

Cleary Bros (Bombo) Pty Ltd

ABN: 28 000 157 808



**CLEARY BROS**

**Albion Park Quarry  
Extraction Area Stage 7  
Extension  
Biodiversity Development  
Assessment Report**

Prepared by

**Niche Environment and Heritage Pty Ltd**



**March 2022**

**Specialist Consultant Studies Compendium**

**Part 4**

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Cleary Bros (Bombo) Pty Ltd

ABN: 28 000 157 808

# Albion Park Quarry Extraction Area Stage 7 Extension

## Biodiversity Development Assessment Report

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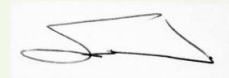
Ref No: 5329

**March 2022**

| Project number | Client                      | Project manager | LGA               |
|----------------|-----------------------------|-----------------|-------------------|
| 5329           | Cleary Bros (Bombo) Pty Ltd | Simon Tweed     | Shellharbour City |

**Declaration**

This Biodiversity Development Assessment Report has been prepared on the basis of the requirements of (and information provided under) the Biodiversity Assessment Method as certified by BAM Accredited Assessor: Simon Tweed (BAAS # 17040)



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## Glossary and list of abbreviations

| Term or abbreviation | Definition   |
|----------------------|--|
| BAM                  | Biodiversity Assessment Method   |
| BAM-C                | Biodiversity Assessment Method Credit Calculator   |
| BC Act               | NSW <i>Biodiversity Conservation Act 2016</i>  |
| BC Reg               | NSW <i>Biodiversity Conservation Regulation 2017</i>   |
| BCF                  | Biodiversity Conservation Fund   |
| BDAR                 | Biodiversity Development Assessment Report   |
| BMP                  | Biodiversity Management Plan   |
| BOS                  | NSW Biodiversity Offsets Scheme  |
| CEEC                 | Critically Endangered Ecological Community   |
| cm                   | Centimetre/s   |
| DAWE                 | Commonwealth Department of Agriculture, Water and the Environment  |
| DBH                  | Diameter at Breast Height  |
| DCP                  | Development Control Plan   |
| DPIE                 | NSW Department of Planning, Industry and Environment (formerly DECCW, DECC, DEC, OEH)  |
| EEC                  | Endangered Ecological Community  |
| EP&A Act             | NSW <i>Environmental Planning and Assessment Act 1979</i>  |
| EPBC Act             | Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>  |
| FM Act               | NSW <i>Fisheries Management Act 1994</i>   |
| ha                   | Hectare/s  |
| IBRA                 | Interim Biogeographic Regionalisation for Australia  |
| ISR                  | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion   |
| km                   | Kilometre/s  |
| LEP                  | Local Environment Plan   |
| LGA                  | Local Government Area  |
| Locality             | The Project Area and surrounds, nominally a 10 km radius from the Project Area   |
| m                    | Metre/s  |
| MAS                  | <i>Melaleuca armillaris</i> tall shrubland in the Sydney Basin Bioregion   |
| MNES                 | Matters of National Environmental Significance (from the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> ) |
| PCT                  | Plant Community Type   |
| Project Area         | The area within which direct impacts from the Project would occur  |
| RDP                  | Rapid Data Point   |
| SAIL                 | Serious and Irreversible Impacts   |
| Study Area           | The Project Area and avoidance areas   |
| TEC                  | Threatened Ecological Community  |
| VI                   | Vegetation Integrity as calculated by the BAM Calculator   |

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## Executive summary

### Context

Cleary Bros is seeking to extend their current hard rock extraction area within their Albion Park Quarry to an area known as Stage 7. The Stage 7 extraction area is located at 270 Dunsters Lane, Croom NSW 2527, across two lots (Lot 1 DP858245 and Lot 7 DP3709) in the Shellharbour City Local Government Area (LGA) (Study area). The current extraction area was approved on 21 February 2006 by the Land and Environment Court (DC 10639/2005) and has been modified in 2009, 2015 and most recently in 2017. The current extraction activities are underway within Stages 5 and 6 of the Quarry although some minor activities continue in Stages 1 to 4.

The Albion Park Quarry Extraction Area - Stage 7 Extension Project (the Project) would provide an additional extraction area on land immediately east of existing extraction operations. It is envisaged that extraction would be undertaken in a similar manner in Stage 7 to the existing operations. Cleary Bros proposes to introduce continuous in-pit primary crushing and screening in addition to the current intermittent campaign crushing and screening. A proportion of the primary crushed and screened rock would then be transported to the fixed processing plant for further processing. The current practices for product loading and dispatch would continue. A State Significant Development (SSD) Development Consent under Division 4.7 of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is required for the Project, including approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act).

### Aims

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by R.W. Corkery & Co. Pty Limited via Cleary Bros (Bombo) Pty Ltd (Cleary Bros) to assess the ecological values and impacts associated with the proposed Project as part of the Environmental Impact Statement (EIS). The primary objective of this Biodiversity Development Assessment Report (BDAR) is to use the Biodiversity Assessment Methodology (BAM) (DPIE 2020a) to describe and assess the ecological values within the Project Area, as required under the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

### Survey overview

Niche conducted ecological assessments and field surveys over April – December 2020 in accordance with the BAM which consisted of:

- Mapping and quantifying the condition of Plant Community Types (PCTs) within the Study Area
- Identification of threatened biodiversity and associated habitat
- Collection of data from 14 BAM plots to quantify PCTs and their condition
- Targeted survey for flora species
- Targeted survey for fauna species.

## **Results**

### **Native vegetation assessment**

Two plant community types (PCTs) were mapped within the Project Area:

- PCT 1300 Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion (Illawarra Subtropical Rainforest) listed as Endangered under BC Act and Critically Endangered under the EPBC Act.
- PCT 720 Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion (*Melaleuca armillaris* Tall Shrubland) listed as Endangered under the BC Act

Illawarra Subtropical Rainforest was present in four different condition classes: High, Low, Poor, Very degraded; and *Melaleuca armillaris* Tall Shrubland was present in six different condition classes High, Moderate – high, Moderate, Low (Dense lantana), Low (No canopy) and Poor.

The majority of areas proposed for clearing have been previously impacted by clearing and other disturbance factors and are therefore of lower condition. Impacted areas are partly or wholly connected to larger areas of similar vegetation communities. Areas actively avoided by the Project are generally better condition well connected areas.

### **Threatened flora**

Two threatened flora species (*Cynanchum elegans* and *Zieria granulata*) were recorded within the Project Area.

### **Threatened fauna**

The Project Area provides foraging habitat for numerous mobile species including within areas of rainforest which may be a locally important food source for some species. Such resources are concentrated within the better-quality vegetation zones of the Project Area (e.g. good condition rainforest) which was the focus of avoidance measures. Important breeding and sheltering habitat features for threatened fauna were limited.

Five threatened fauna species were recorded (including potential recordings) or known to use the Project Area constituting mobile species. Four species of threatened microbat were assumed present (recorded or potentially recorded); Eastern Bent-winged Bat, Little Bent-winged Bat, Greater Broad-nosed Bat and Yellow-bellied Sheath-tailed Bat (all Vulnerable under the BC Act – not listed under the EPBC Act). The Grey-headed Flying-fox (vulnerable under the BC Act and EPBC Act) is also known to use the Project Area.

### **Impacts – Native vegetation**

The main impact on terrestrial biodiversity associated with the Project is clearing of native vegetation and removal of associated habitat. The extent of clearing of native vegetation communities is estimated at 7.61 hectares from the identified Threatened Ecological Communities (TECs) constituting:

- 4.69 hectares of Illawarra Subtropical Rainforest in the Sydney Basin Bioregion listed as Endangered under BC Act and Critically Endangered under EPBC Act (PCT1300); and
- 2.92 hectares of *Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion listed as Endangered under BC Act (PCT 720).

An offset requirement for the identified impact has been calculated for the PCTs (via ecosystem credits) in accordance with the requirements of the BAM. An Assessment of Significance completed under the EPBC Act for the Illawarra Subtropical Rainforest TEC indicated that a significant impact is likely, therefore a referral to the Commonwealth DAWE has been completed.

### **Impacts – Threatened fauna and flora habitat**

Impacts to threatened fauna primarily constitute impacts to foraging habitat, with some potential breeding habitat for hollow-dwelling microbats also proposed to be impacted (albeit from more degraded areas of the Project Area) constituting five trees containing eight hollows.

One EPBC Act listed threatened fauna was considered impacted by the Project, the Grey-headed Flying-fox, which was likely to utilise the foraging habitat of the Project Area. No species credit fauna were considered to be impacted by the Project.

Assessments of Significance completed for the Grey-headed Flying Fox considered that a significant impact is unlikely.

### **Avoid, minimise and mitigate impacts**

Avoidance measures incorporated into design planning for the Project have avoided or minimised impacts on biodiversity through the following actions:

- Project designed to use existing processing and transport infrastructure which avoids impacts from the establishment of new infrastructure;
- Avoidance areas totalling two hectares within land zoned for extraction were incorporated into the Project design targeting high quality areas of threatened TECs and *Zieria granulata* habitat.

Avoidance measures regarding the positioning of the Project footprint were limited by the position of the suitable hard rock resource and a requirement for close proximity to existing processing infrastructure.

### **Credit calculations and offsetting**

A total of 101 ecosystem credits are required to offset impacts to native vegetation as a result of the Project:

- PCT 1300 Illawarra Subtropical Rainforest - 74 credits
- PCT 720 *Melaleuca armillaris* Shrubland - 27 credits.

Two threatened species require offsetting as a result of the Project. Their credit requirements are:

- *Cynanchum elegans* (White-flowered Wax Plant) – 4 credits
- *Zieria granulata* (Illawarra Zieria) – 4344 credits.

Cleary Bros intends to offset impacts from the Project in accordance with the credit requirements outlined above via available options under the NSW Biodiversity Offset Scheme (BOS).

## Introduction

### 1.1 Context and objectives

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by R.W. Corkery & Co. Pty Limited via Cleary Bros (Bombo) Pty Ltd (Cleary Bros) to prepare a Biodiversity Development Assessment Report (BDAR) for the Albion Park Quarry Extraction Area - Stage 7 Extension Project as part of the Environmental Impact Statement (EIS) (the Project).

The primary objective of this Biodiversity Development Assessment Report (BDAR) is to use the Biodiversity Assessment Methodology (BAM) (DPIE 2020a) to describe and assess the ecological values within the Project Area (Figure 1) and surrounds, determine whether the Project is likely to have an impact on threatened biodiversity listed under relevant biodiversity legislation, including the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act), and to identify and quantify any associated biodiversity offsetting requirements.

### 1.2 The Project

Cleary Bros proposes to extend the current extraction area within the Albion Park Quarry (the Quarry) located approximately 20km south-southwest of Wollongong and approximately 4km south-west of Shellharbour City Centre (Figure 2). The property on which the Quarry is located measures 142.7 ha of which approximately 54 ha is currently developed for quarry-related activities. The proposed Stage 7 extension area is located immediately east of the current extraction area and covers approximately 20 ha, and consists of four substages, namely Stages 7a, 7b, 7c and 7d.

Extraction would be undertaken in a staged manner commencing with the removal of services, fences, buildings and internal stone walls after which vegetation, topsoil, and subsoil would be removed. The weathered rock (overburden) would then be extracted using a bulldozer rip method pushing material into stockpiles for excavator/haul truck removal. The drilling and blasting process would follow with extraction proceeding in a sequential manner with the objective of ultimately operating three active extraction areas/benches for the three geological units to be extracted (Upper Latite, Agglomerate and Lower Latite). Extraction would commence in Stage 7a, followed by Stage 7b. It is noted that extraction in Stages 7c and 7d would initially be confined to the western side of both substages with extraction concluding in the Eastern Rim (see Figure 11). This area would be the final area extracted in order to minimise views of the extraction operations from the east. Cleary Bros proposes to introduce continuous in-pit primary crushing and screening in addition to the current intermittent campaign crushing and screening. A proportion of the primary crushed and screened rock would then be transported to the fixed processing plant for further processing. Processed quarry products would continue to be stockpiled adjacent to the fixed processing plant for loading from the product stockpiles and delivery to customers/projects.

It is understood that a State Significant Development (SSD) Development Consent under Division 4.7 of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) would be required for the Project. Approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) will also be required due to potential impacts to MNES.

### 1.3 The Project Area

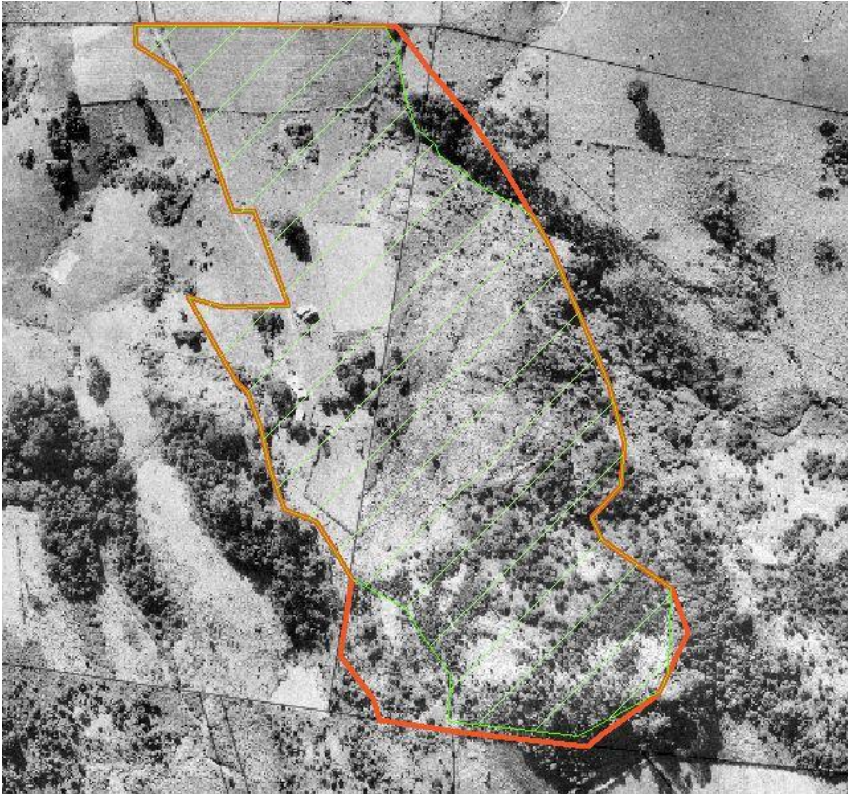
The current extraction area is located at 270 Dunsters Lane, Croom NSW, with Stages 1 to 6 located wholly within Lot 1 DP85824 and Stage 7 located immediately east and extending from Lot 1 DP85824 onto the

adjoining Lot 7 DP3709 (Figure 1). Stage 7 encompasses 18.67 hectares (ha) of land zoned RU1 and 1.24 ha of land zoned E2 in the Shellharbour Council Local Environment Plan (LEP) currently comprising of agriculture lands adjacent to the current extraction area (Plate 1 and Plate 2).

The property is currently primarily used for grazing cattle. The Project Area constitutes a local topographical high (ridge spur), which drops to vegetated valleys (Plate 1). The majority of the Project Area is cleared or has been historically cleared for agriculture or other uses at some time and now supports exotic vegetation or regrowth vegetation (both recent and advanced) with some remnant trees having been retained (Plate 1 and Plate 2). The Project Area is approximately 4 km south-west of Shellharbour City Centre, in the Shellharbour City LGA.



**Plate 1: Aerial photography of the Project Area: Top - north looking south; Bottom – south looking north (note southern extent of Project Area is not visible)**



**Plate 2: 1961 Aerial imagery of the Study Area and Surrounds**

A list of the digital files created for the BDAR are included in Annex 11.

## 1.4 Approval and assessment process

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

### 1.4.1 Planning Secretary's Environmental Assessment Requirements (SEARS)

The key biodiversity assessment issues outlined in the SEARs for the Project and addressed within this report are listed in **Table 1**.

**Table 1: Address of Project SEARs**

| Issue identified in SEARs   | Relevant section within report  |
|---|---|
| Accurate predictions of any vegetation clearing on site.  | Section 2.2- Native vegetation and flora assessment.                        |
| A detailed assessment of the likely biodiversity impacts of the development (the Project). Paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, undertaken in accordance with the <i>Biodiversity Assessment Method</i> and documented in a Biodiversity Development Assessment Report (BDAR). | Covered throughout this BDAR report.  |
| A strategy to offset any residual impacts of the development in accordance with the Biodiversity Offsets Scheme (BOS).  | An approach to satisfying offset obligations is described in section 4.1.3. |

#### 1.4.2 State approval and assessment process – application of the BAM

The EP&A Act provides an assessment framework in concert with the BC Act for the consideration of impacts to biodiversity including threatened biodiversity. Under section 7.2 of the BC Act, development is likely to significantly affect threatened species if:

- (a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in section 7.3, or
- (b) the development exceeds the biodiversity offsets scheme threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values, or
- (c) it is carried out in a declared area of outstanding biodiversity value.

For NSW State approval, the Project is to be assessed as SSD under Part 4 Division 4.7 of the EP&A Act, which requires proponents to use the NSW Biodiversity Offset Scheme (BOS) and BAM to prepare a BDAR under the BC Act. The BDAR is to outline avoidance and mitigation measures as well as offset requirements for all native vegetation clearing regardless of whether significant impacts on threatened biodiversity are likely to occur.

Clearing of native vegetation will require offsetting as outlined within the BDAR or, to a varied degree, if agreed to after consultation with the Minister administering the BC Act.

This BDAR describes the biodiversity values present within the Project Area and identifies impacts from the Project on these values. The assessment has been conducted using BAM 2020 and supporting documents. This assessment has used the BAM Calculator (BAM-C) (version 1.4).

#### 1.4.3 Commonwealth approval and assessment process

Matters of National Environmental Significance (MNES) are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Under the EPBC Act, activities that have potential to result in significant impacts on MNES must be referred to the Commonwealth Minister for the Environment for assessment. Assessment of impacts under the EPBC Act has been undertaken via assessments of significance for EPBC Act listed species with the potential to be affected by the Project (Annex 8). A Referral has been lodged with the Commonwealth Department of Agriculture Water and Energy (DAWE).

The NSW BAM also requires proponents to identify and assess the impacts on all nationally listed threatened species and threatened ecological communities that may be present on or near the development Project Area. This BDAR has identified threatened biodiversity listed under the EPBC Act that may be potentially impacted by the Project. The BAM has partly been used to perform assessment of impacts under the EPBC Act.

The Project is subject to a bilateral agreement between State and Commonwealth governments under the EPBC Act.

#### 1.4.4 Biosecurity Act 2015

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

- Preventing their entry into NSW
- Quickly finding, containing and eradicating any new entries

- Effectively minimising the impacts of those pests, diseases, weeds and contaminants that cannot be eradicated through robust management arrangements.

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

- Weeds of National Significance
- National environmental Alert List Weeds
- Water weeds
- Native plants considered weeds.

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

Weeds identified under the *Biosecurity Act 2015* have been identified in section 2.2.5.

### **1.5 Assessment objectives and format**

The primary objective of this assessment is to use the guidelines and methodology provided in the BAM to determine the impact the Project would have on biodiversity, outline avoidance and mitigation measures and then calculate the Project's biodiversity offset requirement.

This BDAR has two broad stages consistent with the BAM methodology:

#### ***Stage 1 – Biodiversity Assessment***

- assessment of landscape features
- assessment of native vegetation
- assessment of threatened species and populations.

#### ***Stage 2 – Impact Assessment***

- avoid and minimise impacts on biodiversity values
- consider impact and offset thresholds
- determine and calculate offset requirements.

### **1.6 Assessment resources and assessor qualifications**

This BDAR has been prepared by the accredited personnel and support staff identified in Table 2. Resources and survey guidelines used in the development of this BDAR are detailed in Table 3.



**Table 2: Assessor qualifications and resources**

| Personnel      | Qualifications   | Tasks carried out  |
|----------------|--|--|
| Simon Tweed    | Senior Ecologist<br>Accredited Biodiversity Assessor (BAAS 18088)  | BAM plots and targeted threatened flora searches; data management, data entry, credit calculations, review of credit calculations, report preparation and quality assurance. |
| Sian Griffiths | Senior Ecologist<br>Accredited Biodiversity Assessor (BAAS 17066 ) | Report preparation, fieldwork; targeted threatened flora searches.   |
| Sarah Hart     | Ecologist  | Report preparation, fieldwork; targeted threatened flora searches and data management.   |
| Kayla Asplet   | Ecologist  | Report preparation, fieldwork; targeted threatened flora searches, passive fauna and habitat surveys and data management.  |
| Greg Tobin     | GIS Specialist   | Mapping.   |

**Table 3: Assessment resources and guidelines used**

| Assessment resources/guideline |   |
|--------------------------------|---|
| <b>Resources</b>               | <ul style="list-style-type: none"> <li>Biodiversity Assessment Method (BAM) (DPIE 2020a)</li> <li>BAM Operational Manual – Stage 1 (DPIE 2020k)</li> <li>BAM Operational Manual – Stage 2 (DPIE 2019a)</li> <li>BAM Calculator User Guide (DPIE 2018)</li> </ul>  |
| <b>Survey guidelines</b>       | <ul style="list-style-type: none"> <li>Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (DPIE 2020l).</li> <li>'Species credit' threatened bats and their habitats, NSW survey guide for the Biodiversity Assessment Method (OEH 2018).</li> <li>2004 Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (DECC 2004).</li> </ul> |

## 2. Biodiversity Assessment

### 2.1 Landscape assessment

#### 2.1.1 Methods

As detailed in Section 3 of the BAM (DPIE 2020a), a landscape assessment for the Project is required, which was conducted within the BAM-C. Landscape value is an assessment of a number of factors including:

- Native vegetation cover
- Rivers, streams and estuaries
- Areas of geological significance
- Habitat connectivity.

For each factor, the current state of the landscape is assessed then compared with the state of the landscape if the Project were to proceed.

#### 2.1.2 Landscape features and scoring

Table 4 provides details of the landscape settings and scored landscape features for the Project.

**Table 4: Landscape features and scoring under the NSW BAM**

| Landscape features                                      | Description   | Figure reference         |
|---|---|--------------------------|
| Project Area  | The area within which direct impacts from the Project will occur - 19.91 ha.  | Figure 1                 |
| IBRA bioregion/subregion                                | The Project is located within the Illawarra subregion which is within the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) bioregion.  | Figure 2                 |
| NSW (Mitchell) Landscapes                               | The Project Area is mapped as occurring within the Kiama Coastal Slopes Mitchell Landscape.   | Figure 2                 |
| Rivers, streams and estuaries and Strahler stream order | There is a single mapped 1 <sup>st</sup> order stream within the Project Area which links with another stream to form a 2 <sup>nd</sup> order stream east of the Project Area. All drainage from the Project Area runs east and south into the Rocklow Creek catchment of the Minnamurra River catchment.   | Figure 1<br>Figure 2     |
| Wetlands within and adjacent to development             | There are no wetlands within or adjacent to the Project Area. Drainage from the Project Area flows into a Coastal Wetland associated with the Minnamurra River approximately 2.3km to the south-east.   | Figure 2                 |
| Connectivity features                                   | Vegetation within the Project Area is partly connected to larger patches of vegetation to the south-west via a corridor of vegetation at the southern portion of the Project Area. Connectivity south of the Project Area would remain, however the width of the vegetated corridor would be reduced (from approximately 130m to 65m).  | Figure 1 and<br>Figure 2 |
| Buffer area (percent native vegetation cover)           | A 1,500 m buffer was applied to the Project Area resulting in an overall buffer area of 1,036 ha. Existing vegetation mapping (DPIE 2016) identified areas of vegetation within the buffer area.<br><b><i>Native vegetation cover</i></b><br>The native vegetation extent and cover of woody vegetation was determined via aerial photography interpretation based on canopy cover, local vegetation mapping (DPIE 2016) and knowledge of the Project Area.<br>For <b>woody vegetation</b> 27.6 percent of the buffer area was determined to support native woody vegetation with canopy cover (285.95 ha). | Figure 2                 |

| Landscape features                | Description  | Figure reference |
|-----------------------------------|--|------------------|
|                                   | <p>For <b>non-woody vegetation (grassland)</b> zero percent of the buffer area was determined to support natural/native grassland. The surrounding grasslands are mainly cleared for agricultural lands and are not mapped as naturally occurring (DPIE 2016).</p> <p><b>Total native vegetation cover</b></p> <p>Combining the estimated woody and non-woody vegetation cover resulted in 27.6 percent of the buffer area supporting native vegetation. This falls into the &gt;10-30 per cent category within the BAM-C.</p> |                  |
| Project Area context              | Project Area-based assessment  | -                |
| Geological significance and soils | There are no karst, caves, crevices, cliffs or other areas of geological significance within the Project Area. There are no high hazard soil areas.  | -                |

## 2.2 Native vegetation and flora assessment

All clearing calculations were conducted for the Project Area, see Section 3.2 for more detail on avoidance and mitigation measures taken within the Project.

### 2.2.1 Methods – data review

A review of relevant literature, databases and existing vegetation mapping was undertaken to identify potentially occurring vegetation communities and threatened biodiversity within the Study Area. This process informed initial survey effort and survey design.

The following resources were accessed as part of the data review:

- NSW BioNet Atlas Database (DPIE 2020c) for spatial records of threatened flora listed under the BC Act within a 10 km radius of the Study Area.
- EPBC Act Protected Matters Search Tool (PMST) (DAWE 2020) for flora and ecological communities identified as MNES known from or with potential habitat within a 10 km radius of the Study Area.
- BAM-C tool (using benchmark condition for previously mapped Plant Community Types, PCTs) to identify candidate species credit species and predicted ecosystem credit species known or predicted to occur within the IBRA subregion.
- Vegetation mapping: existing vegetation mapping was examined prior to the field survey to determine the vegetation communities likely to be present in the Study Area.
- Illawarra Plant Community Type Vegetation Map, 2016. VIS\_ID 4678 (DPIE 2016).

### 2.2.2 Methods – field survey

Multiple field surveys of the Project Area and surrounds were undertaken over the course of seven months (April, July, August, September, October, November and December), totalling approximately 164 hours (Table 5).

Plant Community Types (PCTs) and condition classes (zones) across the Study Area were recorded and mapped using a combination of BAM plots, transects and walking meanders. Vegetation mapped as occurring within the Study Area is shown on Figure 3 along with the location of the completed BAM plots. Table 6 lists the PCT zones present, including their vegetation formation, class and status. Alignment of the vegetation communities to a PCT is discussed in 2.2.6 below. The number of plots conducted for each PCT and vegetation zone is provided in Table 6.

### **Targeted threatened flora survey – Project Area**

The requirement for targeted survey for each candidate species surveyed to determine presence/absence from the Project Area (and the subsequent requirement for offset credits to be generated) was determined by consideration of the following:

- For each candidate species, review of associated PCTs (as per the NSW Threatened Biodiversity Data Collection (TBDC)) compared with the Project Area
- Presence of habitat constraints (as identified in the TBDC) within the Project Area
- Quality/suitability of habitat present as determined during the initial field survey.

Where species presence could not be ruled out based on lack of associated PCTs or habitat, a conservative approach was taken and targeted surveys conducted.

### **2.2.3 Survey Effort**

Survey tasks and effort completed for vegetation and flora survey are tabulated below:

**Table 5: Survey effort (flora and vegetation)**

| <b>Field survey activity</b>  | <b>Method</b>  | <b>Effort/timing</b>  |
|---|--|---|
| Plant community delineation and mapping                             | 14 BAM plots<br>Rapid Data Points (RDPs)<br>Transects and walking meanders to record boundaries between vegetation zones<br>Habitat quality assessment<br>High threat and priority weed observation  | 21, 30 April 2020<br>10, 15, 16 & 17 July 2020<br>12 August 2020<br>1 October 2020<br>13 November 2020<br>18 December 2020                                      |
| Threatened plant surveys (all species)                              | As above described for potentially occurring threatened flora plus additional survey during relevant flowering periods if relevant. <ul style="list-style-type: none"> <li>• <i>Irenepharsus trypherus</i> (Illawarra Irene)</li> <li>• <i>Cynanchum elegans</i> (White-flowered Wax Plant)</li> <li>• <i>Daphnandra johnsonii</i> (Illawarra Socketwood)</li> </ul> | 21, 30 April 2020,<br>10, 15, 16 & 17 July 2020,<br>12 August 2020,<br>22, 30 September 2020<br>1, 6 and 7 October 2020<br>13 November 2020<br>18 December 2020 |
| <i>Zieria granulata</i> (Illawarra Zieria) survey (Section 2.2.3.1) | Detailed density mapping and measurement of reproduction and size:<br>50 x 50m quadrats<br>10 x 10m <sup>2</sup> quadrats<br>Targeted transects  | 10, 15, 16 & 17 July 2020<br>12 August 2020, 1 October 2020   |

**Table 6: Plant Community Types present across the Project Area**

| PCT ID | PCT name   | Condition                                | TEC status per BioNet Vegetation Classification (BC Act/EPBC act)         | Vegetation Formation (Keith 2004) | Vegetation Class (Keith 2004) | PCT % cleared | Area to be cleared /impacted for development (ha) | Total Area requiring offset (ha) | BAM Plots required for the impact area | BAM Plots completed |
|--------|--|--|---|-----------------------------------|-------------------------------|---------------|---|----------------------------------|--|---------------------|
| 1300   | Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion | Very degraded                            | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (E/CE)     | Rainforests                       | Dry Rainforests               | 90            | 1.24  | 4.69                             | 1                                      | 1                   |
| 1300   | Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion | Poor                                     | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (E/CE)     | Rainforests                       | Dry Rainforests               | 90            | 0.30  |                                  | 1                                      | 1                   |
| 1300   | Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion | Low                                      | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (E/CE)     | Rainforests                       | Dry Rainforests               | 90            | 3.14  |                                  | 2                                      | 2                   |
| 1300   | Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion | High                                     | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (E/CE)     | Rainforests                       | Dry Rainforests               | 90            | 0.01  |                                  | 1                                      | 1                   |
| 720    | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion            | Poor                                     | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion (E/N.A) | Heathlands                        | Southern Montane Heaths       | 75            | 0.77  | 2.92                             | 1                                      | 2                   |
| 720    | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion            | Low (regenerating midstorey – no canopy) | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion (E/N.A) | Heathlands                        | Southern Montane Heaths       | 75            | 0.43  |                                  | 1                                      | 1                   |
| 720    | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics,  | Low (dense lantata)                      | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion (E/N.A) | Heathlands                        | Southern Montane Heaths       | 75            | 0.29  |                                  | 1                                      | 1                   |

| PCT ID | PCT name  | Condition       | TEC status per BioNet Vegetation Classification (BC Act/EPBC act)         | Vegetation Formation (Keith 2004) | Vegetation Class (Keith 2004) | PCT % cleared | Area to be cleared /impacted for development (ha) | Total Area requiring offset (ha) | BAM Plots required for the impact area | BAM Plots completed |
|--------|---|-----------------|---|-----------------------------------|-------------------------------|---------------|---|----------------------------------|--|---------------------|
|        | southern Sydney Basin Bioregion   |                 |   |                                   |                               |               |   |                                  |  |                     |
| 720    | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion | Moderate        | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion (E/N.A) | Heathlands                        | Southern Montane Heaths       | 75            | 0.47  |                                  | 1                                      | 1                   |
| 720    | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion | Moderate - High | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion (E/N.A) | Heathlands                        | Southern Montane Heaths       | 75            | 0.58  |                                  | 1                                      | 2                   |
| 720    | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion | High            | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion (E/N.A) | Heathlands                        | Southern Montane Heaths       | 75            | 0.38  |                                  | 1                                      | 1                   |

Key: E = Endangered; CE = Critically Endangered N.A = Not Applicable (not listed under relevant Act).

Detailed vegetation community descriptions including species used to aid in determining PCTs and justification for alignment to each of the nominated PCTs are provided in Annex 1.

### 2.2.3.1 *Zieria granulata* targeted survey effort and method

Due to the high abundance of *Zieria granulata* across the Study Area, detailed surveys were conducted to gain a thorough understanding of the population, identifying appropriate areas of avoidance and to assist with offsetting calculations in the BAM-C. *Z. granulata* is listed as a “count” species under the BAM requiring that offset requirements be based on the number of mature plants rather than the area occupied by the species. Therefore, methods were employed to determine the number of plants across the Project Area via counts and the size at which plants should be classed as mature (as defined by the ability to reproduce via flowering). It was hypothesized that reproductive ability would be highly correlated to the size of plants. Similar approaches to assessing mature population size by using plant size measurements are relatively standard for flowering plants, including *Z. granulata* (e.g. DEC 2005).

Correlation between size measurements and reproductive status were investigated prior to selecting a preferred indicator for reproductive capacity (e.g. height, stem size or a combination of the two). The density of plants across the Project Area was mapped and refined over several surveys until a thorough representation of population density was achieved.

The following parameters were assessed for *Z. granulata* within targeted systematic surveys for the species:

- Counts of plants within quadrats
- Approximate height of each plant
- Stem diameter at base – typically the widest point (measured with callipers)
- Reproductive status as per the following classes; signs of imminent flowering (e.g. buds), some flowers present, many flowers present, some spent flowers, many spent flowers, some fruit/seed present, many fruit/seed present, other.

A 50 m grid was applied over the Project Area using GIS. An initial trial was conducted to count and measure plants within 50x50 m plots (corresponding to a single grid cell) inside high density areas to gauge the viability of this approach in terms of time and accuracy, however that method was abandoned part way through as it was overly time consuming, requiring counts and measurements of every plant within the Project Area.

Subsequently, two 10x10m plots within each 50 x 50 grid cell were conducted. Plot positioning was via navigating to pre-determined points within the south-west and north-east portion of each grid cell to generate a dataset over the entire area of potential habitat.

The initial set of 10 x 10 m plots were conducted in July prior to peak flowering. However, only 10 x 10 m plots conducted between September and October were used for maturity analysis to ensure analysis occurred within the peak flowering period. Some of the initial (July) plots were repeated at the same location to ensure sufficient data was collected within the peak flowering period. This resulted in a September/October “B” plot in roughly the same location as the original July plot. Where this occurred, only the B plot was selected for maturity and density analyses.

Data was finalised and quality assured (QA) daily after surveys. A limitation observed during the QA was subplots were not always directly at the survey point (GPS limitation, or observer not waiting long enough

for GPS to adjust). If this resulted in an obvious inconsistency in coverage, a third plot was conducted within a grid cell and the data from the initial plot was ignored. Therefore, leaving two plots within the 50x50m plot. To allow for consistency across the Project Area, the 50x50m plot data collected at the start of the assessment were excluded from any density analysis.

