod_Good, 1567_VZ8_Mod_Good, 1590_VZ3_Regenerating, 1590_VZ4_Weedy**	29.1	728.00
Tetratheca juncea / Black-eyed Susan	**1619_VZ7_Regenerating, 1619_VZ5_Mod_Good, 1590_VZ1_Mod_Good, 1567_VZ8_Mod_Good**	19.4	572.00

Credit Retirement Options

Like-for-like credit retirement options

Callistemon linearifolius / Netted Bottle Brush	Spp	IBRA subregion
	Callistemon linearifolius / Netted Bottle Brush	Any in NSW
Myotis macropus / Southern Myotis	Spp	IBRA subregion
	Myotis macropus / Southern Myotis	Any in NSW
Petaurus norfolcensis / Squirrel Glider	Spp	IBRA subregion

	Petaurus norfolcensis / Squirrel Glider	Any in NSW
Phascolarctos cinereus / Koala	Spp	IBRA subregion
	Phascolarctos cinereus / Koala	Any in NSW
Tetratheca juncea / Black-eyed Susan	Spp	IBRA subregion
	Tetratheca juncea / Black-eyed Susan	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00022618/BAAS21021/20/00022619

Proposal Name
Deep Creek Quarry

BAM data last updated *
19/12/2022

Assessor Name
Gilbert Whyte

Assessor Number
BAAS18041

BAM Data version *
56

Proponent Name(s)

Report Created
23/12/2022

BAM Case Status
Finalised

Assessment Revision
3

Assessment Type
Major Projects

Date Finalised
23/12/2022

* 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.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast
1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Not a TEC	18.4	222	99	321.00
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Not a TEC	8.7	154	12	166.00
1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast	Not a TEC	0.2	5	0	5.00
1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast	Not a TEC	1.8	52	0	52.00

1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914	Northern Hinterland Wet Sclerophyll Forests <50%	1556_VZ9_Mod_Good	Yes	5	Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Wet Sclerophyll Forests (Grassy sub-formation)	Tier 4 or higher threat status	1556_VZ9_Mod_Good	Yes (including artificial)	5	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1567-Tallowwood - Brush Box - Sydney Blue Gum moist shrubby tall open forest on foothills of the lower North Coast	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	North Coast Wet Sclerophyll Forests This includes PCT's: 487, 613, 661, 684, 686, 692, 693, 694, 695, 699, 747, 748, 752, 812, 826, 827, 1073, 1208, 1217, 1222, 1237, 1244, 1245, 1257, 1259, 1260, 1261, 1265, 1266, 1282, 1284, 1285, 1504, 1561, 1562, 1563, 1566, 1567, 1568, 1569, 1572, 1573, 1575, 1579, 1841, 1843, 1915	North Coast Wet Sclerophyll Forests <50%	1567_VZ8_ Mod_Good	Yes	52	Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Wet Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1567_VZ8_ Mod_Good	Yes (including artificial)	52	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748	Hunter-Macleay Dry Sclerophyll Forests <50%	1590_VZ2_ Managed	No	77	Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748	Hunter-Macleay Dry Sclerophyll Forests <50%	1590_VZ1_ Mod_Good	Yes	222	Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748	Hunter-Macleay Dry Sclerophyll Forests <50%	1590_VZ3_ Regenerati ng	No	15	Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748	Hunter-Macleay Dry Sclerophyll Forests <50%	1590_VZ4_ Weedy	No	7	Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region
Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 4 or higher threat status	1590_VZ2_ Managed	No	77	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 4 or higher threat status	1590_VZ1_ Mod_Good	Yes (including artificial)	222	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 4 or higher threat status	1590_VZ3_ Regenerating	No	15	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 4 or higher threat status	1590_VZ4_Weedy	No	7	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Sydney Coastal Dry Sclerophyll Forests <50%	1619_VZ7_Regenerating	Yes	62	Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Sydney Coastal Dry Sclerophyll Forests <50%	1619_VZ6_Managed	No	12	Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Sydney Coastal Dry Sclerophyll Forests <50%	1619_VZ5_ Mod_Good	Yes	92	Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region
Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1619_VZ7_ Regenerating	Yes (including artificial)	62	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1619_VZ6_ Managed	No	12	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1619_VZ5_ Mod_Good	Yes (including artificial)	92	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

BAM Biodiversity Credit Report (Variations)

Species	Vegetation Zone/s	Area / Count	Credits
Callistemon linearifolius / Netted Bottle Brush	**1590_VZ2_Managed, 1619_VZ5_Mod_Good, 1590_VZ1_Mod_Good, 1567_VZ8_Mod_Good**	60.0	92.00
Myotis macropus / Southern Myotis	**1590_VZ2_Managed, 1619_VZ7_Regenerating, 1619_VZ6_Managed, 1619_VZ5_Mod_Good, 1590_VZ1_Mod_Good, 1567_VZ8_Mod_Good, 1590_VZ3_Regenerating, 1590_VZ4_Weedy**	17.7	409.00
Petaurus norfolcensis / Squirrel Glider	**1590_VZ2_Managed, 1619_VZ7_Regenerating, 1619_VZ6_Managed, 1619_VZ5_Mod_Good, 1590_VZ1_Mod_Good, 1556_VZ9_Mod_Good, 1567_VZ8_Mod_Good, 1590_VZ3_Regenerating, 1590_VZ4_Weedy**	28.8	714.00

Phascolarctos cinereus / Koala	**1590_VZ2_Managed, 1619_VZ7_Regenerating, 1619_VZ6_Managed, 1619_VZ5_Mod_Good, 1590_VZ1_Mod_Good, 1556_VZ9_Mod_Good, 1567_VZ8_Mod_Good, 1590_VZ3_Regenerating, 1590_VZ4_Weedy**	29.1	728.00
Tetratheca juncea / Black-eyed Susan	**1619_VZ7_Regenerating, 1619_VZ5_Mod_Good, 1590_VZ1_Mod_Good, 1567_VZ8_Mod_Good**	19.4	572.00

Credit Retirement Options

Like-for-like options

Callistemon linearifolius/ Netted Bottle Brush

Spp	IBRA region
Callistemon linearifolius/Netted Bottle Brush	Any in NSW

Variation options

Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

	Flora	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Myotis macropus/ Southern Myotis	Spp	IBRA region	
	Myotis macropus/Southern Myotis	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Petaurus norfolcensis/ Squirrel Glider	Spp	IBRA region	
	Petaurus norfolcensis/Squirrel Glider	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing	IBRA region

		under Part 4 of the BC Act shown below	
	Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Phascolarctos cinereus/ Koala	Spp	IBRA region	
	Phascolarctos cinereus/Koala	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Endangered	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Tetratheca juncea/ Black-eyed Susan	Spp	IBRA region	
	Tetratheca juncea/Black-eyed Susan	Any in NSW	
	Variation options		

	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

APPENDIX 8: ASSESSMENTS OF SIGNIFICANCE (EPBC ACT) - HABITAT MAPS

Black-eyed Susan (*Tetratheca juncea*)

Tetratheca juncea is confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. It is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. While some studies show the species has a preference for cooler southerly aspects, it has been found on slopes with a variety of aspects. It generally prefers well-drained sites below 200m elevation and annual rainfall between 1000 - 1200mm. The preferred substrates are sandy skeletal soil on sandstone, sandy-loam soils, low nutrients; and clayey soil from conglomerates, pH neutral. (DPIE, 2020; Harden, 2000).

Assessment of this species was conducted in accordance with Approved Listing Advice, Approved Conservation Advice, Recovery Action Plans and the Referral guidelines for the vulnerable Black-eyed Susan *Tetratheca juncea* (DSEWPC 2011). Surveys for the species were completed in accordance with the recommended survey methods detailed in the Referral guidelines for the vulnerable Black-eyed Susan *Tetratheca juncea* (DSEWPC 2011) as detailed in the table below.

Recommended Survey Method	Requirements	Surveys Completed
Determine Peak Flowering	Prior to conducting detailed surveys, preliminary field visits are required to determine whether flowering has begun at a particular affected area. Preliminary investigations should compare the number of flowers to the number of buds. A minimum of 75 per cent of buds should be in flower before conducting surveys at a proposed affected area.	Local reference populations (including individuals detected on site) were inspected prior to the completion of targeted surveys.
Initial Coarse Level Survey	• Set up belt transects, maximum of 50 m apart, to cover a minimum of 10% of the entire study area • Count plant clumps in accordance with Payne et al. (2002)*. • Record tracks of transects covered • Record the location of plant clumps, and • Determine the distribution of black-eyed susan	5 metre wide parallel transects during peak flowering throughout the Affected Area (i.e. the Development Footprint). 10 metre wide parallel transects were completed within areas characterised by sparse/open groundcover. Surveys were condutced in accordance with the BAM and *Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method* (DPIE 2020h). See **Section 4.2.1** and **Figure 9**.
Detailed Targeted Survey	• Set up belt transects approximately 4-5 m apart to cover the distributed area of blackeyed susan • Count and record plant clumps as outlined above • Calculate plant clump density per hectare of suitable habitat, and • Determine the area of occupancy polygons	
Habitat Assessment	In addition to undertaking surveys for black-eyed susan, the following habitat characteristics should be assessed. Assessment of the habitat in the affected area may provide further indication of the likely presence (or absence) of the species at a site and may also provide information to determine significance: • soil type • landscape • vegetation community • botanical description (flora list) of the study area.	Vegetation and habitat assessments were completed throughout the Study Area in accordance with the BAM.

*Payne, R., Stevenson, D. & Wellington, R. (2002). A standardised method for counting black-eyed susan populations. Unpublished Report

Significant Impact Criteria

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

- ***lead to a long-term decrease in the size of an important population of a species***

Yes, the proposed action will lead to a decrease in the size of an important population. The proposed action will result in impacts to 584 *Tetratheca juncea* clumps, representing a total of 32 % of known individuals within Subpopulation A (Total: 1,828 clumps known).

A total of 1,830 *Tetratheca juncea* individuals were identified during the assessment. Based on the distribution of individuals (**Figure B1**), two separate subpopulations occur. The larger subpopulation is comprised of 1,828 individuals, of which 584 individuals occur within the Development Site, 19 individuals occur within the Study Area (outside of the Development Site) and 1,225 individuals occur within the remaining landholdings (that have been surveyed) and will not be impacted. The second smaller subpopulation of 2 individuals was identified on the access road and will be impacted by the proposed Action. The extent of habitat that will be impacted within the Development Site was determined to be 19.05 ha as shown in **Figure B1**.

An 'important population' is defined as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

A *Tetratheca juncea* population is regarded as an important population if it meets any of the following (DSEWPaC, 2011):

- Has greater than 1000 plant clumps.
- An area of habitat has an average estimated plant clump density of 20 clumps/hectare or greater.
- Occurs in rare habitat.
- Occurs in an area of "important habitat" as defined in Maps 4a 4 and 4b and has greater than 500 plant clumps.
- Occurs at or near the distributional limits of the species.
- Occurs in close proximity to a protected area (e.g. National Park) where the species is known to occur. Close proximity refers to:
    - Within 500 m if connected by a suitable habitat corridor such as native vegetation.
    - Within 100 m over disturbed habitat or non-native vegetation.

On the basis of the above criteria, the larger subpopulation of 1,828 individuals (clumps) which occurs in and around the Study Area would comprise an important population. A total of 586 individuals (32%) from this subpopulation would be removed by the proposed Action.

- ***reduce the area of occupancy of an important population***

Yes, the proposed action will reduce the area of occupancy for the important population.

The area of occupancy of the important population is approximately 44.21 ha. A total of 10.56 ha of this area of occupancy would be removed by the action.

- ***fragment an existing important population into two or more populations***

No, the proposed action will not lead to the fragmentation of an important population.

The majority of the population to be retained following the proposed Action occurs to the south of the Development Site. The vegetation in this area has good habitat connectivity and will not be fragmented. The proposed Action would not fragment an existing important population into two or more populations.

- ***adversely affect habitat critical to the survival of a species***

No, the proposed action will not affect "Important Habitat for Black-Eyed Susan".

No habitat critical to the survival of this species has been identified by the Commonwealth (DAWE, 2020).

- ***disrupt the breeding cycle of an important population***

No, the proposed action will not fragment an important population of the species, as such there is unlikely to be an impact on the breeding cycle of the important population.

Approximately 32% of an important population for the species would be removed by the proposed Action. The remaining 68% of the population would not be directly impacted and would be retained in areas of good quality habitat. Given the large number of individuals to be retained and the high quality of the habitat, it is unlikely that the breeding cycle of the population would be significantly disrupted in the locality.

- ***modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

Yes, the proposed action will impact a total of 19.36 ha of Suitable Habitat within the Development Site.

The habitat for the population to be retained outside the Development Site has good connectivity with the surrounding bushland. The loss of *Tetratheca juncea* habitat within the Study Area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline (see **Figure A1**). Habitat for the species for the purpose of this assessment was considered to align to the PCTs and condition states identified within the species polygon for the BDAR (see **Figure 14**). The habitat identified within the Development Site extended into vegetation with comparable floristics and condition within the broader Subject Area (see **Figure A1**) and included the following Plant Community Types (PCTs):

- *PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest*
- *PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands*, and
- *PCT 1556: Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast*

- ***result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat***

Several invasive weed species such as *Lantana camara* (Lantana) may compete with *Tetratheca juncea* for resources such as light and water. Smothering by Lantana may lead to the decline and death of native plants, including *Tetratheca juncea*. Invasive herbivore pest fauna such as Goats and Rabbits may also cause harm.

The existing weed and feral animal threat levels are unlikely to change significantly due to the proposed Action. Management measures are presented in **Section 5.3** to reduce the potential for impacts to the species.

- ***introduce disease that may cause the species to decline, or***

The plant pathogen *Phytophthora cinnamomi* is declared a key threatening process in NSW. *Tetratheca juncea* is identified as a species that may be adversely affected by direct infestation or habitat degradation by *P. cinnamomi* (TSSC 2005). The Action is unlikely to include activities that are likely to introduce any disease.

- ***interfere substantially with the recovery of the species.***

A Recovery Plan has not been developed for this species.

Conclusion

The proposed Action has the potential to have a significant impact on the species due to the following:

- A total of 586 individuals would be removed by the proposed Action, including 584 individuals from Subpopulation A (32% of population, total: 1,828 plants. A total of 1,225 individuals (67%) will be retained in good quality habitat.
- The area of occupancy of the important population which occurs within the Study Area is approximately 44.21 ha. A total of 19.05 ha of this area of occupancy would be removed by the action.

- Given the large number of individuals to be retained and the high quality of the habitat, it is unlikely that the breeding cycle of the population would be significantly disrupted in the locality.
- The loss of *Tetratheca juncea* habitat within the Study Area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.
- Management measures are presented in **Section 5.3** to reduce the potential for impacts to the species.

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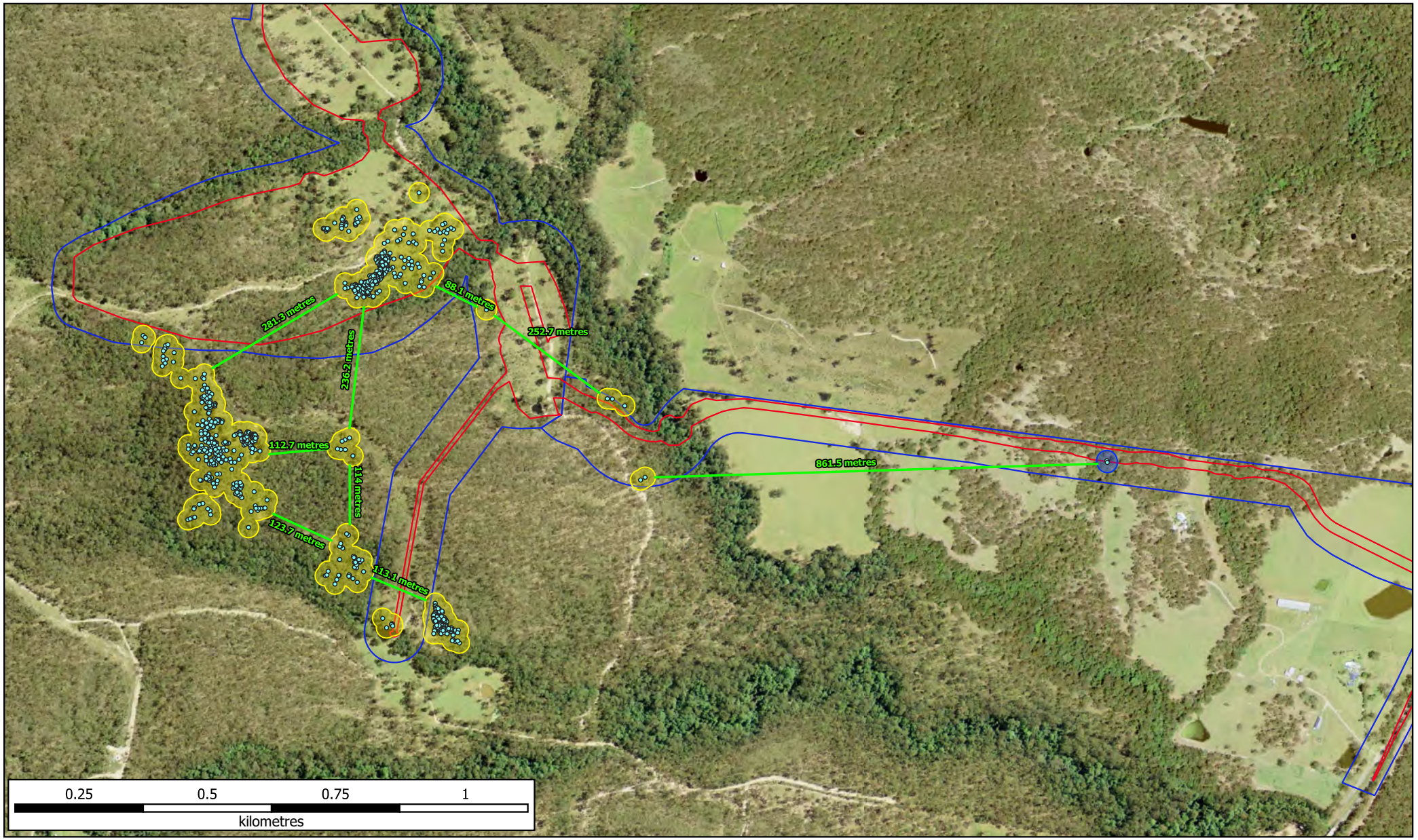
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Legend

- Development Site Boundary
- Study Area
- *Tetratheca juncea* detected
- Distance between patches
- Subpopulation A
- Subpopulation B

Habitat for *Tetratheca juncea* (Black-eyed Susan)

Figure: **B1**

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Deep Creek Quarry
Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

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Koala (*Phascolarctos cinereus*)

The Koala (*Phascolarctos cinereus*) generally occurs from the Townsville district in northern Queensland, south along the coast and ranges into Victoria and part of South Australia. Within New South Wales and Queensland, this distribution extends into the western slopes and plains. The Koala lives entirely on a diet of leaves of both eucalypt and non-eucalypt trees and it has been shown that within its range there are local and regional preferences for the tree species used for feeding. Examples of eucalypts used as feed trees are *E. camaldulensis; E. viminalis; E. ovata; E. tereticornis; E. microcorys; E. punctata*. Throughout its range the Koala suffers from either a lack of numbers or severe over-population where problems such as eye disease and reproductive tract bacterial disease caused by *Chlamydia psittaci* become prevalent (Martin and Handasyde, 1995; Moore and Foley, 2000; Phillips and Callaghan, 2000; Phillips et al., 2000).

Habitat Critical to the survival of the species

Habitat critical to the survival of the koala is habitat considered to be important for the species' long-term survival and recovery. An impact area that scores five or more using the habitat assessment tool for the koala in Table 4 of the *EPBC Act Referral Guidelines for the Vulnerable Koala* (DotE, 2014) (the relevant guidelines at the time of submission) is highly likely to contain habitat critical to the survival of the koala.

An assessment using the habitat assessment tool resulted in a habitat score of eight (8). This indicates that the Development Site contains habitat that is critical to the survival of the Koala (**Table 9**).

Important Population

An 'important population' is defined as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

No evidence of Koala breeding was found within the Study Area. Due to the extent of habitat in the locality and the large occurrence of local Koala records, it is unlikely that the Koala population within the Study Area is necessary for maintaining genetic diversity within the species. The Study Area is not near the limit of the species range. It is unlikely the Koala population within the Study Area comprises an important population.

Significant Impact Criteria

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

- ***lead to a long-term decrease in the size of an important population of a species***

The Koala was recorded within the Study Area (six detections in four locations - see **Figure B2**). Koala feed tree species were recorded across the Study Area. A total of 29.15 ha of Koala habitat within the Development site will be removed by the Action. The habitat mapped within the Study Area meets the definition of habitat critical to the survival of the species in accordance with the assessment criteria provided in the EPBC Act Referral Guidelines for the Vulnerable Koala (DotE, 2014).

No evidence of Koala breeding was found within the Study Area. Due to the extent of habitat in the locality and the large occurrence of local Koala records, it is unlikely that the Koala population within the Study Area is necessary for maintaining genetic diversity within the species. The Study Area is not near the limit of the species range. As such, it is unlikely the Koala population within the Study Area comprises an important population and the proposed action is not anticipated to result in the long-term decrease in the size of an important population of the species.

- ***reduce the area of occupancy of an important population***

The Koala population within the Study area is not identified as an important population. The area of occupancy for the population present will be reduced by 29.15 hectares due to the removal of critical habitat.

Approximately 235 hectares of suitable habitat for the Koala will be retained within the property boundary, outside the proposed Development Site. Vegetation mapping determined that the majority of this area is comprised of "Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590)". This PCT is dominated by Koala feed trees such as *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Broad-

leaved Ironbark) and *Eucalyptus umbra* (Bastard White Mahogany). These areas are therefore likely to represent suitable Koala habitat. Areas of suitable koala habitat are mapped within **Figure B2**.

- ***fragment an existing important population into two or more populations***

The Koala population within the Study area is not identified as an important population. The proposed Action would not fragment an existing important population into two or more populations.

- ***adversely affect habitat critical to the survival of a species***

An assessment of the habitat within the study area against the Koala habitat assessment criteria (DotE, 2014) has been undertaken in **Table 9**. The assessment determined that the Study Area contains habitat critical to the survival of the Koala. Approximately 29.15 ha of habitat critical to the survival of the Koala would be removed by the proposed action.

- ***disrupt the breeding cycle of an important population***

The Koala population within the Study area is not identified as an important population. The Koala is a highly mobile species that is likely to utilise areas of the Study Area as part of a larger network of habitats. Given the large areas of habitat to be retained within the Study Area and the surrounding locality, it is likely that the breeding cycle of the population would not be significantly disrupted.

- ***modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The habitat onsite is well connected to vast expanses of surrounding habitat. The loss of Koala habitat within the study area would not isolate remaining areas of habitat. Therefore, Koala population which occurs within the Study Area could move into adjacent areas of suitable habitat, such that this species would persist within the landscape. It is unlikely that the project would lead to the decline of this species.

- ***result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat***

Wild and domestic dog (*Canis lupus familiaris*) attacks are a recognised threat to the Koala (DAWE, 2020). The existing weed and feral animal threat levels are unlikely to change significantly due to the proposed Action. Management measures are presented in **Section 5.3** to reduce the potential for these impacts.

- ***introduce disease that may cause the species to decline, or***

Chlamydia is a recognised threat to the Koala. The Action is unlikely to include activities that are likely to increase the occurrence of this disease.

- ***interfere substantially with the recovery of the species.***

A national recovery plan for the Koala is currently in place (Department of Environment and Climate Change, 2008). The proposed Action is unlikely to interfere substantially with the recovery of the Koala given that habitat resources for this species would remain outside of the Development Site, such that the species is likely to persist in the landscape.

Conclusion

The proposed Action is unlikely to have a significant impact on the species due to the following:

- The Koala population within the Study area is not identified as an important population.
- Approximately 235 hectares of suitable habitat for the Koala will be retained within the property boundary, outside the proposed Development Site.
- The proposed Action would not fragment an existing important population into two or more populations.
- Given the extent of suitable habitat to be retained, it is unlikely that the breeding cycle of the population would be significantly disrupted in the locality.
- The loss of habitat is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.
- The existing feral animal threat levels are unlikely to change significantly due to the proposed Action.

- Management measures are presented in **Section 5.3** to reduce the potential for impacts to the species.

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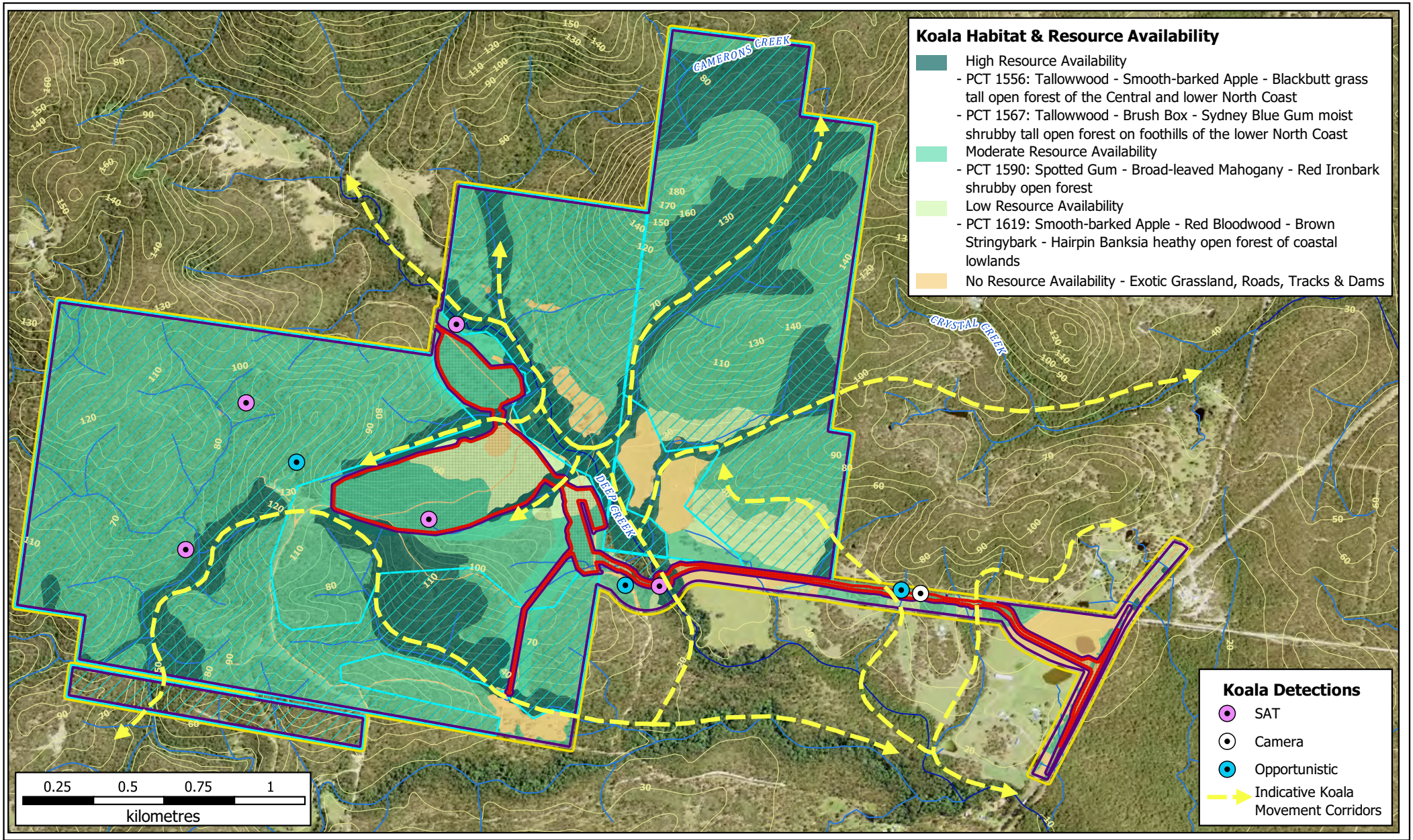
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Legend

- Subject Site
- Proposed Stewardship Site
- Development Site Boundary
- Retained Vegetation
- Major watercourse
- Minor watercourse
- Contours (10m)

Habitat for the Koala (*Phascolarctos cinereus*)

Figure: **B2**

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N

Grey-headed Flying Fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox (*Pteropus poliocephalus*) occurs along the eastern seaboard of Australia roosting in large communal aggregations known as 'camps'. These camps are used permanently, annually, or occasionally, varying in size from hundreds to many thousands of individuals, fluctuating according to food resources (Eby and Law, 2008; Parry-Jones and Augee, 1991; Tidemann, 1995). This species forages on nectar and pollen from flowers of canopy trees (particularly *Eucalyptus, Melaleuca* and *Banksia*) and fleshy fruits from rainforest trees and vines. This species is highly mobile, dispersing to sites as far as 40 km to forage and returning to the camp in one night, and seasonally they may move hundreds of kilometres in response to variation in food resource productivity which largely explains the extensive migration movement of this species (Eby and Law, 2008). Roost sites are typically located near water, such as lakes, rivers or the coast. Roost vegetation includes rainforest patches, stands of *Melaleuca*, mangroves and riparian vegetation, but colonies also use highly modified vegetation in urban and suburban areas.