Mapping of different density zones was carried out during and after survey based on plot data, ground observations, walked GPS tracks and aerial photography interpretation to assist with delineation of areas with different management practices, weed invasion etc.

#### 2.2.4 Project Area values

##### ***Plant community types***

The majority of the Project Area is cleared or has been historically cleared for agriculture or other uses at some time and now supports exotic vegetation (11.79 ha) or regrowth vegetation (both recent and advanced) with some large remnant trees (e.g. fig trees) having been retained (Plate 1 and Plate 2).

The two mapped PCTs (PCT1300 and PCT720) recorded from the Project Area are listed in Table 6 along with other values including their threat status. Low and very degraded condition zones comprise the majority of native vegetation remaining within the Project Area to be cleared.

PCT720 is present at various condition states within the Project Area. A total of 2.92 hectares of PCT720 would be cleared as part of the Project. Areas mapped as PCT720 were categorised into the following condition classes:

- Poor
- Low (regenerating midstorey – no canopy)
- Low (dense lantana)
- Moderate
- Moderate – High
- High

PCT1300 is highly variable in condition throughout having areas of good condition separated by significant areas of lantana infestation due to previous agricultural clearing activities. A total of 4.69 hectares of PCT1300 would be cleared as part of the Project. The majority of better condition areas of the Study Area were identified and avoided. Remaining areas constitute four condition classes:

- High
- Low
- Poor
- Very degraded (isolated small patches)

Justification for the assignment of areas to the above condition classes and further detail on each class are described in Annex 1. Plant community descriptions are mapped in Figure 3. Overall, 7.61ha of native vegetation within the Project Area is proposed to be removed.

An additional area of 0.52 ha of revegetation (including native species) occurs within the Project Area (Figure 3) and will be cleared as part of the Project. This area constitutes planted areas which have been revegetated in 2008 as part of previous extraction operations. Such areas constitute category 1 – exempt



land under Section 2.3 of the BAM, which are not assessed or offset under the BAM. The justification of this area as Category 1 land (as per Part 5A of the Local Land Services Act (2013)) is that the land was lawfully cleared of native vegetation between 1 January 1990 and the commencement of the Local Land Services Act (2013). It is not considered necessary to perform any further assessment of these areas under any other legislation given they have limited ecological value.

### **Flora**

A total of 157 flora species were recorded across the 14 BAM plots; including 108 native species and 49 exotic species. Floristic plot data including cover and abundance of all species recorded is provided in Annex 2.

### **Plot and transect values**

Results of the floristic composition, structure and function data obtained during BAM plots is provided in Annex 3.

### **Project Area value scores**

The Project Area value assessment was carried out by entering BAM plot data into the BAM-C. The data provides quantitative measures of composition, structure and function for each vegetation zone (Annex 3). The BAM-C compares the values recorded at the Project Area with the benchmark for the vegetation class to provide the Project Area value score. This score represents the overall condition of the vegetation compared to the benchmark value (out of 100).

The score from these inputs, coupled with threatened species data, is used to determine the number of ecosystem credits that are required for development.

Patch size for all vegetation zones was given the highest score in the BAM-C (>100 hectares), as the native vegetation in the Project Area is directly connected to other large areas of native vegetation (as can be seen on Figure 1 and Figure 2).

The current and future vegetation integrity (VI) scores from the BAM-C are detailed in Table 7. The future integrity scores for all areas of the Project Area were reduced to zero as all vegetation and habitats within these zones would be removed.

**Table 7: Vegetation zones within the Project Area with current and future vegetation integrity scores**

| Vegetation zone (PCT number and condition abbreviation) | PCT abbreviated name              | Area (ha) | Min. no. of plots | Plots conducted | Patch size (ha) | Current VI score | Future VI score | Change in VI score |
|---|-----------------------------------|-----------|-------------------|-----------------|-----------------|------------------|-----------------|--------------------|
| 1300 High   | Whalebone Tree - Native           | 0.01      | 1                 | 1               | 160             | 63.6             | 0               | -63.6              |
| 1300 Low  |                                   | 3.14      | 2                 | 2               | 160             | 44.9             | 0               | -44.9              |
| 1300 Poor   | Quince dry subtropical rainforest | 0.30      | 1                 | 1               | 160             | 21.2             | 0               | -21.2              |
| 1300 Very Degraded                                      |                                   | 1.24      | 1                 | 1               | 160             | 9.1              | 0               | -9.1               |
| 720 High  | Melaleuca armillaris Tall         | 0.38      | 1                 | 1               | 160             | 23.3             | 0               | -23.3              |
| 720 Mod-High  |                                   | 0.58      | 1                 | 2               | 160             | 24.5             | 0               | -24.5              |
| 720 Moderate  | Shrubland                         | 0.47      | 1                 | 1               | 160             | 15.9             | 0               | -15.9              |

| Vegetation zone (PCT number and condition abbreviation) | PCT abbreviated name | Area (ha)   | Min. no. of plots | Plots conducted | Patch size (ha) | Current VI score | Future VI score | Change in VI score |
|---|----------------------|-------------|-------------------|-----------------|-----------------|------------------|-----------------|--------------------|
| 720_Low Lantana   |                      | 0.29        | 1                 | 1               | 160             | 10.2             | 0               | -10.2              |
| 720 Low No Canopy                                       |                      | 0.43        | 1                 | 1               | 160             | 25.4             | 0               | -25.4              |
| 720_Poor  |                      | 0.77        | 1                 | 2               | 160             | 10.3             | 0               | -10.3              |
| <b>Total</b>  |                      | <b>7.61</b> | <b>11</b>         | <b>14</b>       |                 |                  |                 |                    |

### 2.2.5 High threat and priority weeds

During the field surveys 13 high threat weed species were recorded: *Acetosa sagittata*, *Araujia sericifera*, *Bidens pilosa*, *Briza subaristata*, *Cardiospermum grandiflorum*, *Delairea odorata*, *Ehrharta erecta*, *Lantana camara*, *Ligustrum lucidum*, *Olea europaea*, *Paspalum dilatatum*, *Pyracantha angustifolia*, *Rubus fruticosus* sp. agg.; as well as three species listed as priority weeds under the NSW Biosecurity Act 2015 for the Shellharbour LGA (South East) region; *Lantana camara*, *Rubus fruticosus* sp. agg. and *Senecio madagascariensis*. There were large areas of exotic species across the Project Area, including dense patches of Lantana.

## 2.2.6 Threatened ecological communities

In the BAM Calculator, PCT 1300 and PCT720 are both listed as TECs on either the BC or EPBC Acts (Table 8). Both ecological communities are also candidates for serious and irreversible impacts (SAII) under the BC Act.

**Table 8: Threatened ecological communities characteristics in the Project Area**

| PCT ID | PCT name   | TEC Name  | TEC status per BioNet Vegetation Classification (BC Act) | TEC status per BioNet Vegetation Classification (EPBC Act) | Characteristic species recorded on Project Area   |
|--------|--|---|--|--|---|
| 1300   | Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion    | Endangered   | Critically Endangered                                      | <i>Alectryon subcinereus</i> ,<br><i>Alphitonia excelsa</i> , <i>Ficus</i> sp.,<br><i>Guioa semiglauc</i> , <i>Hibiscus heterophyllus</i> subsp.<br><i>heterophyllus</i> , <i>Streblus brunonianus</i>  |
| 720    | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion            | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion | Critically Endangered                                    | N/A  | <i>Commelina cyanea</i> ,<br><i>Dichelachne</i> spp., <i>Digitaria</i> spp.,<br><i>Einadia hastata</i> , <i>Geitonoplesium cymosum</i> ,<br><i>Glycine clandestine</i> , <i>Leucopogon juniperinus</i> ,<br><i>Melaleuca armillaris</i> subsp.<br><i>armillaris</i> , <i>Microlaena stipoides</i> ,<br><i>Oplismenus</i> sp., <i>Plectranthus parviflorus</i> ,<br><i>Poa labillardierei</i> var. <i>labillardierei</i> ,<br><i>Sigesbeckia orientalis</i> subsp.<br><i>orientalis</i> , <i>Themeda triandra</i><br>and <i>Zieria granulata</i> . |

The Project would impact on these TECs, further detail regarding impacts on these TECs have been completed in Annex 8 and Annex 9 with supporting information regarding context of impacts demonstrated in Figure 9 and Figure 10.

## 2.2.7 Threatened flora

A total of eight threatened flora species were identified by the BAM-C as species credit species or judged as other threatened flora with a moderate to high likelihood of occurring in the impact area (Table 9 and Annex 6).

Of the species identified, none are candidate species for SAII. Table 9 details the list of candidate and threatened flora species, including habitat constraints and required survey timing (as identified in the BAM-C). The status column indicates whether a species was found within the Project Area or considered absent based on survey or other means. After extensive surveys undertaken within the Project Area, two of the eight candidate species were observed.

**Table 9: Candidate and other threatened flora species with the potential to occur**

| Scientific name               | Common name              | NSW BC Act | EPBC Act | Subject to SAIL? | Habitat constraint (BAM) | Survey timing/effort | Species presence and justification      |
|-------------------------------|--------------------------|------------|----------|------------------|--------------------------|----------------------|---|
| <b>Candidate species</b>      |                          |            |          |                  |                          |                      |   |
| <i>Cynanchum elegans</i>      | White-flowered Wax Plant | E          | E        | No               | None                     | All year             | Yes – recorded during targeted surveys. |
| <i>Daphnandra johnsonii</i>   | Illawarra Socketwood     | E          | E        | No               | None                     | All year             | No (surveyed)                           |
| <i>Gossia acmenoides</i>      |                          | EP         |          | No               | None                     | All year             | No (surveyed)                           |
| <i>Irenepharsus trypherus</i> | Illawarra Irene          | E          | E        | No               | None                     | December – April     | No (surveyed)                           |
| <i>Rhodamnia rubescens</i>    | Brush Turpentine         | CE         | -        | No               | None                     | All year             | No (surveyed)                           |
| <i>Senna acclinis</i>         | Rainforest Cassia        | E          | -        | No               | None                     | All year             | No (surveyed)                           |
| <i>Solanum celatum</i>        | -                        | E          | -        | No               | None                     | August – November    | No (surveyed)                           |
| <i>Zieria granulata</i>       | Illawarra Zieria         | E          | E        | No               | None                     | All year             | Yes – recorded during targeted surveys. |

Key: CE = Critically Endangered; E = Endangered, EP = Endangered Population

Targeted threatened flora surveys were undertaken for all candidate species according to relevant survey guidelines (e.g. DPIE 2020I), with survey effort shown in Figure 3 and Figure 4.

Species credits are required for those species identified as present within the Project Area (or assumed present). In order to determine the offset requirement, species polygons were developed as described below.

#### ***Zieria granulata* (Illawarra Zieria) – Count species**

The overall species polygon for Illawarra Zieria was calculated through targeted search methods conducted throughout the Project Area. All areas of potential habitat were assigned to density zones as described in Section 2.2.3.1. resulting in high, moderate and low-density areas across the Project Area (Table 10 and Figure 4, Figure 7). The area of high, moderate and low density Zieria within the Project Area is estimated at 3.01ha.

Count species require offsetting of only mature individuals. Therefore, credits were calculated by first estimating the number of stems within each density zone (from extrapolation of 10 x 10m plot data) then analysing patterns of stem diameter and plant height in relation to reproductive status to determine what proportion of individuals were mature plants.

Stem size was found to be highly correlated with maturity (i.e. flowering status) and on this basis it was determined that a mature plant was any individual greater than 13mm stem diameter. The total number of mature plants within the Project Area was calculated at 4,521, of which 2,170 (48%) were classed as mature plants.

**Table 10: Zieria density for mature individuals**

| Zieria Density | Area (ha)     | Average plants / ha | Total no. of plants | Total no. of mature plants |
|----------------|---------------|---------------------|---------------------|----------------------------|
| High           | 0.3945        | 5133.3              | 2,025               | 972                        |
| Mod            | 1.1912        | 1812.5              | 2,159               | 1,036                      |
| Low            | 1.4199        | 236.8               | 336                 | 161                        |
| <b>Total</b>   | <b>3.0057</b> | -                   | <b>4,521</b>        | <b>2,170</b>               |

**Table 11: Zieria density calculations including non-mature plants**

| Vegetation Zones  | Zieria density (see Table 10) | Area of Zieria (ha) | Area*density (av/ha) | Total plants calculation | Mature plant calculation |      |
|---|-------------------------------|---------------------|----------------------|--------------------------|--------------------------|------|
| Exotic pasture  | High                          | 0.0671              | 344.2                | 692.6                    | 693                      | 333* |
|   | Moderate                      | 0.1801              | 326.5                |                          |                          |      |
|   | Low                           | 0.0922              | 21.8                 |                          |                          |      |
| Illawarra Subtropical Rainforest - High                                   | Low                           | 0.0094              | 2.2                  | 2.2                      | 2                        | 1    |
| <i>Melaleuca armillaris</i> Shrubland - High                              | High                          | 0.0373              | 191.4                | 713.6                    | 714                      | 343  |
|   | Moderate                      | 0.2796              | 506.9                |                          |                          |      |
|   | Low                           | 0.0643              | 15.2                 |                          |                          |      |
| <i>Melaleuca armillaris</i> Shrubland - Low (dense lantana)               | Low                           | 0.2769              | 65.6                 | 65.6                     | 66                       | 32   |
| <i>Melaleuca armillaris</i> Shrubland - Low (regen midstorey - no canopy) | High                          | 0.1828              | 938.4                | 1190.7                   | 1191                     | 572  |
|   | Moderate                      | 0.1285              | 232.9                |                          |                          |      |
|   | Low                           | 0.0824              | 19.5                 |                          |                          |      |
| <i>Melaleuca armillaris</i> Shrubland - Moderate                          | High                          | 0.0309              | 158.4                | 608.9                    | 609                      | 292  |
|   | Moderate                      | 0.2239              | 405.8                |                          |                          |      |
|   | Low                           | 0.1886              | 44.7                 |                          |                          |      |
| <i>Melaleuca armillaris</i> Shrubland - Moderate-high                     | High                          | 0.0168              | 86.1                 | 265.6                    | 266                      | 128  |
|   | Moderate                      | 0.0373              | 67.5                 |                          |                          |      |
|   | Low                           | 0.4731              | 112.0                |                          |                          |      |
| <i>Melaleuca armillaris</i> Shrubland - Poor                              | High                          | 0.0598              | 306.7                | 981.5                    | 982                      | 471  |
|   | Moderate                      | 0.3418              | 619.6                |                          |                          |      |
|   | Low                           | 0.2329              | 55.2                 |                          |                          |      |

\* Note: The offset requirement for these individuals has been entered under the Illawarra Subtropical Rainforest – Very degraded zone within the BAM Calculator since entry of an exotic vegetation PCT is not possible within the BAM Calculator.

### ***Cynanchum elegans* (White-flowered Wax Plant) – Area species**

The species polygon for *Cynanchum elegans* covers the area of the single plant found plus a modelled area of habitat accounting for additional area of potential habitat covered by the species as per the BAM method. Potential habitat was identified as ecotone areas between the *Melaleuca armillaris* Shrubland and Illawarra Subtropical Rainforest communities which had not been recently cleared as evidenced by surrounding records of the species. Note that this was considered a conservative approach to cater for any lack of detection of this species. The resulting offset polygon is 0.15 hectares (Figure 8).

### 2.2.8 Threatened fungi

There were no threatened fungi species identified by the BAM Calculator as species credit species and/or having a moderate to high likelihood of occurring in the impact area (Annex 6).

## 2.3 Fauna assessment

### 2.3.1 Methods – data review

A review of relevant literature, databases and vegetation mapping was undertaken to identify fauna habitat and determine potentially occurring threatened fauna within the Project Area (as described for the native vegetation and flora assessment (Section 2.2.1)). Results of the review were considered to inform field survey requirements.

### 2.3.2 Methods – field survey

Field surveys across the Project Area included habitat assessment and targeted surveys for threatened fauna. Key habitat features were assessed to determine the likely presence of threatened species, including:

- Type, condition and diversity of vegetation communities
- Roosting/breeding/sheltering resources such as hollow-bearing trees, rock ledges/rocky outcrops/shelters/caves and logs
- Permanent and ephemeral aquatic habitat.

Targeted threatened fauna surveys were undertaken for those species identified as having a moderate to high likelihood of occurrence (Annex 6), and identified as candidate species within the BAM Calculator. A likelihood of occurrence assessment was completed and updated after field survey results were considered (Annex 6).

#### ***Predicted (ecosystem credit) fauna species***

For offsetting calculation purposes, within the BAM calculator all ecosystem credit species were assumed present despite the likelihood of occurrence assessment (see Table 13).

#### ***Determining candidate (species credit) fauna species***

Targeted threatened fauna surveys were completed for those species identified as having a moderate to high likelihood of occurrence (based on presence of suitable habitat/required habitat constraints) (Annex 6) or for species identified as candidate species by the BAM-C once the BAM vegetation plot data was entered and habitat values considered.

A total of eleven threatened fauna species were identified by the BAM-C as species credit species (Table 13), none of which are species listed as candidate species for serious and irreversible impacts (SAII). Methods and survey effort for fauna survey are presented in Table 12 and illustrated in Figure 5.

**Table 12: Fauna survey methods, timing and effort**

| Method   | Target species   | Timing                     | Effort   |
|--|--|----------------------------|--|
| Diurnal bird survey and checks around hollow trees | Threatened birds (e.g. Gang-gang Cockatoo, Little Lorikeet, Superb | August, November, December | 2 x 30 minute bird surveys were conducted as well as opportunistic observations around the Project |

| Method                               | Target species                     | Timing                 | Effort   |
|--------------------------------------|------------------------------------|------------------------|--|
|                                      | Fruit-Dove, Spotted Emerald Dove). |                        | Area over each of the survey periods resulting in a reasonably extensive species list (Annex 4). |
| Echolocation detectors               | Microchiropteran bats              | 1 October – 23 October | 2 x detectors set for 22 nights  |
| Incidental and indirect observations | All species                        | April - December       | Over 14 days of survey   |

### 2.3.3 Fauna habitats

Habitat condition within the Project Area has been influenced by previous clearing of native vegetation for agriculture across the Project Area, as evidenced by the generally poor quality of vegetation within the Project Area (see Plate 1 and Plate 2). Better condition vegetation and fauna habitat is present within the southern part of the Project Area (Figure 3).

The Project Area and the adjoining vegetation on Cleary Bros' property provides foraging habitat for numerous mobile species including within areas of rainforest which may be a locally important food source for some species. Such resources are concentrated within the better-quality vegetation zones of the Project Area (e.g. good condition rainforest) which was the focus of avoidance measures. Resident native fauna are generally those that are tolerant of disturbed areas and unconsolidated patches of vegetation. As the Project Area has varied vegetation types and structural elements a good diversity of bird species was recorded, predominantly from better quality remnants, however also within patches of regenerating vegetation and Lantana. Small mammal and frog assemblages are likely to be limited to commonly occurring species. A variety of bats were recorded foraging within better condition areas of the Project Area and these species are also expected to use other parts of the Project Area.

Eight hollows from five hollow bearing trees were recorded within the Project Area. All with hollows smaller than 20 cm in diameter. A single hollow stag was also recorded.

Aquatic habitat present within the Project Area is considered degraded. Two farm dams are present in the Project Area, providing low to poor quality habitat for aquatic or water dependent fauna species. Frequent cattle access to dams was evident and there was limited growth of aquatic macrophytes (water-plants). One of the farm dams is at the head of an ephemeral stream within the Project Area which has limited ephemeral aquatic habitat (i.e. stream bed which is typically dry).

Watercourses from the Project Area and surrounds are described in detail within the Project's Soil and Water Assessment (SEEC 2021). They flow east and south ultimately into the Rocklow Creek catchment of the Minnamurra River catchment. Sections of unnamed watercourses approximately 1.5 km to the south-east of the Project Area contain or are associated with dam and ephemeral wetland habitat formed from the former dredge ponds of the Dunmore Sand and Soil sand extraction operation west of the Princes Highway. These wetlands are not mapped under the Coastal Wetland SEPP (the larger Minnamurra River area is) or as important wetlands such as RAMSAR wetlands. Ephemeral wetland habitat may however experience visitation from avian fauna including threatened species. Potential impacts to these areas are considered minimal or negligible however and therefore these wetland habitats were not investigated further as part of field survey. No records of threatened fauna from wetland habitat west of the Princes

Highway were present in the NSW Wildlife Atlas. Further consideration of impacts to off-site aquatic habitat is provided within Section 3 of this report.

#### 2.3.4 Fauna recorded from field survey

Fauna field surveys using the methods described in Table 12 were undertaken with a focus on areas of intact vegetation most suitable for detection of individuals. Notable opportunistic sightings whilst travelling between areas within the Project Area were also recorded. A species list is provided in (Annex 4).

Species recorded or potentially present (Annex 4) included four species of threatened microbat Eastern Bentwing Bat, Little Bentwing Bat, Greater Broad-nosed Bat and Yellow-bellied Sheath-tailed Bat (all Vulnerable under the BC Act – not listed under the EPBC Act). The Grey-headed Flying-fox (vulnerable under the BC Act and EPBC Act) is also known to use the Project Area being a wide-ranging species which forages on fruit and blossom within the local area (e.g. DECCW 2011)

#### 2.3.5 Assessment of threatened species and populations

The list of predicted and candidate species generated via the BAM Calculator is in Table 13 below. A status for each species is provided which represents the basis for deciding whether a species was present or absent from the Project Area. No ecosystem credit species were omitted from the BAM Calculator despite there being very limited habitat present within the Project Area for many of the predicted species.

**Table 13: List of predicted and candidate threatened species generated by the BAM calculator for the Project**

| Common Name  | Scientific Name                        | Status          | Notes   |
|--|--|-----------------|---|
| <b>Predicted threatened species (ecosystem credit species)</b> |  |                 |   |
| Barking Owl  | <i>Ninox connivens</i>                 | Assumed present | -   |
| Dusky Woodswallow  | <i>Artamus cyanopterus cyanopterus</i> | Assumed present | -   |
| Eastern Coastal Free-tailed Bat                                | <i>Micronomus norfolkensis</i>         | Detected        | Echolocation Definite   |
| Gang-gang Cockatoo (Foraging)                                  | <i>Callocephalon fimbriatum</i>        | Assumed present | -   |
| Grey-headed Flying-fox (Foraging)                              | <i>Pteropus poliocephalus</i>          | Assumed present | EPBC Act assessment of significance completed for species: Annex 8. EPBC Act Significant Impact Criteria Assessment |
| Large Bent-winged Bat (Foraging)                               | <i>Miniopterus orianae oceanensis</i>  | Assumed present | A possible record from the detector (Annex 4), see breeding habitat notes below.                                    |
| Little Bent-winged Bat (Foraging)                              | <i>Miniopterus australis</i>           | Assumed present | A probable record from the detector (Annex 4), see breeding habitat notes below.                                    |
| Little Eagle (Foraging)  | <i>Hieraetus morphnoides</i>           | Assumed present | -   |
| Little Lorikeet  | <i>Glossopsitta pusilla</i>            | Assumed present | -   |
| Masked Owl (Foraging)  | <i>Tyto novaehollandiae</i>            | Assumed present | -   |



| Common Name                                       | Scientific Name                  | Status   | Notes   |
|---|----------------------------------|--|---|
| Powerful Owl (Foraging)                           | <i>Ninox strenua</i>             | Assumed present                                | -   |
| Spotted-tailed Quoll                              | <i>Dasyurus maculatus</i>        | Assumed present                                | -   |
| Superb Fruit-Dove                                 | <i>Ptilinopus superbus</i>       | Assumed present                                | -   |
| Varied Sittella                                   | <i>Daphoenositta chrysoptera</i> | Assumed present                                | -   |
| White-throated Needle-tail                        | <i>Hirundapus caudacutus</i>     | Assumed present                                | -   |
| Yellow-bellied Sheath-tail-bat                    | <i>Saccolaimus flaviventris</i>  | Assumed present                                | A probable record from the detector (Annex 4).  |
| <b>Candidate species (species credit species)</b> |                                  |  |   |
| Gang-gang Cockatoo (Breeding)                     | <i>Callocephalon fimbriatum</i>  | No (no suitable breeding habitat)              | No suitable breeding habitat present. Hollows not sufficient size/type.   |
| Eastern Pygmy-possum                              | <i>Cercartetus nanus</i>         | No (no suitable habitat present in Study Area) | The Project Area does not contain any large stands of Banksia, Eucalyptus or Callistemon or other preferred foraging habitat. Twenty records of Eastern Pygmy-possum occur within the Illawarra IBRA subregion (DPIE 2020c) (1992 - 2019), the closest of which is approximately 15km south-east of the Project Area.                         |
| Large-eared Pied Bat                              | <i>Chalinolobus dwyeri</i>       | No (surveyed)                                  | Echolocation detectors did not detect species.  |
| Little Eagle (Breeding)                           | <i>Hieraaetus morphnoides</i>    | No (surveyed)                                  | No nest trees within Project Area - live (occasionally dead) large old trees within vegetation. The Project Area contains one stag in the Project Area (Annex 5), although it is not a large tree, it is approximately 4m tall and has a broken limb at the apex (Plate 6) and underneath a large fig tree, this is not suitable for nesting. |
| Green and Golden Bell Frog                        | <i>Litoria aurea</i>             | No (no habitat present in Study Area)          | The habitat present within the Project Area is considered substantially degraded such that this species is unlikely to utilise the Project Area. There are no creek or dams of the nature that the species prefers within or adjacent to the Project Area. The species would not occur at the Project Area.                                   |

| Common Name                       | Scientific Name                       | Status   | Notes   |
|-----------------------------------|---------------------------------------|--|---|
| Little Bent-winged Bat (Breeding) | <i>Miniopterus australis</i>          | No (no breeding habitat present in Project Area) | Although there was a possible record from the detector (Annex 4), there is no suitable breeding habitat within the Project Area for this species. There are no caves, tunnel, mine, culvert or other breeding structures. |
| Large Bent-winged Bat (Breeding)  | <i>Miniopterus orianae oceanensis</i> | No (no breeding habitat present in Project Area) | Although there was a probable record on the detector (Annex 4), there is no suitable breeding habitat within the Project Area for this species. There are no caves, tunnel, mine, culvert or other breeding structures.   |
| Southern Myotis                   | <i>Myotis macropus</i>                | No (surveyed)                                    | Very limited habitat present in Project Area. Echolocation detectors did not detect species.  |
| Barking Owl (Breeding)            | <i>Ninox connivens</i>                | No (no breeding habitat present in Project Area) | No living or dead trees with hollows greater than 20cm diameter.  |
| Powerful Owl (Breeding)           | <i>Ninox strenua</i>                  | No (no breeding habitat present in Project Area) | No living or dead trees with hollow greater than 20cm diameter.   |
| Brush-tailed Rock-wallaby         | <i>Petrogale penicillata</i>          | No (vagrant/degraded habitat)                    | Habitat is not connected to any remnant populations -there are substantial areas of degraded habitat between the Project Area and such areas.   |
| Grey-headed Flying-fox (Breeding) | <i>Pteropus poliocephalus</i>         | No (no breeding habitat present in Project Area) | No known breeding camps adjacent to Project Area.   |
| Masked Owl (Breeding)             | <i>Tyto novaehollandiae</i>           | No (no breeding habitat present in Project Area) | No living or dead trees with hollow greater than 20cm diameter.   |

### **Species polygons**

There were no candidate (species credit) species within the Project Area, therefore no species polygons are required.

### **2.3.6 Connectivity**

Patches of intact vegetation within and adjacent to the Project Area provide the main connectivity pathways to and around the Project Area (Figure 2). Vegetation within the Project Area is partly connected to larger patches of vegetation to the south-west via a corridor of vegetation at the southern portion of the Project Area. Connectivity south of the Project Area would remain, however the width of the vegetated corridor would be reduced (from approximately 130m to 65m at its narrowest point).

### 3. Impact Assessment

The Impact Assessment forms Stage 2 of the BDAR as detailed in Section 7 of the BAM (DPIE 2020a).

#### 3.1 Potential impacts of the Project Area development footprint

An assessment of the potential impacts of the proposed works on biodiversity is provided in Table 3. Impacts are categorised as direct or indirect as described in DPIE (2020a), which states:

*“Direct impacts: impacts on biodiversity values and threatened species habitat that relate to clearing native vegetation and impacts on biodiversity values prescribed by the BC Regulation. This includes impacts from activities related to the construction or operational phase of the proposal.*

*Indirect impacts: impacts that occur when the proposal affects native vegetation and threatened species habitat beyond the development footprint or within retained areas (e.g. transporting weeds or pathogens, dumping rubbish). This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts.”*

A likelihood rating of Known, High, Moderate, Low or None has been assigned to each of the potential impacts listed in Table 6.

**Table 14: Assessment of direct and indirect impacts as a result of the Project**

| Impact within the Project Area development footprint | Likelihood of impact as a result of the Project   |
|--|---|
| <b>Direct impacts</b>                                |   |
| Removal or modification of native vegetation         | <p><b>Known:</b> approximately 7.6 hectares of native vegetation, including areas of two EECs (Illawarra Subtropical Rainforest and Melaleuca armillaris Shrubland) would be removed as part of the Project. See Section 3.2 for avoidance measures and Annexure 8 and 9.</p> <p>The total extent of Illawarra Subtropical Rainforest (PCT 1300) is estimated to be approximately 6,357 ha, therefore the extent would be reduced by approximately 0.07% after removal of 4.69 hectares.</p> <p>The total extent of MAS (PCT 720) is estimated to be 250 ha, therefore the extent would be reduced by approximately 1.2% after removal of 2.92 ha.</p>  |
| Loss of individuals of a threatened species          | <p><b>Known:</b> An area of 3.01 hectares of <i>Z. granulata</i> habitat will be removed by the Project with an area of approximately 0.58 hectares to be retained within areas zoned for extraction. The Project amounts to the clearing of 84% and retention of 16% of the habitat within the Study Area.</p> <p>The area to be removed supports an estimated 4,521 plants comprising 2,170 mature plants and 2,351 immature plants as described in Section 2.2.7. A large number of immature plants occur at the site due to the species response to previous disturbance.</p> <p>Additional information and assessment under the EPBC Act is provided for <i>Z. granulata</i> in Annex 8. The project is considered to have a significant impact on the species.</p> <p>One known individual of <i>Cynanchum elegans</i> is likely to be removed as a result of the Project which occurs within approximately 0.01 ha of the site (10 x 10m).</p> |

| Impact within the Project Area development footprint  | Likelihood of impact as a result of the Project  |
|---|--|
|   | An additional allowance has been made for impacts to habitat of the species with total impacts assumed to be 0.15 ha for the purpose of assessment and offsetting. See Section 2.2.7 and Annex 8 for details.  |
| Removal or modification of threatened species habitat other than native vegetation (micro-habitat features) | <b>Low/Moderate:</b> the area to be impacted contains limited tree hollows or other important habitat features which are recognised important habitat for threatened species. The Project Area does however provide foraging habitat for a range of threatened fauna.  |
| Death through trampling or vehicle strike   | <b>Low:</b> clearing is the main impact from the Project, there would be limited increased risk from trampling or vehicle strike.  |
| Death through poisoning   | <b>Low:</b> no poisons are proposed to be used as part of the Project other than as required to control exotic species to meet obligations under the Biosecurity Act 2015.   |
| Fragmentation   | <b>Moderate:</b> Vegetation within the Project Area is already fragmented. Clearing proposed would increase fragmentation impacts, however the majority of impacts would impact lesser quality remnant vegetation.   |
| <b>Indirect impacts</b>   |  |
| Predation by domestic and/or feral animals  | <b>Low:</b> the Project is not likely to increase the presence of domestic or feral animals in the local area as the Project is within a semi-rural area with nearby agricultural farms.   |
| Loss of shade/shelter   | <b>Known:</b> the removal of 7.6 ha of native vegetation in the Project Area would result in a loss of shade and shelter for local fauna. This impact is considered low considering there is similar habitat in the immediate vicinity that would not be impacted by the Project.  |
| Loss of individuals through starvation  | <b>Low:</b> the habitat to be removed in the Project Area is considered unlikely to cause loss of individuals through starvation.  |
| Loss of individuals through exposure  | <b>Low:</b> habitat to be removed in the Project Area occurs primarily as stands of previously disturbed native vegetation. Areas of habitat nearby would not be impacted by the Project. Therefore the Project is considered unlikely to cause a loss of individuals through exposure.  |
| Edge effects (noise, light, traffic)  | <b>Moderate:</b> the Project is unlikely to increase traffic although will increase light and noise levels within the Project Area as the extraction area expands. Clearing of vegetation would increase light exposure for adjacent remnant vegetation which may lead to higher weed density. This would be monitored and managed via weed control.   |
| Deleterious hydrological changes  | <b>Low:</b> the Project is likely to cause some alteration to existing flow regimes of 1 <sup>st</sup> order ephemeral watercourses within and adjacent to the Project Area. The Project has avoided the first order watercourse to the north east of the Project Area. Hydrological impacts from the Project are considered within SEEC (2021) which states: <i>The catchments draining to these watercourses will decrease slightly as they will drain internally towards the west and not to the existing watercourses to the east. This has the potential to decrease flows in these downstream catchments, however this will be offset by the discharge of runoff captured within the quarry sump(s) following the settlement of any fines, resulting in minimal change in overall flows.</i> |

| Impact within the Project Area development footprint                            | Likelihood of impact as a result of the Project  |
|---|--|
| Aquatic habitat impacts   | <p><b>Low:</b> The Project has the potential to indirectly impact aquatic habitats outside of the Project area however such impacts are considered minimal or negligible based on SEEC 2021: <i>The Project has the potential to decrease peak flows in downstream catchments. However this would be offset by the discharge of runoff captured within the quarry sump(s) following the settlement of fine sediment, resulting in a reduced potential impact in overall flow volumes. This change would reduce peak flow volumes while extending the duration of flows following storm events.</i></p> <p>The most notable or sensitive habitats that are potentially impacted by the Project are wetland and river floodplain habitats approximately 1.5 km to the south-east of the Project Area including dam and ephemeral wetland habitat formed from the former dredge ponds of the Dunmore Sand and Soil sand extraction operation west of the Princes Highway which occur in an agricultural setting. Given the modelled decreases in peak flows for watercourses around ephemeral wetland habitat west of the Princes Highway (approximately 4% to 18%), discharge from the quarry sump to compensate for some of the loss in peak flows and predictions of limited water quality impacts from the Project, the impacts to sensitive downstream areas are expected to be minor. Potential water quality impacts during the construction stage will be managed via sediment and erosion control plans.</p> |
| Weed invasion   | <p><b>Moderate:</b> Clearing of vegetation would increase light exposure for adjacent remnant vegetation which may lead to higher weed density. This would be monitored and managed via weed control.</p>  |
| Increased human activity within or directly adjacent to sensitive habitat areas | <p><b>Known:</b> the Project involves the extended area of hard rock extraction and therefore will increase human activity. There are recommendations in place to reduce the indirect impacts outside the Project Area.</p>  |

### 3.2 Avoid and minimise impacts

In accordance with the BAM, proponents of a project must demonstrate the measures employed to avoid, mitigate and offset impacts to biodiversity values. This section outlines the avoidance, management and mitigation measures that Cleary Bros have incorporated into the Project design or will employ during construction, operation or completion of the Project to reduce impacts on biodiversity values.