Significant Impact Criteria

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

- ***lead to a long-term decrease in the size of an important population of a species***

The Grey-headed Flying-fox was detected flying over the Study Area. This species roosts communally in large, established camps which may support several thousand individuals. The Action will not affect the foraging movements of this nocturnal species. The Action would not isolate any areas of habitat or cause significant habitat fragmentation that would affect the breeding, foraging or dispersive movements of this highly mobile species.

The Action would remove up to 29.02 ha of foraging habitat for this species. Approximately 235 hectares of suitable habitat for the Grey-headed Flying Fox will be retained within the property boundary, outside the proposed Development Site.

This species has very large home range and may travel up to 50 km in a night to forage (Eby and Law 2008). The habitat to be removed would therefore make up a very small proportion of the home range of locally occurring individuals. Given the large areas of native vegetation in the locality, it is considered that the removal of habitats would be unlikely to lead to a long-term decrease in the size of the population.

- ***reduce the area of occupancy of an important population***

The habitat to be removed does not represent breeding habitat (no camps identified) for the species and therefore any individuals utilising this habitat do not represent an important population. Additionally, the area of potential foraging habitat to be removed would constitute a very small proportion of the available habitat within the locality.

- ***fragment an existing important population into two or more populations***

The Grey-headed Flying Fox is a highly mobile species. The Action will not introduce physical barriers that would fragment an existing important population into two or more populations.

- ***adversely affect habitat critical to the survival of a species***

The draft national recovery plan (DECCW 2009) states that foraging habitat that meets at least one of the following criteria qualifies as critical habitat:

- productive during winter and spring, when food bottlenecks have been identified;
- known to support populations of > 30 000 individuals within an area of 50 km radius (the maximum foraging distance of an adult)
- productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May);
- productive during the final stages of fruit proposal and ripening in commercial crops affected by Grey-headed Flying-foxes (months vary between regions)
- known to support a continuously occupied camp.

The habitat within the Study Area does not support a continuously occupied roost camp and is unlikely to support a population of more than 30,000 individuals. Habitats within the Study Area contain winter and spring-

flowering eucalypts and may therefore qualify as critical foraging habitat as they would be productive during identified food bottlenecks. The resources present in the Study Area, however, are limited in comparison to available foraging resources in nearby areas. In this context the removal of 29.02 ha of foraging habitat is unlikely to threaten the survival of local populations of this species.

- ***disrupt the breeding cycle of an important population***

No camps of the Grey-headed Flying Fox were detected within the Study Area. The closest Nationally Important Flying-fox Camp is located approximately 10 km west of the Study Area at Glenn William (identification number 241). The Action is unlikely to disrupt the breeding cycle of an important population of the Grey-headed Flying-fox.

- ***modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The loss of habitat within the Study Area would not isolate remaining habitat from other patches and it is unlikely that the Action would significantly reduce the area of available habitat such that it would lead to a decline of this species.

- ***result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat***

Wild and domestic dog (*Canis lupus familiaris*) attacks are a recognised threat to the Koala (DAWE, 2020). The existing feral animal threat levels are unlikely to change significantly due to the Action. Management measures are presented in **Section 5.3** to reduce the potential for these impacts.

- ***introduce disease that may cause the species to decline, or***

Australian bat Lyssavirus (ABL), Bat Paramyxovirus and Menangle Pig virus are recognised threats to the Grey-headed flying fox; however, the Action is unlikely to include activities that area likely to introduce any disease.

- ***interfere substantially with the recovery of the species.***

As discussed above, foraging habitat within the Study Area is consistent with the definition of habitat critical to the survival of the Grey-headed Flying-fox. The Action is therefore inconsistent with one of the stated objectives of the draft recovery plan (DEWHA 2009), which is to "identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range". As discussed above, however, the 29.02 ha of foraging habitat to be removed represents a very small proportion of available foraging habitat for this highly mobile species. It is considered unlikely, therefore, that the Action would substantially interfere with the recovery of the species.

Conclusion

The proposed Action is unlikely to have a significant impact on the species due to the following:

- The Grey-headed Flying-fox population within the Study area is not identified as an important population.
- Approximately 235 hectares of suitable habitat for the species will be retained within the property boundary, outside the proposed Development Site.
- The proposed Action would not fragment an existing important population into two or more populations.
- Given the extent of suitable habitat to be retained, it is unlikely that the breeding cycle of the population would be significantly disrupted in the locality.
- The loss of habitat is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.
- The existing feral animal threat levels are unlikely to change significantly due to the proposed Action.
- Management measures are presented in **Section 5.3** to reduce the potential for impacts to the species.

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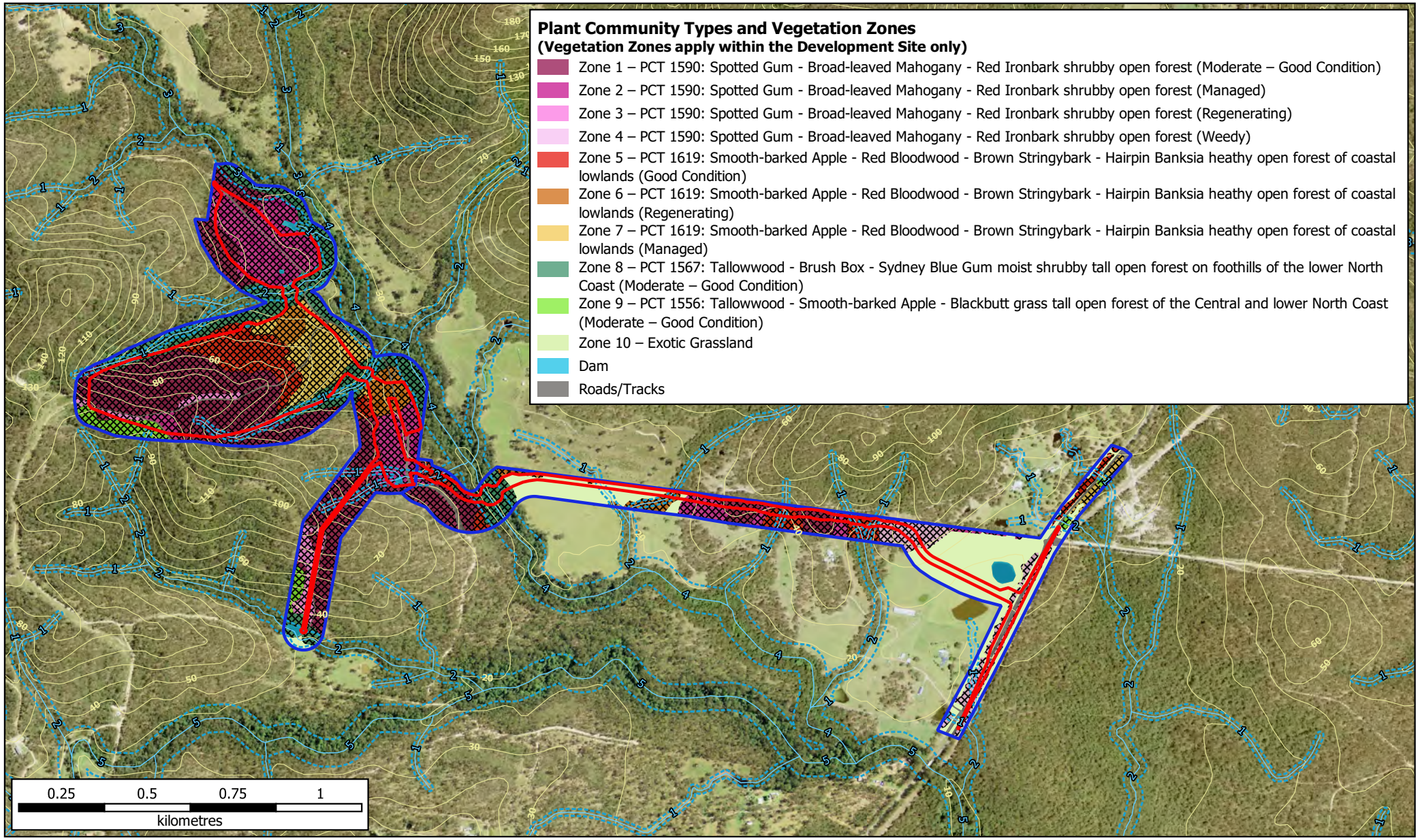
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Legend

- Development Site Boundary
- Study Area
- Contours (10m)
- Watercourse
- Riparian Buffer
- Flying Fox (*Pteropus poliocephalus*) Foraging Habitat

Foraging Habitat for the Grey-headed Flying Fox (*Pteropus poliocephalus*)

Figure: **B3**

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Deep Creek Quarry
Biodiversity Development Assessment Report
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Large-eared Pied Bat (*Chalinolobus dwyeri*)

The Large-eared Pied Bat (*Chalinolobus dwyeri*) is 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. This species is Found in well-timbered areas containing gullies. It 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. Sandstone cliffs and fertile woodland valley habitat within close proximity of each other is habitat of importance to the Large-eared Pied Bat (Department of Environment and Climate Change, 2007). Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. This species likely forages for small, flying insects below the forest canopy (OEH, 2019).

Significant Impact Criteria

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

- ***lead to a long-term decrease in the size of an important population of a species***

The Large-eared Pied Bat was detected by Anabat bat-call detectors on the proposed access road of the Development Site. Individuals detected during the survey are likely to utilise the foraging habitats associated with drainage channels such as Deep Creek. The majority of this habitat will be retained within and outside the property boundary to the north, east and south of the proposed Development Site.

No suitable roosting or breeding habitat for the Long-eared Pied Bat occurs within the Development Site (foraging habitat only).

An 'important population' is defined as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

It is unlikely that any potentially occurring population within the Study Area would be considered an important population.

- ***reduce the area of occupancy of an important population***

It is unlikely that any potentially occurring local population would be important population. Given the highly mobile nature of the species and the large area of surrounding suitable foraging habitat, it is unlikely that the Action would impact on the area of occupancy of a locally occurring population. Approximately 246.84 hectares of suitable habitat for the species will be retained within the property boundary, outside the proposed Development Site.

- ***fragment an existing important population into two or more populations***

Due to the high mobility of this species, the loss of habitat within the Development Site would not isolate remaining habitat from other patches and it is unlikely that the Action would fragment an existing population into two or more populations.

- ***adversely affect habitat critical to the survival of a species***

Sandstone cliffs and fertile wooded valley habitat within close proximity of each other, and any maternity roosts, should be considered habitat critical to the survival of the Large-eared Pied Bat (Department of Environment and Resource Management, 2011). No sandstone cliffs have been observed within the Study Area or within its close proximity. The structure of maternity roosts appears to be very specific (arch caves with dome roofs). Caves need to be high and deep enough to allow juvenile bats to learn to fly safely inside and have indentations in the roof (Department of Environment and Resource Management, 2011). Such structures are not present within the Study Area. On this basis, no habitat critical for the survival of the Large-eared Pied Bat occurs within the Study Area, and therefore the Action is unlikely to have a significant adverse impact on a local population.

- ***disrupt the breeding cycle of an important population***

It is unlikely that any potentially occurring local population would be important population, as such the Action is unlikely to disrupt the breeding cycle of the species, furthermore there no breeding habitat for the species is present within the Study Area.

- ***modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The loss of 29.02 ha of foraging habitat within the Study Area would not isolate remaining habitat from other patches and it is unlikely that the Action would significantly reduce the area of available habitat such that it would lead to the decline of these species.

- ***result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat***

Disturbance and damage to primary nursery roosts of the Large-eared Pied Bat by feral goats (*Capra hircus*) is a recognised threat for this species (Department of Environment and Resource Management, 2011). No breeding or roosting habitat for the Large-eared Pied Bat is present within the Study Area.

The existing weed and feral animal threat levels are unlikely to change significantly due to the Action. A site-specific CEMP will be prepared and implemented prior to the commencement of any clearing or construction works to ensure that impacts are minimised.

- ***introduce disease that may cause the species to decline, or***

The Action is unlikely to include activities that area likely to introduce any disease to the Large-eared Pied Bat.

- ***interfere substantially with the recovery of the species.***

A National Recovery Plan for the Large-eared Pied Bat is currently in place (Department of Environment and Resource Management, 2011; Smith and Robertson, 1999). The Action would not interfere substantially with the recovery of the species given that habitat resources would remain outside the Study Area, such that the species is likely to persist in the landscape.

Conclusion

The proposed Action is unlikely to have a significant impact on the species due to the following:

- The Large-eared Pied Bat population within the Study area is not identified as an important population.
- Approximately 246.84 hectares of suitable habitat for the species will be retained within the property boundary, outside the proposed Development Site.
- The proposed Action would not fragment an existing important population into two or more populations.
- Given the extent of suitable habitat to be retained, it is unlikely that the breeding cycle of the population would be significantly disrupted in the locality.
- The loss of habitat is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.
- The existing feral animal threat levels are unlikely to change significantly due to the proposed Action.
- Management measures are presented in **Section 5.3** to reduce the potential for impacts to the species.