#### 3.2.1 Avoidance measures (pre-construction)

Cleary Bros has aimed to avoid and minimise environmental impacts from their Project during the design process. A preliminary ecological assessment was conducted which included consideration of constraints such as threatened vegetation communities, threatened species habitat and other identified ecological constraints. After further surveys (described herein) there has been a re-design of the Project to avoid and mitigate impacts to the better condition areas of biodiversity with particular emphasis on avoiding areas of habitat for:

- Threatened ecological communities:
  - *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion* (ISR) Endangered Ecological Community (EEC) under the BC Act and Critically Endangered (CEEC) EPBC Act
  - *Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion* Endangered Ecological Community (EEC) under the BC Act.

- Habitat for threatened flora species:
  - *Zieria granulata*, Illawarra Zieria Endangered under the BC Act and Endangered under the EPBC Act.
  - *Cynanchum elegans*, White-flowered Wax Plant Endangered under the BC Act and Endangered under the EPBC Act.

Efforts to avoid and minimise impacts through siting and design of the Project are detailed below.

### **Location**

The Project Area is primarily located within the area zoned for extraction under the Shellharbour Council LEP 2013. At the time when the LEP was formulated, extraction areas were informed by a review of hard rock resources within NSW which took into account biodiversity values within the locality. Since that time, a considerable amount of regrowth has occurred within the area now defined as the Project Area. Avoidance measures regarding the positioning of the Project footprint were limited by the position of the suitable hard rock resource and a requirement for close proximity to existing processing infrastructure which avoids impacts from the establishment of new infrastructure.

### **Design**

The Project design was developed and amended taking into account biodiversity surveys and consultation with the NSW BCD. Avoidance areas totalling 2.01 hectares within land zoned for extraction were incorporated into the Project design (Figure 3). The avoidance areas include higher condition threatened ecological communities (PCT1300 moderate condition) present within the southern and north-eastern parts of the Project Area and areas supporting better condition habitat of the threatened plants *Zieria granulata* and *Cynanchum elegans*.

In order, to compensate for these avoidance areas, an additional Project Area largely without native vegetation was incorporated into the Project. This area is highly degraded cleared exotic pasture.

### **3.2.2 Mitigation measures (construction and post construction)**

The following management and mitigation measures will be further developed and implemented during the construction and operational phases and documented through a Biodiversity Management Plan (BMP):

- Establishment of robust fencing around areas of native vegetation adjacent to the Project Area, with fencing maintained throughout the life of the Project - the Project Area boundary is to be clearly defined with well-marked posts.
- Stockpiling of topsoil for use in any rehabilitation areas.
- Using adaptive dust management and monitoring programs to control air quality in accordance with Cleary Bros current protocols.
- Training staff and conducting Project briefings to communicate environmental features and threatened flora (e.g. *Zieria granulata*) to be protected and measures to be implemented.
- Formulation and implementation of a Vegetation Management Plan covering areas within a 50 m radius of the Project Area boundary. The objective of the VMP would be to monitor adjacent vegetation to detect and minimise adverse impacts from adjacent clearing such that declines in condition can be compensated for by management actions that maintain or improve vegetation condition. The VMP would be employed for the life of the Project. This will limit the potential for indirect impacts to remnant vegetation.

- Establishment and regular maintenance of erosion and sediment controls during construction and until excavated or disturbed areas are vegetated.
- Pre-clearing inspections of hollow-bearing trees to be removed to ensure the absence of roosting/breeding threatened species. Any native vertebrate fauna present within hollow-bearing trees will be managed to minimise the risk of mortality or injury. Tree clearing will be undertaken in accordance with best practice principles.
- Clearing of hollow-bearing trees should not be undertaken during the breeding season for the majority of hollow-dwelling fauna (spring).
- Management and removal of all waste from the Project Area.

### 3.3 Potential serious and irreversible impacts (SAII)

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

The BC Act and the BC Regulation provide a framework to guide the consent authority in making this determination. The framework consists of a series of principles defined in the BC Regulation and supporting guidance, provided for under section 6.5 of the BC Act, to interpret these principles (DPIE 2020f). Criteria to interpret the principles is included in Table 1 of *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2020f) and these are addressed below.

There are two TECs which have the potential to experience serious and irreversible impacts (SAII) as a result of the Project:

- Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (EEC): listed under Principle 2 – species or ecological communities with a very small population size.
- *Melaleuca armillaris tall shrubland in the Sydney Basin Bioregion* (EEC): listed under the following principles: *Principle 1 – species or ecological community currently in a rapid rate of decline; Principle 2 – species or ecological communities with a very small population size; Principle 3: Impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.*

SAII considerations for these TECs has been completed in Annex 9 with supporting information regarding context of impacts demonstrated in Figure 9 and Figure 10.

## 4. Quantifying Offset Requirements

The BAM identifies the BAM-C as the appropriate tool for quantifying the offsets required in both ecosystem credit and species credit terms (see Table 4). A calculation of the nature and extent of biodiversity credits required due to ecological impacts associated with the Project has been undertaken using the BAM-C.

### 4.1.1 Summary of ecosystem credits required

The results of the BAM-C ecosystem offset credit requirements, including current, future and change in vegetation integrity scores are shown below in Table 15.

Impacts to native vegetation communities within the Project Area generate a requirement for 74 PCT1300 ecosystem credits and 27 PCT720 ecosystem credits. These ecosystem credits also cover the credit requirement for ecosystem credit species. The full BAM-C biodiversity credit report is provided in Annex 7. Ecosystem and species credits required (BAM-C Credit report).

**Table 15: Ecosystem credit requirement**

| Vegetation zone    | PCT abbreviated name                                      | Area (ha) | Impact Area (ha) | Vegetation Integrity Loss | Biodiversity risk weighting | Required credits | Total credits |
|--------------------|---|-----------|------------------|---------------------------|-----------------------------|------------------|---------------|
| 1300_High          | Whalebone Tree - Native Quince dry subtropical rainforest | 0.01      | 4.69             | 63.6                      | 2                           | 1                | 74            |
| 1300_Low           |   | 3.14      |                  | 44.9                      | 2                           | 70               |               |
| 1300_Poor          |   | 0.30      |                  | 21.2                      | 2                           | 3                |               |
| 1300_Very Degraded |   | 1.24      |                  | 9.1                       | 2                           | 0                |               |
| 720_High           | Melaleuca armillaris Tall Shrubland                       | 0.38      | 2.92             | 23.3                      | 2.5                         | 6                | 27            |
| 720_Mod-High       |   | 0.58      |                  | 24.5                      | 2.5                         | 9                |               |
| 720_Moderate       |   | 0.47      |                  | 15.9                      | 2.5                         | 5                |               |
| 720_Low_Lant       |   | 0.29      |                  | 10.2                      | 2.5                         | 0                |               |
| 720_Low_NoCanop    |   | 0.43      |                  | 25.4                      | 2.5                         | 7                |               |
| 720_Poor           |   | 0.77      |                  | 10.3                      | 2.5                         | 0                |               |
| <b>Total</b>       | -   |           | <b>7.61</b>      | -                         | -                           | -                | <b>101</b>    |

### 4.1.2 Summary of species credits required

The results of the BAM-C species offset credit requirements are shown in Table 16. Threatened species identified or assumed to be present within the Project Area and likely to be impacted by the Project generate a requirement for two species credit species. The full BAM-C biodiversity credit report is provided in Annex 7. Ecosystem and species credits required (BAM-C Credit report).

**Table 16. Species credits required**

| Threatened species                                  | Area or Count | Habitat impacted (ha) or number mature individuals | Required credits |
|---|---------------|--|------------------|
| <i>Cynanchum elegans</i> / White-flowered Wax Plant | Area          | 0.15   | 4                |
| <i>Zieria granulata</i> / Illawarra Zieria          | Count         | 2172   | 4344             |



#### 4.1.3 Approach to offset requirements

Cleary Bros intends to offset impacts from the Project in accordance with the credit requirements outlined in Table 15 and Table 16 above via available options under the BOS including:

- Retiring credits based on the like-for-like rules via either;
  - establishment of a Stewardship Site
  - or facilitating the establishment of a Stewardship Site, or
- making a payment to the Biodiversity Conservation Fund calculated using the offset payments calculator.

No application to vary the credit requirement or depart from a like-for-like credit obligation using the ancillary rules is presently anticipated.

#### 4.1.4 Staged credit requirement application

Impacts from the Project on threatened biodiversity requiring offsets will occur over an approximate 30-year period. Therefore, it is appropriate to seek a staged offset requirement for the Project commensurate with the timing of impacts. Three broad project impact stages have been identified, around which it is considered appropriate to structure the offset requirements. The proposed impact and offsetting stages are identified within Table 17 and Figure 11. All offset credit requirements would be satisfied prior to disturbing any vegetation within the relevant stage, under the staged offset proposal.

**Table 17: Proposed impact and offset stages for the Project**

| Proposed stage and approximate timing (years from start) | Vegetation zone impacted   | Area proposed for clearing per stage | Proportion of zone area impacted per stage | Proposed staged offset credit requirement* <sup>1</sup> | Proportion of offset requirement for zone | Sum of PCT credits for stage | <i>Zieria granulata</i> proposed staged offset credit requirement | <i>Cynanchum elegans</i> proposed staged offset credit requirement |
|--|--|--------------------------------------|--|---|---|------------------------------|---|--|
| <b>One (0-5 years)</b>                                   | 1300 - Illawarra Subtropical Rainforest - Poor                           | 0.22                                 | 76%  | 3   | 100%                                      | 3                            | 0   | 0  |
| <b>Two (5-15 years)</b>                                  | 1300 - Illawarra Subtropical Rainforest - High                           | 0.01                                 | 100%                                       | 1   | 100%                                      | 3                            | 4,344   | 4  |
|  | 1300 - Illawarra Subtropical Rainforest - Low                            | 0.05                                 | 2%   | 2   | 3%  |                              |   |  |
|  | 1300 - Illawarra Subtropical Rainforest - Very degraded                  | 0.10                                 | 8%   | 0   | N/A                                       |                              |   |  |
|  | 720 - Melaleuca armillaris Shrubland - High                              | 0.38                                 | 100%                                       | 6   | 100%                                      | 27                           |   |  |
|  | 720 - Melaleuca armillaris Shrubland - Low (dense lantana)               | 0.29                                 | 100%                                       | 0   | 100%                                      |                              |   |  |
|  | 720 - Melaleuca armillaris Shrubland - Low (regen midstorey - no canopy) | 0.43                                 | 100%                                       | 7   | 100%                                      |                              |   |  |
|  | 720 - Melaleuca armillaris Shrubland - Moderate                          | 0.47                                 | 100%                                       | 5   | 100%                                      |                              |   |  |
|  | 720 - Melaleuca armillaris Shrubland – Moderate-high                     | 0.58                                 | 100%                                       | 9   | 100%                                      |                              |   |  |
| 720 - Melaleuca armillaris Shrubland - Poor              | 0.77   | 100%                                 | 0  | 100%  |   |                              |   |  |
| <b>Three (15-30 years)</b>                               | 1300 - Illawarra Subtropical Rainforest - Low                            | 3.09                                 | 98%  | 68  | 97%                                       | 68                           | 0   | 0  |
|  | 1300 - Illawarra Subtropical Rainforest - Poor                           | 0.07                                 | 24%  | 0   | N/A                                       |                              |   |  |
|  | 1300 - Illawarra Subtropical Rainforest - Very degraded                  | 1.14                                 | 92%  | 0   | N/A                                       |                              |   |  |
| <b>Total</b>   |  | <b>7.61</b>                          | -  | <b>101</b>  | -   | <b>101</b>                   | <b>4,344</b>  | <b>4</b>   |

<sup>1</sup> Where a credit requirement was split over two separate stages the credit requirement was rounded up for the earlier stage and removed from the later stage.

## 5. Summary

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Impacts of the Project on ecological values are summarised as follows:

- Direct removal of 7.61 ha and potential indirect impacts to adjacent native vegetation containing two threatened PCTs
- Removal of fauna habitat (native vegetation and drainage lines)
- Removal of flora habitat associated with native vegetation
- Removal of up to five hollow-bearing trees and one hollow stag.

Cleary Bros have aimed to avoid and minimise environmental impacts from the Project where possible through detailed design of the Project and implementation of actions aimed at mitigating and managing potential indirect impacts of the Project as detailed in Section 3.

A Referral for the Project has been lodged with the Commonwealth Department of Agriculture Water and Energy (DAWE) due to potential impacts on MNES. Assessments of significance under the EPBC Act were conducted for threatened flora (*Cynanchum elegans* and *Zieria granulata*), which concluded a significant impact as a result of the Project is likely for *Zieria granulata* due to the number of individuals being removed. An assessment of significance under the EPBC Act was completed for the threatened ecological community Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (ISR) which concluded a significant impact as a result of the Project was likely.

Offset requirements for impacts from the Project have been calculated in accordance with the requirements of the NSW BAM. It is expected that the offset requirement would also meet any Commonwealth offset requirement due to the existing bilateral agreement between the State and Commonwealth for environmental assessments under the BC Act.

## References

- DAWE (2008). Approved Conservation Advice for *Cynanchum elegans* (White-flowered Wax Plant), Department of Agriculture, Water and the Environment, approved by the Minister/Delegate of the Minister on: 26/3/2008, Accessed December 2020, <http://www.environment.gov.au/biodiversity/threatened/species/pubs/12533-conservation-advice.pdf>
- DAWE (2020). SPRAT Profiles (accessed November 2019), <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>, Commonwealth Department of the Environment and Energy. Provides access to threatened species profiles, recovery plans and final determinations by the Commonwealth Scientific Committee.
- DAWE (2021). National Recovery Plan for the Grey-headed Flying-fox '*Pteropus poliocephalus*', Department of Agriculture, Water and the Environment, Canberra, March. CC BY 4.0.
- DEC (2005). Department of Environment and Conservation (2005) *Zieria granulata* (Illawarra Zieria) Recovery Plan. NSW Department of Environment and Conservation, Hurstville NSW.
- DECC (2004). Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft), New South Wales Department of Environment and Conservation, Hurstville, NSW.
- DECCW (2009). Draft National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus*. Prepared by Dr Peggy Eby. Department of Environment, Climate Change and Water NSW, Sydney.
- DECCW (2011). Department Environment, Climate Change and Water Strategy for the Conservation and Management of Biodiversity in the Dunmore – Shellharbour Hills Area, Published March 2011, <https://www.environment.nsw.gov.au/resources/threatenedspecies/0172conservationstrategy.pdf>
- DoEE (2019). Department of the Environment and Energy, Conservation Advice (incorporating listing advice) for the Illawarra-Shoalhaven subtropical rainforest of the Sydney Basin Bioregion. Canberra. Available online: <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/148-conservation-advice.pdf>
- DPIE (2016). NSW Department of Planning Industry and Environment, Illawarra Plant Community Type Vegetation Map, 2016. VIS\_ID 4678, <https://datasets.seed.nsw.gov.au/dataset/illawarra-compiled-plant-community-type-map-2016-vis-id-4678>
- DPIE (2018). NSW Department of Planning Industry and Environment, Biodiversity Assessment Method (BAM) Calculator User guide. State of NSW and Department of Planning, Industry and Environment. Dated July 2018.
- DPIE (2019a). NSW Department of Planning Industry and Environment, Biodiversity Assessment Method (BAM) Operational Manual Stage 2. State of NSW and Department of Planning, Industry and Environment. Dated September 2019.
- DPIE (2019b). Bionet Vegetation Classification Database. Last updated 06/01/2021, <https://www.environment.nsw.gov.au/NSWVCA20PRapp/default.aspx>
- DPIE (2020a). NSW Department of Planning Industry and Environment, Biodiversity Assessment Method (BAM) 2020. State of NSW and Department of Planning, Industry and Environment. Dated October

2020.DPIE (2020b). NSW Department of Planning Industry and Environment, Biodiversity Assessment Methodology - NSW Biodiversity Offsets Policy for Major Projects, State of NSW and Office of Environment and Heritage.

DPIE (2020c). NSW Department of Planning Industry and Environment, BioNet Threatened Species Database. <http://www.bionet.nsw.gov.au/>

DPIE (2020d). NSW Department of Planning Industry and Environment, Office of Environment and Heritage, Approved Recovery Plan for *Zieria granulata* (Illawarra Zieria), Accessed November 2020  
<https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Recovery-plans/illawarra-zieria-zieria-granulata-recovery-plan.pdf>

DPIE (2020e). NSW Department of Planning Industry and Environment, Grey-headed Flying-fox – profile, Accessed December 2020,  
<https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10697>

DPIE (2020f). NSW Department of Planning Industry and Environment, Guidance to assist a decision-maker to determine a serious and irreversible impact, State of NSW and Office of Environment and Heritage.

DPIE (2020g). NSW Department of Planning Industry and Environment, Office of Environment and Heritage, Threatened Species profiles, Illawarra Subtropical rainforest in the Sydney Basin Bioregion – endangered ecological community listing, Final determination, accessed November 2020  
<https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10427>

DPIE (2020h). NSW Department of Planning Industry and Environment, Office of Environment and Heritage, Threatened Species profiles, Illawarra *Zieria* profile, accessed November 2020  
<https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10856>

DPIE (2020i). NSW Department of Planning Industry and Environment, Office of Environment and Heritage, Threatened Species profiles, *Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion - endangered ecological community listing, Final determination, accessed November 2020  
<https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2000-2003/melaleuca-armillaris-tall-shrubland-sydney-basin-bioregion-endangered-ecological-community-listing#:~:text=Melaleuca%20armillaris%20Tall%20Shrubland%20is,Alphitonia%20excelsa>

DPIE (2020j). NSW Department of Planning Industry and Environment, White-flowered Wax Plant – profile, Accessed December 2020,  
<https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10196>

DPIE (2020k). NSW Department of Planning Industry and Environment, Biodiversity Assessment Method (BAM) 2020 Operational Manual Stage 1. State of NSW and Department of Planning, Industry and Environment. Dated December 2020.

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

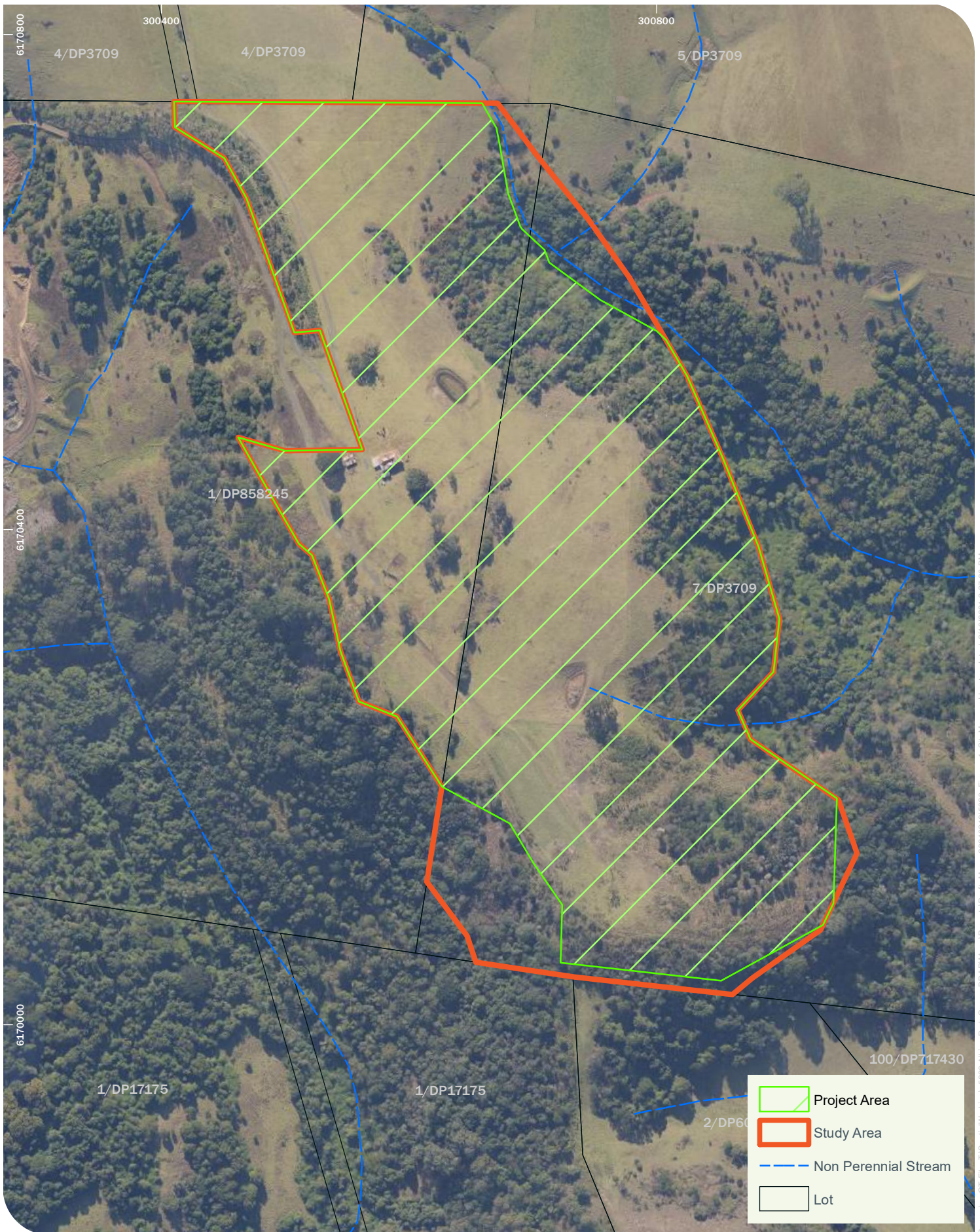
Floyd, AG (1990). Australian Rainforest in New South Wales. Surrey Beattie and Sons, Chipping Norton.





NPWS (2002). National Parks and Wildlife Services, Environmental Impact Assessment Guidelines, Accessed December 2020, <https://www.environment.nsw.gov.au/resources/nature/CelegansEia1202.pdf>

NSW Threatened Species Scientific Committee (2020). Conservation Assessment of Melaleuca armillaris Tall Shrubland. NSW Threatened Species Scientific Committee. Accessed online November 2020. <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/Determinations/Preliminaries/conservation-assessment-melaleuca-armillaris-preliminary-determination.pdf?la=en&hash=04F59EC351E9E64A3AD5588251469AAAF53DF21>

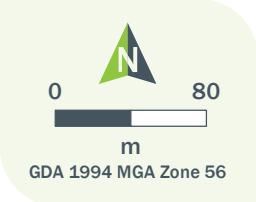
SEEC (2021). Strategic Environmental & Engineering Consulting, Soil and Water Assessment: Albion Park Quarry – Extraction Area Stage 7.

Tozer MG, Turner K, Keith DA, Tindall D, Pennay C, Simpson C, MacKenzie B, Beukers P (2010). Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11, 359-406.



|   |                      |
|---|----------------------|
|  | Project Area         |
|  | Study Area           |
|  | Non Perennial Stream |
|  | Lot                  |

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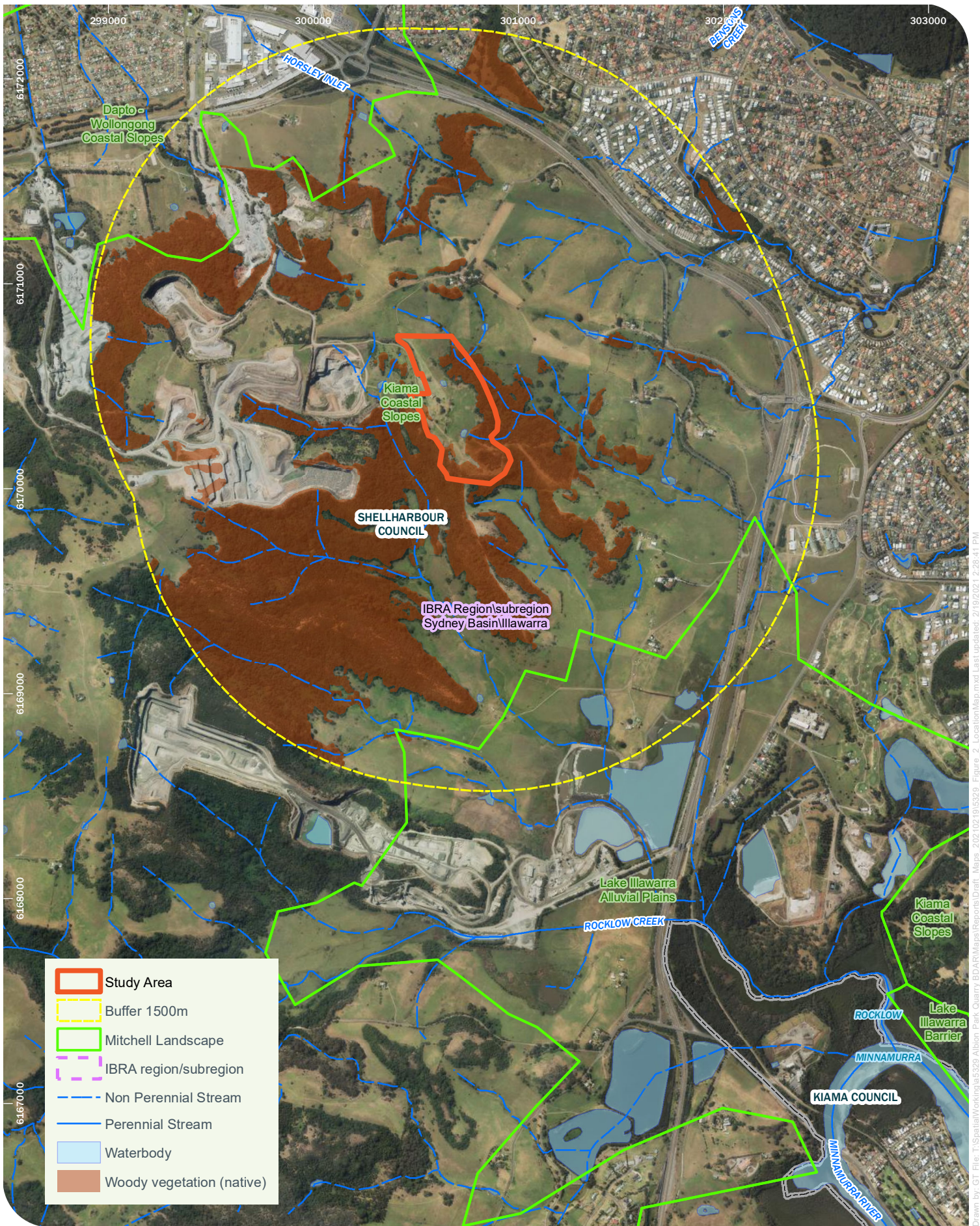


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**Site Map**  
 Albion Park Quarry - Stage 7 BDAR

**Figure 1**

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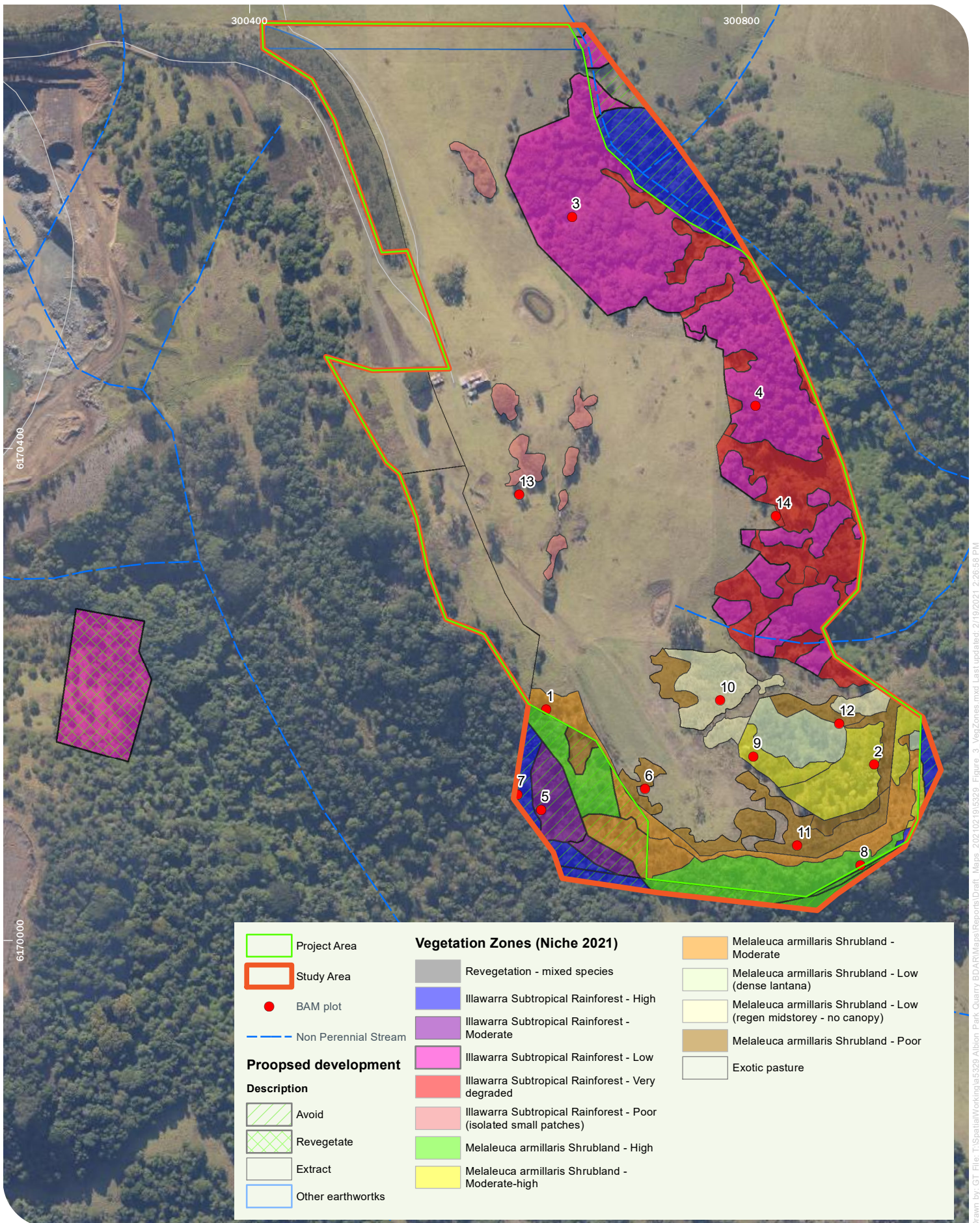
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**Location Map**  
 Albion Park Quarry – Stage 7 BDAR

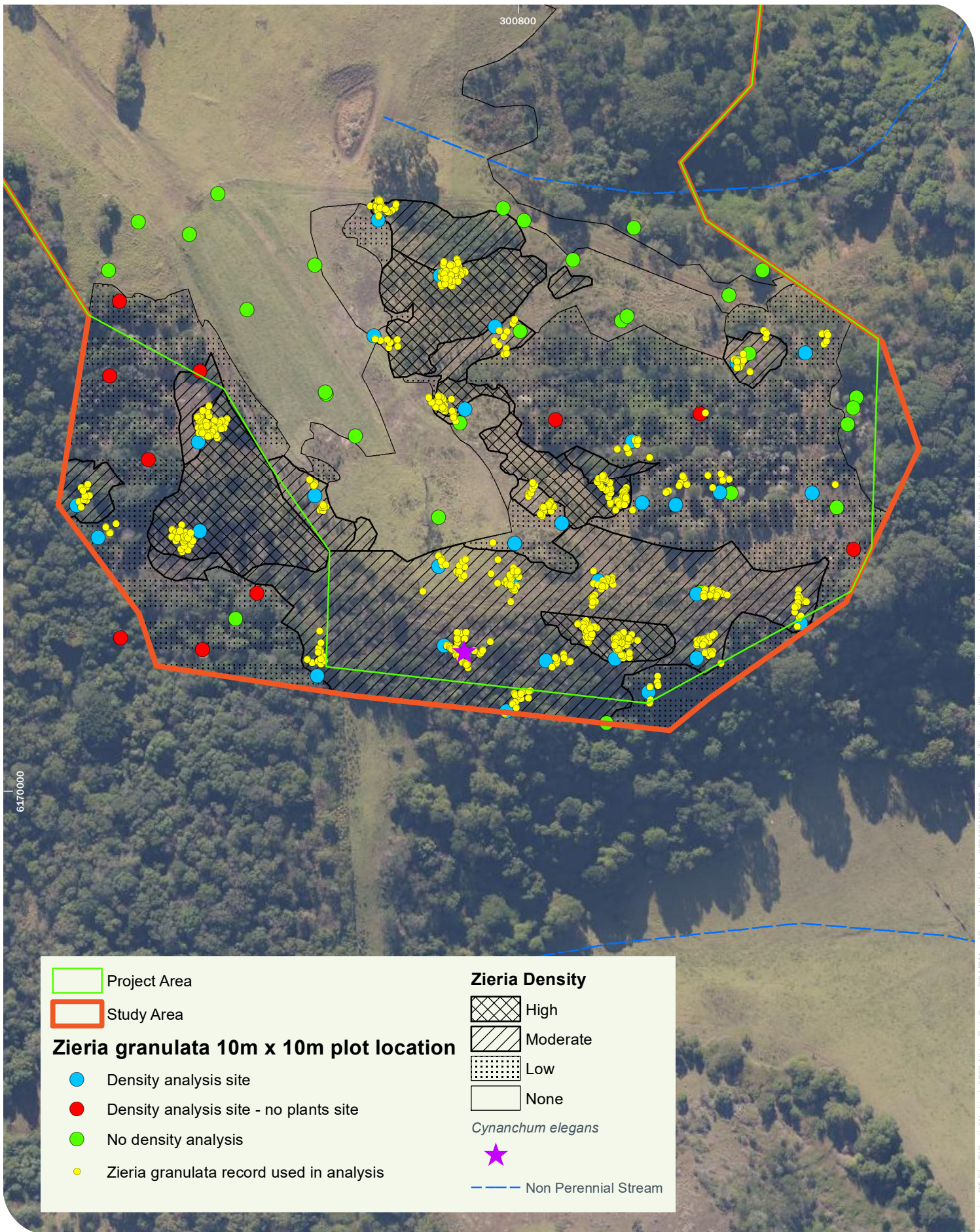
**Figure 2**

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Project Area  
 Study Area

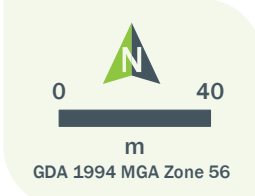
**Zieria granulata 10m x 10m plot location**

- Density analysis site
- Density analysis site - no plants site
- No density analysis
- Zieria granulata record used in analysis

**Zieria Density**

- High
- Moderate
- Low
- None

*Cynanchum elegans*  
  
 Non Perennial Stream



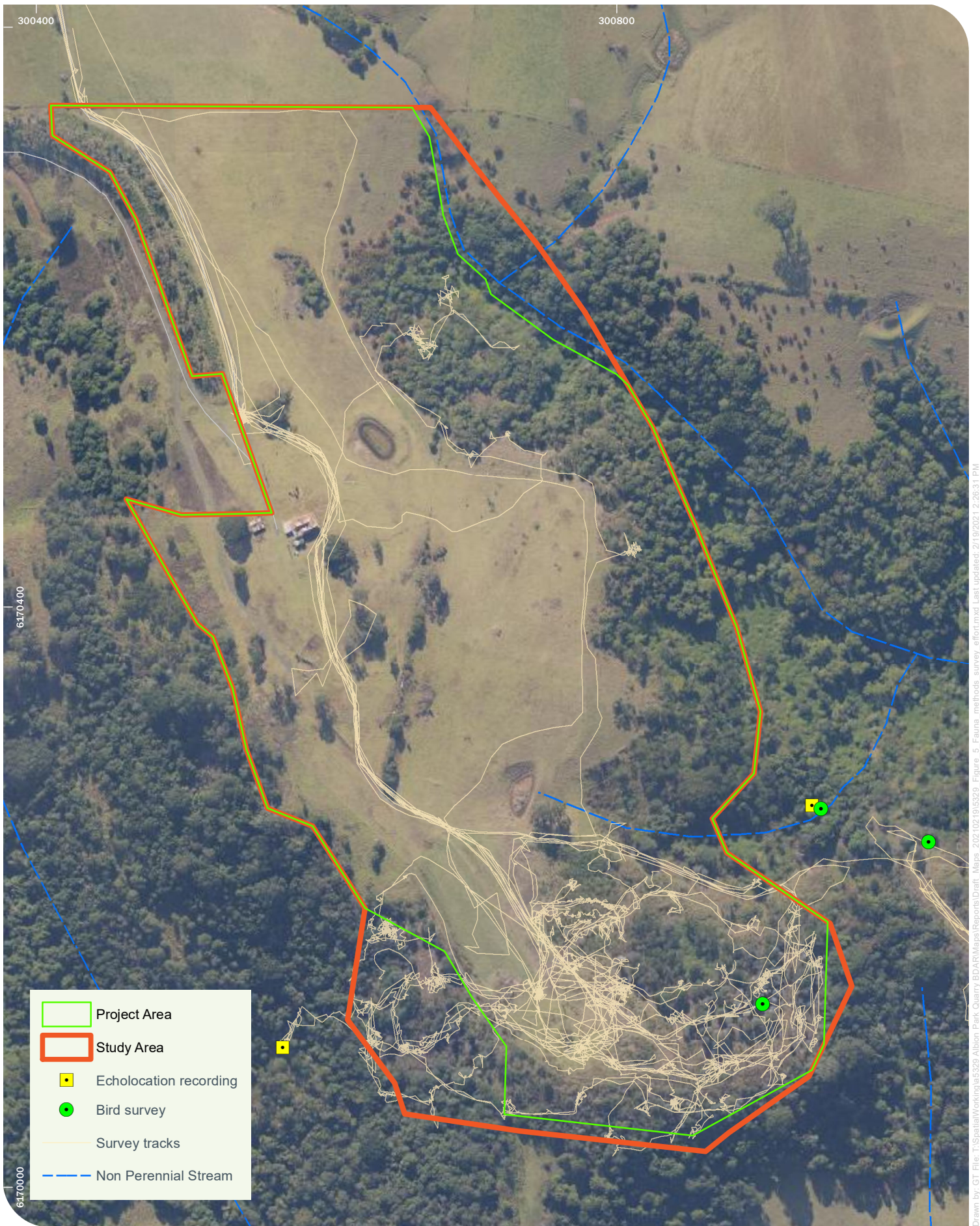
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**Threatened species recorded during survey**  
 Albion Park Quarry - Stage 7 BDAR

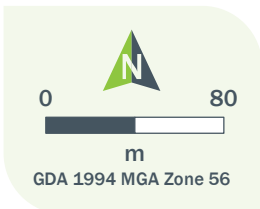
**Figure 4**

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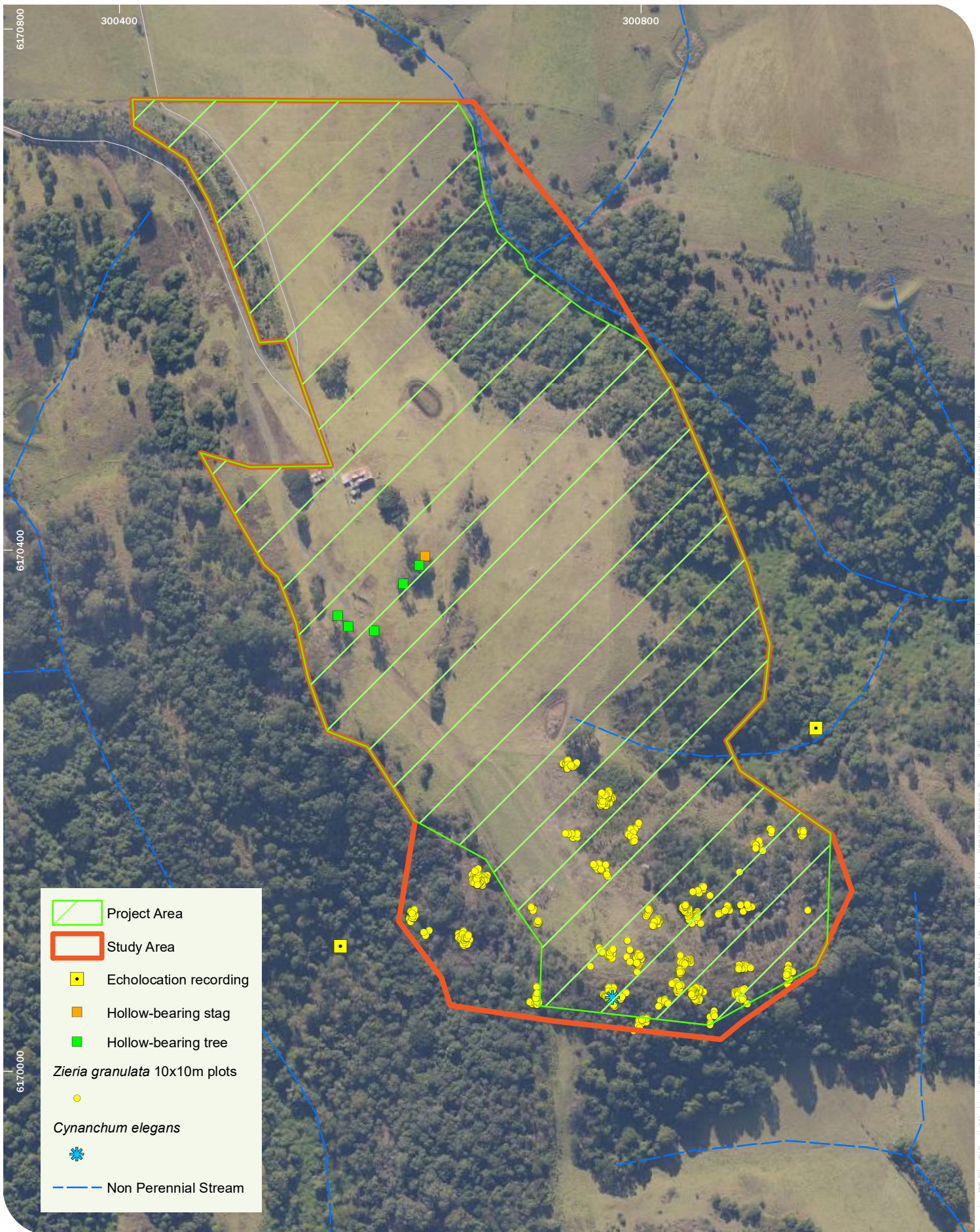


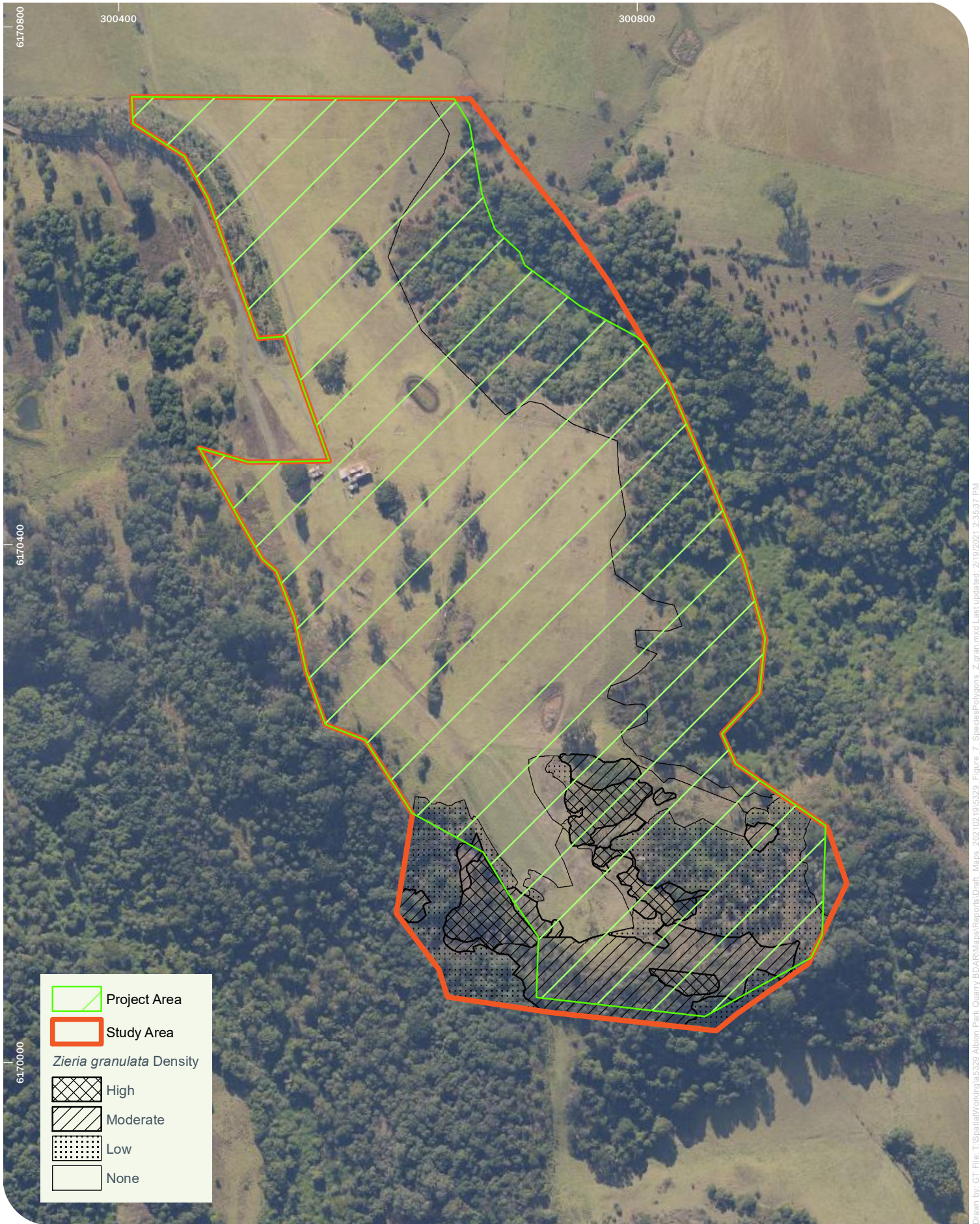
Fauna methods/survey effort  
Albion Park Quarry - Stage 7 BDAR

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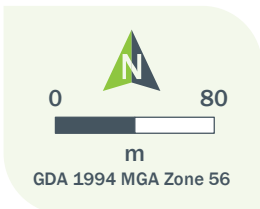
**Figure 5**

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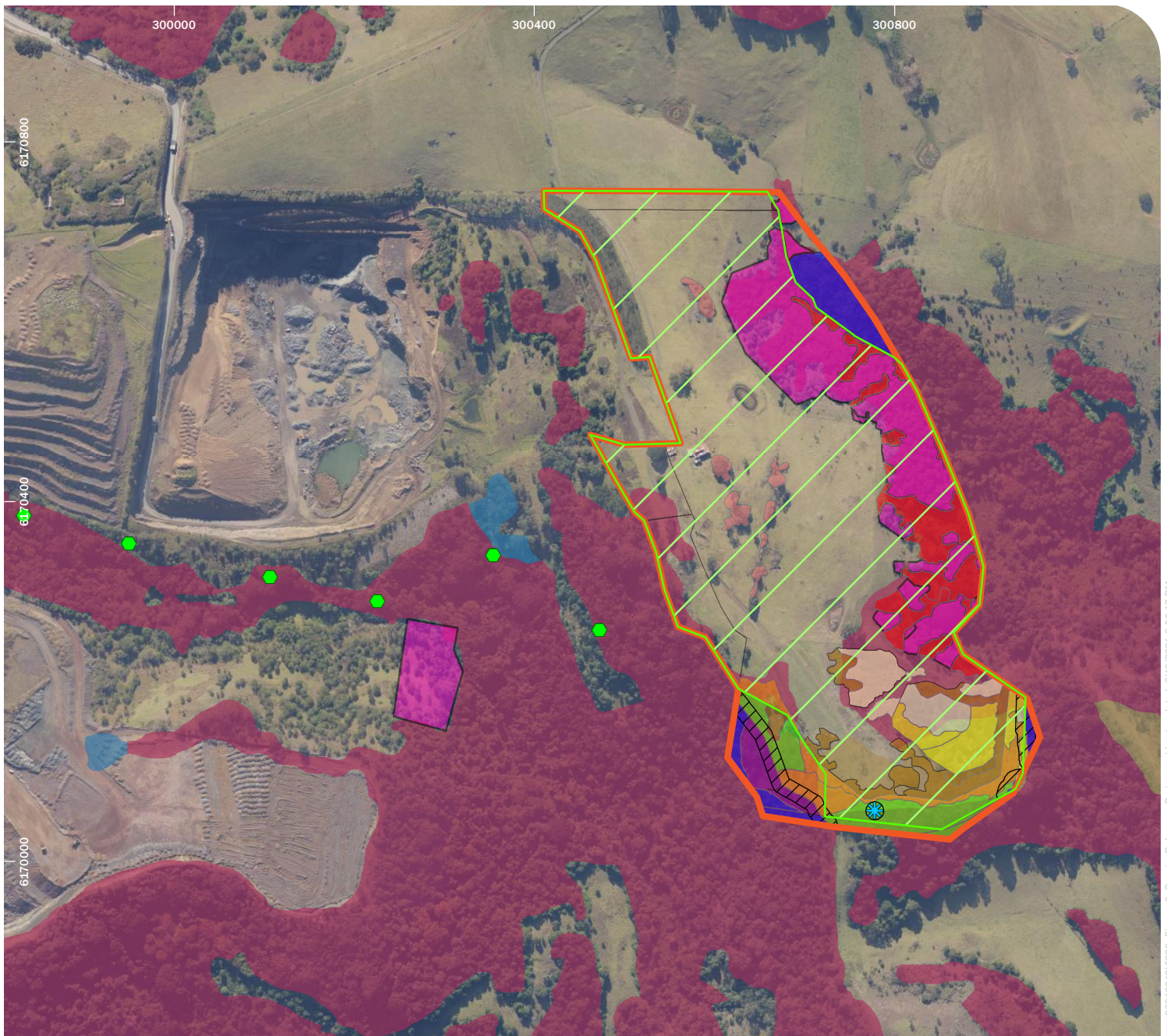


**Species polygon - *Zieria granulata***  
**Albion Park Quarry - Stage 7 BDAR**

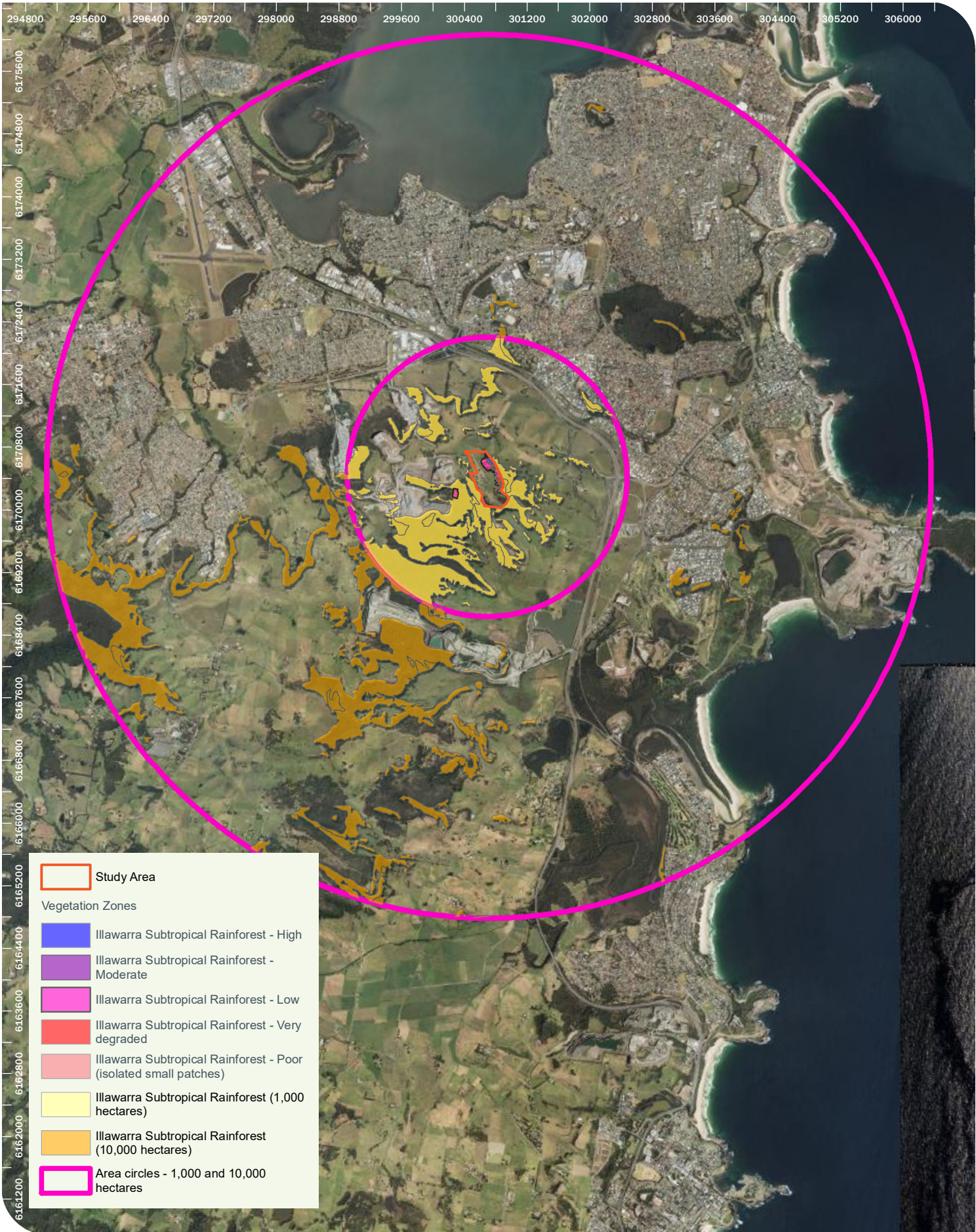
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**Figure 7**

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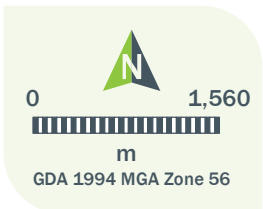
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|---|--|---|
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|---|--|---|



**Study Area**

**Vegetation Zones**

- Illawarra Subtropical Rainforest - High
- Illawarra Subtropical Rainforest - Moderate
- Illawarra Subtropical Rainforest - Low
- Illawarra Subtropical Rainforest - Very degraded
- Illawarra Subtropical Rainforest - Poor (isolated small patches)
- Illawarra Subtropical Rainforest (1,000 hectares)
- Illawarra Subtropical Rainforest (10,000 hectares)
- Area circles - 1,000 and 10,000 hectares



**Illawarra Subtropical Rainforest within the region  
Albion Park Quarry - Stage 7 BDAR**

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 Niche Proj. #: 5329  
 Client: Cleary Bros  
 Imagery: © Department of Finance, Services & Innovation 2018

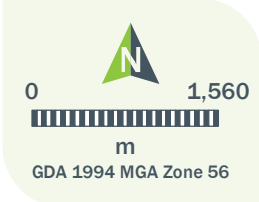
**Figure 9**

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|                         |  |
|-------------------------|--|
|                         | Study Area   |
| <b>Vegetation Zones</b> |  |
|                         | Melaleuca armillaris Shrubland - High                              |
|                         | Melaleuca armillaris Shrubland - Moderate-high                     |
|                         | Melaleuca armillaris Shrubland - Moderate                          |
|                         | Melaleuca armillaris Shrubland - Low (dense lantana)               |
|                         | Melaleuca armillaris Shrubland - Low (regen midstorey - no canopy) |
|                         | Melaleuca armillaris Shrubland - Poor                              |
|                         | Melaleuca armillaris Shrubland (1,000) ha                          |
|                         | Melaleuca armillaris Shrubland (10,000) ha                         |
|                         | Area circles - 1,000 and 10,000 hectares                           |

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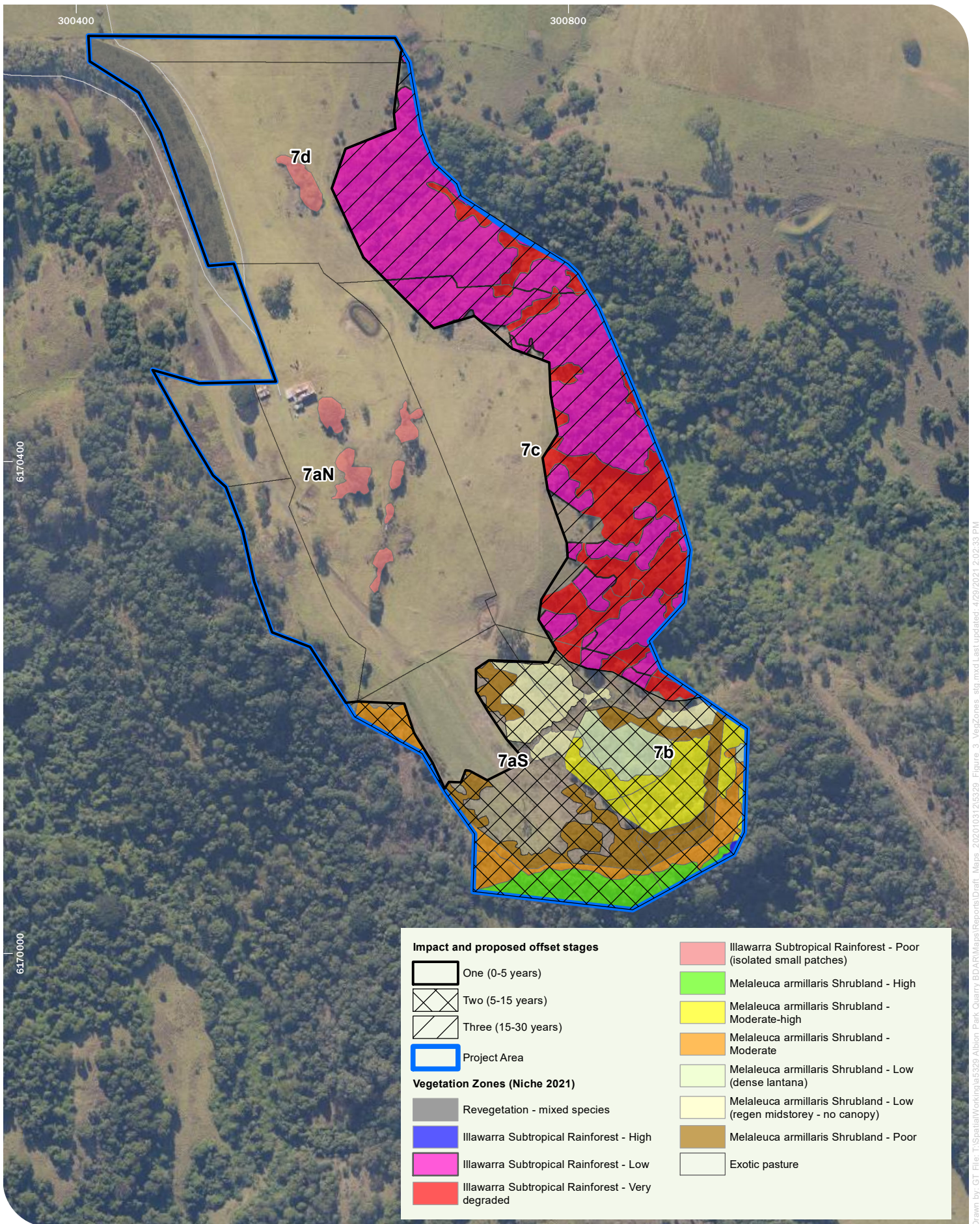


**Melaleuca armillaris Shrubland within the region**  
**Albion Park Quarry - Stage 7 BDAR**

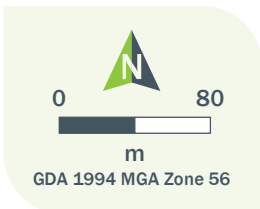
Niche PM: Simon Tweed  
 Niche Proj. #: 5329  
 Client: Cleary Bros  
 Imagery: © Department of Finance, Services & Innovation 2018

**Figure 10**





Drawn by: GT File: F:\Spatial\Working\6329 Albion Park Quarry BDAR\Maps\Reports\Draft\_Maps\_2020\103126529 Albion Park Quarry BDAR\Maps\Reports\Draft\_Maps\_2020\103126529\_VegZones\_slg.mxd Last updated: 4/29/2021 2:02:33 PM



**Proposed impact and offset staging**  
Albion Park Quarry - Stage 7 BDAR

Niche PM: Simon Tweed  
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**Figure 11**

## Annex 1. Plant community descriptions

### PCT 720 - Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion

**Extent:** The *Melaleuca armillaris* tall shrubland in the Sydney Basin Bioregion (PCT720) is restricted to outcrops of volcanic soils on dry rocky ridges in the Illawarra area within the Sydney Basin Bioregion. The community occurs on the flat to sloping areas of the Project Area including the vegetated southern parts of the Project Area and provides a transition between the cleared agriculture lands and the rainforest gullies and slopes (Figure 3).

**Condition and presence of weeds:** PCT720 is present at various condition states within the Project Area. A total of 2.92 hectares of PCT7209 would be cleared as part of the Project.

The majority of better (High) condition areas of the Project Area were identified and avoided. Remaining areas (Table 6) constitute six condition classes described as:

- Poor
- Low (regenerating midstorey – no canopy)
- Low (dense lantana)
- Moderate
- Moderate – High
- High.

The poor and low condition areas comprise the majority of the area to be cleared. The main area of *Melaleuca armillaris* tall shrubland within the Project Area has been historically disturbed with clearing having taken place historically and in more recent times.

**Conservation status:** This PCT aligns to *Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion* listed as Endangered under the BC Act and not listed under EPBC Act.

**Characteristic species used for identification of PCT (Niche 2020):** *Commelina cyanea*, *Dichelachne* spp., *Digitaria* spp., *Einadia hastata*, *Geitonoplesium cymosum*, *Glycine clandestine*, *Leucopogon juniperinus*, *Melaleuca armillaris* subsp. *armillaris*, *Microlaena stipoides*, *Oplismenus* sp., *Plectranthus parviflorus*, *Poa labillardierei* var. *labillardierei*, *Sigesbeckia orientalis* subsp. *orientalis*, *Themeda triandra* and *Zieria granulata*.

**Justification of evidence used to identify the PCT:** The stated distribution and habitat information for the PCT, as given in the DPIE VIS Community Profile Report (DPIE 2019b), is highly consistent with the geographic location, habitat and floristics of the PCT at the Project Area. The key matching characteristics are its distribution along dry rocky ridges away from the coast, usually where volcanic soils overlay latite. PCT as given in the VIS Community Profile Report generally matches the habitat and floristics of the PCT in the Project Area.



**Plate 3. PCT 720 in various conditions: Moderate condition (Plot 1)(top); Moderate-high condition (Plot 2) (middle); and Low condition with dense lantana (Plot 12) (bottom)**

**PCT 1300 – Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion -Associated with TEC Illawarra Subtropical Rainforest – (ISR)**

**Extent:** The Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (ISR) (PCT 1300) is an Illawarra rainforest community characterised by low, closed forest with prominent shrub stratum and sparse groundcover. Occurring mainly on dry slopes on fertile soils below about 300m in the Illawarra-Kiama and Milton areas. The community is the predominant community on sloping parts of the Project Area including the vegetated eastern and southern margins of the Project Area (Figure 3).

**Condition and presence of weeds:** The ISR community is highly variable in condition throughout having areas of good condition separated by significant areas of lantana infestation due to previous agricultural clearing activities (see plates below).

The majority of better condition areas of the Project Area were identified and avoided. Remaining areas in the Project Area constitute four condition classes:

- High
- Low
- Poor (isolated small patches)
- Very degraded (Table 6).

The low and very degraded areas comprise the majority of the area to be cleared. The main area of rainforest on the Project Area has been disturbed with clearing having taken place historically and some clearing of regrowth in more recent times.

**Conservation status:** Endangered under BC Act and Critically Endangered under EPBC Act.

**Characteristic species used for identification of PCT:** *Alectryon subcinereus*, *Alphitonia excelsa*, *Acacia maidenii*, *Breynia oblongifolia*, *Clerodendrum tomentosum*, *Ficus* sp., *Geitonoplesium cymosum*, *Guioa semiglauca*, *Hibiscus heterophyllus* subsp. *heterophyllus*, *Streblus brunonianus* *Pittosporum undulatum*, *Pandorea pandorana*, *Pittosporum multiflorum*, *Pittosporum revolutum*, *Smilax australis* and *Cassine australis*.

**Justification of evidence used to identify the PCT:** The stated distribution and habitat information for the PCT, as given in the DPIE VIS Community Profile Report (DPIE 2019b), is highly consistent with the geographic location, habitat and floristics of the PCT at the Project Area. The key matching characteristics are its distribution along dry fertile slopes, PCT as given in the VIS Community Profile Report generally matches the habitat and floristics of the PCT in the Project Area. A total of 4.69 hectares of ISR would be cleared as part of the Project.