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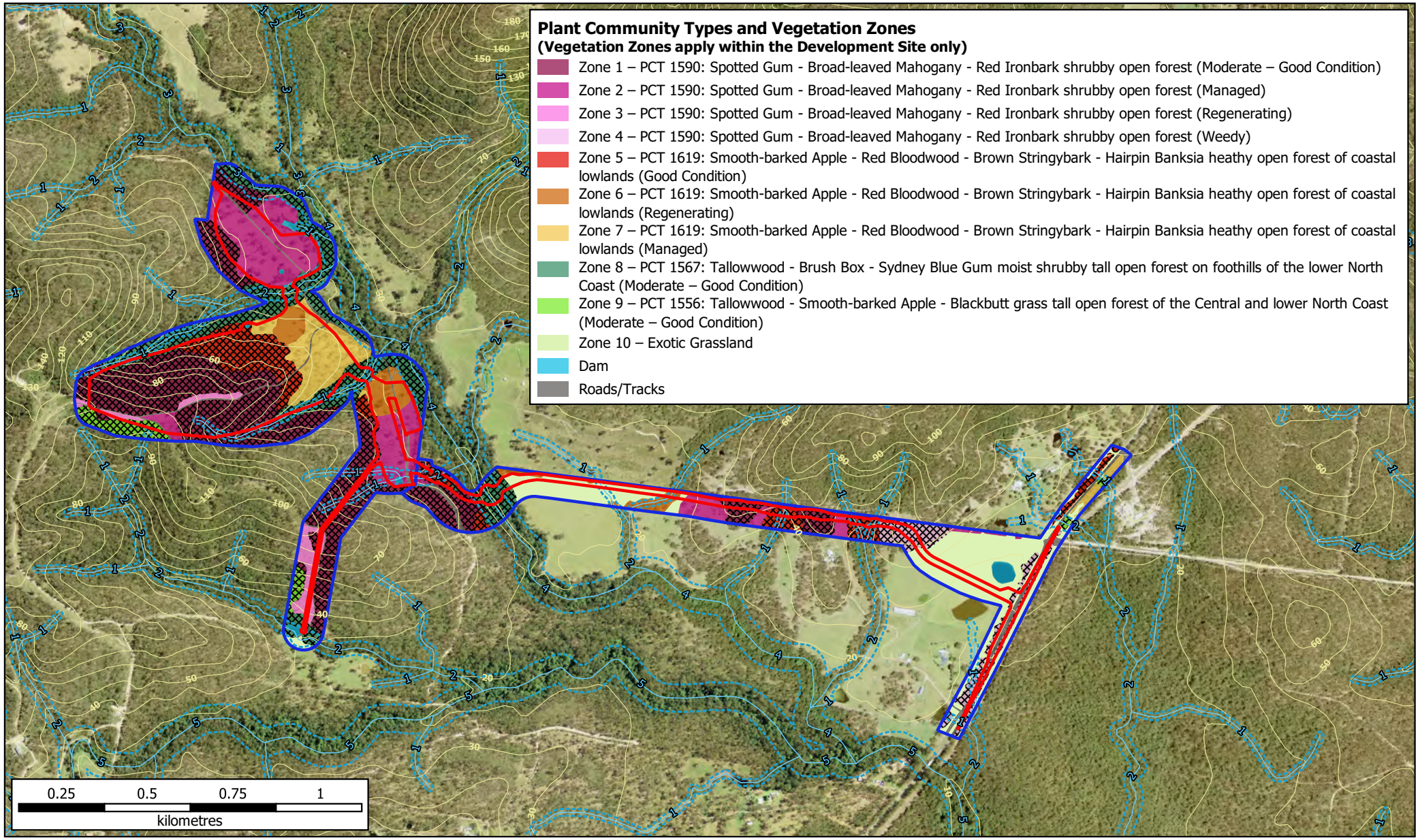
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Legend

- Development Site Boundary
- Study Area
- Contours (10m)
- Watercourse
- Riparian Buffer
- Large-eared Pied Bat (*Chalinolobus dwyeri*) Habitat

Potential Foraging Habitat for the Large-eared Pied Bat (*Chalinolobus dwyeri*)

Figure: **B4**

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Biodiversity Development Assessment Report
Bucketts Way, Limeburners Creek NSW 2324

N

New Holland Mouse (*Pseudomys novaehollandiae*)

The New Holland Mouse (*Pseudomys novaehollandiae*) has a fragmented distribution across Tasmania, Victoria, NSW and Queensland. The species is now largely restricted to the coast of central and northern NSW, with one inland occurrence near Parkes (ACT Environment and Sustainable Development Directorate, 2013). The New Holland Mouse has been found from coastal areas and up to 100 km inland on sandstone country (Wilson and Laidlaw 2003). The species has been recorded from sea level up to around 900 m above sea level (Menkhorst et al., 2008). Across the species' range, the New Holland Mouse is known to inhabit open heathland, open woodland with a heathland understorey and vegetated sand dunes (DAWE, 2020). The New Holland Mouse is nocturnal and omnivorous, with seeds forming a main component of its diet (Tasmanian Threatened Species Section, 2009), though leaves, fungi and invertebrates are consumed based on seasonal or floristic characteristics of individual sites (Wilson and Bradtke, 1999). The New Holland Mouse is a social animal, living predominantly in burrows shared with other individuals (Kemper 1980; Lazenby et al., 2008). The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha (Lazenby, 1999; Lazenby et al., 2008).

Significant Impact Criteria

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

- ***lead to a long-term decrease in the size of an important population of a species***

The New Holland Mouse was recorded at 13 locations within the Study Area (Kleinfelder 3 and Biolink 10), three of which occur within the Development Site. A further Ten locations recorded outside of the Study Area boundary in the remaining land holdings and will not be impacted.

An ‘important population’ is defined as a population that is necessary for a species’ long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

The Action Area is not near the limit of the species range. The Action Area however does contain a population for the purpose of breeding and dispersal and possibly for maintaining genetic diversity. Therefore, the individuals recorded within the Action Area are likely to form part of an important population.

The BioLink report defined the the Extent of Occurrence (EoO) at 77.02 ha with a density of 15.01 New Holland Mouse per hectare, equating to a total population of 1,156 individuals. The proposed pit would directly impact on 10.62 ha of this EoO, which represents a total of 14% of the local population (160 individuals).

Both the Development Site and the retained land adjoining the Development Site represent suitable habitat for the New Holland Mouse. An Offset site is proposed for approximately 235 ha of land to the west of the Development, which also represents suitable habitat for the species.

While the proposal will directly impact on the EoO of the New Holland Mouse, the Proponent is committed to incorporating mitigation measures recommended by BioLink in the operation of the Quarry. These include preparation of a translocation management plan, which would include long term management and monitoring of the species. As part of this plan high-resolution floristic / pedological and landscape data from the 10 NHM capture sites should be used to develop an optimum NHM habitat model to assist identification of potential sites for relocation / translocation. As such, while the proposed Action will directly impact on the EoO of the species, it is likely that the individual within the Development Site can be translocation to suitable and available habitat in the surrounding landscape. As such, it is unlikely that the proposed Action will lead to the long-term decline of the size of an important population.

- ***reduce the area of occupancy of an important population***

As the proposed Action will not impact on a large proportion of the EoO (14%) and due to the availability of suitable habitat in the surrounding areas, it is unlikely that the proposed Action will reduce the area of occupancy of an important population.

- *fragment an existing important population into two or more populations*

Due to the location of the NHM extent of occurrence occurring within the western portion of the Development Site and extending out to the west / south of the Development Site, the loss of habitat within the Development Site would not isolate remaining areas of the population or its habitat (**Plate 19**).

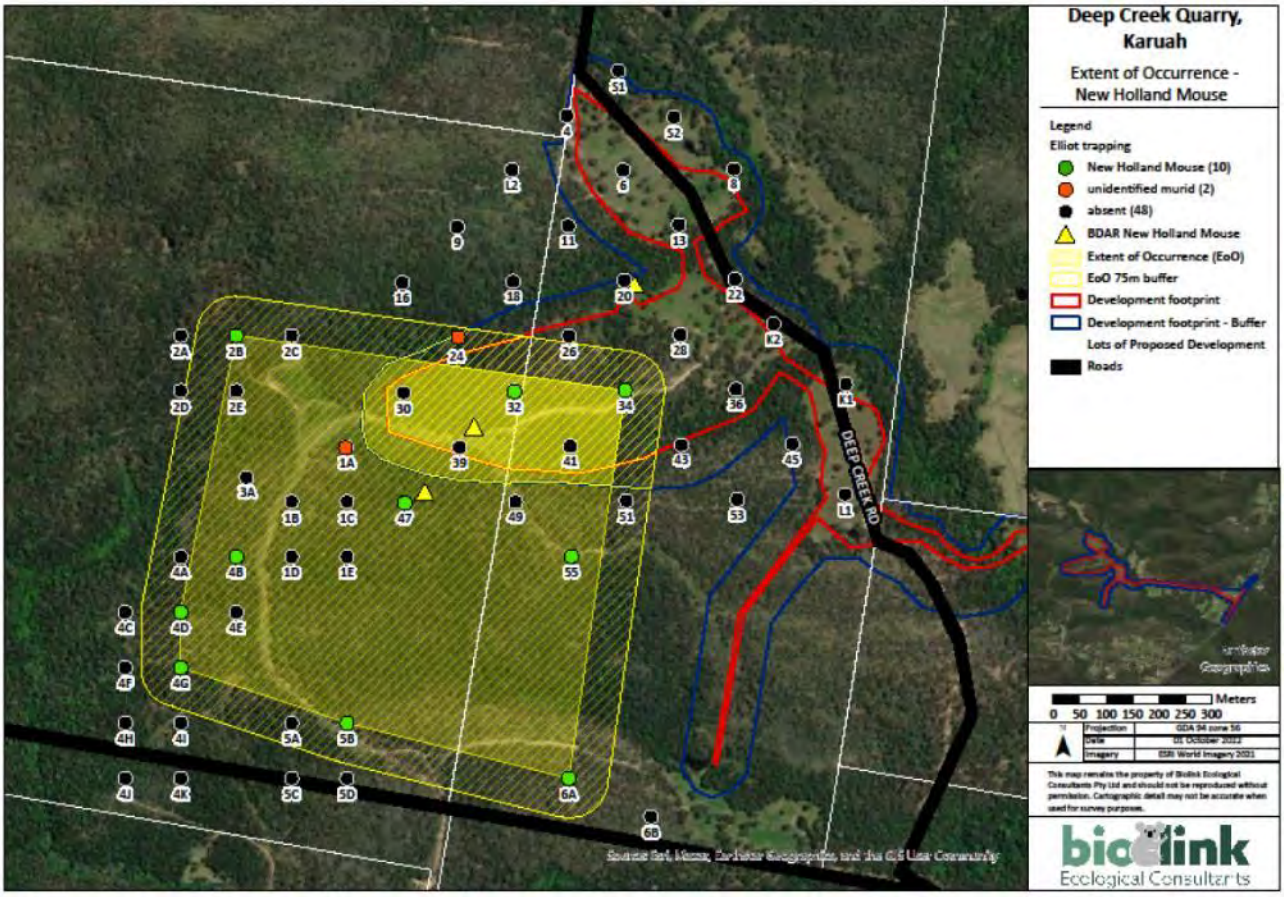


Plate 19: Hew Holland Mouse trapping results and Species Extent of Occurrence (yellow polygon) and associated buffer (yellow hatching) based on two (2) survey events. Kleinfelder (2021) New Holland Mouse records (yellow triangles), New Holland Mouse absent (black circles) and present (green circles) records from Biolink surveys are also included (Biolink 2022). Red circles indicate presence records for *Rattus sp.* (Biolink 2022).

- *adversely affect habitat critical to the survival of a species*

Critical habitat for the species is not defied, as such, conservatively it is assumed that the habitat on-site is critical to the survival of the species.

Both the Development Site and the retained land adjoining the Development Site represent suitable habitat for the New Holland Mouse. This species habitat is generic (self-constructed burrows) and would not be restricted to the Action Area. Expanses of similar habitat, including softer substrates preferred for burrowing (DAWE, 2020), is available within areas to be retained within the Study Area. As such the removal of a total of 29.14 ha of native vegetation is unlikely to adversely affect habitat critical to the survival of the species.

- *disrupt the breeding cycle of an important population*

Breeding takes place late winter to early summer, followed by a gestation period of 32 – 39 days.

Due to the progressive nature of the clearing (smaller parcels of land cleared progressively within the larger Development Site) and relatively small area of habitat removal, in the context of the available habitat in the area, it is unlikely that any potential disruption to the species breeding will be significant.

- ***modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

Both the Development Site and the retained land adjoining the Development Site represent suitable habitat for the New Holland Mouse. As such the removal of a total of 29.14 ha of native vegetation is unlikely to cause the species to decline. Additionally, the proposed Action will not isolate any habitat or populations.

- ***result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat***

Weed invasion is a recognised threat to the New Holland Mouse (Seebeck et al., 1996). Predation by introduced predators, including the Red Fox (*Vulpes vulpes*), Cat (*Felis catus*) and Dog (*Canis familiaris*) is a recognised threat to the New Holland Mouse (Seebeck et al., 1996; Smith and Quin,1996; Ford, 2003). Competition from introduced rodents, such as the house mouse is a potential threat (Fox and Gullick, 1989; Seebeck et al., 1996). The existing feral animal threat levels are unlikely to change significantly due to the Action. Management measures are presented in **Section 5.3** to reduce the potential for these impacts.

- ***introduce disease that may cause the species to decline, or***

Vegetation dieback caused by *Phytophthora cinnamomi* is a recognised threat to the New Holland Mouse (Seebeck et al., 1996). The action is unlikely to introduce any disease, fungus or virus to the local population of this species.

- ***interfere substantially with the recovery of the species.***

There is no adopted or made Recovery Plan for this species. The Approved Conservation Advice for *Pseudomys novaehollandiae* (New Holland Mouse) (Department of the Environment, Water, Heritage and the Arts, 2010) lists a number of priority actions for this species. The action would be inconsistent with the following priority action listed in this plan, given the three individuals recorded within the Action Area:

- Ensure there is no disturbance in areas where the New Holland Mouse occurs, excluding necessary actions to manage the conservation of the species.

The activities which comprise the action are otherwise not inconsistent with the priority actions listed in this plan, and the action would not interfere substantially with the recovery of this species.

Conclusion

The proposed Action is likely to have a significant impact on the species due to the following:

- The New Holland Mouse population within the Study Area could be identified as an important population. It is unlikely that the proposed Action will lead to the long-term decline of the size of the important population.
- Approximately 235 hectares of suitable habitat for the species will be retained within the property boundary, outside the proposed Development Site.
- The proposed Action would not fragment an existing important population into two or more populations.
- Given the extent of suitable habitat to be retained, it is possible that the breeding cycle of the population could be significantly disrupted in the locality.
- The loss of habitat is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.
- The existing feral animal and weed threat levels are unlikely to change significantly due to the proposed Action.
- Management measures are presented in **Section 5.3** to reduce the potential for impacts to the species.