**Plate 4: PCT 1300 conditions – High condition rainforest (Plot 7 retained area)(top), Low condition rainforest (Plot 3 proposed for clearing) (bottom).**

## Annex 2. Floristic plot data

**Table 18: Floristic Plot cover (%) data**

| Family       | Species                          | Common Name               | 01  | 02  | 03  | 04  | 05  | 06  | 07  | 08  | 09  | 10  | 11  | 12  | 13  | 14  |
|--------------|----------------------------------|---------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Acanthaceae  | <i>Pseuderanthemum variabile</i> | Pastel Flower             |     |     |     | 0.2 | 0.4 |     | 0.2 |     | 0.1 |     |     |     |     |     |
| Adiantaceae  | <i>Cheilanthes sieberi</i>       | Rock Fern                 | 0.2 | 0.4 |     |     |     |     |     | 0.5 |     |     | 0.1 |     | 0.1 |     |
| Adoxaceae    | <i>Sambucus australasica</i>     | Native Elderberry         |     |     |     |     |     |     | 5   |     |     |     |     |     |     |     |
| Apiaceae     | <i>Centella asiatica</i>         | Indian Pennywort          |     | 2   |     |     |     |     |     |     |     |     |     |     |     |     |
| Apiaceae     | <i>Daucus glochidiatus</i>       | Native Carrot             |     | 0.2 |     |     |     |     |     |     |     |     |     |     |     |     |
| Apocynaceae  | <i>Araujia sericifera*</i>       | Moth Vine                 |     |     | 0.2 |     |     |     |     | 0.2 | 0.1 |     |     |     |     | 0.2 |
| Apocynaceae  | <i>Cynanchum elegans</i>         | White-flowered Wax Plant  |     |     |     |     |     |     | 2   |     |     |     |     |     |     |     |
| Apocynaceae  | <i>Gomphocarpus fruticosus*</i>  | Narrow-leaved Cotton Bush |     |     |     |     |     |     |     |     |     |     |     |     | 0.1 |     |
| Apocynaceae  | <i>Gomphocarpus physocarpus*</i> | Balloon Cotton Bush       |     |     |     |     |     | 0.2 |     |     |     |     |     |     |     |     |
| Apocynaceae  | <i>Marsdenia rostrata</i>        | Milk Vine                 |     |     |     |     |     |     | 2   |     |     |     |     |     |     |     |
| Apocynaceae  | <i>Parsonia straminea</i>        | Common Silkpod            |     |     | 2   |     | 4   |     | 10  |     |     |     |     |     | 5   |     |
| Araceae      | <i>Gymnostachys anceps</i>       | Settler's Twine           |     |     |     |     | 0.2 |     | 0.2 |     |     |     |     |     |     |     |
| Araliaceae   | <i>Polyscias elegans</i>         | Celery Wood               |     |     |     |     |     |     | 25  |     |     |     |     |     |     |     |
| Aspleniaceae | <i>Asplenium flabellifolium</i>  | Necklace Fern             |     |     | 0.2 |     | 0.2 |     | 3   |     |     |     |     |     |     |     |
| Asteraceae   | <i>Bidens pilosa*</i>            | Cobbler's Pegs            | 4   | 180 | 2   | 2   | 0.4 | 6   | 1   | 0.3 | 0.2 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 |
| Asteraceae   | <i>Bidens subalternans*</i>      | Greater Beggar's Ticks    |     |     |     |     |     |     |     |     |     |     |     | 0.1 |     |     |
| Asteraceae   | <i>Cirsium vulgare*</i>          | Spear Thistle             |     |     | 0.2 |     |     |     |     |     |     | 0.1 |     |     | 0.1 |     |
| Asteraceae   | <i>Conyza bonariensis*</i>       | Flaxleaf Fleabane         |     | 0.2 |     |     |     |     |     | 0.1 | 0.1 | 0.1 |     |     | 0.1 |     |
| Asteraceae   | <i>Delairea odorata*</i>         | Cape Ivy                  | 0.2 | 0.2 | 0.2 | 2   | 0.2 |     | 4   | 5   | 0.2 |     |     |     |     | 0.5 |
| Asteraceae   | <i>Hypochaeris radicata*</i>     | Catsear                   |     | 0.2 |     |     |     |     |     |     |     | 0.1 |     |     |     |     |

| Family          | Species   | Common Name                              | 01  | 02  | 03  | 04  | 05  | 06  | 07 | 08  | 09  | 10  | 11  | 12  | 13  | 14  |
|-----------------|---|--|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|
| Asteraceae      | <i>Hypochoeris radicata</i> *                   | Catsear                                  |     |     |     |     |     |     |    |     |     |     |     |     | 0.1 |     |
| Asteraceae      | <i>Senecio linearifolius</i>                    | Fireweed Groundsel                       |     |     |     |     |     |     |    |     |     |     |     |     |     |     |
| Asteraceae      | <i>Senecio madagascariensis</i> *               | Fireweed                                 | 0.2 |     | 0.2 |     |     | 0.4 |    | 0.1 | 0.1 |     | 0.1 | 0.1 | 0.2 |     |
| Asteraceae      | <i>Sigesbeckia australiensis</i>                |  |     |     |     |     |     |     |    |     |     |     | 0.1 |     |     |     |
| Asteraceae      | <i>Sigesbeckia orientalis subsp. orientalis</i> | Indian Weed                              |     | 10  |     |     | 0.2 |     | 1  | 3   | 0.1 | 0.1 |     |     |     | 0.1 |
| Asteraceae      | <i>Sonchus asper</i> *                          | Prickly Sowthistle                       |     |     |     |     |     |     |    | 0.2 |     |     |     |     |     |     |
| Asteraceae      | <i>Tagetes minuta</i> *                         | Stinking Roger                           | 14  | 10  | 0.2 |     |     | 20  |    | 1   |     | 0.1 | 2   | 0.1 | 5   | 0.1 |
| Asteraceae      | <i>Taraxacum spp.</i>                           | Dandelion                                | 0.2 |     |     |     |     |     |    |     |     |     |     |     |     |     |
| Asteraceae      | <i>Xerochrysum bracteatum</i>                   | Golden Everlasting                       |     |     |     |     |     |     |    | 2   |     |     | 2   |     |     |     |
| Bignoniaceae    | <i>Pandorea pandorana</i>                       | Wonga Wonga Vine                         |     |     | 4   | 0.2 | 0.4 |     | 5  |     |     |     |     |     |     | 1   |
| Blechnaceae     | <i>Blechnum ambiguum</i>                        |  |     |     |     |     |     |     |    | 0.1 |     |     |     |     |     | 0.1 |
| Boraginaceae    | <i>Ehretia spp.</i>                             |  |     |     |     |     |     |     | 8  |     |     |     |     |     |     |     |
| Cactaceae       | <i>Opuntia stricta</i> *                        | Common Prickly Pear,<br>Smooth Pest Pear | 0.2 |     |     |     |     |     |    |     |     |     |     |     |     |     |
| Campanulaceae   | <i>Wahlenbergia spp.</i>                        | Bluebell                                 |     |     |     |     |     |     |    |     |     |     | 0.1 |     |     |     |
| Caryophyllaceae | <i>Petrorhagia dubia</i> *                      |  |     |     |     |     |     |     |    |     |     |     | 0.1 |     |     |     |
| Caryophyllaceae | <i>Polycarpon tetraphyllum</i> *                | Four-leaved Allseed                      |     |     |     |     |     |     |    |     |     |     | 0.1 |     | 0.1 |     |
| Caryophyllaceae | <i>Stellaria media</i> *                        | Common Chickweed                         |     | 4.2 |     |     |     |     |    |     |     |     |     |     | 0.1 |     |
| Celastraceae    | <i>Elaeodendron australe</i>                    |  |     |     |     |     |     |     | 20 |     |     |     |     |     |     |     |
| Chenopodiaceae  | <i>Einadia hastata</i>                          | Berry Saltbush                           | 0.2 |     |     |     |     |     |    | 0.1 | 0.1 |     |     |     |     |     |
| Chenopodiaceae  | <i>Einadia trigonos</i>                         | Fishweed                                 |     |     |     |     |     |     |    |     |     |     |     |     | 0.1 |     |
| Commelinaceae   | <i>Commelina cyanea</i>                         | Native Wandering Jew                     | 4   | 0.2 |     |     |     |     | 2  | 3   | 0.1 | 0.1 | 0.1 |     | 0.1 |     |
| Commelinaceae   | <i>Commelina diffusa</i>                        |  |     |     | 0.2 | 4   |     |     |    |     |     |     |     |     |     |     |
| Commelinaceae   | <i>Tradescantia albiflora</i> *                 | Wandering Jew                            |     |     |     |     |     |     |    |     |     |     |     |     |     |     |

| Family                 | Species                         | Common Name                | 01  | 02  | 03  | 04  | 05 | 06  | 07  | 08  | 09  | 10  | 11  | 12  | 13  | 14  |
|------------------------|---------------------------------|----------------------------|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Convolvulaceae         | <i>Dichondra repens</i>         | Kidney Weed                | 0.4 |     | 0.2 |     |    |     |     |     | 0.1 | 0.1 |     | 0.1 | 0.1 | 0.1 |
| Cyperaceae             | <i>Carex appressa</i>           | Tall Sedge                 | 4   | 0.2 | 0.2 |     |    |     | 1   |     |     |     |     |     |     |     |
| Cyperaceae             | <i>Carex inversa</i>            | Knob Sedge                 |     |     |     |     |    |     |     |     |     | 0.1 |     |     |     |     |
| Cyperaceae             | <i>Carex spp.</i>               |                            |     |     |     |     |    |     |     | 0.1 |     |     |     |     |     |     |
| Cyperaceae             | <i>Cyperus gracilis</i>         | Slender Flat-sedge         |     |     |     |     |    |     |     |     | 0.1 |     |     |     | 0.2 |     |
| Cyperaceae             | <i>Cyperus spp.</i>             |                            |     |     | 0.2 | 0.4 |    |     |     |     |     | 0.1 |     |     |     |     |
| Cyperaceae             | <i>Cyperus tetraphyllus</i>     |                            |     |     |     |     |    |     |     |     |     | 0.1 |     |     |     |     |
| Davalliaceae           | <i>Nephrolepis cordifolia</i>   | Fishbone Fern              | 0.2 |     |     |     |    |     |     |     |     |     |     |     |     |     |
| Ebenaceae              | <i>Diospyros pentamera</i>      | Myrtle Ebony               |     |     |     |     |    |     | 10  |     |     |     |     |     |     |     |
| Ericaceae              | <i>Leucopogon juniperinus</i>   | Prickly Beard-heath        | 0.2 | 4   |     |     |    |     |     |     |     | 0.1 | 0.1 |     |     |     |
| Euphorbiaceae          | <i>Alchornea ilicifolia</i>     | Native Holly               |     |     | 16  | 1   | 2  |     |     |     |     |     |     |     |     |     |
| Euphorbiaceae          | <i>Homalanthus populifolius</i> |                            |     |     |     |     | 2  |     | 0.2 |     |     |     |     |     |     |     |
| Fabaceae (Faboideae)   | <i>Desmodium varians</i>        | Slender Tick-trefoil       |     |     |     |     |    |     |     |     | 0.1 | 0.1 | 0.1 |     |     |     |
| Fabaceae (Faboideae)   | <i>Glycine clandestina</i>      | Twining glycine            | 0.2 |     | 0.2 | 0.2 |    |     |     |     |     |     |     |     |     |     |
| Fabaceae (Faboideae)   | <i>Glycine spp.</i>             |                            |     |     |     |     |    |     |     |     |     |     |     |     |     |     |
| Fabaceae (Faboideae)   | <i>Glycine tabacina</i>         | Variable Glycine           | 0.4 |     |     |     |    |     |     |     |     |     |     |     |     |     |
| Fabaceae (Faboideae)   | <i>Indigofera australis</i>     | Australian Indigo          |     |     |     |     |    |     |     | 4   |     |     |     |     |     |     |
| Fabaceae (Faboideae)   | <i>Lotus angustissimus*</i>     | Slender Birds-foot Trefoil |     |     |     |     |    |     |     |     |     | 0.1 |     |     |     |     |
| Fabaceae (Faboideae)   | <i>Trifolium repens*</i>        | White Clover               |     |     |     |     |    |     |     |     |     |     |     |     | 0.1 |     |
| Fabaceae (Faboideae)   | <i>Vicia sativa*</i>            | Common vetch               |     |     |     |     |    | 0.2 |     |     |     |     | 0.1 |     |     |     |
| Fabaceae (Mimosoideae) | <i>Acacia linifolia</i>         | White Wattle               | 0.2 |     |     |     |    |     |     |     |     |     |     |     |     |     |
| Fabaceae (Mimosoideae) | <i>Acacia maidenii</i>          | Maiden's Wattle            |     |     | 0.2 |     |    |     | 10  |     |     |     |     |     |     | 0.5 |
| Fabaceae (Mimosoideae) | <i>Acacia mearnsii</i>          | Black Wattle               |     |     |     |     |    |     |     | 5   | 5   | 0.1 | 0.1 | 1   |     |     |
| Fabaceae (Mimosoideae) | <i>Acacia parvipinnula</i>      | Silver-stemmed Wattle      | 0.2 | 0.2 |     |     |    |     |     |     |     |     |     |     |     |     |
| Fabaceae (Mimosoideae) | <i>Acacia spp.</i>              | Wattle                     |     |     |     |     |    |     |     |     |     |     |     | 0.1 |     |     |



| Family                 | Species   | Common Name         | 01  | 02  | 03  | 04  | 05  | 06  | 07  | 08  | 09  | 10  | 11  | 12  | 13  | 14  |
|------------------------|---|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Fabaceae (Mimosoideae) | <i>Pararchidendron pruinosum</i> var. <i>pruinosum</i>    | Snow Wood           |     |     |     |     |     |     | 3   |     |     |     |     |     |     |     |
| Gentianaceae           | <i>Centaurium erythraea</i> *                             | Common Centaury     |     |     |     |     |     |     |     |     |     | 0.1 | 0.1 |     |     |     |
| Geraniaceae            | <i>Geranium solanderi</i>                                 | Native Geranium     |     |     |     |     |     |     |     |     |     |     |     |     | 0.1 |     |
| Iridaceae              | <i>Patersonia</i> spp.                                    |                     |     | 0.2 |     |     |     |     |     |     |     |     |     |     |     |     |
| Iridaceae              | <i>Sisyrinchium iridifolium</i> *                         | Blue Pigroot        |     |     |     |     |     |     |     |     |     |     | 0.1 |     |     |     |
| Juncaceae              | <i>Juncus homalocaulis</i>                                |                     |     |     |     |     |     |     |     |     |     | 0.1 |     |     |     |     |
| Juncaceae              | <i>Juncus usitatus</i>                                    |                     |     |     |     |     |     |     |     |     | 0.1 | 0.1 |     |     | 0.1 | 0.1 |
| Lamiaceae              | <i>Clerodendrum tomentosum</i>                            | Hairy Clerodendrum  |     |     |     |     | 0.2 |     | 0.5 | 0.1 |     |     |     |     |     | 0.2 |
| Lamiaceae              | <i>Plectranthus cilatus</i> *                             |                     |     |     |     |     |     |     | 1   |     |     |     |     |     |     |     |
| Lamiaceae              | <i>Plectranthus parviflorus</i>                           |                     | 30  | 10  |     | 2   |     | 0.2 |     | 3   | 0.2 | 0.1 | 0.2 | 0.1 | 0.2 | 0.2 |
| Lindsaeaceae           | <i>Lindsaea linearis</i>                                  | Screw Fern          |     |     |     |     |     |     | 1   | 1.5 |     |     |     |     |     |     |
| Loranthaceae           | <i>Amyema</i> spp.  | Mistletoe           |     |     |     |     |     |     |     |     | 0.1 |     |     |     |     |     |
| Luzuriagaceae          | <i>Eustrephus latifolius</i>                              | Wombat Berry        |     |     | 0.2 |     | 0.6 |     | 10  |     |     |     |     |     |     |     |
| Luzuriagaceae          | <i>Geitonoplesium cymosum</i>                             | Scrambling Lily     | 0.6 | 0.2 | 0.2 | 0.4 | 0.4 |     |     | 1   | 0.1 |     |     |     | 0.1 |     |
| Luzuriagaceae          | <i>Geitonoplesium</i> spp.                                |                     |     |     |     |     |     |     | 5   |     |     |     |     |     |     |     |
| Malaceae               | <i>Pyracantha angustifolia</i> *                          | Orange Firethorn    |     |     | 60  | 12  |     |     |     |     |     |     |     |     |     |     |
| Malvaceae              | <i>Hibiscus heterophyllus</i> subsp. <i>heterophyllus</i> | Native Rosella      | 4   |     |     | 2   | 1   |     | 5   | 10  | 7   | 1   | 0.1 |     |     | 1   |
| Malvaceae              | <i>Modiola caroliniana</i> *                              | Red-flowered Mallow |     |     |     |     |     |     |     |     |     |     |     |     | 0.1 |     |
| Malvaceae              | <i>Sida rhombifolia</i> *                                 | Paddy's Lucerne     |     |     | 0.2 |     |     | 0.4 |     | 0.2 | 0.1 | 0.1 | 2   | 0.1 | 0.5 | 0.1 |
| Meliaceae              | <i>Melia azedarach</i>                                    | White Cedar         |     |     | 0.2 |     |     |     |     |     |     |     |     |     |     | 8   |
| Menispermaceae         | <i>Legnephora moorei</i>                                  | Round-leaf Vine     |     |     |     |     |     |     | 2   |     |     |     |     |     |     |     |
| Monimiaceae            | <i>Wilkiea huegeliana</i>                                 | Veiny Wilkiea       |     |     |     |     |     |     | 15  |     |     |     |     |     |     |     |

| Family         | Species                                       | Common Name             | 01  | 02  | 03  | 04  | 05  | 06 | 07  | 08  | 09  | 10 | 11  | 12  | 13  | 14  |
|----------------|---|-------------------------|-----|-----|-----|-----|-----|----|-----|-----|-----|----|-----|-----|-----|-----|
| Moraceae       | <i>Ficus macrophylla</i>                      |                         |     |     |     |     |     |    | 0.5 | 20  |     |    |     |     | 12  |     |
| Moraceae       | <i>Maclura cochinchinensis</i>                | Cockspur Thorn          |     |     |     |     | 0.2 |    | 1   |     |     |    |     |     |     |     |
| Moraceae       | <i>Streblus brunonianus</i>                   | Whalebone Tree          |     |     | 2   | 0.6 | 4   |    | 25  | 0.2 |     |    |     |     | 0.5 | 0.2 |
| Myrsinaceae    | <i>Anagallis arvensis*</i>                    | Scarlet Pimpernel       |     |     |     |     |     |    |     | 0.2 |     |    | 0.1 | 0.1 |     |     |
| Myrtaceae      | <i>Eucalyptus tereticornis</i>                | Forest Red Gum          |     |     |     |     |     |    |     |     |     |    |     |     | 8   |     |
| Myrtaceae      | <i>Leptospermum juniperinum</i>               | Prickly Tea-tree        |     |     |     |     |     |    |     | 2   |     |    |     |     |     |     |
| Myrtaceae      | <i>Melaleuca armillaris subsp. armillaris</i> | Bracelet Honey-myrtle   | 30  | 130 |     |     |     | 4  |     | 5   | 12  | 2  | 0.5 | 12  |     |     |
| Oleaceae       | <i>Ligustrum lucidum*</i>                     | Large-leaved Privet     |     |     | 1   |     |     |    |     |     |     |    |     |     |     |     |
| Oleaceae       | <i>Notelaea longifolia</i>                    | Large Mock-olive        |     |     |     |     |     |    | 5   | 0.1 |     |    |     |     |     |     |
| Oleaceae       | <i>Notelaea venosa</i>                        | Veined Mock-olive       |     |     |     |     | 0.6 |    |     |     |     |    |     |     |     |     |
| Oleaceae       | <i>Olea africana*</i>                         |                         |     |     | 40  |     | 0.4 |    |     |     |     |    |     |     |     |     |
| Oleaceae       | <i>Olea europaea*</i>                         | Common Olive            |     |     |     | 20  |     |    |     |     |     |    |     |     |     |     |
| Oleaceae       | <i>Olea europaea subsp. africana*</i>         |                         | 0.2 |     |     |     |     |    |     |     |     |    |     |     |     |     |
| Oleaceae       | <i>Olea europaea subsp. cuspidata*</i>        | African Olive           |     |     |     |     |     |    |     |     |     |    |     |     | 0.1 |     |
| Oxalidaceae    | <i>Oxalis corniculata*</i>                    | Creeping Oxalis         |     |     |     |     |     |    |     |     |     |    | 0.1 |     |     |     |
| Oxalidaceae    | <i>Oxalis perennans</i>                       |                         |     |     | 0.2 |     |     |    |     |     |     |    |     |     | 0.1 | 0.1 |
| Phyllanthaceae | <i>Breynia oblongifolia</i>                   | Coffee Bush             |     |     |     | 2   |     |    |     | 1   | 0.1 |    |     |     |     | 0.2 |
| Phyllanthaceae | <i>Breynia spp.</i>                           |                         |     |     |     |     |     |    | 0.5 |     |     |    |     |     |     |     |
| Pittosporaceae | <i>Pittosporum multiflorum</i>                | Orange Thorn            |     |     | 0.2 |     | 0.2 |    |     |     |     |    |     |     | 0.5 |     |
| Pittosporaceae | <i>Pittosporum revolutum</i>                  | Rough Fruit Pittosporum |     |     | 4   | 1   |     |    |     |     |     |    |     |     |     | 0.1 |
| Pittosporaceae | <i>Pittosporum undulatum</i>                  | Sweet Pittosporum       |     |     | 2   | 2   | 20  |    |     |     |     |    |     |     |     |     |
| Plantaginaceae | <i>Plantago lanceolata*</i>                   | Lamb's Tongues          |     |     |     |     |     |    |     |     |     |    | 0.1 |     | 0.1 |     |
| Plantaginaceae | <i>Plantago spp.</i>                          | Plantain                |     | 0.2 |     |     |     |    |     |     |     |    |     |     |     |     |

| Family         | Species                                       | Common Name             | 01  | 02  | 03  | 04  | 05  | 06  | 07 | 08  | 09  | 10  | 11  | 12  | 13  | 14  |
|----------------|---|-------------------------|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|
| Plantaginaceae | <i>Veronica plebeia</i>                       | Trailing Speedwell      |     |     |     |     |     |     |    | 1   | 0.1 | 0.1 |     |     |     |     |
| Poaceae        | <i>Aristida spp.</i>                          | A Wiregrass             |     | 0.2 |     |     |     |     |    |     |     |     |     |     |     |     |
| Poaceae        | <i>Austrostipa ramosissima</i>                | Stout Bamboo Grass      |     |     |     |     |     |     |    |     | 0.1 |     |     | 0.2 |     |     |
| Poaceae        | <i>Briza minor*</i>                           | Shivery Grass           |     |     |     |     |     |     |    |     |     |     | 0.1 |     |     |     |
| Poaceae        | <i>Briza subaristata*</i>                     |                         |     |     |     |     |     |     |    |     |     | 0.1 |     |     | 0.1 |     |
| Poaceae        | <i>Bromus spp.*</i>                           | A Brome                 |     |     |     |     |     |     |    |     |     |     |     |     | 5   |     |
| Poaceae        | <i>Chloris virgata*</i>                       | Feathertop Rhodes Grass |     |     | 20  |     |     |     |    |     |     |     |     |     |     |     |
| Poaceae        | <i>Cynodon dactylon</i>                       | Common Couch            |     |     |     |     |     |     |    |     |     |     |     |     | 10  |     |
| Poaceae        | <i>Dichelachne crinita</i>                    | Longhair Plumegrass     |     |     |     |     |     |     |    |     |     |     |     |     |     |     |
| Poaceae        | <i>Dichelachne spp.</i>                       | A Plumegrass            |     | 0.2 |     |     |     |     |    |     |     |     |     |     |     |     |
| Poaceae        | <i>Digitaria spp.*</i>                        | A Finger Grass          | 0.2 | 0.2 |     |     |     |     |    |     |     |     |     |     |     |     |
| Poaceae        | <i>Ehrharta erecta*</i>                       | Panic Veldtgrass        |     |     |     |     |     |     |    |     | 0.1 |     |     | 0.1 |     |     |
| Poaceae        | <i>Entolasia spp.</i>                         |                         |     |     |     |     |     |     |    | 0.2 |     |     |     |     |     |     |
| Poaceae        | <i>Eragrostis brownii</i>                     | Brown's Lovegrass       |     |     |     |     |     |     |    |     |     |     | 0.5 | 0.1 |     |     |
| Poaceae        | <i>Lolium perenne*</i>                        | Perennial Ryegrass      |     |     |     |     |     |     |    | 0.5 |     |     | 10  |     | 10  |     |
| Poaceae        | <i>Melinis repens*</i>                        | Red Natal Grass         |     |     |     |     |     | 2   |    |     |     |     | 10  |     |     |     |
| Poaceae        | <i>Microlaena stipoides</i>                   | Weeping Grass           | 90  | 4   | 0.2 | 0.4 |     |     |    | 3   | 5   | 5   | 5   |     | 20  | 0.2 |
| Poaceae        | <i>Oplismenus aemulus</i>                     |                         | 0.2 | 40  |     |     |     |     | 3  |     |     |     |     |     |     | 0.2 |
| Poaceae        | <i>Oplismenus imbecillis</i>                  |                         |     |     | 0.4 | 70  | 0.4 |     |    |     | 7   | 2   |     | 5   | 0.1 |     |
| Poaceae        | <i>Oplismenus spp.</i>                        |                         |     |     |     |     |     |     |    | 1   |     |     |     |     |     |     |
| Poaceae        | <i>Paspalum dilatatum*</i>                    | Paspalum                |     |     | 0.4 |     |     |     |    |     |     |     |     |     |     |     |
| Poaceae        | <i>Pennisetum clandestinum*</i>               | Kikuyu Grass            |     | 0.4 |     |     |     | 110 |    |     |     | 0.1 |     |     | 20  | 0.1 |
| Poaceae        | <i>Pentameris airoides*</i>                   | False Hairgrass         |     |     |     |     |     |     |    |     |     |     | 0.1 |     |     |     |
| Poaceae        | <i>Poa labillardierei var. labillardierei</i> | Tussock                 |     | 0.2 |     |     |     |     |    | 7   | 2   | 1   | 0.1 |     |     |     |

| Family        | Species                            | Common Name              | 01  | 02  | 03  | 04  | 05  | 06  | 07 | 08  | 09  | 10  | 11  | 12  | 13  | 14  |
|---------------|------------------------------------|--------------------------|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|
| Poaceae       | <i>Rytidosperma spp.</i>           |                          |     | 0.2 |     |     |     |     |    |     |     |     | 0.1 |     |     |     |
| Poaceae       | <i>Sporobolus creber</i>           | Slender Rat's Tail Grass |     |     |     |     |     |     |    |     |     | 0.1 | 0.1 |     |     |     |
| Poaceae       | <i>Sporobolus spp.*</i>            | Rat's Tail Couch         |     | 0.2 |     |     |     |     |    |     |     |     |     |     |     |     |
| Poaceae       | <i>Themeda triandra</i>            |                          |     |     |     |     |     |     |    | 5   |     |     |     |     |     |     |
| Polygonaceae  | <i>Acetosa sagittata*</i>          | Rambling Dock            |     |     |     |     |     |     |    |     |     | 0.1 |     |     | 0.1 |     |
| Ranunculaceae | <i>Clematis aristata</i>           | Old Man's Beard          |     |     |     |     |     |     |    | 0.1 |     |     |     |     |     |     |
| Rhamnaceae    | <i>Alphitonia excelsa</i>          | Red Ash                  |     |     | 0.6 | 0.4 | 10  |     | 25 |     | 5   |     |     | 3   |     | 1   |
| Rosaceae      | <i>Rubus fruticosus sp. agg.*</i>  | Blackberry complex       |     |     |     |     |     |     |    |     |     |     |     |     | 0.1 |     |
| Rutaceae      | <i>Melicope micrococca</i>         | Hairy-leaved Doughwood   |     |     | 0.2 |     | 6   |     |    |     |     |     |     |     |     |     |
| Rutaceae      | <i>Zieria granulata</i>            | Illawarra Zieria         | 0.2 | 2   |     |     |     | 0.4 |    | 8   | 1   | 10  | 2   | 0.1 |     |     |
| Sapindaceae   | <i>Alectryon subcinereus</i>       | Wild Quince              |     |     | 6   | 0.6 | 24  |     | 5  |     |     |     |     |     |     |     |
| Sapindaceae   | <i>Cardiospermum grandiflorum*</i> | Balloon Vine             |     |     |     |     |     |     |    | 4   |     |     |     |     |     |     |
| Sapindaceae   | <i>Dodonaea viscosa</i>            | Sticky Hop-bush          |     |     |     |     |     |     |    |     |     |     | 0.2 |     |     |     |
| Sapindaceae   | <i>Guioa semiglauca</i>            | Guioa                    |     |     | 4   |     | 2.2 |     |    |     |     |     |     |     |     |     |
| Solanaceae    | <i>Solanum cinereum</i>            | Narrawa Burr             |     |     |     |     |     |     | 1  |     |     |     |     |     |     |     |
| Solanaceae    | <i>Solanum mauritianum*</i>        | Wild Tobacco Bush        |     | 0.2 |     |     |     |     |    |     |     |     |     |     |     | 0.1 |
| Solanaceae    | <i>Solanum nigrum*</i>             | Black-berry Nightshade   | 0.2 |     |     |     |     |     |    |     | 0.1 |     |     |     |     | 0.1 |
| Solanaceae    | <i>Solanum pungetium</i>           | Eastern Nightshade       |     |     |     |     |     |     |    | 0.1 |     |     |     |     |     |     |
| Sterculiaceae | <i>Commersonia fraseri</i>         | Brush Kurrajong          |     |     |     | 4   |     | 2   |    |     |     | 35  | 20  | 5   |     |     |
| Verbenaceae   | <i>Lantana camara*</i>             | Lantana                  | 110 | 20  | 2   | 6   | 0.2 |     | 1  | 30  | 50  | 8   | 0.5 | 85  | 0.5 | 55  |
| Verbenaceae   | <i>Verbena bonariensis*</i>        | Purpletop                |     |     | 0.2 |     |     | 0.2 |    |     |     |     | 0.1 |     |     |     |
| Vitaceae      | <i>Cayratia clematidea</i>         | Native Grape             |     |     |     | 0.2 | 0.2 |     |    |     |     | 0.1 |     | 0.1 |     | 0.1 |

### Annex 3. BAM plot transect scores

| Plot no. | PCT code | PCT abbreviated name and condition  | Species richness |       |       |      |      |       | Cover (%) |       |       |      |      |       |                  |
|----------|----------|---|------------------|-------|-------|------|------|-------|-----------|-------|-------|------|------|-------|------------------|
|          |          |   | Tree             | Shrub | Grass | Forb | Fern | Other | Tree      | Shrub | Grass | Forb | Fern | Other | High threat weed |
| 1        | 720      | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion_Moderate        | 0.0              | 7.0   | 4.0   | 5.0  | 2.0  | 4.0   | 0.0       | 18.4  | 47.2  | 17.4 | 0.2  | 0.6   | 57.2             |
| 2        | 720      | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion_Moderate/High   | 0.0              | 4.0   | 10.0  | 7.0  | 1.0  | 1.0   | 0.0       | 68.1  | 22.7  | 11.4 | 0.2  | 0.1   | 0                |
| 3        | 1300     | Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion_Low  | 5.0              | 6.0   | 4.0   | 3.0  | 1.0  | 5.0   | 22.1      | 30.1  | 0.5   | 0.3  | 0.1  | 9.3   | 26.4             |
| 4        | 1300     | Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion_Low  | 3.0              | 7.0   | 3.0   | 4.0  | 0.0  | 4.0   | 30.0      | 32.5  | 10.4  | 3.2  | 0.0  | 0.5   | 21.0             |
| 5        | 1300     | Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion_Low  | 5.0              | 10.0  | 1.0   | 3.0  | 1.0  | 6.0   | 8.2       | 28.4  | 0.2   | 0.4  | 0.1  | 2.9   | 0.4              |
| 6        | 720      | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion_Poor            | 0.0              | 3.0   | 0.0   | 1.0  | 0.0  | 0.0   | 0.0       | 3.2   | 0.0   | 0.1  | 0.0  | 0.0   | 3.0              |
| 7        | 1300     | Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion_High | 10.0             | 8.0   | 2.0   | 5.0  | 2.0  | 9.0   | 112.0     | 51.7  | 4.0   | 3.4  | 4.0  | 37.0  | 6.0              |
| 8        | 720      | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion_High            | 4.0              | 7.0   | 6.0   | 7.0  | 3.0  | 2.0   | 20.4      | 35.0  | 16.3  | 12.2 | 2.1  | 1.1   | 39.5             |

| Plot no. | PCT code | PCT abbreviated name and condition   | Species richness |       |       |      |      |       | Cover (%) |       |       |      |      |       |                  |
|----------|----------|--|------------------|-------|-------|------|------|-------|-----------|-------|-------|------|------|-------|------------------|
|          |          |  | Tree             | Shrub | Grass | Forb | Fern | Other | Tree      | Shrub | Grass | Forb | Fern | Other | High threat weed |
| 9        | 720      | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion_Moderate/High            | 1                | 5     | 6     | 7    | 0    | 3     | 5.0       | 25.1  | 14.3  | 0.8  | 0.0  | 0.3   | 50.6             |
| 10       | 720      | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion_Low_NoCanopy             | 0.0              | 6.0   | 9.0   | 5.0  | 0.0  | 2.0   | 0.0       | 48.2  | 8.6   | 0.5  | 0.0  | 0.2   | 8.3              |
| 11       | 720      | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion_Poor                     | 0.0              | 7.0   | 6.0   | 5.0  | 1.0  | 1.0   | 0.0       | 23.0  | 5.8   | 2.5  | 0.1  | 0.1   | 0.7              |
| 12       | 720      | Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion_Low_lantana              | 1.0              | 5.0   | 3.0   | 2.0  | 0.0  | 1.0   | 3.0       | 18.2  | 5.3   | 0.2  | 0.0  | 0.1   | 85.2             |
| 13       | 1300     | Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion_Poor          | 3.0              | 1.0   | 6.0   | 6.0  | 1.0  | 2.0   | 20.5      | 0.5   | 35.4  | 0.7  | 0.1  | 5.1   | 1.0              |
| 14       | 1300     | Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion_Very_degraded | 5.0              | 3.0   | 3.0   | 4.0  | 1.0  | 2.0   | 9.9       | 1.3   | 0.5   | 0.5  | 0.1  | 1.1   | 55.8             |

| Plot no. | Tree regeneration | Large trees (count) | Trees with hollows (count) | Litter cover (%) | Fallen logs (m) | Tree composition |                  |                   |                   |                   |
|----------|-------------------|---------------------|----------------------------|------------------|-----------------|------------------|------------------|-------------------|-------------------|-------------------|
|          |                   |                     |                            |                  |                 | Stems 5 to 10 cm | Stems 10 to 20cm | Stems 20 to 30 cm | Stems 30 to 50 cm | Stems 50 to 80 cm |
| 1        | Present           | 0                   | 0                          | 15.0             | 10.0            | Present          | Present          | Present           | Absent            | Absent            |
| 2        | Present           | 0                   | 0                          | 18.0             | 5.0             | Present          | Present          | Absent            | Absent            | Absent            |
| 3        | Present           | 0                   | 0                          | 75.0             | 13.0            | Present          | Present          | Present           | Present           | Absent            |
| 4        | Present           | 0                   | 0                          | 62.0             | 13.0            | Present          | Present          | Present           | Absent            | Absent            |
| 5        | Present           | 0                   | 0                          | 53.0             | 18.0            | Present          | Present          | Present           | Present           | Absent            |
| 6        | Absent            | 0                   | 0                          | 6.0              | 10.0            | Absent           | Absent           | Present           | Absent            | Absent            |
| 7        | Present           | 0                   | 0                          | 70.0             | 13.0            | Present          | Absent           | Present           | Absent            | Absent            |
| 8        | Absent            | 0                   | 0                          | 56.0             | 14.0            | Present          | Present          | Present           | Present           | Absent            |
| 9        | Absent            | 1                   | 0                          | 0.0              | 10.0            | Present          | Present          | Absent            | Absent            | Absent            |
| 10       | Absent            | 0                   | 0                          | 0.0              | 0.0             | Present          | Present          | Present           | Present           | Absent            |
| 11       | Present           | 0                   | 0                          | 0.0              | 0.0             | Absent           | Absent           | Absent            | Absent            | Absent            |
| 12       | Absent            | 1                   | 0                          | 0.0              | 0.0             | Absent           | Absent           | Absent            | Absent            | Absent            |
| 13       | Absent            | 2                   | 1                          | 5.2              | 5.7             | Absent           | Absent           | Absent            | Absent            | Absent            |
| 14       | Absent            | 0                   | 0                          | 15               | 0.0             | Present          | Present          | Absent            | Absent            | Present           |

Note: field data was collected in electronic format, therefore raw data sheets have not been provided.

## Annex 4. Fauna species list

| Class            | Common Name            | Scientific Name                     | Observation Type and status for bats | Total |
|------------------|------------------------|-------------------------------------|--------------------------------------|-------|
| <b>Amphibia</b>  | Bleating Tree Frog     | <i>Litoria dentata</i>              | Heard call                           | 1     |
|                  | Brown-striped Frog     | <i>Limnodynastes peronii</i>        | Heard call                           | 2     |
|                  | Common Eastern Froglet | <i>Crinia signifera</i>             | Heard call                           |       |
| <b>Aves</b>      | Australasian Figbird   | <i>Sphecotheres vieilloti</i>       | Observed and Heard call              | 1     |
|                  | Australian King-Parrot | <i>Alisterus scapularis</i>         | Observed and Heard call              | 3     |
|                  | Australian Raven       | <i>Corvus coronoides</i>            | Observed and Heard call              | 2     |
|                  | Bar-shouldered Dove    | <i>Geopelia humeralis</i>           | Heard call                           | 1     |
|                  | Brown Quail            | <i>Coturnix ypsilophora</i>         | Observed and Heard call              | 10    |
|                  | Brown Thornbill        | <i>Acanthiza pusilla</i>            | Observed and Heard call              | 2     |
|                  | Brush Cuckoo           | <i>Cacomantis variolosus</i>        | Heard call                           | 1     |
|                  | Channel-billed Cuckoo  | <i>Scythrops novaehollandiae</i>    | Heard call                           | 1     |
|                  | Crimson Rosella        | <i>Platycercus elegans</i>          | Observed                             | 1     |
|                  | Eastern Spinebill      | <i>Acanthorhynchus tenuirostris</i> | Observed                             | 2     |
|                  | Eastern Whipbird       | <i>Psophodes olivaceus</i>          | Heard call                           | 1     |
|                  | Eastern Yellow Robin   | <i>Eopsaltria australis</i>         | Observed and Heard call              | 1     |
|                  | European Goldfinch*    | <i>Carduelis carduelis</i>          | Observed                             | 2     |
|                  | Fan-tailed Cuckoo      | <i>Cacomantis flabelliformis</i>    | Observed and Heard call              | 1     |
|                  | Golden Whistler        | <i>Pachycephala pectoralis</i>      | Observed                             | 1     |
|                  | Grey Butcherbird       | <i>Cracticus torquatus</i>          | Heard call                           | 2     |
|                  | Grey Fantail           | <i>Rhipidura albiscapa</i>          | Observed and Heard call              | 1     |
|                  | Grey Shrike-thrush     | <i>Colluricincla harmonica</i>      | Heard call                           | 1     |
|                  | Lewin's Honeyeater     | <i>Meliphaga lewinii</i>            | Observed                             | 2     |
|                  | Little Wattlebird      | <i>Anthochaera chrysoptera</i>      | Observed                             | 1     |
|                  | New Holland Honeyeater | <i>Phylidonyris novaehollandiae</i> | Observed                             | 2     |
|                  | Red-browed Finch       | <i>Neochmia temporalis</i>          | Observed                             | 2     |
|                  | Red-whiskered Bulbul   | <i>Pycnonotus jocosus</i>           | Observed and Heard call              | 2     |
|                  | Satin Bowerbird        | <i>Ptilonorhynchus violaceus</i>    | Observed                             | 3     |
|                  | Shining Bronze-Cuckoo  | <i>Chalcites lucidus</i>            | Heard                                | 1     |
|                  | Silvereye              | <i>Zosterops lateralis</i>          | Observed                             | 4     |
|                  | Spotted Pardalote      | <i>Pardalotus punctatus</i>         | Observed                             | 1     |
|                  | Superb Fairy-wren      | <i>Malurus cyaneus</i>              | Observed                             | 1     |
|                  | Topknot Pigeon         | <i>Lopholaimus antarcticus</i>      | Observed                             | 1     |
|                  | White-browed Scrubwren | <i>Sericornis frontalis</i>         | Observed                             | 1     |
|                  | Wonga Pigeon           | <i>Leucosarcia melanoleuca</i>      | Observed                             | 2     |
| Yellow Thornbill | <i>Acanthiza nana</i>  | Observed                            | 1                                    |       |



| Class           | Common Name                     | Scientific Name                       | Observation Type and status for bats | Total |
|-----------------|---------------------------------|---------------------------------------|--------------------------------------|-------|
|                 | Yellow-rumped Thornbill         | <i>Acanthiza chrysorrhoa</i>          | Observed                             | 1     |
|                 | Yellow-tailed Black-Cockatoo    | <i>Calyptorhynchus funereus</i>       | Heard call                           | 1     |
| <b>Mammalia</b> | Eastern Grey Kangaroo           | <i>Macropus giganteus</i>             | Observed/Scat                        | 1     |
|                 | Goat*                           | <i>Capra hircus</i>                   | Scat/heard                           | 1     |
|                 | Short-beaked Echidna            | <i>Tachyglossus aculeatus</i>         | Observed                             | 1     |
|                 | Chocolate Wattled Bat           | <i>Chalinolobus morio</i>             | Echolocation Definite                |       |
|                 | Eastern Coastal Freetail bat    | <i>Micronomous norfolkensis</i>       | Echolocation Definite                |       |
|                 | Eastern False Pipistrelle       | <i>Falsistrellus tasmaniensis</i>     | Echolocation Definite                |       |
|                 | Gould's Wattled Bat             | <i>Chalinolobus gouldii</i>           | Echolocation Definite                |       |
|                 | Greater Broad-nosed Bat         | <i>Scoteanax ruepellii</i>            | Echolocation Probable                |       |
|                 | Large Bentwing Bat              | <i>Miniopterus orianae oceanensis</i> | Echolocation Possible                |       |
|                 | Large Forest Bat                | <i>Vespadelus darlingtonii</i>        | Echolocation Definite                |       |
|                 | Little Bentwing Bat             | <i>Miniopterus australis</i>          | Echolocation Probable                |       |
|                 | Little Forest Bat               | <i>Vespadelus vulturnus</i>           | Echolocation Definite                |       |
|                 | Long-eared Bat spp.             | <i>Nyctophilus spp.</i>               | Echolocation Possible                |       |
|                 | Ride's freetail Bat             | <i>Ozimops ridei</i>                  | Echolocation Definite                |       |
|                 | Southern Forest Bat             | <i>Vespadelus regulus</i>             | Echolocation Definite                |       |
|                 | White-striped Freetail Bat      | <i>Austronomus australis</i>          | Echolocation Definite                |       |
|                 | Yellow-bellied Sheathtailed bat | <i>Saccolaimus flaviventris</i>       | Echolocation Probable                |       |
| <b>Reptilia</b> | Red-bellied Black Snake         | <i>Pseudechis porphyriacus</i>        | Observed                             | 1     |

KEY: \* = introduced species

Note: field data was collected in electronic format, therefore raw data sheets have not been provided.

## Annex 5. Hollow-bearing tree register

| Tree number | Scientific name                | Common name    | No. of hollows | Hollow size class (cm) | Height above ground (m) |
|-------------|--------------------------------|----------------|----------------|------------------------|-------------------------|
| 1 (Plate 5) | <i>Eucalyptus tereticornis</i> | Forest Red Gum | 2              | 10-15, 15-20           | 3.5                     |
| 2           | Ficus sp                       | Fig tree       | 2              | 5-10, 10-15            | 4                       |
| 3           | <i>Eucalyptus tereticornis</i> | Forest Red Gum | 1              | 5-10                   | 3.5                     |
| 4 (Plate 6) | Stag                           | Dead tree      | 0              | 0                      | 0                       |
| 5           | Ficus sp                       | Fig tree       | 2              | 5-10, 10-15            | 3.9                     |
| 6 (Plot 13) | <i>Eucalyptus tereticornis</i> | Forest Red Gum | 1              | 10-15                  | 3.4                     |

\*Located within or close to edge of proposed impact footprint

Note: field data was collected in electronic format, therefore raw data sheets have not been provided.



**Plate 5: Hollow-bearing tree (Tree 1)**



**Plate 6: Hollow-bearing Stag (Tree 4)**

## Annex 6. Threatened species status and likelihood of occurrence

E = Endangered; V = Vulnerable, CE = Critically Endangered, R = Rare, Ex = Presumed Extinct.

Note: Some marine migratory birds, reptiles and mammals have been omitted from the results here. Unless otherwise stated, habitat information obtained from DoEE 2019 and DPIE 2020b.

| Scientific Name                 | Common Name                | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact   |
|---------------------------------|----------------------------|--------|----------|---|--------------------------|--|
| <b>Amphibians</b>               |                            |        |          |   |                          |  |
| <i>Heleioporus australiacus</i> | Giant Burrowing Frog       | V      | V        | The Giant Burrowing Frog has been recorded breeding in a range of water bodies associated with more sandy environments of the coast and adjacent ranges from the Sydney Basin south the eastern Victoria. It breeds in hanging swamps, perennial non-flooding creeks and occasionally permanent pools, but permanent water must be present to allow its large tadpoles time to reach metamorphosis.   | Low                      | None – no heathland or other preferred vegetation types. No swamps or permanent pools within streams or connecting/ limiting habitat.  |
| <i>Litoria aurea</i>            | Green and Golden Bell Frog | E      | V        | Inhabits a very wide range of water bodies including marshes, dams and streams, particularly those containing emergent vegetation such as bull rushes or spike-rushes. It also inhabits numerous types of man-made water bodies including quarries and sand extraction sites. Optimum habitat includes water-bodies that are un-shaded, free of predatory fish such as Plague Minnow, have a grassy area nearby and diurnal sheltering sites available. | Low                      | None – no large permanent pools or connecting/ limiting habitat.<br>Habitat is confined to small farm dams that are Plague-minnow affected, isolated from other permanent water sources and have little to no emergent vegetation.<br>Nearest populations are distant. |
| <i>Litoria littlejohni</i>      | Littlejohn's Tree Frog     | V      | V        | Occurs in wet and dry sclerophyll forests and heathland associated with sandstone outcrops between 280 and 1000 m on the eastern slopes of the Great Dividing Range from the Central Coast down into Victoria. Individuals have been collected from a wide range of water bodies that includes  | Low                      | None – no heathland or other preferred vegetation types. No swamps or permanent pools within streams or connecting/ limiting habitat.  |

| Scientific Name            | Common Name       | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact   |
|----------------------------|-------------------|--------|----------|---|--------------------------|--|
|                            |                   |        |          | semi-permanent dams, permanent ponds, temporary pools and permanent streams, with calling occurring from fringing vegetation or on the banks. Individuals have been observed sheltering under rocks on high exposed ridges during summer and within deep leaf litter adjacent to the breeding site. Calling occurs in all months of the year, often in association with heavy rains. The tadpoles are distinctive, being large and very dark in colouration.  |                          |  |
| <i>Mixophyes balbus</i>    | Stuttering Frog   | E      | V        | Associated with streams in dry sclerophyll and wet sclerophyll forests and rainforests of more upland areas of the Great Dividing Range of NSW and down into Victoria. Breeding occurs along forest streams with permanent water where eggs are deposited within nests excavated in riffle zones by the females and the tadpoles swim free into the stream when large enough to do so. Outside of breeding, individuals range widely across the forest floor and can be found hundreds of metres from water   | Low                      | None – no large permanent pools or connecting/ limiting habitat. Not currently known from area.                                  |
| <b>Birds</b>               |                   |        |          |   |                          |  |
| <i>Anthochaera phrygia</i> | Regent Honeyeater | CE     | E,M      | The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. The distribution of the species has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding | Low                      | Low – not within the mapped important area and no or very limiting foraging habitat such as ironbark and box dominated woodland. |

| Scientific Name                        | Common Name          | BC Act | EPBC Act | Habitat  | Likelihood of Occurrence | Potential for impact  |
|--|----------------------|--------|----------|--|--------------------------|---|
|  |                      |        |          | fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests.  |                          |   |
| <i>Artamus cyanopterus cyanopterus</i> | Dusky Woodswallow    | V      | -        | Dusky woodswallows are widespread in eastern, southern and south-western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. | Low                      | Low – not observed at Project Area.   |
| <i>Botaurus poiciloptilus</i>          | Australasian Bittern | E      | E        | The Australasian Bittern is widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes and spikerushes.   | Low                      | None – no permanent freshwater wetlands or limiting habitat in Project Area. Dams small isolated and highly degraded at Project Area. |
| <i>Burhinus grallarius</i>             | Bush Stone-curlew    | E      | -        | The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights.   | None                     | None – no limiting habitat – not known from locality.   |
| <i>Calidris alba</i>                   | Sanderling           | V      | -        | Found in coastal areas on low beaches of firm sand, near reefs and inlets, along tidal mudflats and bare open coastal lagoons; individuals are rarely recorded in near-coastal wetlands.   | None                     | None – no limiting habitat  |

| Scientific Name                 | Common Name           | BC Act | EPBC Act          | Habitat   | Likelihood of Occurrence | Potential for impact   |
|---------------------------------|-----------------------|--------|-------------------|---|--------------------------|--|
| <i>Calidris canutus</i>         | Red Knot              | -      | E, M, MA, C, K, J | The Red Knot is a non-breeding migratory visitor from Arctic regions of Siberia. In NSW it is recorded in small numbers replenishing fat stores along some of the major river estuaries and sheltered embayments of the coastline, in particular the Hunter River estuary, after which the birds proceed to Victoria by October.  | None                     | None – no limiting habitat, migratory species  |
| <i>Calidris ferruginea</i>      | Curlew Sandpiper      | E      | -                 | The Curlew Sandpiper is distributed around most of the coastline of Australia. It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes the inland | None                     | None – no limiting habitat   |
| <i>Calidris tenuirostris</i>    | Great Knot            | V      | -                 | In NSW, the species has been recorded at scattered sites along the coast to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms.   | None                     | None – no limiting habitat   |
| <i>Calyptorhynchus lathamii</i> | Glossy Black-Cockatoo | V      | -                 | Inhabits forest with low nutrients, characteristically with key Allocasuarina spp. Tends to prefer drier forest types with a middle stratum of Allocasuarina below Eucalyptus or Angophora. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead. Endangered population in the Riverina.   | Low                      | Low – no appropriate hollows for breeding are present on Project Area. Very limited foraging habitat. Not detected during survey. Assumed present under BAM. |

| Scientific Name                 | Common Name         | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact   |
|---------------------------------|---------------------|--------|----------|---|--------------------------|--|
| <i>Charadrius leschenaultii</i> | Greater Sand-plover | V      | V        | Occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons. Non-breeding in Australia.   | None                     | None – no coastal or limiting habitat  |
| <i>Charadrius mongolus</i>      | Lesser Sand-plover  | V      | -        | Inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. Non-breeding in Australia.  | None                     | None – no limiting habitat   |
| <i>Circus assimilis</i>         | Spotted Harrier     | V      | -        | The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.  | Low                      | Not observed during survey though could potentially use habitat within the Project Area to forage – assumed present under BAM. |
| <i>Dasyornis brachypterus</i>   | Eastern Bristlebird | E      | E        | The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. There are three main populations: Northern - southern Queensland/northern NSW, Central - Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern - Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky | Low                      | None – no heath or open woodland with dense understorey habitat present in Project Area. No records within the locality.       |



| Scientific Name                            | Common Name              | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact                           |
|--|--------------------------|--------|----------|---|--------------------------|--|
|  |                          |        |          | grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.  |                          |  |
| <i>Diomedea antipodensis</i>               | Antipodean Albatross     |        | V, M, MA | The species ranges across the southern Pacific Ocean, east to the coast of Chile and west to eastern Australia. Breeds biennially in colonies on ridges, slopes and plateaus of isolated subantarctic islands, usually in vegetation such as grass tussocks. This species regularly occurs in small numbers off the NSW south coast from Green Cape to Newcastle during winter where they feed on cuttlefish. | None                     | None – no limiting habitat, migratory species. |
| <i>Diomedea antipodensis gibsoni</i>       | Gibson's Albatross       | V      | V, MA, M | Marine, pelagic and aerial, however breed in New Zealand. In Australian territory, this species has been recorded foraging between Coffs Harbour, NSW, and Wilson's Promontory, Victoria.   | None                     | None – no limiting habitat, migratory species  |
| <i>Diomedea epomophora (sensu stricto)</i> | Southern Royal Albatross |        | V, M, MA | Marine and pelagic. It occurs in subantarctic, subtropical and occasionally Antarctic waters where the water surface temperature is 6 to 20°C. Nests on flat or gently sloping ground on slopes, ridges, gullies and plateaux of large islands, and on the summits of islets.   | Low                      | None – no limiting habitat, migratory species  |
| <i>Diomedea exulans</i>                    | Wandering Albatross      | E      | -        | The Wandering Albatross is marine, pelagic and aerial.  | None                     | None – no limiting habitat                     |
| <i>Diomedea exulans (sensu lato)</i>       | Wandering Albatross      |        | V, M, MA | The Wandering Albatross is marine, pelagic and aerial. It occurs where water surface temperatures range from -2° to 24°C. On breeding islands, it nests on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground.   | None                     | None – no limiting habitat, migratory species  |
| <i>Diomedea sanfordi</i>                   | Northern Royal Albatross |        | E, M, MA | Migratory marine species that ranges widely over the Southern Ocean, with individuals seen in Australian waters off south-eastern Australia. Nesting on the flat summits of tiny islands with herb fields and grasses.  | None                     | None – no limiting habitat, migratory species  |

| Scientific Name                     | Common Name                | BC Act | EPBC Act | Habitat  | Likelihood of Occurrence | Potential for impact   |
|-------------------------------------|----------------------------|--------|----------|--|--------------------------|--|
| <i>Epthianura albifrons</i>         | White-fronted Chat         | V      | -        | Low vegetation in salty coastal and inland areas and crops. Runs along ground and is found in local flocks in Winter.  | None                     | None – no limiting habitat   |
| <i>Falco hypoleucos</i>             | Grey Falcon                | E      | -        | Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey.   | Low                      | None – no limiting habitat   |
| <i>Fregatta grallaria grallaria</i> | White-bellied Storm-Petrel |        | V        | The White-bellied Storm-Petrel (Tasman Sea) breeds on small offshore islets and rocks in the Lord Howe Island group, including Roach Island and Balls Pyramid.   | None                     | None – no limiting habitat   |
| <i>Grantiella picta</i>             | Painted Honeyeater         | V      | V        | Inhabits Boree/ Weeping Myall ( <i>Acacia pendula</i> ), Brigalow ( <i>A. harpophylla</i> ) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> . | None                     | None – no limiting habitat   |
| <i>Haematopus fuliginosus</i>       | Sooty Oystercatcher        | V      | -        | In NSW the Sooty Oystercatcher occupies rocky headlands, reefs and offshore islands along the entire coast, apparently as a single continuous population.  | None                     | None – no limiting habitat   |
| <i>Haematopus longirostris</i>      | Pied Oystercatcher         | E      | -        | The Pied Oystercatcher inhabits marine littoral habitats, including islands. It occupies muddy, sandy, stony or rocky estuaries, inlets and beaches, particularly intertidal mudflats and sandbanks in large marine bays.  | None                     | None – no limiting habitat   |
| <i>Hieraaetus morphnoides</i>       | Little Eagle               | V      | -        | Most abundant in lightly timbered areas with open areas nearby. Often recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. May nest in farmland, woodland and forest in tall trees.  | Low                      | Low – no breeding habitat, few large trees for nesting. Potential foraging habitat but not detected during survey and limited records. |

| Scientific Name               | Common Name            | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact   |
|-------------------------------|------------------------|--------|----------|---|--------------------------|--|
| <i>Irediparra gallinacea</i>  | Comb-crested Jacana    | V      | -        | Inhabits permanent wetlands with a good surface cover of floating vegetation, especially water-lilies.  | None                     | None – no limiting habitat or wetlands present in the Project Area   |
| <i>Ixobrychus flavicollis</i> | Black Bittern          | V      | -        | Usually found on coastal plains below 200 m. Often found along timbered watercourses, in wetlands with fringing trees and shrub vegetation. The sites where they occur are characterized by dense waterside vegetation.   | None                     | None – no permanent freshwater wetlands or limiting habitat in Study Area. Dams small isolated and highly degraded at Project Area.    |
| <i>Lathamus discolor</i>      | Swift Parrot           | E      | E        | The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects . The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW . This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability. | Low                      | Low – very limited foraging habitat in Project Area. No breeding habitat.  |
| <i>Limicola falcinellus</i>   | Broad-billed Sandpiper | V      | -        | Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons. Broad-billed Sandpipers roost on banks on sheltered sand, shell or shingle beaches.                 | None                     | None – no limiting habitat   |
| <i>Limosa limosa</i>          | Black-tailed Godwit    | V      | -        | Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and-or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps.   | None                     | None – no limiting habitat   |
| <i>Lophoictinia isura</i>     | Square-tailed Kite     | V      | -        | Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by   | Low                      | Low – no breeding habitat, few large trees for nesting. Potential foraging habitat but not detected during survey and limited records. |

| Scientific Name              | Common Name           | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact                          |
|------------------------------|-----------------------|--------|----------|---|--------------------------|---|
|                              |                       |        |          | <i>Eucalyptus longifolia</i> , <i>Corymbia maculata</i> , <i>E. elata</i> or <i>E. smithii</i> . Individuals appear to occupy large hunting ranges of more than 100km <sup>2</sup> . They require large living trees for breeding, particularly near water with surrounding woodland -forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.   |                          |   |
| <i>Macronectes giganteus</i> | Southern Giant Petrel | E      | E        | The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20 S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory.  | None                     | None – no limiting habitat, migratory species |
| <i>Macronectes halli</i>     | Northern Giant-petrel | V      | V        | Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer.  | None                     | None – no limiting habitat, migratory species |
| <i>Neophema chrysogaster</i> | Orange-bellied Parrot | CE     | CE, M    | The Orange-bellied Parrot breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia and southern Victoria. There are occasional reports from NSW, with the most recent records from Shellharbour and Maroubra in May 2003. It is expected that NSW habitats may be more frequently utilised than observations suggest. Typical winter habitat is saltmarsh and strandline-foredune vegetation communities either on coastlines or coastal lagoons. Spits and islands are favoured but they will turn up anywhere within these coastal regions. The species can be found foraging in weedy areas associated with these coastal habitats or even in totally modified landscapes such as pastures, seed crops and golf courses. | None                     | None – no limiting habitat, migratory species |

| Scientific Name                        | Common Name            | BC Act | EPBC Act  | Habitat   | Likelihood of Occurrence | Potential for impact  |
|--|------------------------|--------|-----------|---|--------------------------|---|
| <i>Neophema pulchella</i>              | Turquoise Parrot       | V      | -         | The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust. | Low                      | None – no limiting habitat  |
| <i>Ninox connivens</i>                 | Barking Owl            | V      | -         | Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country.  | Low                      | None – no limiting habitat  |
| <i>Numenius madagascariensis</i>       | Eastern Curlew         | -      | CE, MA, M | A primarily coastal distribution. Found in all states, particularly the north, east, and south-east regions including Tasmania. Rarely recorded inland. Mainly forages on soft sheltered intertidal sand flats or mudflats, open and without vegetation or cover. Breeds in the northern hemisphere.  | None                     | None – no limiting habitat, migratory species   |
| <i>Oxyura australis</i>                | Blue-billed Duck       | V      | -         | Widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal areas. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation.   | Low                      | None – no limiting habitat. Small dams within site not preferred habitat and unlikely to be used. |
| <i>Pachyptila turtur subantarctica</i> | Fairy Prion (southern) |        | V         | The fairy prion (southern) breeds on Macquarie Island and a number of other subantarctic islands outside of Australia. The subspecies digs burrows among rocks or low vegetation  | None                     | None – no limiting habitat  |

| Scientific Name              | Common Name     | BC Act | EPBC Act | Habitat  | Likelihood of Occurrence | Potential for impact   |
|------------------------------|-----------------|--------|----------|--|--------------------------|--|
|                              |                 |        |          | in which to nest. Burrows may be dug below mat forming herbs.  |                          |  |
| <i>Pandion cristatus</i>     | Eastern Osprey  | V      | M, MA    | Found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.  | None                     | None – no limiting habitat, migratory species                |
| <i>Petroica boodang</i>      | Scarlet Robin   | V      | -        | The Scarlet Robin is found from SE Queensland to SE South Australia and also in Tasmania and SW Western Australia. In NSW, it occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.   | Low                      | Low - Not observed during survey not preferred habitat.      |
| <i>Petroica rodinogaster</i> | Pink Robin      | V      | -        | The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. | Low                      | Low - Not observed during survey. Preferred habitat avoided. |
| <i>Phoebastria fusca</i>     | Sooty Albatross | V      | -        | In Australian waters, this species is generally recorded in winter off the south coast from Tasmania to Western Australia, while there are occasional sightings off the NSW coast, north of Grafton. This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters,  | None                     | None – no limiting habitat                                   |

| Scientific Name                         | Common Name              | BC Act | EPBC Act | Habitat  | Likelihood of Occurrence | Potential for impact                          |
|---|--------------------------|--------|----------|--|--------------------------|---|
|   |                          |        |          | spending the majority of its time at sea, and rarely occurs in continental shelf waters.   |                          |   |
| <i>Pterodroma leucoptera leucoptera</i> | Gould's Petrel           |        | E        | Pelagic marine species, spending much of its time foraging at sea and coming ashore only to breed. The Australian subspecies breeds and roosts on two islands off NSW, Cabbage Tree and Boondelbah Islands. They nest predominantly in natural rock crevices among the rock scree and also in hollow fallen palm trunks, under mats of fallen palm fronds and in cavities among the buttresses of fig trees. | None                     | None – no limiting habitat                    |
| <i>Pterodroma neglecta neglecta</i>     | Kermadec Petrel          | V      | V        | Breeds on Balls Pyramid, near Lord Howe Island, and on Phillip Island. Its pelagic distribution is poorly known. It generally occurs in subtropical and tropical waters from about 20° S to 35° S, although it may disperse north of the equator. It occasionally reaches the eastern coast of mainland Australia.   | None                     | None – no limiting habitat                    |
| <i>Rostratula australis</i>             | Painted Snipe            | E      | E, MA    | In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.  | None                     | None – no limiting habitat, migratory species |
| <i>Rostratula australis</i>             | Australian Painted Snipe | E      | E, M     | In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open   | None                     | None – no limiting habitat, migratory species |

| Scientific Name                           | Common Name            | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact                                 |
|---|------------------------|--------|----------|---|--------------------------|--|
|   |                        |        |          | timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.  |                          |  |
| <i>Sternula nereis nereis</i>             | Fairy Tern             | -      | V        | Distribution includes the southern half of NSW coast. Fairy Terns utilise a variety of habitats including offshore, islands in estuaries or lakes, wetlands, beaches and spits.   | None                     | None – no relevant habitat present.                  |
| <i>Stictonetta naevosa</i>                | Freckled Duck          | V      | -        | The freckled duck breeds in permanent fresh swamps that are heavily vegetated. Found in fresh or salty permanent open lakes, especially during drought. Often seen in groups on fallen trees and sand spits.  | Low                      | None – no permanent fresh swamps or limiting habitat |
| <i>Thalassarche bulleri</i>               | Buller's Albatross     |        | V, M, MA | In Australia, Buller's Albatross are seen over inshore, offshore and pelagic waters. Nesting occurs on subtropical and subantarctic islands and rock stacks in the New Zealand region.  | None                     | None – no limiting habitat, migratory species        |
| <i>Thalassarche bulleri platei</i>        | Pacific Albatross      |        | V, M, MA | Non-breeding visitor to Australian waters. Foraging birds are mostly limited to the Pacific Ocean and the Tasman Sea, although birds do reach the east coast of the Australian mainland.  | None                     | None – no limiting habitat, migratory species        |
| <i>Thalassarche cauta</i>                 | Black-browed Albatross | V      | -        | The Black-browed Albatross has a circumpolar range over the southern oceans, and are seen off the southern Australian coast mainly during winter. Inhabits antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. | None                     | None – no limiting habitat, migratory species        |
| <i>Thalassarche cauta (sensu stricto)</i> | Shy Albatross          |        | V, M, MA | Marine species occurring in subantarctic and subtropical waters. Birds have been noted in shelf-waters around breeding islands and over adjacent rises. Nests on rocky islands.   | None                     | None – no limiting habitat, migratory species        |



| Scientific Name                   | Common Name            | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact                          |
|-----------------------------------|------------------------|--------|----------|---|--------------------------|---|
| <i>Thalassarche cauta eremita</i> | Chatham Albatross      |        | E, M, MA | Marine species that occurs in subantarctic and subtropical waters reaching the tropics. It appears to be largely pelagic and has been noted in shelf-waters around breeding islands, over continental shelves during the non-breeding season, and occurs inshore and offshore. It usually nests on rocky ledges and steep slopes. | None                     | None – no limiting habitat, migratory species |
| <i>Thalassarche cauta steadi</i>  | White-capped Albatross |        | V, M, MA | Common off the coast of south-east Australia throughout the year. It has been observed that juveniles are rare in New Zealand waters, being more common off south-east Australia and South Africa. Breeding colonies occur on islands south of New Zealand.   | None                     | None – no limiting habitat, migratory species |
| <i>Thalassarche eremita</i>       | Chatham Albatross      |        | E, M, MA | Marine species that occurs in subantarctic and subtropical waters reaching the tropics. It appears to be largely pelagic and has been noted in shelf-waters around breeding islands, over continental shelves during the non-breeding season, and occurs inshore and offshore. It usually nests on rocky ledges and steep slopes. | None                     | None – no limiting habitat, migratory species |
| <i>Thalassarche impavida</i>      | Campbell Albatross     |        | V, M, MA | Marine species occurring in subantarctic and subtropical waters. It occurs inshore and offshore over continental shelves, around continents and may enter harbours and bays. Nests on ledges and steep slopes covered in low native grasses, tussocks and mud.  | None                     | None – no limiting habitat, migratory species |
| <i>Thalassarche melanophris</i>   | Black-bowed albatross  | V      | V, M, MA | The Black-browed Albatross is a marine species that inhabits Antarctic, subantarctic and temperate waters and occasionally enters the tropics.  | None                     | None – no limiting habitat, migratory species |
| <i>Thalassarche salvini</i>       | Salvin's Albatross     |        | V, M, MA | Marine species occurring in subantarctic and subtropical waters. It occurs inshore and offshore over continental  | None                     | None – no limiting habitat, migratory species |

| Scientific Name              | Common Name            | BC Act | EPBC Act       | Habitat   | Likelihood of Occurrence | Potential for impact  |
|------------------------------|------------------------|--------|----------------|---|--------------------------|---|
|                              |                        |        |                | shelves, around continents and may enter harbours and bays. It breeds mostly on small, bare rocky islands.  |                          |   |
| <i>Thalassarche steadi</i>   | White-capped Albatross |        | V, M, MA       | Common off the coast of south-east Australia throughout the year. It has been observed that juveniles are rare in New Zealand waters, being more common off south-east Australia and South Africa. Breeding colonies occur on islands south of New Zealand.   | None                     | None – no limiting habitat, migratory species   |
| <i>Thinornis rubricollis</i> | Hooded Plover          | CE     | V, MA          | The Hooded Plover occurs on sandy beaches and inland saltlakes of south-eastern and south-western Australia. Within NSW, the Hooded Plover occurs along the southern coast, north to Jervis Bay. In souther-eastern Australian, the Hooded Plover is found mostly on long stretches of sandy shore, backed by tussock and creeper covered dunes with nearby inland lakes. | None                     | None – no limiting habitat, migratory species   |
| <i>Tyto tenebricosa</i>      | Sooty Owl              | V      | -              | Often found in tall old-growth forests, including temperate and subtropical rainforests. In NSW mostly found on escarpments with a mean altitude less than 500 metres. Nests and roosts in hollows of tall emergent trees, mainly eucalypts often located in gullies. Nests have been located in trees 125 to 161 centimetres in diameter.                                | Low                      | None – no hollows large enough within the Project Area for breeding habitat and not preferred aspect. Low likelihood of foraging. |
| <i>Xenus cinereus</i>        | Terek Sandpiper        | V      | M, MA, C, J, K | Forages in the open, on soft wet intertidal mudflats or in sheltered estuaries, embayment's, harbours or lagoons. The species has also been recorded on islets, mud banks, sandbanks and spits, and near mangroves and occasionally in samphire. Northern hemisphere breeding.  | None                     | None – no limiting habitat, migratory species   |

| Scientific Name                     | Common Name                        | BC Act | EPBC Act | Habitat  | Likelihood of Occurrence | Potential for impact  |
|-------------------------------------|------------------------------------|--------|----------|--|--------------------------|---|
| <b>Mammals</b>                      |                                    |        |          |  |                          |   |
| <i>Chalinolobus dwyeri</i>          | Large-eared Pied Bat               | V      | V        | Located in a variety of drier habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range. Can also be found on the edges of rainforests and in wet sclerophyll forests. This species roosts in caves and mines in groups of between 3 and 37 individuals.  | Low                      | Low – not recorded during survey.   |
| <i>Dasyurus maculatus maculatus</i> | Spotted-tailed Quoll               | V      | E        | Spotted-tailed Quoll are found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. 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.  | Moderate                 | Low – exposed farmland adjacent to intact vegetation with no exposed rocks or cliffs nearby.                |
| <i>Isodon obesulus obesulus</i>     | Southern Brown Bandicoot (eastern) | E      | E        | Prefers sandy soils with scrubby vegetation and-or areas with low ground cover that are burn from time to time. A mosaic of post fire vegetation is important for this species.  | Low                      | None – no limiting habitat. Not recorded from locality.   |
| <i>Micronomus norfolkensis</i>      | Eastern Freetail-bat               | V      | -        | Most records are from dry eucalypt forests and woodlands to the east of the Great Dividing Range. Appears to roost in trees, but little is known of this species' habits.  | Known                    | Recorded during survey.   |
| <i>Miniopterus australis</i>        | Little Bentwing-bat                | V      | -        | Coastal north-eastern NSW and eastern Queensland. Little Bent-wing Bat is an insectivorous bat that roost in caves, in old mines, in tunnels, under bridges, or in similar structures. They breed in large aggregations in a small number of known caves and may travel 100s km from feeding home ranges to breeding sites. Little Bent-wing Bat has a preference for moist eucalypt forest, rainforest or dense | Known                    | High – recorded during survey near to proposed development areas. Project Area limited to foraging habitat. |