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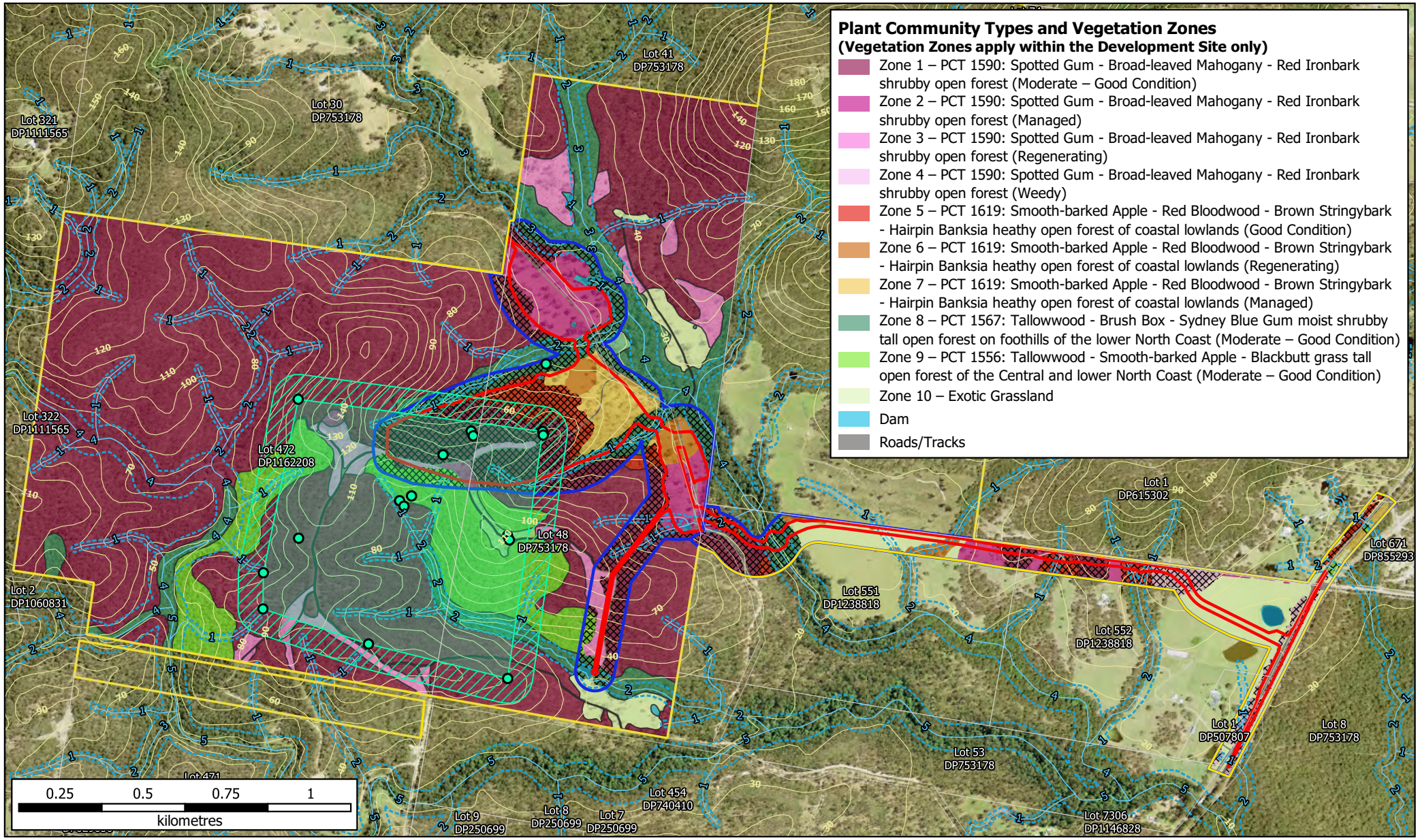
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Legend

- Development Site Boundary
- Study Area
- Contours (10m)
- Watercourse
- Riparian Buffer
- New Holland Mouse detected
- New Holland Mouse Extent of Occurrence
- Extent of Occurrence Buffer (75m)
- New Holland Mouse Habitat

Habitat for the New Holland Mouse
(*Pseudomys novaehollandiae*)

Figure: **B5**

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Deep Creek Quarry
Biodiversity Development Assessment Report
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Swift Parrot (*Lathamus discolor*)

The Swift Parrot (*Lathamus discolor*) is small parrot about 25 cm long. It is bright green with red around the bill, throat and forehead. The red on its throat is edged with yellow. Its crown is blue purple. There are bright red patches under the wings. One of most distinctive features from a distance is its long (12 cm), thin tail, which is dark red. This species breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as *Eucalyptus robusta* (Swamp Mahogany), *Corymbia maculata* (Spotted Gum), *C. gummifera* (Red Bloodwood), *E. tereticornis* (Forest Red Gum), *E. sideroxylon* (Mugga Ironbark), and *E. albens* (White Box). Commonly used lerp infested trees include *E. microcarpa* (Inland Grey Box), *E. moluccana* (Grey Box), *E. pilularis* (Blackbutt), and *E. melliodora* (Yellow Box). Individuals return to some foraging sites on a cyclic basis depending on food availability (OEH, 2019).

Significant Impact Criteria

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

- ***lead to a long-term decrease in the size of a population***

The species was not detected during the assessment and there are only two records of the species in the locality. The Study Area represents potential foraging habitat for the species, with no breeding being recorded on the Australian mainland. A total of 29.02 ha of potential foraging habitat occurs within the Development Site. Approximately 235 hectares of suitable habitat for the species will be retained within the property boundary, outside the proposed Development Site. As such, it is unlikely that the proposed Action will decrease the size of a population of the species.

- ***reduce the area of occupancy of the species***

The Action will result in a relatively small reduction in the potential habitat for the species in the local area. Approximately 235 hectares of suitable habitat for the species will be retained within the property boundary, outside the proposed Development Site.

- ***fragment an existing population into two or more populations***

The species is highly mobile, and a local population will be nomadic using a wide range of food resources depending on the availability flowering eucalypts and lerp infestations. Due to the highly mobile nature of these species, and the distribution of similar suitable habitat within the locality, the Action is unlikely to fragment an existing population into two or more populations.

- ***adversely affect habitat critical to the survival of a species***

Habitat critical to the survival of the Swift Parrot includes areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance or are otherwise identified by the recovery team (Saunders and Tzaros, 2011). As there are only 2 records of the species in the locality (from 2002 and 2010) it is unlikely that the Study Area contains habitat critical to the survival of the Swift Parrot.

- ***disrupt the breeding cycle of a population***

The Swift Parrot does not breed within mainland Australia (DoEE, 2019). As such, it is unlikely that the proposed Action will disrupt the breeding cycle of the species.

- ***modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The loss of any potential habitat for the species within the Study Area would not isolate remaining habitat from other patches and it is unlikely that the proposed Action would significantly reduce the area of habitat occupied by the species relative to its regional distribution.

- ***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 existing feral animal threat levels are unlikely to change significantly due to the Action. Management measures are presented in **Section 5.3** to reduce the potential for these impacts.

- ***introduce disease that may cause the species to decline, or***

The action is unlikely to introduce any disease, fungus or virus to the local population of this species.

- ***interfere with the recovery of the species.***

A national recovery plans for the Swift Parrot, is currently in place (Saunders, D.L. and Tzaros, C.L. 2011). The activities which comprise the Action are not inconsistent with the recovery plan, and the Action would not interfere substantially with the recovery of the species given habitat resources would remain outside of the Study Area, such that the species are likely to persist in the landscape.

Conclusion

The proposed Action is unlikely to have a significant impact on the species due to the following:

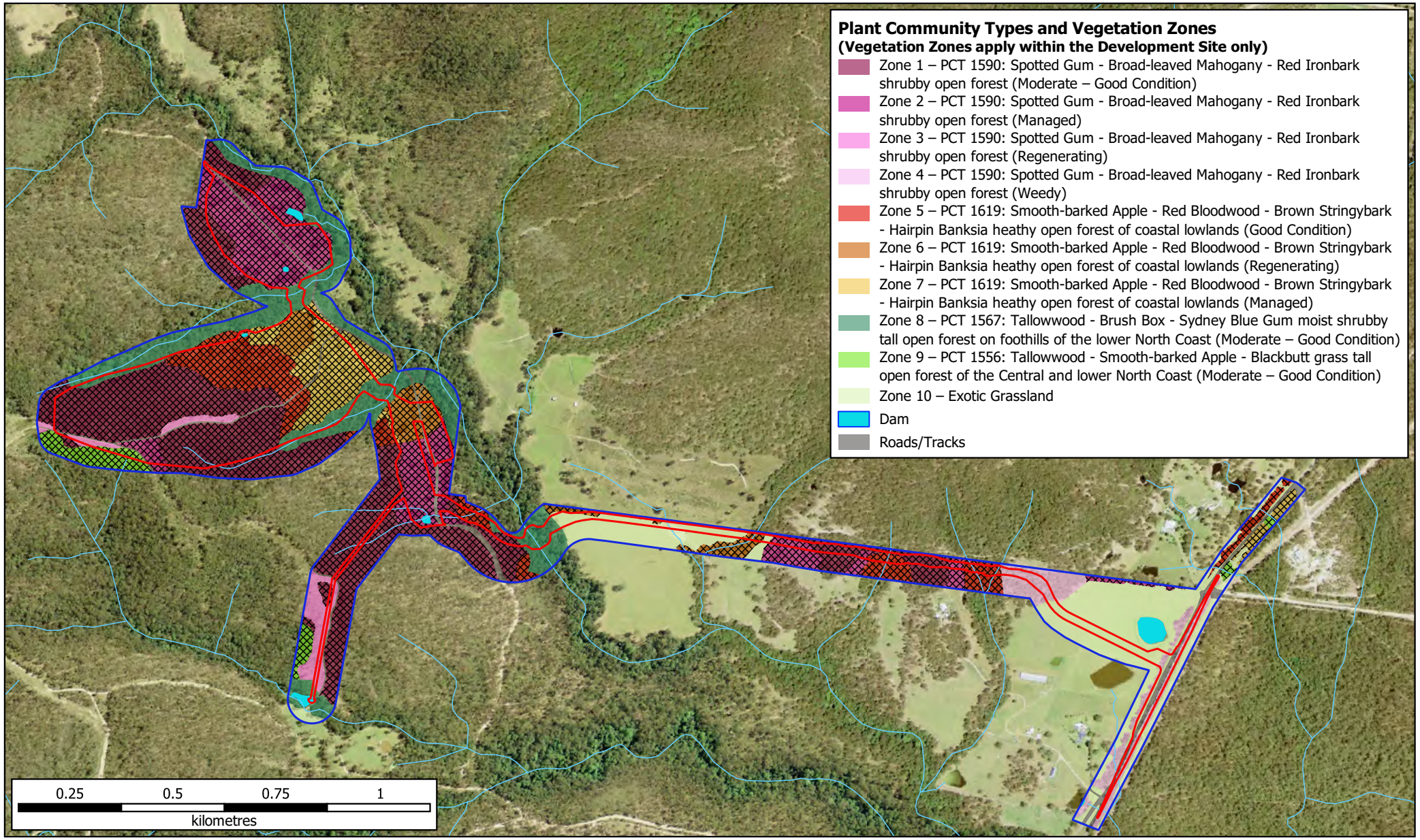
- The Swift Parrot was not detected during the assessment.
- The proposed Action would not fragment an existing important population into two or more populations.
- Given the extent of suitable habitat to be retained, it is unlikely that the breeding cycle of the population would be significantly disrupted in the locality.
- The loss of habitat is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.
- The existing feral animal and weed threat levels are unlikely to change significantly due to the proposed Action.
- Management measures are presented in **Section 5.3** to reduce the potential for impacts to the species.

References

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Legend

- Development Site Boundary
- Study Area
- Contours (10m)
- Watercourse
- Potential Foraging Habitat

Potential Foraging Habitat for the Swift Parrot (*Lathamus discolour*)

Figure: **B7**

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Biodiversity Development Assessment Report
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Regent Honeyeater (*Anthochaera phrygia*)

The Regent Honeyeater (*Anthochaera phrygia*) is a nomadic feeder and can be found throughout its range where there is suitable blossom occurring (Franklin *et al*., 1989). This species is mostly recorded in box-ironbark eucalypt associations. They prefer the wettest, most fertile sites within these associations, such as along creek flats, broad river valleys and foothills. In NSW, riparian forests of River Oak (*Casuarina cunninghamiana*) with Needle-leaf Mistletoe (*Amyema cambagei*), are also important for feeding and breeding. Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Yellow Box (*E. melliodora*) and Yellow Gum (*E. leucoxylon*) are particularly important food trees. At times of food shortage, the birds also use other woodland types and wet lowland coastal forest dominated by Swamp Mahogany (*E. robusta*) or Spotted Gum (*Corymbia maculata*) (Franklin *et al*., 1989; Ley and Williams, 1992; Webster and Menkhorst, 1992; Geering and French, 1998; Oliver *et al*., 1999).

Significant Impact Criteria

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

- ***lead to a long-term decrease in the size of a population***

The species was not detected during the assessment and there are no records of the species in the locality. The Study Area represents potential foraging habitat for the species, with no breeding being recorded in the region. A total of 29.02 ha of potential foraging habitat occurs within the Development Site. Approximately 235 hectares of suitable habitat for the species will be retained within the property boundary, outside the proposed Development Site. As such, it is unlikely that the proposed Action will decrease the size of a population of the species.

- ***reduce the area of occupancy of the species***

The Action will result in a relatively small reduction in the potential habitat for the species in the local area. Approximately 235 hectares of suitable habitat for the species will be retained within the property boundary, outside the proposed Development Site.

- ***fragment an existing population into two or more populations***

The species is highly mobile, and a local population will be nomadic using a wide range of food resources depending on the availability flowering eucalypts and lerp infestations. Due to the highly mobile nature of these species, and the distribution of similar suitable habitat within the locality, the Action is unlikely to fragment an existing population into two or more populations.

- ***adversely affect habitat critical to the survival of a species***

There are no records of the Regent Honeyeater in the locality. Habitat critical to the survival of the Regent Honeyeater includes; any breeding or foraging areas where the species is likely to occur, and any newly discovered breeding or foraging locations (DoE, 2016). While the Study Area has been assessed as having a moderate to low likelihood of occurrence for the Regent Honeyeater, it is unlikely to contain habitat critical to the survival of the Regent Honeyeater. disrupt the breeding cycle of a population

- ***modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The loss of any potential habitat for the species within the Study Area would not isolate remaining habitat from other patches and it is unlikely that the proposed Action would significantly reduce the area of habitat occupied by the species relative to its regional distribution.