| Scientific Name                       | Common Name          | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact   |
|---------------------------------------|----------------------|--------|----------|---|--------------------------|--|
|                                       |                      |        |          | coastal banksia scrub where it forages below the canopy for insects.  |                          |  |
| <i>Miniopterus orianae oceanensis</i> | Eastern Bentwing-bat | V      | -        | Eastern Bent-wing 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. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.   | Known                    | High – recorded during survey near to proposed development areas. Project Area limited to foraging habitat.  |
| <i>Myotis macropus</i>                | Southern Myotis      | V      | -        | The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. 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.  | Low                      | Low – not recorded during targeted survey. Limited foraging or breeding habitat within Project Area due to very limited permanent watercourses (i.e. small poorly connected farm dams only). |
| <i>Petauroides volans</i>             | Greater Glider       | -      | V        | The Greater Glider occurs in eucalypt forests and woodlands. The Greater Glider occurs in eucalypt forests and woodlands. The species nests in hollows and are typically found in older forests. Generally the home range for the greater glider is between 0.7-3 hectares and tends to have a population density of 0.01-5 individuals per hectare. The home ranges of females can overlap with males and females however for the males the home ranges never overlap. | Low                      | Low – The Project Area contains mainly disturbed rainforest and Melaleuca shrublands, no preferred habitat (i.e. eucalypt woodland/forest).  |
| <i>Petaurus norfolcensis</i>          | Squirrel Glider      | V      | -        | Generally occurs in dry sclerophyll forests and woodlands but is absent from dense coastal ranges in the southern part of its range . Requires abundant hollow bearing trees and a mix of eucalypts, banksias and acacias . There is only limited information available on den tree use by Squirrel gliders, but it has been observed using both living and dead trees as   | Low                      | None – no smooth bark Eucalypts or large stands of Banksias, with only small scattered hollows across the Project Area and no limiting habitat. Not known from locality.                     |

| Scientific Name                         | Common Name                   | BC Act | EPBC Act | Habitat  | Likelihood of Occurrence | Potential for impact  |
|---|-------------------------------|--------|----------|--|--------------------------|---|
|   |                               |        |          | well as hollow stumps. Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked. Endangered population in the Wagga Wagga LGA.  |                          |   |
| <i>Petrogale penicillata</i>            | Brush-tailed Rock-wallaby     | E      | V        | Found in rocky areas in a wide variety of habitats including rainforest gullies, wet and dry sclerophyll forest, open woodland and rocky outcrops in semi-arid country. Commonly sites have a northerly aspect with numerous ledges, caves and crevices.                                       | Low                      | Low. Not known from locality with nearest records distant.  |
| <i>Potorous tridactylus tridactylus</i> | Long-nosed Potoroo            | V      | V        | Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy.  | Low                      | None – no coastal heath or liming habitat. Not known from locality.   |
| <i>Pseudomys novaehollandiae</i>        | New Holland Mouse             | -      | V        | The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. | Low                      | Low, limited habitat, not known from area.  |
| <i>Pteropus poliocephalus</i>           | Grey-headed Flying-fox        | V      | V        | <b>This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.</b>               | Known                    | <b>Known.</b><br>Impacts on relatively small area of preferred local foraging habitat including some large rainforest trees. See EPBC Act assessment of significance. |
| <i>Saccolaimus flaviventris</i>         | Yellow-bellied Sheathtail-bat | V      | -        | Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open  | Low                      | None – no limiting habitat and no records within survey.  |

| Scientific Name                  | Common Name             | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact  |
|----------------------------------|-------------------------|--------|----------|---|--------------------------|---|
|                                  |                         |        |          | country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.  |                          |   |
| <i>Scoteanax rueppellii</i>      | Greater Broad-nosed Bat | V      | -        | Prefer moist gullies in mature coastal forests and rainforests, between the Great Dividing Range and the coast. They are only found at low altitudes below 500 m. In dense environments they utilise natural and human-made opening in the forest for flight paths. Creeks and small rivers are favoured foraging habitat. This species roosts in hollow tree trunks and branches.  | High                     | High likelihood of some localised impacts. Probable calls recorded and known from area. |
| <b>Reptiles</b>                  |                         |        |          |   |                          |   |
| <i>Hoplocephalus bungaroides</i> | Broad-headed Snake      | E      | V        | Occurs almost exclusively in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they spend most of the year sheltering in and under rock crevices and exfoliating rock. However, some individuals will migrate to tree hollows to find shelter during hotter parts of summer. | None                     | None – no large exposed sandstone rocky outcrops on cliff or limiting habitat           |
| <b>Plants</b>                    |                         |        |          |   |                          |   |
| <i>Acacia bynoeana</i>           | Bynoe's Wattle          | E      | V        | Grows mainly in heath and dry sclerophyll forest in sandy soils. Mainly south of Dora Creek-Morriset area to Berrima and the Illawarra region, west to the Blue Mountains, also recorded from near Kurri Kurri in the Hunter Valley and from Morton National Park.  | None                     | None – no limiting habitat  |
| <i>Caladenia tessellata</i>      | Thick-lip Spider Orchid | E      | V        | The Tessellated Spider Orchid is found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony   | Low                      | None – no limiting habitat  |

| Scientific Name                | Common Name   | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact  |
|--------------------------------|---|--------|----------|---|--------------------------|---|
|                                |   |        |          | soil. Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct.  |                          |   |
| <i>Chorizema parviflorum</i>   | <i>Chorizema parviflorum</i> Benth. in the Wollongong and Shellharbour Local Government Areas | EP     | -        | This endangered population has been recorded from between Austinmer and Albion Park in the local government areas of Wollongong and Shellharbour. All known sites (excluding the site at Austinmer) occupy woodland or forest dominated by <i>Eucalyptus tereticornis</i> and-or <i>E. longifolia</i> . At Austinmer, the species is recorded from a coastal headland.  | Low                      | None – not known from habitat prevalent within the Project Area.                                |
| <i>Cryptostylis hunteriana</i> | Leafless Tongue-orchid  | V      | V        | Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum ( <i>Eucalyptus sclerophylla</i> ), Silvertop Ash ( <i>E. sieberi</i> ), Red Bloodwood ( <i>Corymbia gummifera</i> ) and Black Sheoak ( <i>Allocasuarina littoralis</i> ); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid ( <i>C. subulata</i> ) and the Tartan Tongue Orchid ( <i>C. erecta</i> ). | Low                      | None – not known from habitat prevalent at the Project Area.                                    |
| <i>Cynanchum elegans</i>       | White-flowered Wax Plant  | E      | E        | <b>Recorded from rainforest gullies scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar.</b>   | Known                    | <b>Known. Removal of one individual plant. See EPBC Act Assessment of Significance.</b>         |
| <i>Daphnandra johnsonii</i>    | Illawarra Socketwood  | E      | E        | Restricted to the Illawarra region where it has been recorded from the local government areas of Shoalhaven, Kiama, Shellharbour and Wollongong. Occupies the rocky hillsides and gullies of the Illawarra lowlands, occasionally   | Low                      | Low – no individuals detected during surveys. Occurs in older remnants which have been avoided. |

| Scientific Name                                   | Common Name          | BC Act | EPBC Act | Habitat   | Likelihood of Occurrence | Potential for impact  |
|---|----------------------|--------|----------|---|--------------------------|---|
|   |                      |        |          | extending onto the upper escarpment slopes. Associated vegetation includes rainforest and moist eucalypt forest.  |                          |   |
| <i>Genoplesium baueri</i>                         | Bauer's Midge Orchid | E      | E        | Grows in dry sclerophyll forest and moss gardens over sandstone. Flowers February to March. Has been recorded between Ulladulla and Port Stephens. Currently the species is known from just over 200 plants across 13 sites. The species has been recorded in Berowra Valley Regional Park, Royal National Park and Lane Cove National Park and may also occur in the Woronora, Oâ€™Hares, Metropolitan and Warragamba Catchments.  | Low                      | None – not known from habitat prevalent at the Project Area.  |
| <i>Haloragis exalata</i><br><i>subsp. exalata</i> | Square Raspwort      | V      | V        | Occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the central coast, south coast and north-western slopes botanical subdivisions of NSW. The species appears to require protected and shaded damp situations in riparian habitats.  | Low                      | None – not known from habitat prevalent at the Project Area.  |
| <i>Irenepharsus trypherus</i>                     | Illawarra Irene      | E      | E        | Typically inhabits steep rocky slopes near cliff lines and ridge tops. The species is less typically found growing out of rock crevices or on narrow benches along cliff lines. Most sites are recorded from the upper slopes of the ridge systems that extend south and east of the Illawarra escarpment, although the species has also been recorded from the deep sandstone gorges of the Shoalhaven River. Associated vegetation includes moist sclerophyll forest, ironwood thicket, and rainforest. | Moderate                 | Low – no individuals found during extensive targeted surveys. |
| <i>Melaleuca biconvexa</i>                        | Biconvex Paperbark   | V      | V        | Grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north.  | Low                      | None – not known from habitat prevalent at the Project Area.  |



| Scientific Name                                  | Common Name                                      | BC Act | EPBC Act | Habitat  | Likelihood of Occurrence | Potential for impact   |
|--|--|--------|----------|--|--------------------------|--|
| <i>Persicaria elatior</i>                        | Tall Knotweed                                    | V      | V        | This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.  | Low                      | None – not known from habitat prevalent at the Project Area. |
| <i>Persoonia hirsuta</i>                         | Hairy Geebung                                    | E      | E        | Distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. A large area of occurrence, but occurs in small populations, increasing the species fragmentation in the landscape. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. Usually present as isolated individuals or very small populations. Probably killed by fire (as other <i>Persoonia</i> spp. are) but will regenerate from seed. | Low                      | None – not known from habitat prevalent at the Project Area. |
| <i>Pimelea curviflora</i> var. <i>curviflora</i> | <i>Pimelea curviflora</i> var. <i>curviflora</i> | V      | V        | Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Occurs on shaley-lateritic soils over sandstone and shale-sandstone transition soils on ridgetops and upper slopes amongst woodlands.   | Low                      | None – not known from habitat prevalent at the Project Area. |
| <i>Pimelea spicata</i>                           | Spiked Rice-flower                               | E      | E        | In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. On the Cumberland Plain sites it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark.   | Low                      | None – not known from habitat prevalent at the Project Area. |
| <i>Prasophyllum affine</i>                       | Jervis Bay Leek Orchid                           | E      | E        | Grows on poorly drained grey clay soils that support low heathland and sedgeland communities. The underground dormant tubers commence shooting in mid winter and leaves are known to have emerged above ground by June. By January the leaves and fruiting stems have withered and   | Low                      | None – not known from habitat prevalent at the Project Area. |

| Scientific Name             | Common Name                           | BC Act | EPBC Act | Habitat  | Likelihood of Occurrence | Potential for impact   |
|-----------------------------|---------------------------------------|--------|----------|--|--------------------------|--|
|                             |                                       |        |          | the plants then persist as underground tubers until they resprout the following winter.  |                          |  |
| <i>Pterostylis gibbosa</i>  | Illawarra Greenhood                   | E      | E        | Grows in open forest or woodland, on flat or gently sloping land with poor drainage. Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra).   | Low                      | None – not known from habitat prevalent at the Project Area. |
| <i>Pultenaea aristata</i>   | Bearded Bush-pea                      | V      | V        | Grows in moist, dry sclerophyll woodland to heath on sandstone, specifically the drier areas of Upland Swamps. Restricted to the Woronora Plateau, a small area between Helensburgh, south of Sydney, and Mt Keira above Wollongong.   | Low                      | None – not known from habitat prevalent at the Project Area. |
| <i>Rhizanthella slateri</i> | Eastern Australian Underground Orchid | V      | E        | Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed. In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. | Low                      | None – not known from habitat prevalent at the Project Area. |
| <i>Rhodamnia rubescens</i>  | Scrub Turpentine                      | CE     | -        | Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of <i>R. rubescens</i> typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm   | Low                      | Low – not detected during targeted survey.                   |

| Scientific Name             | Common Name            | BC Act | EPBC Act | Habitat  | Likelihood of Occurrence                            | Potential for impact   |
|-----------------------------|------------------------|--------|----------|--|---|--|
|                             |                        |        |          | temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.   |   |  |
| <i>Solanum celatum</i>      | <i>Solanum celatum</i> | E      | -        | Grows on hills and slopes in eucalypt woodland; commonly found after fire or disturbance. Restricted to an area from Wollongong to a little south of Nowra and west to Bungonia Nature Reserve.  | Low   | Low – not detected during targeted survey.                   |
| <i>Syzygium paniculatum</i> | Magenta Lilly Pilly    | E      | V        | Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State forest. On the south coast the species occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral rainforest. On the central coast it occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities | Low   | None – not known from habitat prevalent at the Project Area. |
| <i>Thesium australe</i>     | Austral Toadflax       | V      | V        | Grows in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland or grassy woodland. Grows on kangaroo grass tussocks but has also been recorded within the exotic coolatai grass.  | Low   | None – not known from habitat prevalent at the Project Area. |
| <i>Zieria granulata</i>     | Illawarra Zieria       | E      | E        | <b>Restricted to the Illawarra region where it is recorded from a number of sites. The species primarily occupies the coastal lowlands between Oak Flats and Toolijooa, in the local government areas of Shellharbour and Kiama. This is a range of approximately 22 kilometres.</b>   | <b>Known – threatened species surveys conducted</b> | <b>Known – see EPBC Act assessment of significance.</b>      |

## Annex 7. Ecosystem and species credits required (BAM-C Credit report)

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## Proposal Details

|                                |                                    |                         |
|--------------------------------|------------------------------------|-------------------------|
| Assessment Id                  | Proposal Name                      | BAM data last updated * |
| 00031549/BAAS17040/22/00031550 | Albion Park Quarry Stage 7<br>BDAR | 24/11/2021              |
| Assessor Name                  | Report Created                     | BAM Data version *      |
| Simon Tweed                    | 09/03/2022                         | 50                      |
| Assessor Number                | BAM Case Status                    | Date Finalised          |
| BAAS17040                      | Finalised                          | 09/03/2022              |
| Assessment Revision            | Assessment Type                    |                         |
| 3                              | Major Projects                     |                         |

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

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

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

## Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion

|   |                     |   |      |      |      |                      |  |   |            |      |      |   |
|---|---------------------|---|------|------|------|----------------------|--|---|------------|------|------|---|
| 5 | 720_High            | Melaleuca<br>armillaris Tall<br>Shrubland in the<br>Sydney Basin<br>Bioregion | 23.3 | 23.3 | 0.38 | PCT Cleared -<br>75% | High<br>Sensitivity to<br>Potential Gain | Critically<br>Endangered<br>Ecological<br>Community | Not Listed | 2.50 | TRUE | 6 |
| 6 | 720_Mod-<br>High    | Melaleuca<br>armillaris Tall<br>Shrubland in the<br>Sydney Basin<br>Bioregion | 24.5 | 24.5 | 0.58 | PCT Cleared -<br>75% | High<br>Sensitivity to<br>Potential Gain | Critically<br>Endangered<br>Ecological<br>Community | Not Listed | 2.50 | TRUE | 9 |
| 7 | 720_Mode<br>rate    | Melaleuca<br>armillaris Tall<br>Shrubland in the<br>Sydney Basin<br>Bioregion | 15.9 | 15.9 | 0.47 | PCT Cleared -<br>75% | High<br>Sensitivity to<br>Potential Gain | Critically<br>Endangered<br>Ecological<br>Community | Not Listed | 2.50 | TRUE | 5 |
| 8 | 720_Low_L<br>ant    | Melaleuca<br>armillaris Tall<br>Shrubland in the<br>Sydney Basin<br>Bioregion | 10.2 | 10.2 | 0.29 | PCT Cleared -<br>75% | High<br>Sensitivity to<br>Potential Gain | Critically<br>Endangered<br>Ecological<br>Community | Not Listed | 2.50 | TRUE | 0 |
| 9 | 720_Low_<br>NoCanop | Melaleuca<br>armillaris Tall<br>Shrubland in the<br>Sydney Basin<br>Bioregion | 25.4 | 25.4 | 0.43 | PCT Cleared -<br>75% | High<br>Sensitivity to<br>Potential Gain | Critically<br>Endangered<br>Ecological<br>Community | Not Listed | 2.50 | TRUE | 7 |

|   |           |   |      |      |      |                      |  |   |                          |                 |           |    |
|---|-----------|---|------|------|------|----------------------|--|---|--------------------------|-----------------|-----------|----|
| 10  | 720_Poor  | Melaleuca<br>armillaris Tall<br>Shrubland in the<br>Sydney Basin<br>Bioregion | 10.3 | 10.3 | 0.77 | PCT Cleared -<br>75% | High<br>Sensitivity to<br>Potential Gain | Critically<br>Endangered<br>Ecological<br>Community | Not Listed               | 2.50            | TRUE      | 0  |
|   |           |   |      |      |      |                      |  |   |                          | <b>Subtotal</b> | <b>27</b> |    |
| <b>Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion</b> |           |   |      |      |      |                      |  |   |                          |                 |           |    |
| 1   | 1300_High | Illawarra<br>Subtropical<br>Rainforest in the<br>Sydney Basin<br>Bioregion    | 63.6 | 63.6 | 0.01 | PCT Cleared -<br>90% | High<br>Sensitivity to<br>Potential Gain | Endangered<br>Ecological<br>Community               | Critically<br>Endangered | 2.00            | TRUE      | 1  |
| 2   | 1300_Low  | Illawarra<br>Subtropical<br>Rainforest in the<br>Sydney Basin<br>Bioregion    | 44.9 | 44.9 | 3.1  | PCT Cleared -<br>90% | High<br>Sensitivity to<br>Potential Gain | Endangered<br>Ecological<br>Community               | Critically<br>Endangered | 2.00            | TRUE      | 70 |
| 3   | 1300_Poor | Illawarra<br>Subtropical<br>Rainforest in the<br>Sydney Basin<br>Bioregion    | 21.2 | 21.2 | 0.3  | PCT Cleared -<br>90% | High<br>Sensitivity to<br>Potential Gain | Endangered<br>Ecological<br>Community               | Critically<br>Endangered | 2.00            | TRUE      | 3  |

|   |                    |  |     |     |     |                   |                                    |                                 |                       |      |                 |            |
|---|--------------------|--|-----|-----|-----|-------------------|------------------------------------|---------------------------------|-----------------------|------|-----------------|------------|
| 4 | 1300_Very Degraded | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion | 9.1 | 9.1 | 1.2 | PCT Cleared - 90% | High Sensitivity to Potential Gain | Endangered Ecological Community | Critically Endangered | 2.00 | TRUE            | 0          |
|   |                    |  |     |     |     |                   |                                    |                                 |                       |      | <b>Subtotal</b> | <b>74</b>  |
|   |                    |  |     |     |     |                   |                                    |                                 |                       |      | <b>Total</b>    | <b>101</b> |

## Species credits for threatened species

| Vegetation zone name   | Habitat condition (Vegetation Integrity) | Change in habitat condition | Area (ha)/Count (no. individuals) | Sensitivity to loss (Justification) | Sensitivity to gain (Justification) | BC Act Listing status | EPBC Act listing status | Potential SAll | Species credits |          |
|--|--|-----------------------------|-----------------------------------|-------------------------------------|-------------------------------------|-----------------------|-------------------------|----------------|-----------------|----------|
| <b><i>Cynanchum elegans / White-flowered Wax Plant ( Flora )</i></b> |  |                             |                                   |                                     |                                     |                       |                         |                |                 |          |
| 1300_Low   |  | 44.9                        | 44.9                              | 0.14                                |                                     | Endangered            | Endangered              | False          | 3               |          |
| 1300_High  |  | 63.6                        | 63.6                              | 0.01                                |                                     | Endangered            | Endangered              | False          | 1               |          |
|  |  |                             |                                   |                                     |                                     |                       |                         |                | <b>Subtotal</b> | <b>4</b> |
| <b><i>Zieria granulata / Illawarra Zieria ( Flora )</i></b>          |  |                             |                                   |                                     |                                     |                       |                         |                |                 |          |
| 720_Moderate   | N/A                                      | N/A                         | 292                               |                                     |                                     | Endangered            | Endangered              | False          | 584             |          |
| 720_Mod-High   | N/A                                      | N/A                         | 128                               |                                     |                                     | Endangered            | Endangered              | False          | 256             |          |
| 720_Poor   | N/A                                      | N/A                         | 471                               |                                     |                                     | Endangered            | Endangered              | False          | 942             |          |
| 1300_High  | N/A                                      | N/A                         | 1                                 |                                     |                                     | Endangered            | Endangered              | False          | 2               |          |
| 720_High   | N/A                                      | N/A                         | 343                               |                                     |                                     | Endangered            | Endangered              | False          | 686             |          |
| 720_Low_Lant   | N/A                                      | N/A                         | 32                                |                                     |                                     | Endangered            | Endangered              | False          | 64              |          |



## BAM Credit Summary Report

|                    |     |     |     |  |  |            |            |                 |             |
|--------------------|-----|-----|-----|--|--|------------|------------|-----------------|-------------|
| 1300_Very_Degraded | N/A | N/A | 333 |  |  | Endangered | Endangered | False           | 666         |
| 720_Low_NoCa_nop   | N/A | N/A | 572 |  |  | Endangered | Endangered | False           | 1144        |
|                    |     |     |     |  |  |            |            | <b>Subtotal</b> | <b>4344</b> |



# BAM Biodiversity Credit Report (Like for like)

## Proposal Details

|                                |                                 |                         |
|--------------------------------|---------------------------------|-------------------------|
| Assessment Id                  | Proposal Name                   | BAM data last updated * |
| 00031549/BAAS17040/22/00031550 | Albion Park Quarry Stage 7 BDAR | 24/11/2021              |
| Assessor Name                  | Assessor Number                 | BAM Data version *      |
| Simon Tweed                    | BAAS17040                       | 50                      |
| Proponent Names                | Report Created                  | BAM Case Status         |
| Mark Hammond                   | 09/03/2022                      | Finalised               |
| Assessment Revision            | Assessment Type                 | Date Finalised          |
| 3                              | Major Projects                  | 09/03/2022              |

\* 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   |
|---|--|---|
| Illawarra Subtropical Rainforest in the Sydney Basin Bioregion    | Endangered Ecological Community            | 1300-Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion |
| Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion | Critically Endangered Ecological Community | 720-Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion             |
| Species   |  |   |
| <b>Nil</b>  |  |   |

## BAM Biodiversity Credit Report (Like for like)

### Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT

No Changes

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 |
|---|---|----------------|--------|-----------|-----------------------------|
| 1300-Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion    | 4.7            | 3      | 71        | 74                          |
| 720-Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion             | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion | 2.9            | 0      | 27        | 27                          |

## BAM Biodiversity Credit Report (Like for like)

| 720-Bracelet Honey-myrtle -<br>Australian Indigo dry<br>shrubland on volcanics,<br>southern Sydney Basin<br>Bioregion | Like-for-like credit retirement options  |               |              |     |  |  |
|---|--|---------------|--------------|-----|--|--|
|   | Name of offset trading group   | Trading group | Zone         | HBT | Credits  | IBRA region  |
|   | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion<br>This includes PCT's:<br>720 | -             | 720_High     | No  | 6  | Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts.<br><br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
|   | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion<br>This includes PCT's:<br>720 | -             | 720_Mod-High | No  | 9  | Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts.<br><br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion<br>This includes PCT's:<br>720                      | -  | 720_Moderate  | No           | 5   | Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts.<br><br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |  |



## BAM Biodiversity Credit Report (Like for like)

|  |  |               |                     |     |         |  |
|--|--|---------------|---------------------|-----|---------|--|
|  | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion<br>This includes PCT's:<br>720 | -             | 720_Low_Lant        | No  | 0       | Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts.<br><br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
|  | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion<br>This includes PCT's:<br>720 | -             | 720_Low_NoCa<br>nop | No  | 7       | Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts.<br><br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
|  | Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion<br>This includes PCT's:<br>720 | -             | 720_Poor            | No  | 0       | Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts.<br><br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| <b>1300-Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion</b> | <b>Like-for-like credit retirement options</b>   |               |                     |     |         |  |
|  | Name of offset trading group   | Trading group | Zone                | HBT | Credits | IBRA region  |

## BAM Biodiversity Credit Report (Like for like)

|  |   |   |           |     |   |
|--|---|---|-----------|-----|---|
|  | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion<br>This includes PCT's:<br>906, 1300 | - | 1300_High | No  | 1 Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.  |
|  | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion<br>This includes PCT's:<br>906, 1300 | - | 1300_Low  | No  | 70 Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
|  | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion<br>This includes PCT's:<br>906, 1300 | - | 1300_Poor | Yes | 3 Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.  |

## BAM Biodiversity Credit Report (Like for like)

|  |  |   |                    |    |  |
|--|--|---|--------------------|----|--|
|  | Illawarra Subtropical Rainforest in the Sydney Basin Bioregion<br>This includes PCT's: 906, 1300 | - | 1300_Very_Degraded | No | 0 Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts.<br><br>or<br>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 |
|---|---|--------------|---------|
| <b>Cynanchum elegans</b> / White-flowered Wax Plant | <b>1300_Low, 1300_High</b>  | 0.2          | 4.00    |
| <b>Zieria granulata</b> / Illawarra Zieria          | <b>720_Moderate, 720_Mod-High, 720_Poor, 1300_High, 720_High, 720_Low_Lant, 1300_Very_Degraded, 720_Low_NoCanop</b> | 2172.0       | 4344.00 |

### Credit Retirement Options

Like-for-like credit retirement options

|   |   |                |
|---|---|----------------|
| <b>Cynanchum elegans</b> / White-flowered Wax Plant | Spp   | IBRA subregion |
|   | <b>Cynanchum elegans</b> / White-flowered Wax Plant | Any in NSW     |



## BAM Biodiversity Credit Report (Like for like)

| Zieria granulata / Illawarra Zieria | Spp                                 | IBRA subregion |
|-------------------------------------|-------------------------------------|----------------|
|                                     | Zieria granulata / Illawarra Zieria | Any in NSW     |



## Annex 8. EPBC Act Significant Impact Criteria Assessment

Assessments of Significance and supplementary information (where relevant) are presented for the following MNES in relation to the Project:

- Threatened Ecological Communities: Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion
- Threatened Flora: *Zieria granulata* and *Cynanchum elegans*
- Threatened Fauna: *Pteropus poliocephalus* (Grey-headed Flying fox)

### Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (Critically Endangered)

**Description:** The Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (ISR) is an Illawarra rainforest community closely associated with topographically more sheltered sites and with more fertile (relatively high-nutrient) soils with greater water-holding capacity. Both of these environmental constraints are closely linked to variations in geology and drainage lines. Within this context, the ecological community occupies a number of landscape positions, including the slopes of the escarpment, on rocky scree and in gully lines. It typically occurs on fertile volcanic soils; and also, on other relatively high-nutrient soils on escarpment benches and in sheltered gullies.

#### Distribution

The Illawarra–Shoalhaven subtropical rainforest ecological community occurs south of Sydney in NSW, in the Sydney Basin IBRA Bioregion. It occurs in the Illawarra, Jarvis and Sydney Cataract IBRA subregions, and just over the borders into Burragorang, Moss Vale and Ettrema subregions; it may also occur elsewhere in the Sydney Basin Bioregion, in other subregions. The majority of the ecological community occurs in the Illawarra IBRA Subregion.

#### Summary of impacts and context of ISR for the Project

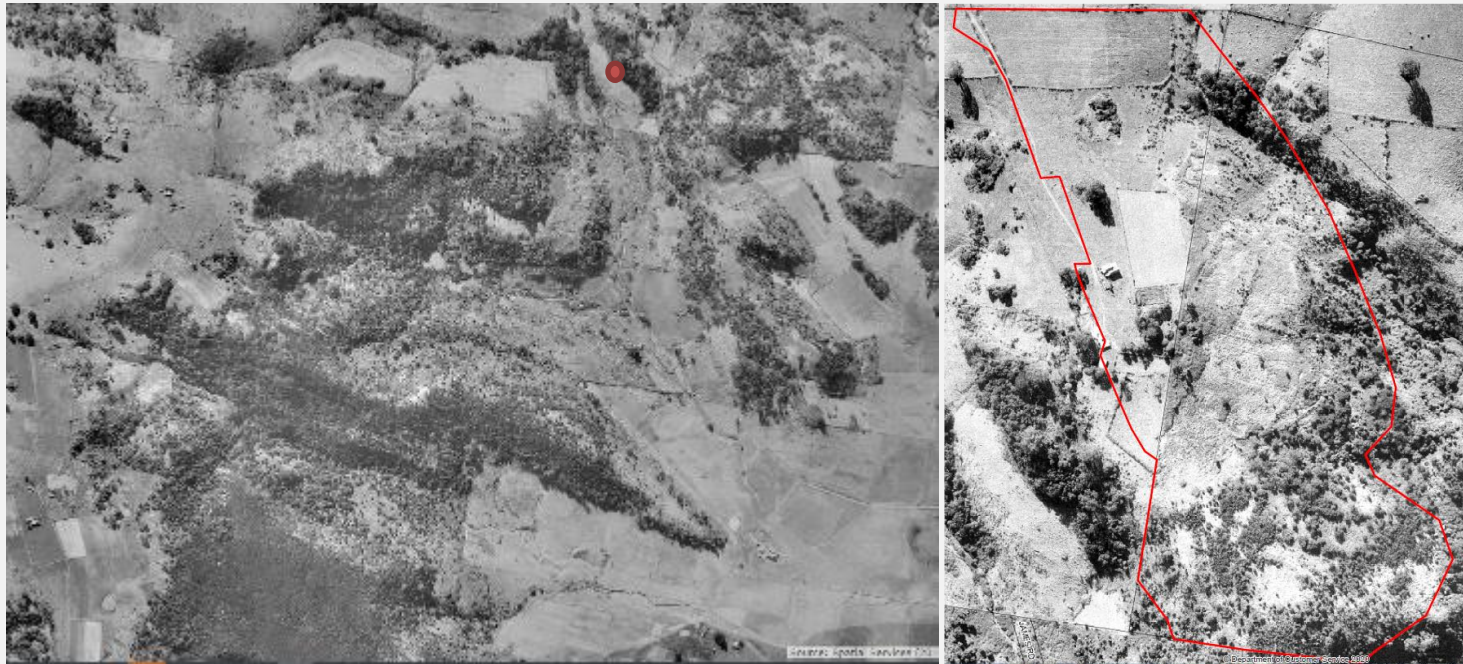
The rainforest patch considered within this assessment and impacted by the Project constitutes the area of rainforest along the eastern part of the Project Area, extending 400 m to the east and approximately 3.5 km to the south-west of the Project Area encompassing approximately 160 hectares. While sampling was not conducted over the entire patch, the patch is considered to be a 'Moderate Condition Category A' class patch based on at least 50% canopy cover (all canopy strata from sub-canopy to emergent layer), a minimum of 5 native plant species from Table A1 (of DoEE 2019) per 0.04 ha sample plot on average for the patch and the patch being greater than 1 hectare. The patch is not considered to be a high condition class because the majority of the patch would have less than 70% canopy cover and less than 30 species from the relevant species list.

The assessed patch is highly variable in condition throughout having areas of good condition separated by significant areas of lantana infestation due to previous clearing activities, primarily for agriculture (see plates below). The area of rainforest to be impacted by the Project has somewhat poor connectivity to the larger patch of ISR within the locality. Remnant patches that have not been cleared (corresponding with the best condition) have been largely avoided by the Project.

A total of 4.69 hectares of ISR would be cleared as part of the Project according to the condition classes below. Almost all the clearing is of low condition areas with the better condition areas of ISR having been avoided via project redesign. Offsetting requirements for the Project are likely to lead to a no net loss outcome for ISR in terms of condition and extent, however there would be a lag between the impacts and conservation gains. Offsetting gains have not been taken into account in performing this assessment (in terms of overall conclusions) as per relevant EPBC Act guidelines, however reference has been made to offsetting as it is relevant to the Project.

**Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (Critically Endangered)**

| Vegetation zone                                  | Condition description   | Area    |
|--|---|---------|
| Illawarra Subtropical Rainforest - High          | Canopy intact with high species richness. All strata generally present and older growth.  | 0.01 ha |
| Illawarra Subtropical Rainforest - Low           | Regenerating rainforest with native species forming a moderate canopy cover and diversity – high weed occurrence in most areas. | 3.14 ha |
| Illawarra Subtropical Rainforest - Very degraded | Vast majority of cover is from thick lantana and other weeds. Previously cleared  | 1.24 ha |
| Illawarra Subtropical Rainforest - Poor          | Small isolated rainforest in paddocks (most does not meet EPBC Act condition thresholds)  | 0.30 ha |



**Plate 4: Historic (1961) imagery showing areas of previous clearing within and around the Project Area.**

| Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (Critically Endangered)  |   |  |
|--|---|--|
| Assessment of significance   | Response  | Likelihood   |
| An action is likely to have a significant impact on an endangered or critically endangered community if there is a real chance or possibility that it will:  |   |  |
| <ul style="list-style-type: none"> <li>reduce the extent of an ecological community</li> </ul>   | <p>The Project would involve the removal of 4.69 hectares of predominantly low condition ISR native vegetation. The extent of ISR is estimated to be 6500 ha (DoEE 2019), therefore the extent would be reduced by approximately 0.07%, not accounting for any increased extent which may result from offset requirements for the Project.</p> <p>The extent of occurrence of a community is considered as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence (as per IUCN criteria). The current extent of ISR includes areas of the community in all directions from the proposed clearing Project Area. Therefore, the current Project is considered unlikely to reduce the overall extent of occurrence of the community.</p>  | <p>Likely – small reduction extent.</p> <p>No reduction in overall extent of occurrence.</p> |
| <ul style="list-style-type: none"> <li>fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines</li> </ul>  | <p>The Project would result in a small increase in the level of fragmentation for the existing remnant ISR patch. The increased fragmentation is via the introduction of a large area extracted between areas of ISR to the west and east of the Project Area which are currently separated via fenced paddocks. This may reduce seed dispersal and animal dispersal for some species that are currently able to move between east and west. Connectivity south of the Project Area would remain, however the width of the vegetated corridor would be reduced (from approximately 130m to 65m). The majority of the ISR patch is to the south-west of the Project Area.</p>  | <p>Likely – relatively small increase.</p>   |
| <ul style="list-style-type: none"> <li>adversely affect habitat critical to the survival of an ecological community</li> </ul>   | <p>The area considered critical to the survival of the ecological community includes all patches that meet the Key diagnostic characteristics and at least the minimum condition thresholds (Moderate or High Condition classes) (DoEE 2019). Therefore the Project would adversely affect habitat critical to the survival of ISR.</p>   | <p>Unlikely</p>  |
| <ul style="list-style-type: none"> <li>modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns</li> </ul> | <p>Some potential indirect impacts via edge effects may occur from the Project on adjacent areas of ISR that remain to the east, south-east, south and south-west of the Project Area after areas are extracted. Areas of ISR downslope of the extraction area constitute approximately 5-10 hectares. Such areas would likely experience some level of reduced surface run-off such that overall water availability would slightly decrease. The overall magnitude of the impacts is considered to be low, given the main impacted area would be to the east of the Project Area which is predominantly lower condition ISR.</p> <p>Increased light and heat penetration may occur around the boundaries of the Project Area which may have some impacts on remnant ISR surrounding the Project Area via desiccation and increased risk of weed invasion. These impacts would be managed via rehabilitation efforts within ISR adjacent to the Project Area. Given the current high concentrations of weeds adjacent to large parts of the Project Area, any increased light/heat impacts would likely be balanced via rehabilitation which would increase canopy cover to facilitate lower weed concentrations and desiccation tolerance.</p> | <p>Potential impacts which would be managed.</p>   |

**Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (Critically Endangered)**

|   |  |                 |
|---|--|-----------------|
| <ul style="list-style-type: none"> <li>cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting</li> </ul>  | <p>Given the current high concentrations of weeds within areas to be impacted both directly and indirectly together with commitments to control weeds adjacent to the Project Area the composition of the community is unlikely to change substantially and no new weeds are likely to become established. Any changes in plant composition are likely to be limited and localised, with some positive changes likely to occur via rehabilitation commitments. The fauna assemblage is unlikely to change substantially given the location and size of the impact area in the context of the larger ISR patch.</p> <p>There are no known risks of chemical or pollutant mobilisation from the Project.</p> | <p>Unlikely</p> |
| <ul style="list-style-type: none"> <li>cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:               <ul style="list-style-type: none"> <li>– assisting invasive species, that are harmful to the listed ecological community, to become established, or</li> <li>– causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or</li> </ul> </li> </ul> | <p>Given the current high concentrations of weeds within areas to be impacted both directly and indirectly together with commitments to control weeds adjacent to the Project Area and weed control protocols in place during clearing, no new weeds are likely to become established.</p> <p>There are no known risks of chemical or pollutant mobilisation from the Project.</p>   | <p>Unlikely</p> |
| <ul style="list-style-type: none"> <li>interfere with the recovery of an ecological community.</li> </ul>   | <p>The Project will not impact upon areas of ISR that are part of targeted recovery efforts. Areas of ISR that are proposed to be impacted by the Project are unlikely to recover as the present threats via weed invasion are a significant barrier to their recovery if left unmanaged.</p>  | <p>Unlikely</p> |

**Conclusion:** The EPBC Act assessment requires that the ISR habitat to be impacted is classed as habitat critical to the survival of ISR. There will be a small decrease in the extent of ISR from the Project. Therefore, based on EPBC Act guidelines, the Project is likely to have a significant impact on ISR. This conclusion has not taken into account offsetting requirements which are designed to reach a no net loss outcome, which given the degraded nature of areas to be impacted is considered a likely outcome over the medium to long-term (i.e. 20 years).