- ***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 existing feral animal threat levels are unlikely to change significantly due to the Action. Management measures are presented in **Section 5.3** to reduce the potential for these impacts.

- ***introduce disease that may cause the species to decline, or***

The action is unlikely to introduce any disease, fungus or virus to the local population of this species.

- ***interfere with the recovery of the species.***

A national recovery plans for the Regent Honeyeater, is currently in place 2016). The activities which comprise the Action are not inconsistent with the recovery plan, and the Action would not interfere substantially with the recovery of the species given habitat resources would remain outside of the Study Area, such that the species are likely to persist in the landscape.

Conclusion

The proposed Action is unlikely to have a significant impact on the species due to the following:

- The Regent Honeyeater was not detected during the assessment.
- The proposed Action would not fragment an existing important population into two or more populations.
- Given the extent of suitable habitat to be retained, it is unlikely that the breeding cycle of the population would be significantly disrupted in the locality.
- The loss of habitat is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.
- The existing feral animal and weed threat levels are unlikely to change significantly due to the proposed Action.
- Management measures are presented in **Section 5.3** to reduce the potential for impacts to the species.

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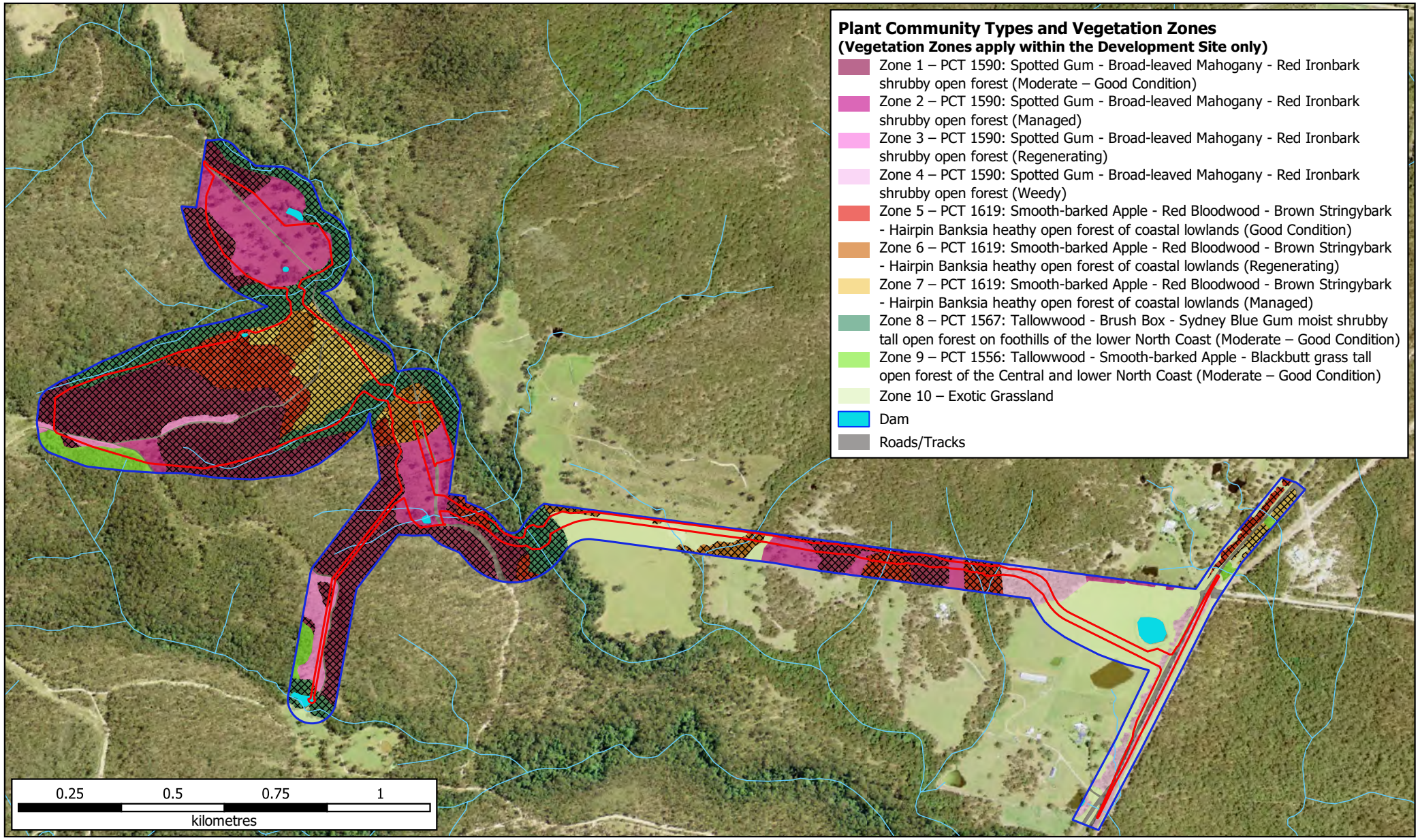
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Legend

- Development Site Boundary
- Study Area
- Contours (10m)
- Watercourse
- Potential Foraging Habitat

Potential Foraging Habitat for the regent Honeyeater
(*Anthochaera phrygia*)

Figure: **B8**

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N

Migratory Species

Foraging habitat was identified for the following migratory species within the Development Site:

- *Apus pacificus* (Fork- tailed Swift) – The Fork- tailed swift is found in a wide range of climatic zones and habitats. It breeds in sheltered locations such as caves, natural rock crevices or under the roofs of houses. The species It breeds in eastern Asia. It is strongly migratory, spending the northern hemisphere's winter in Southeast Asia and Australia (Barret *et al*. 2003; DSEWPC 2013). The species forages in high open spaces over varied habitat types. mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh.
- *Hirundapus caudacutus (*White-throated Needletail) – The species is a migratory bird, breeding in Central Asia and southern Siberia, and wintering south in the Indian Subcontinent, Southeast Asia and Australia (Chantler 1999). They build their nests in rock crevices in cliffs or hollow trees (Higgns 1999).
- *Monarcha melanopsis* (Black-faced Monarch) – The species is found along the eastern seaboard of Australia, and also New Guinea where most birds migrate to during the austral winter (May to August). The preferred habitat is rainforest and wet forest (Barret *et al*. 2003).
- *Myiagra cyanoleuca* (Satin Flycatcher) - The Satin Flycatcher is found in Australia, Indonesia, and Papua New Guinea (Blakers *et al. 1984*). Its natural habitats are temperate forests and subtropical or tropical moist lowland forests. It breeds mostly in south-eastern Tasmania and Australia. It is declining throughout the eastern seaboard due to predation from the introduced Red Fox and habitat loss.
- *Rhipidura rufifrons* (Rufous Fantail) - This species is found in Australia, Indonesia, Micronesia, New Guinea and the Solomon Islands. They are migratory, travelling to south-eastern Australia in the spring to breed, and then north in the autumn (Barret *et al.* 2003). The species tends to feed on small insects in the lower parts of the canopy.

The above listed species are listed migratory species under the EPBC Act. None of these species were detected during the assessment; however, based on habitat availability, the species have a moderate to low likelihood of occurrence.

Significant impact criteria

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

- ***substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species***

The Action will result in a relatively small reduction in the potential habitat for these species in the local area. Approximately 235 hectares of suitable habitat for the species will be retained within the property boundary, outside the proposed Development Site.

- ***result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or***

The Action is unlikely to cause an increase in pest species that are harmful to these migratory species.

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

These species are highly mobile and can readily move between habitats. The action is therefore unlikely to disrupt or interfere with the natural behaviour of these species.

Conclusion

The proposed Action is unlikely to have a significant impact on these species due to the following:

- None of these migratory species were detected during the assessment.

- The proposed Action would not fragment an existing important population into two or more populations.
- Given the extent of suitable habitat to be retained, it is unlikely that the breeding cycle of these species would be significantly disrupted in the locality.
- The loss of habitat is unlikely to decrease the availability or quality of habitat to the extent that these species are likely to decline.
- The existing feral animal and weed threat levels are unlikely to change significantly due to the proposed Action.
- Management measures are presented in **Section 5.3** to reduce the potential for impacts to the species.

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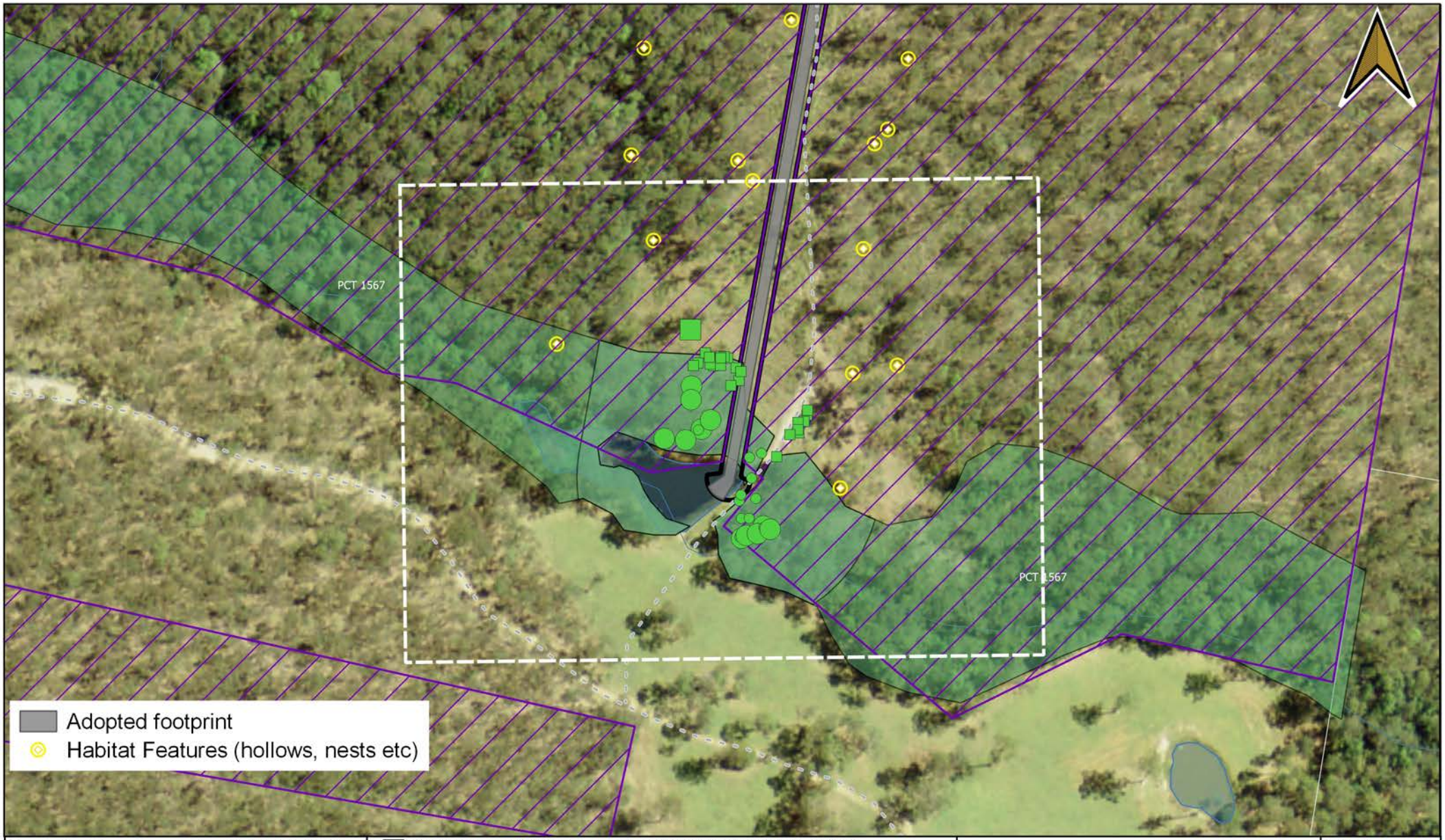
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APPENDIX 9: PREFERRED KOALA FEED TREE MAPPING (ACCESS/HAUL ROAD)



Created by: J.Berry
Date: 21/12/2022

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Version: B

WEDGETAIL PROJECT CONSULTING

Project Application Area
Vehicle Tracks
PCT 1567 - Alluvial PCT with highest PKFTs

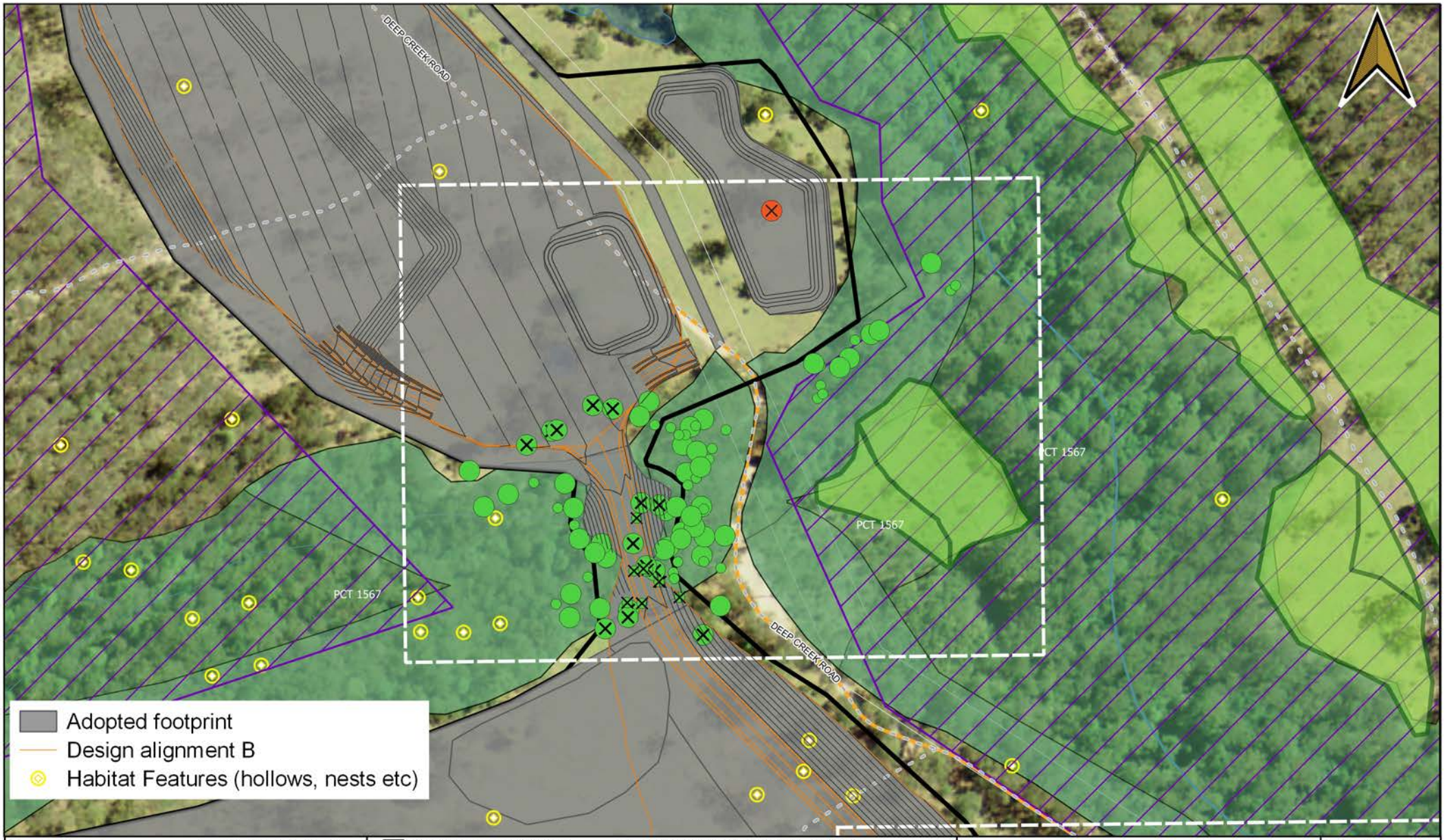
Preferred Koala Feed Trees

Impacted Tree
>300mm DBH - Alluvial
>300mm DBH - Non-Alluvial
100mm to 300mm DBH - Alluvial
100mm to 300mm DBH - Non-Alluvial
E. punctata (Grey Gum)
E. microcorys (Tallowwood)
E. tereticornis (Forest Red Gum)
Blue Gum / red gum
Proposed PKFT Supplementary Planting Area

PKFT Stadiametric Mapping and Avoidance Consdiderations

Figure: A

Deep Creek Quarry Project
Ironstone Developments Pty Ltd
Deep Creek Road, Limburners Creek NSW



Created by: J.Berry
Date: 21/12/2022

0 10 20 30 40 50 m

Version: B

WEDGETAIL PROJECT CONSULTING

Project Application Area
Vehicle Tracks
PCT 1567 - Alluvial PCT with highest PKFTs

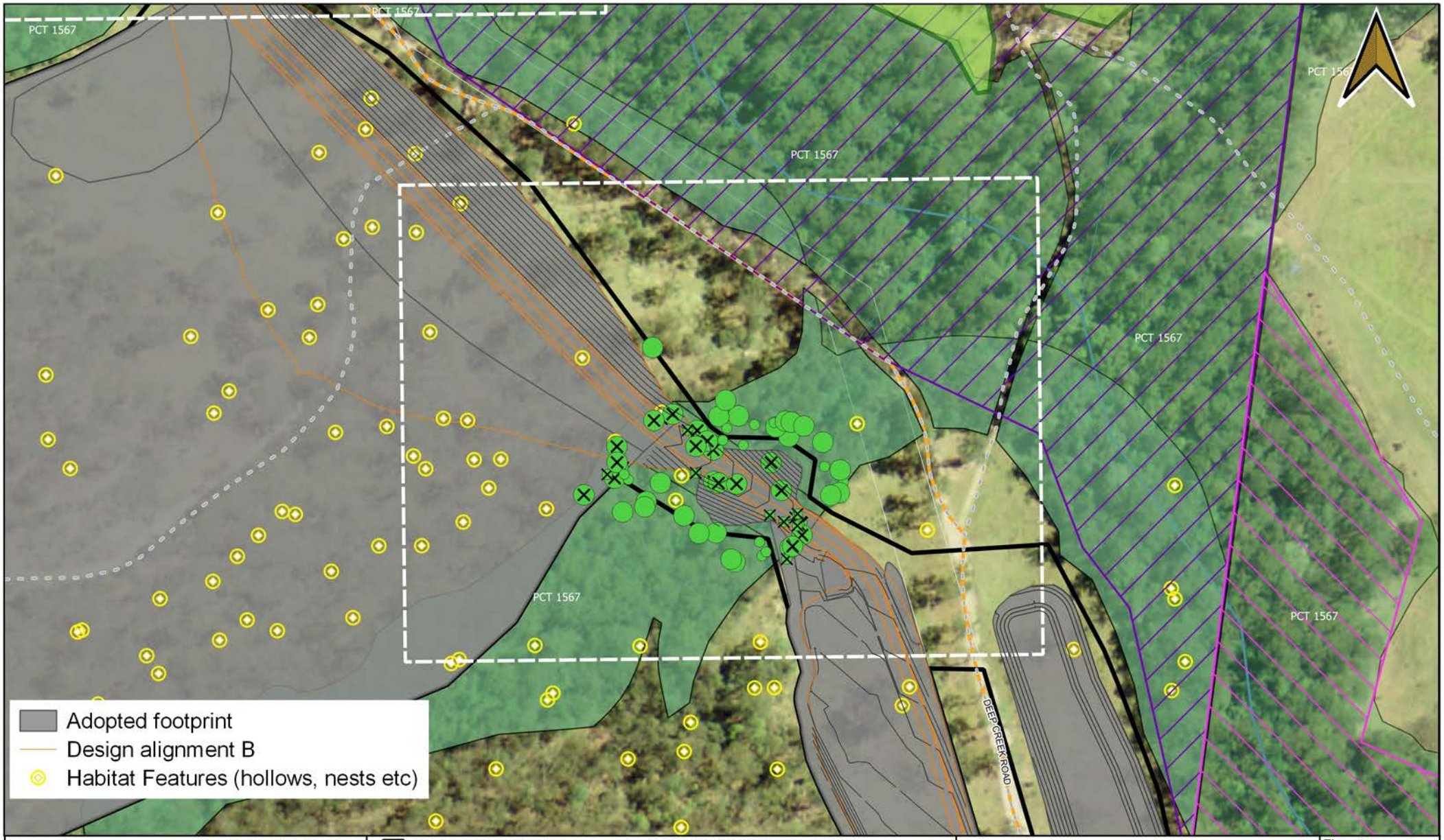
Preferred Koala Feed Trees

Impacted Tree
>300mm DBH - Alluvial
>300mm DBH - Non-Alluvial
100mm to 300mm DBH - Alluvial
100mm to 300mm DBH - Non-Alluvial
E. punctata (Grey Gum)
E. microcorys (Tallowwood)
E. tereticornis (Forest Red Gum)
Blue Gum / red gum
Proposed PKFT Supplementary Planting Area

PKFT Stadiametric Mapping and Avoidance Consdiderations

Figure: B

Deep Creek Quarry Project
Ironstone Developments Pty Ltd
Deep Creek Road, Limburners Creek NSW



Created by: J.Berry
Date: 21/12/2022

0 10 20 30 40 50 m

Version: B

WEDGETAIL PROJECT CONSULTING

Project Application Area
Vehicle Tracks
PCT 1567 - Alluvial PCT with highest PKFTs

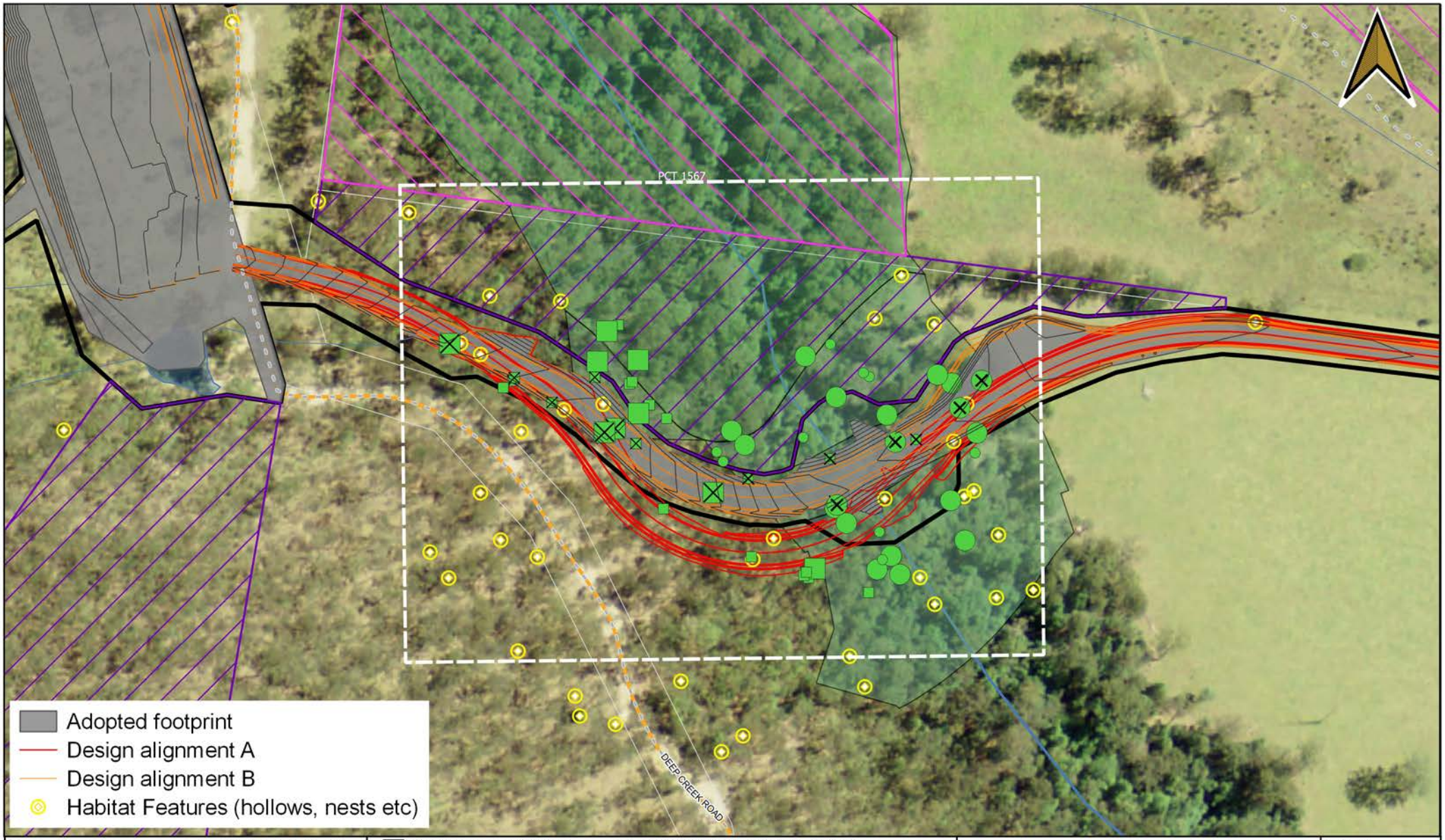
Preferred Koala Feed Trees

Impacted Tree
>300mm DBH - Alluvial
>300mm DBH - Non-Alluvial
100mm to 300mm DBH - Alluvial
100mm to 300mm DBH - Non-Alluvial
E. punctata (Grey Gum)
E. microcorys (Tallowwood)
E. tereticornis (Forest Red Gum)
Blue Gum / red gum
Proposed PKFT Supplementary Planting Area

PKFT Stadiametric Mapping and Avoidance Consdiderations

Figure: C

Deep Creek Quarry Project
Ironstone Developments Pty Ltd
Deep Creek Road, Limburners Creek NSW



Created by: J.Berry
Date: 21/12/2022

0 10 20 30 40 50 m

Version: B

WEDGETAIL PROJECT CONSULTING

Project Application Area
Vehicle Tracks
PCT 1567 - Alluvial PCT with highest PKFTs

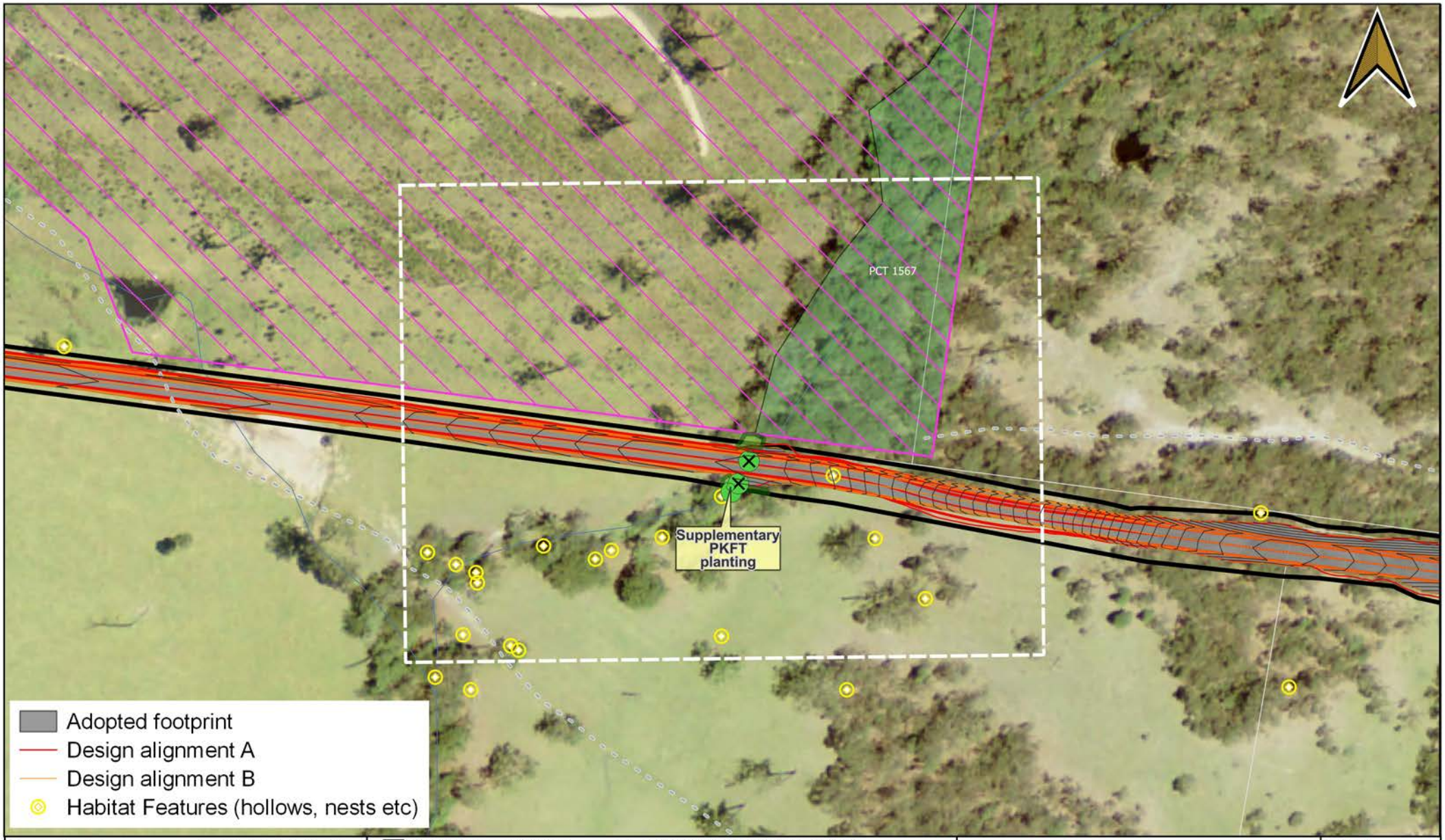
Preferred Koala Feed Trees

Impacted Tree
>300mm DBH - Alluvial
>300mm DBH - Non-Alluvial
100mm to 300mm DBH - Alluvial
100mm to 300mm DBH - Non-Alluvial
E. punctata (Grey Gum)
E. microcorys (Tallowwood)
E. tereticornis (Forest Red Gum)
Blue Gum / red gum
Proposed PKFT Supplementary Planting Area

PKFT Stadiametric Mapping and Avoidance Consdiderations

Figure: D

Deep Creek Quarry Project
Ironstone Developments Pty Ltd
Deep Creek Road, Limburners Creek NSW



Created by: J.Berry
Date: 21/12/2022

0 10 20 30 40 50 m

Version: B

WEDGETAIL PROJECT CONSULTING

Project Application Area
Vehicle Tracks
PCT 1567 - Alluvial PCT with highest PKFTs

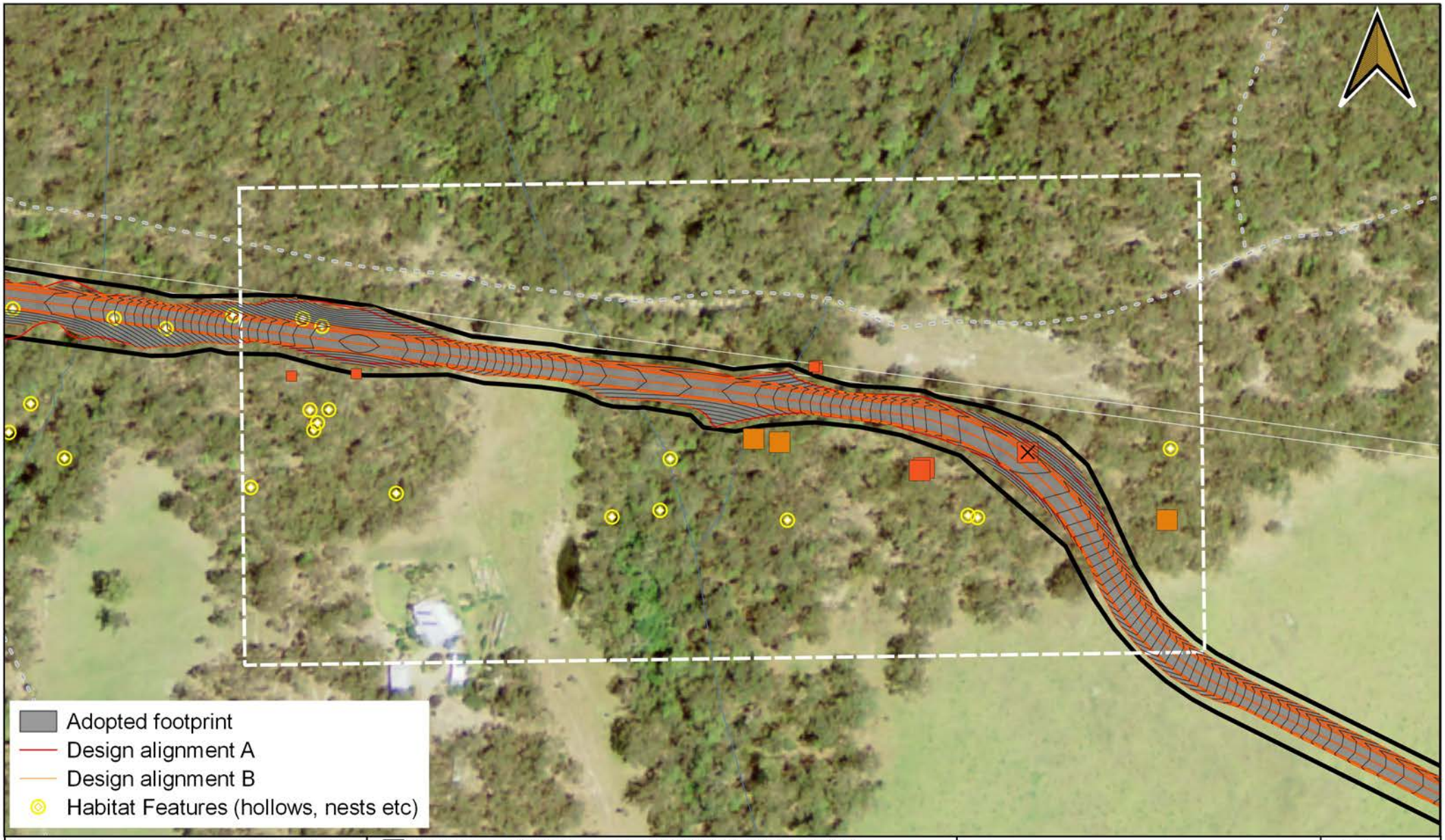
Preferred Koala Feed Trees

Impacted Tree
>300mm DBH - Alluvial
>300mm DBH - Non-Alluvial
100mm to 300mm DBH - Alluvial
100mm to 300mm DBH - Non-Alluvial
E. punctata (Grey Gum)
E. microcorys (Tallowwood)
E. tereticornis (Forest Red Gum)
Blue Gum / red gum
Proposed PKFT Supplementary Planting Area

PKFT Stadiametric Mapping and Avoidance Consdiderations

Figure: E

Deep Creek Quarry Project
Ironstone Developments Pty Ltd
Deep Creek Road, Limburners Creek NSW



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Date: 21/12/2022

0 10 20 30 40 50 m

Version: B

WEDGETAIL PROJECT CONSULTING

Project Application Area
Vehicle Tracks
PCT 1567 - Alluvial PCT with highest PKFTs

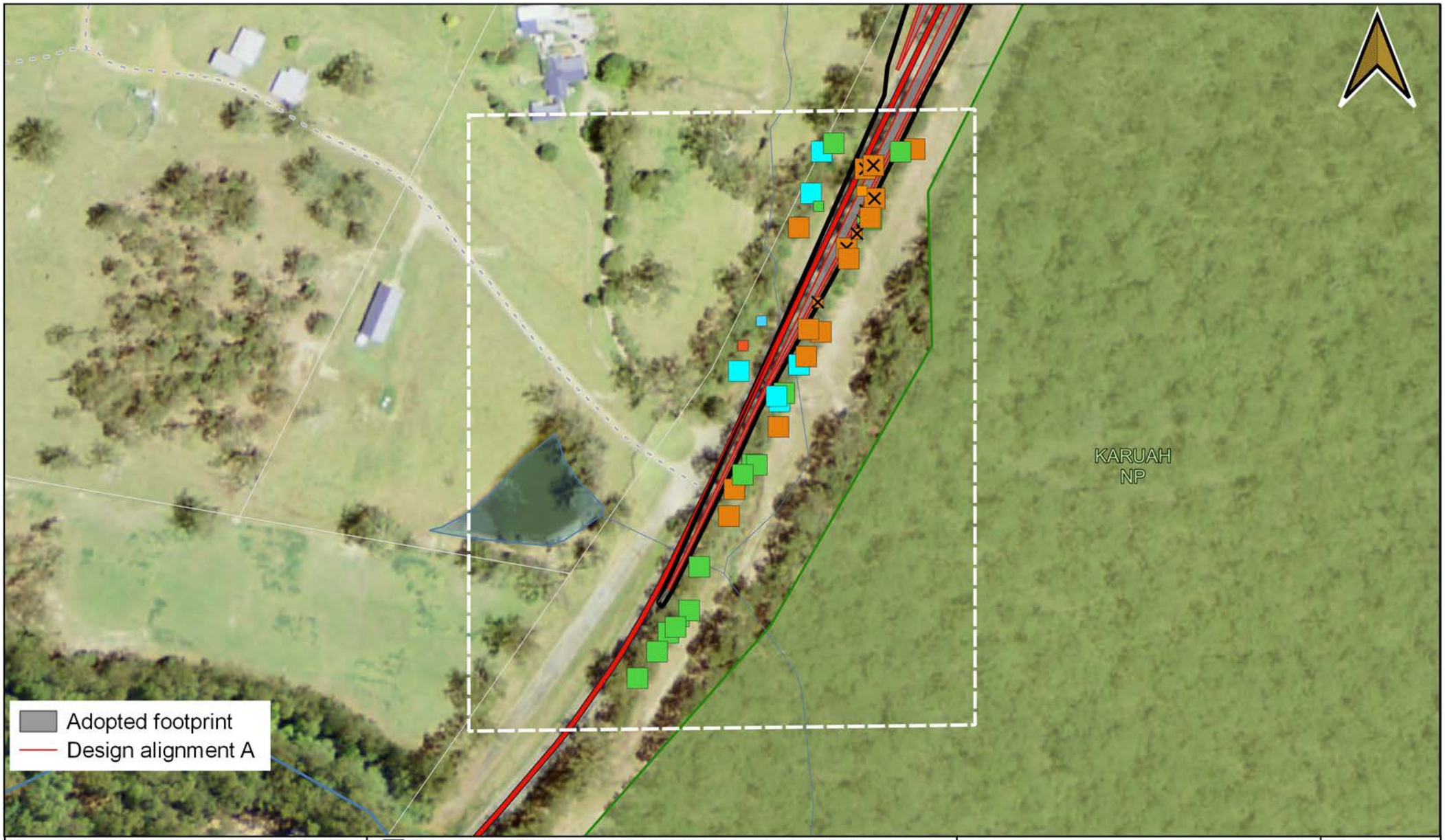
Preferred Koala Feed Trees

Impacted Tree
>300mm DBH - Alluvial
>300mm DBH - Non-Alluvial
100mm to 300mm DBH - Alluvial
100mm to 300mm DBH - Non-Alluvial
E. punctata (Grey Gum)
E. microcorys (Tallowwood)
E. tereticornis (Forest Red Gum)
Blue Gum / red gum
Proposed PKFT Supplementary Planting Area

PKFT Stadiametric Mapping and Avoidance Consdiderations

Figure: F

Deep Creek Quarry Project
Ironstone Developments Pty Ltd
Deep Creek Road, Limburners Creek NSW



Created by: J.Berry
Date: 21/12/2022

0 10 20 30 40 50 m

Version: B

WEDGETAIL
PROJECT CONSULTING

Project Application Area
Vehicle Tracks
PCT 1567 - Alluvial PCT with highest PKFTs

Preferred Koala Feed Trees

Impacted Tree
>300mm DBH - Alluvial
>300mm DBH - Non-Alluvial
100mm to 300mm DBH - Alluvial
100mm to 300mm DBH - Non-Alluvial
E. punctata (Grey Gum)
E. microcorys (Tallowwood)
E. tereticornis (Forest Red Gum)
Blue Gum / red gum
Proposed PKFT Supplementary Planting Area

PKFT Stadiametric Mapping and Avoidance Consdiderations

Figure: G

Deep Creek Quarry Project
Ironstone Developments Pty Ltd
Deep Creek Road, Limburners Creek NSW

APPENDIX 10: STAFF CONTRIBUTIONS

The following staff were involved in the compilation of this report.

Name	Qualification	Title/Experience	Contribution	Organisation
David Martin	MSc, BEnvSc & Mgt Accredited BAM Assessor (BAAS21021)	Senior Ecologist	Reporting, fauna and flora surveys	Wedgetail Project Consulting and Kleinfelder
Mark Dean	BEnvSc&Mgt	Senior Ecologist	Fauna and flora surveys, fauna reporting	Wedgetail Project Consulting, and Kleinfelder
Samara Schulz	BEnvSc & Mgt (Hons) Accredited BAM Assessor (BAAS17039)	Principal Ecologist	Flora Surveys, report review	Wedgetail Project Consulting, and Kleinfelder
Isaac Blundell	TAFE (in progress)	Trainee Ecologist	Fauna Surveys	Wedgetail Project Consulting
Kane Blundell	Grad Dip Spatial Sc (in progress)	Ecologist	GIS data management and figure preparation	Wedgetail Project Consulting
Ash Owen	DipSc BEnvSc (In progress)	Ecologist	Fauna and flora surveys	Kleinfelder
Ben Stewart	MMSc&Mgt	Field Assistant / Ecologist	Flora surveys	Kleinfelder
Chelayne Whyte	BGeog Dip SIS	Senior Environmental Consultant	Report review	Kleinfelder
Daniel O'Brien	BEnvSc & Mgt (Hons)	Senior Ecologist	Report review	Kleinfelder
David Russell	BSc Accredited BAM Assessor	Senior Ecologist	Flora surveys, vegetation mapping	Kleinfelder
Elise Connolly	Dip Cons Lnd Mgmt, Adv Dip Env Mgmt Accredited BAM Assessor	Ecologist (Botanist)	Flora surveys	Kleinfelder
Emily Fittell	BSc (Hons)	Ecologist	Fauna surveys, flora surveys and report writing	Kleinfelder
Gayle Joyce	BSc Forestry (Hons)	GIS Specialist	GIS data management and figure preparation	Kleinfelder
Gilbert Whyte	BSc (Hons) PhD BAM Accredited Ecologist (BAAS18041)	Senior Ecologist	Reporting.	Kleinfelder
Yann Buissiere	BEnvSc & Mgt	Ecologist	Flora surveys	Kleinfelder

APPENDIX 11: LICENSING

Wedgetail Project Consulting employees involved in the current study are licensed or approved under the *Biodiversity Conservation Act 2016* (License Number: SL102506, Expiry: 28 February 2023) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.