### Illawarra Zieria (*Zieria granulata*) (Endangered)

#### Description

A tall bushy shrub that grows to 6 m. The entire plant is densely covered with glandular tubercles (small wart-like outgrowths) that give a strong aroma when crushed. Its leaves consist of three narrow leaflets that are dull green above, pale green below, 19.5 to 42.5 mm long, and have downward curved margins. Its small white flowers grow in dense many-flowered clusters. The fruit is a dry, light brown capsule containing dark reddish brown seeds to 2 mm long

#### Distribution

Restricted to the Illawarra region where it is recorded from a number of sites. The species primarily occupies the coastal lowlands between Oak Flats and Toolijooa, in the local government areas of Shellharbour and Kiama. This is a range of approximately 22 kilometres.

Ninety-seven sites were identified within the recovery plan for *Z. granulata* (DEC 2005), however, since that time additional sites have recorded the species. The Project Area is one of a number of sites associated with locally high elevation areas of latite occurring from the Croome area south to Jamberoo near to the Minnamurra River, some of which is zoned for extraction.

#### Habitat requirements

The typical habitat is dry ridge tops and rocky outcrops on shallow volcanic soils, usually on Bumbo Latite. Less frequently found on the moist slopes of the Illawarra escarpment and in low-lying areas on Quaternary sediments. Associated vegetation includes Bracelet Honey-myrtle *Melaleuca armillaris* scrub, Forest Red Gum *Eucalyptus tereticornis* woodland and rainforest margins, although the species has been recorded from a number of other vegetation types. Most vegetation types are also listed as Endangered Ecological Communities. Much of the natural habitat for the species has been removed and many sites now occupy road verges and paddock edges.

(DPIE 2020h, DPIE 2020b)

#### Summary of impacts and context of *Z. granulata* for the Project

An area of 3.01 hectares of *Z. granulata* habitat will be removed by the Project with an area of approximately 0.58 hectares to be retained within areas zoned for extraction. The area to be removed supports an estimated 4,521 plants (both mature and immature) including an estimated 2,170 mature plants. Habitat to be removed is predominantly *Melaleuca armillaris* shrubland (2.66 ha) with some exotic pasture (0.34 ha) and rainforest (0.01 ha). Vegetation to be removed is predominantly low condition vegetation as tabled below whereas areas to be retained are predominantly higher condition vegetation (moderate or better).

| Vegetation condition | Area (ha)   |
|----------------------|-------------|
| Exotic pasture       | 0.339       |
| Low or poor          | 1.305       |
| Moderate             | 0.443       |
| Moderate-high        | 0.527       |
| High                 | 0.391       |
| <b>Total</b>         | <b>3.01</b> |

### Illawarra Zieria (*Zieria granulata*) (Endangered)

Survey performed for this assessment focused on the Study Area, however one area of known habitat 200 m to the east of the Project Area comprising approximately 2.0 hectares was also surveyed to confirm the presence of *Z. granulata*. Plants within this area face similar threats to those within the Project Area (e.g. weed invasion), however they occur outside of extraction zoned areas.

Surveys within the Project Area and surrounds identified significantly higher densities and smaller plants in areas that have been exposed to soil disturbance associated with farming practices (Figure 4). Lower densities and larger individuals are present in better condition areas with lower disturbance regimes. Therefore while a high number of individual plants will be removed areas of avoidance prioritised condition of habitat rather than number of plants. In addition, disturbed areas have less security since while there are currently a large number of plants within these areas, ongoing disturbance (e.g. cattle grazing and trampling) may hamper the ability of plants to continue to successfully flower, seed and recruit. In addition, significant areas of low condition vegetation within the Project Area are at threat of being smothered by thick Lantana or other regenerating native pioneer species such as *Androcalva fraseri*. Areas of lantana infestations have limited *Z. granulata* (or other native shrubs) presence and dieback of *Z. granulata* is evident in such areas both within the Project Area and surrounds.

The impacts to this species will be offset under the NSW BOS requirements. Offsetting and active regeneration gains have not been taken into account in performing this assessment (in terms of overall conclusions) as per relevant EPBC Act guidelines, however reference has been made to offsetting and regeneration as it is relevant to the Project.

| Assessment of significance   | Response  | Likelihood   |
|--|---|--|
| An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will: |   |  |
| <ul style="list-style-type: none"> <li>lead to a long-term decrease in the size of a population</li> </ul>                       | The population within the Project Area is considered an important population of the species given it is one of the larger documented occurrences in terms of the number of plants and area. The Project is likely to lead to a long-term decrease in the size of the population in the short term.  | Likely   |
| <ul style="list-style-type: none"> <li>reduce the area of occupancy of the species</li> </ul>                                    | The species is known from the locality and immediate surrounds utilising the rocky outcrops and cliffs in the area. The Project is likely to reduce the area of occupancy of the species by approximately 3.01 hectares. This scale of impact does not translate to a reduced area of occupancy using typical methods and scales to calculate area of occupancy for example 1km or 2km grid cells (e.g. IUCN methodologies).  | Likely though not at scales used for area of occupancy calculations. |
| <ul style="list-style-type: none"> <li>fragment an existing population into two or more populations</li> </ul>                   | The area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the Project since areas of habitat around the disturbance area will be retained and managed. The Project layout will not break linkages between areas of <i>Z. granulata</i> around the Project Area. Pollinators of the species are likely to continue to cross pollinate plants within the remaining population. Populations for this species have been considered as the same population when within 2km of each other (DEC 2005), therefore, the Project is not likely to fragment an existing population into two or more populations. | Unlikely   |
| <ul style="list-style-type: none"> <li>adversely affect habitat critical to the survival of a species</li> </ul>                 | No critical habitat for this species has been declared. The distribution of the species is restricted to the fertile soils and ridge tops in the Illawarra and therefore potential habitat is limited in its occurrence.  | Possible   |

**Illawarra Zieria (*Zieria granulata*) (Endangered)**

|   |   |          |
|---|---|----------|
|   | Given these restrictions the type of habitat within the Project Area is considered to be consistent with definitions of critical habitat. However, the removal of the habitat in this instance is unlikely to be critical to the survival of the population of the species given extensive additional habitat present to the south.   |          |
| <ul style="list-style-type: none"> <li>disrupt the breeding cycle of a population</li> </ul>  | <p>The species is known from the locality and immediate surrounds utilising the rocky outcrops and cliffs in the area.</p> <p>Important habitat utilised by the Illawarra Zieria will be removed as part of the Project although the breeding cycle in the broader population is unlikely to be impacted such that the population cannot persist.</p>   | Unlikely |
| <ul style="list-style-type: none"> <li>modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</li> </ul>                                       | Limiting habitat utilised by the Illawarra Zieria will be reduced but not completely removed in the Project Area. Extensive areas of habitat will remain within the Project Area and its surrounds. Given the number of plants to be removed by the Project the overall population is expected to decline at some level. Any such decline would be partially mitigated by management of <i>Zieria granulata</i> within adjacent areas where key threats are currently occurring, most notably Lantana invasion. | Likely   |
| <ul style="list-style-type: none"> <li>result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</li> </ul> | The Project is not likely to introduce or increase the amount of invasive species present within the Project Area, provided mitigation measures detailed in Section 3.2.2 are adhered to.   | Unlikely |
| <ul style="list-style-type: none"> <li>introduce disease that may cause the species to decline</li> </ul>   | The Project is not likely to introduce or increase the amount of diseases present within the Project Area, provided mitigation measures detailed in Section 3.2.2 are adhered to.   | Unlikely |
| <ul style="list-style-type: none"> <li>interfere substantially with the recovery of the species.</li> </ul>   | The Project will not impact upon areas of <i>Z. granulata</i> that are part of targeted recovery efforts. The Project is likely to encourage recovery of the species outside of the Project Area via management commitments and offset requirements.  | Unlikely |

**Conclusion:** Since a relatively large number of plants would be removed there is likely to be a decline in the population size over the medium to long-term, which is considered significant.

### White-flowered Wax Plant (*Cynanchum elegans*) (Endangered)

#### Description

A climber or twiner with a highly variable form. Mature stems have a fissured corky bark and can grow to 10 metres long and 3.5 cm thick. The leaves are paired (or rarely in threes), ovate to broadly ovate in shape, 1.5 to 10.5 cm long, and 1.5 to 7.5 cm wide. The flowers are white, tubular, and up to 4 mm long and 12 mm wide. The fruit is a dry pointed pod to 8 cm long, which contains up to 45 seeds with long silky hairs attached to one end.

#### Distribution

Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. The species has been recorded as far west as Merriwa in the upper Hunter River valley. Seeds are wind dispersed. Seed production is variable and unreliable and it is unlikely that a soil seed bank exists for this species (NPWS 2002).

#### Habitat requirements

The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation, primarily at the transition zone (ecotone) between dry subtropical rainforest and sclerophyll forest/woodland communities in eastern NSW (DAWE 2008). Other associated vegetation types include Littoral Rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; Forest Red Gum Eucalyptus *tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honey Myrtle *Melaleuca armillaris* scrub to open scrub.

#### Summary of impacts and context of *C.elegans* for the Project

An area of 0.15 hectares of *C.elegans* habitat with a single confirmed individual will be removed by the Project with an area of approximately 1.20 hectares of potential habitat to be retained within areas zoned for extraction. While surveys across the Project Area were extensive, as this species is a canopy species which can be difficult to detect and define the extent of, areas of potential habitat have been modelled and referred to on a precautionary basis. The area to be removed supports an estimated known one plant. Habitat to be removed is predominantly *Melaleuca armillaris* shrubland (0.15 ha). Overall vegetation to be removed is predominantly low condition vegetation as tabled below whereas areas to be retained are predominantly higher condition vegetation (moderate or better). Survey performed for this assessment focused on the proposed extraction area and found one individual plant in the high condition *Melaleuca armillaris* shrubland.

The impacts to this species will be offset under the NSW BOS requirements. Offsetting and active regeneration gains have not been taken into account in performing this assessment (in terms of overall conclusions) as per relevant EPBC Act guidelines.

| Assessment of significance   | Response   | Likelihood          |
|--|--|---------------------|
| An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will: |  |                     |
| <ul style="list-style-type: none"> <li>lead to a long-term decrease in the size of a population</li> </ul>                       | <p>The individual(s) within the Project Area is considered likely to be relatively isolated amongst the wider population due to previous clearing and fragmentation of the landscape.</p> <p>The Project is likely to lead to a long-term decrease in the size of the population by one known plant and a small area of potential habitat.</p> | Likely but minimal. |



**White-flowered Wax Plant (*Cynanchum elegans*) (Endangered)**

|   |   |   |
|---|---|---|
| <ul style="list-style-type: none"> <li>• reduce the area of occupancy of the species</li> </ul>   | <p>The species is known from the locality and immediate surrounds utilising the rocky outcrops and cliffs in the area. The Project is likely to reduce the area of occupancy of the species by approximately 0.15 hectares.</p> <p>This scale of impact does not translate to a reduced area of occupancy using typical methods and scales to calculate area of occupancy for example 1km or 2km grid cells (e.g. IUCN methodologies).</p>  | <p>Likely though not at scales used for area of occupancy calculations.</p> |
| <ul style="list-style-type: none"> <li>• fragment an existing population into two or more populations</li> </ul>                                      | <p>The area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the Project since areas of habitat around the disturbance area will be retained and managed so as not to become more degraded.</p> <p>The species seed production is variable and unreliable. Seeds are wind dispersed. It is considered to be unlikely that a soil seed bank for this species exists. The viable population size for <i>C. elegans</i> is unknown, although with six records within 800m of the individual on Project Area, the Project is not likely to fragment an existing population into two or more populations.</p>  | <p>Unlikely</p>   |
| <ul style="list-style-type: none"> <li>• adversely affect habitat critical to the survival of a species</li> </ul>                                    | <p>No critical habitat for this species has been declared.</p> <p>The distribution of the species is restricted to the transition zone (ecotone) between dry subtropical rainforest and sclerophyll forest/woodland communities in eastern, therefore potential habitat is limited in its occurrence.</p> <p>Given these restrictions the type of habitat within the Project Area is considered to be consistent with definitions of critical habitat.</p> <p>However, the removal of the habitat in this instance is unlikely to be critical to the survival of the population in the broader area for the species given additional habitat present to the south and west of the Project Area.</p> | <p>Possible</p>   |
| <ul style="list-style-type: none"> <li>• disrupt the breeding cycle of a population</li> </ul>  | <p>The species is known from the locality and immediate surrounds utilising the transition zone between <i>Melaleuca armillaris</i> shrubland and rainforest.</p> <p>Important habitat utilised by the White-flowered Wax Plant will be removed as part of the Project although the breeding cycle in the broader population is unlikely to be impacted such that the population cannot persist.</p>  | <p>Unlikely</p>   |
| <ul style="list-style-type: none"> <li>• modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent</li> </ul> | <p>Limiting habitat utilised by the White-flowered Wax Plant will be reduced but not completely removed in the Project Area. Given the relatively isolated single plant found on Project Area is to be removed by the Project the overall population is expected to decline at some level.</p>  | <p>Likely</p>   |

**White-flowered Wax Plant (*Cynanchum elegans*) (Endangered)**

|   |   |          |
|---|---|----------|
| that the species is likely to decline   |   |          |
| <ul style="list-style-type: none"> <li>result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</li> </ul> | The Project is not likely to introduce or increase the amount of invasive species present within the Project Area, provided mitigation measures detailed in Section 3.2.2 are adhered to.   | Unlikely |
| <ul style="list-style-type: none"> <li>introduce disease that may cause the species to decline</li> </ul>   | The Project is not likely to introduce or increase the amount of diseases present within the Project Area, provided mitigation measures detailed in Section 3.2.2 are adhered to.   | Unlikely |
| <ul style="list-style-type: none"> <li>interfere substantially with the recovery of the species.</li> </ul>   | The Project will not impact upon areas of <i>Cynanchum elegans</i> that are part of targeted recovery efforts (DAWE 2008). The Project is likely to encourage recovery of the species outside of the Project Area via management commitments and offset requirements. | Unlikely |

**Conclusion:** Given the small area of habitat to be removed and a single plant it is considered unlikely that the proposed action would have a significant impact on the species.

### Grey-headed Flying-fox (*Pteropus poliocephalus*) (Vulnerable)

#### Description

The Grey-headed Flying-fox (GHFF) is the largest Australian bat, with a head and body length of 23 - 29 cm. It has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. The wing membranes are black and the wingspan can be up to 1 m. It can be distinguished from other flying-foxes by the leg fur, which extends to the ankle.

#### Distribution

GHFF are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations.

#### Habitat requirements

GHFF generally occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. The GHFF can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. They feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines (DPIE 2020e).

Within the Dunmore – Shellharbour Hills area, the ‘Flying-fox’ rainforest gully contains a maternity camp where annual breeding and rearing of young take place during the spring and summer months. This is one of three such camps known in the Illawarra region and the only roost not protected within a conservation reserve. This camp is approximately 4.6km south-west from the Project Area. In the Project Area, the grey-headed flying-fox acts as a pollinator and seed disperser for feed trees from Illawarra Lowlands Grassy Woodland, such as forest red gum, as well as for Illawarra Subtropical Rainforest, including Native Tamarind (*Diploglottis australis*), Brown Beech (*Pennantia cunninghamii*) and figs (*Ficus* spp.) (DECCW 2011).

#### Summary of impacts and context of GHFF for the Project

An area of 7.6 hectares of GHFF habitat (native vegetation) will be removed by the Project, although the condition of the total area is variable, the GHFF will utilise the flowering Eucalypts and fig trees throughout the Project Area. There are approximately eight large trees within the Project Area that would provide notable foraging habitat for the GHFF constituting predominantly large fig trees. No breeding camps occur within the immediate vicinity of the Project Area (nearest known is 4.6km south-west).

| Assessment of significance   | Address of Criteria   | Likelihood            |
|--|---|-----------------------|
| An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:    |   |                       |
| <ul style="list-style-type: none"> <li>lead to a long-term decrease in the size of an important population of a species</li> </ul> | There is no known population within the Project Area that is considered an important population of the species. The closest known records of a camp area are 4.6km south-west of the Project Area. The Project is not likely to lead to a long-term decrease in the size of the population given extensive foraging habitat available in the locality, however cumulative impacts of this nature may cause a long-term decrease to some extent. | Unlikely in isolation |

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

|  |   |  |
|--|---|--|
| <ul style="list-style-type: none"> <li>• reduce the area of occupancy of the species</li> </ul>                    | <p>The species is known from the locality and surrounds and travels extensively to forage. The Project is likely to reduce the area of occupancy of the species by approximately 7.6 hectares however would not change the size over which this mobile species forages.</p>   | <p>Unlikely</p>  |
| <ul style="list-style-type: none"> <li>• fragment an existing population into two or more populations</li> </ul>   | <p>The area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the Project since areas of habitat around the disturbance area will be retained.</p> <p>Populations for this species have been considered as the same population when within 20km of each other (DPIE 2020e), therefore, the Project is not likely to fragment an existing population into two or more populations.</p>  | <p>Unlikely</p>  |
| <ul style="list-style-type: none"> <li>• adversely affect habitat critical to the survival of a species</li> </ul> | <p>Habitat critical to the survival of the species has been loosely nominated within the National Recovery Plan for this species (draft recovery plan, (DECCW 2009)) guidelines or a recovery plan for the species, however “productive” areas are acknowledged as potentially being foraging habitat critical to the survival of the species, yet, no measure of productivity is given. Some areas of the Project Area are likely to be productive in terms of foraging output, however impacts from the Project would be limited as most of these areas would be retained.</p>  | <p>Unlikely – modification to foraging habitat, no breeding camps in the Project Area.</p> |
| <ul style="list-style-type: none"> <li>• disrupt the breeding cycle of an important population</li> </ul>          | <p>The following is known about the breeding cycle of the Grey-headed Flying-fox (DPIE 2020e, DAWE 2021):</p> <ul style="list-style-type: none"> <li>• Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.</li> <li>• Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.</li> <li>• Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.</li> <li>• Project Area fidelity to camps is high; some camps have been used for over a century.</li> <li>• Can travel up to 50 km from the camp to forage; commuting distances are more often &lt;20 km.</li> <li>• Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.</li> <li>• Also forage in cultivated gardens and fruit crops. It is uncertain whether mating occurs early in winter or in spring</li> </ul> | <p>Unlikely – modification to foraging habitat, no breeding camps in the Project Area.</p> |

| <b>Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>) (Vulnerable)</b>  |  |                       |
|---|--|-----------------------|
|   | The Project is located approximately 4.6km away from the nearest known breeding camp in the Dunmore region.  |                       |
| <ul style="list-style-type: none"> <li>modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</li> </ul>                                       | There is no limiting habitat utilised by the GHFF that will be removed in the Project Area. Extensive areas of habitat will remain within the Project Area and its surrounds. Any such decline would be partially mitigated by management of native vegetation within adjacent areas where key threats are currently occurring, most notably Lantana invasion.   | Unlikely in isolation |
| <ul style="list-style-type: none"> <li>result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</li> </ul> | Any potential indirect impacts from the invasion of exotic flora species are unlikely to affect the Grey-headed Flying-fox. Invasive fauna are not listed as a threat to the Grey-headed Flying-fox. The main threats to the species are listed on the OEH threatened species profile (DPIE 2020e) as: <ul style="list-style-type: none"> <li>Loss of roosting and foraging sites.</li> <li>Electrocution on powerlines, entanglement in netting and on barbed-wire.</li> <li>Heat stress.</li> <li>Conflict with humans.</li> <li>Incomplete knowledge of abundance and distribution across the species' range</li> <li>Illegal shooting</li> </ul>   | Unlikely              |
| <ul style="list-style-type: none"> <li>introduce disease that may cause the species to decline</li> </ul>   | The Project in not expected to cause an increased risk of any bat diseases.  | Unlikely              |
| <ul style="list-style-type: none"> <li>interfere substantially with the recovery of the species.</li> </ul>   | Overall objectives of the Draft National Recovery Plan for this species are (DAWE 2021): <ul style="list-style-type: none"> <li>To improve the Grey-headed Flying-foxes national population trend by reducing the impact of threatening processes on Grey-headed Flying-foxes through habitat identification, protection, restoration and monitoring, and</li> <li>To assist communities and Grey-headed Flying-foxes to coexist through better education, stakeholder engagement, research, policy and continued support to fruit growers.</li> </ul> <p>While the Project would include a threatening process for the species, the proposed clearing is not of sufficient magnitude to interfere substantially with the recovery of the species.</p> | Unlikely              |
| <b>Conclusion:</b> The Project in isolation is unlikely to have a significant impact on the Grey-headed Flying Fox however some productive foraging habitat will be removed.  |  |                       |



## Annex 9. Consideration of serious and irreversible impacts

### Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISR)

According to the NSW Threatened Biodiversity Data Collection *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion* EEC is identified as SAI in NSW as it aligns with the EPBC Act critically endangered Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion TEC (DPIE 2020c). The ISR community has been identified as at risk of SAI due to Principle 2 of the SAI framework (very small population size). Therefore the Project has been identified as a SAI because it will further reduce the population size of the species that is currently observed, estimated, inferred or reasonably suspected to have a very small population size.

The assessed patch is highly variable in condition throughout having areas of good condition separated by significant areas of lantana infestation due to previous agricultural clearing activities (see plates below). The area of rainforest to be impacted by the Project has somewhat poor connectivity to the larger patch of ISR within the locality. Remnant patches that have not been cleared (corresponding with the best condition) have been largely avoided by the Project.

| Additional impact assessment provisions  | <i>Illawarra Subtropical Rainforest (Endangered)</i>   |                 |                  |                 |                    |                 |                    |           |      |     |      |   |       |          |      |     |      |   |       |           |      |     |      |   |       |                    |      |     |     |   |      |
|--|--|-----------------|------------------|-----------------|--------------------|-----------------|--------------------|-----------|------|-----|------|---|-------|----------|------|-----|------|---|-------|-----------|------|-----|------|---|-------|--------------------|------|-----|-----|---|------|
| a) the action and measures taken to avoid the direct and indirect impact on the potential entity for a SAI   | The approach to avoidance measures for the Project is to utilise as much of the previously impacted low condition areas into the Project design as possible. However, the Project will have a residual impact on 4.69 ha of ISR vegetation. Almost all the clearing is of lower condition areas with the better condition areas of ISR having been avoided via project redesign.   |                 |                  |                 |                    |                 |                    |           |      |     |      |   |       |          |      |     |      |   |       |           |      |     |      |   |       |                    |      |     |     |   |      |
| b) the area (ha) and condition of the threatened ecological community (TEC) to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone | <p>The extent of impacts for ISR via relevant condition zones is tabled below:</p> <table border="1"> <thead> <tr> <th style="background-color: #d9ead3;">Vegetation zone</th> <th style="background-color: #d9ead3;">Area (ha)</th> <th style="background-color: #d9ead3;">Patch size (ha)</th> <th style="background-color: #d9ead3;">Current VI score</th> <th style="background-color: #d9ead3;">Future VI score</th> <th style="background-color: #d9ead3;">Change in VI score</th> </tr> </thead> <tbody> <tr> <td>1300_High</td> <td>0.01</td> <td>160</td> <td>63.6</td> <td>0</td> <td>-63.6</td> </tr> <tr> <td>1300_Low</td> <td>3.14</td> <td>160</td> <td>44.9</td> <td>0</td> <td>-44.9</td> </tr> <tr> <td>1300_Poor</td> <td>0.30</td> <td>160</td> <td>21.2</td> <td>0</td> <td>-21.2</td> </tr> <tr> <td>1300_Very Degraded</td> <td>1.24</td> <td>160</td> <td>9.1</td> <td>0</td> <td>-9.1</td> </tr> </tbody> </table> <p>See Section 2.2.4 for more detail</p> | Vegetation zone | Area (ha)        | Patch size (ha) | Current VI score   | Future VI score | Change in VI score | 1300_High | 0.01 | 160 | 63.6 | 0 | -63.6 | 1300_Low | 3.14 | 160 | 44.9 | 0 | -44.9 | 1300_Poor | 0.30 | 160 | 21.2 | 0 | -21.2 | 1300_Very Degraded | 1.24 | 160 | 9.1 | 0 | -9.1 |
| Vegetation zone  | Area (ha)  | Patch size (ha) | Current VI score | Future VI score | Change in VI score |                 |                    |           |      |     |      |   |       |          |      |     |      |   |       |           |      |     |      |   |       |                    |      |     |     |   |      |
| 1300_High  | 0.01   | 160             | 63.6             | 0               | -63.6              |                 |                    |           |      |     |      |   |       |          |      |     |      |   |       |           |      |     |      |   |       |                    |      |     |     |   |      |
| 1300_Low   | 3.14   | 160             | 44.9             | 0               | -44.9              |                 |                    |           |      |     |      |   |       |          |      |     |      |   |       |           |      |     |      |   |       |                    |      |     |     |   |      |
| 1300_Poor  | 0.30   | 160             | 21.2             | 0               | -21.2              |                 |                    |           |      |     |      |   |       |          |      |     |      |   |       |           |      |     |      |   |       |                    |      |     |     |   |      |
| 1300_Very Degraded   | 1.24   | 160             | 9.1              | 0               | -9.1               |                 |                    |           |      |     |      |   |       |          |      |     |      |   |       |           |      |     |      |   |       |                    |      |     |     |   |      |

| Additional impact assessment provisions  | Illawarra Subtropical Rainforest (Endangered)  |                 |   |  |                 |  |  |  |                  |                 |                                   |                  |                 |                                   |                   |      |        |      |      |        |      |
|--|--|-----------------|---|--|-----------------|--|--|--|------------------|-----------------|-----------------------------------|------------------|-----------------|-----------------------------------|-------------------|------|--------|------|------|--------|------|
| c) a description of the extent to which the impact exceeds the threshold for the potential entity  | There is no threshold specified in the TBDC for ISR.   |                 |   |  |                 |  |  |  |                  |                 |                                   |                  |                 |                                   |                   |      |        |      |      |        |      |
| d) the extent and overall condition of the potential TEC within an area of 1000 ha, and then 10,000 ha, surrounding the proposed development footprint   | <p>ISR has been largely cleared for agriculture and development. Areas of ISR remaining are typically on areas with steeper slopes. Across its distribution, in 2010 approximately 6,500 ha were estimated to remain (Tozer et al. 2010), more recently in 2016 approximately 6,357 ha were estimated to remain (DPIE2016). The condition of ISR within 1,000 ha and 10,000 ha circles is highly variable, however the condition of vegetation to be removed is considered to be generally lower than remnant vegetation outside of the Project Area. The majority of vegetation to be removed within the Project Area has been previously cleared (except for occasional large canopy trees). Within the 1,000 hectare circle, larger intact remnants are present to the west of the Project Area which are less edge-affected and with less historical clearing judged by review of 1961 aerial photography. Within the wider 10,000 hectare circle there are also some large intact remnants with good connectivity but also many fragmented smaller patches with similar characteristics to the Project Area.</p> <p>For the SAI assessment, the Illawarra PCT mapping (DPIE 2016) was combined with mapping across the Project Area. Map units from DPIE 2016 included within the calculations for ISR included PCT 1300/906 and PCT 1300, all component PCTs are directly equivalent to the ISR TEC.</p> <p>The percentage decrease of ISR from the Project is approximately 2.1 % and 0.7 % across 1,000 and 10,000 hectare circles respectively (Table 19).</p> <p><b>Table 19: Illawarra Subtropical Rainforest extent around the Project Area</b></p> <table border="1"> <thead> <tr> <th rowspan="2">PCT ID</th> <th colspan="3">1,000 ha circle around the Project Area</th> <th colspan="3">10,000 ha circle around the Project Area</th> </tr> <tr> <th>Impact Area (ha)</th> <th>Hectares of ISR</th> <th>% of ISR vegetation being removed</th> <th>Impact Area (ha)</th> <th>Hectares of ISR</th> <th>% of ISR vegetation being removed</th> </tr> </thead> <tbody> <tr> <td>1300 and 1300/906</td> <td>4.69</td> <td>225.39</td> <td>2.08</td> <td>4.69</td> <td>670.40</td> <td>0.70</td> </tr> </tbody> </table> | PCT ID          | 1,000 ha circle around the Project Area |  |                 | 10,000 ha circle around the Project Area |  |  | Impact Area (ha) | Hectares of ISR | % of ISR vegetation being removed | Impact Area (ha) | Hectares of ISR | % of ISR vegetation being removed | 1300 and 1300/906 | 4.69 | 225.39 | 2.08 | 4.69 | 670.40 | 0.70 |
| PCT ID   | 1,000 ha circle around the Project Area  |                 |   | 10,000 ha circle around the Project Area |                 |  |  |  |                  |                 |                                   |                  |                 |                                   |                   |      |        |      |      |        |      |
|  | Impact Area (ha)   | Hectares of ISR | % of ISR vegetation being removed       | Impact Area (ha)                         | Hectares of ISR | % of ISR vegetation being removed        |  |  |                  |                 |                                   |                  |                 |                                   |                   |      |        |      |      |        |      |
| 1300 and 1300/906  | 4.69   | 225.39          | 2.08                                    | 4.69                                     | 670.40          | 0.70                                     |  |  |                  |                 |                                   |                  |                 |                                   |                   |      |        |      |      |        |      |
| e) an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration | An estimate before the proposed impact extent of the entire TEC is 6,357 ha (DPIE 2016). The large majority of the TEC's extent is within the Illawarra IBRA subregion. All of the TEC's extent is within the Sydney Basin IBRA region.  |                 |   |  |                 |  |  |  |                  |                 |                                   |                  |                 |                                   |                   |      |        |      |      |        |      |



| Additional impact assessment provisions   | Illawarra Subtropical Rainforest (Endangered)  |
|---|--|
| <p>f) an estimate of the area of the candidate TEC that is in the reserve system within the IBRA region and the IBRA subregion</p>  | <p>Small areas of Illawarra Subtropical Rainforest occur in Budderoo National Park, Macquarie Pass National Park, Morton National Park, Cambewarra Range Nature Reserve, Devils Glen Nature Reserve and Rodway Nature Reserve. Approximately 570 ha remains in reserved areas and is potentially underrepresented in conservation reserves (DPIE 2020g).</p>   |
| <p>g) the development, clearing or biodiversity certification proposal's impact on:</p> <ul style="list-style-type: none"> <li>i. abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns</li> <li>ii. characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants</li> <li>iii. the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC</li> </ul> | <ul style="list-style-type: none"> <li>i. The removal of 4.69 ha of ISR would not result in the reduction of groundwater levels or the substantial alteration of surface water patterns. There is one minor perennial watercourse in the Project Area that would experience some alteration to existing flow regimes..</li> <li>ii. The functionally important species would not be influenced through impacts such as inappropriate fire or flooding regimes. Although the removal of understorey species would impact the functionality of the areas to be removed. There would be no harvesting of plants further to the removal of the 4.69 ha as part of the clearing for the Project.</li> <li>iii. The Project will not largely reduce the quality and integrity of an occurrence of the TEC through threats; with mitigation measures to assisting with reducing potential spread of invasive flora beyond current levels within the Project Area at least for the life of the Project. There is not a perceived risk of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC in the adjacent areas remaining.</li> </ul> |
| <p>h) direct or indirect fragmentation and isolation of an important area of the potential TEC</p>  | <p>Vegetation within the Project Area has previously been subject to fragmentation during agricultural clearing. Clearing proposed would increase fragmentation impacts, however the majority of impacts would impact lesser quality remnant vegetation and the higher-quality native vegetation would be largely avoided.</p>   |
| <p>i) the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.</p>   | <p>Monitoring and management of adjacent remnant vegetation would be undertaken for the life of the Project should adverse impacts such as weed spread be detected. Offset requirements are likely to result in recovery of the TEC within the IBRA subregion given the distribution of the TEC.</p>   |

### **Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion (MAS)**

*Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion is considered at risk of SAI under Principles 1, 2 & 3 of the SAI framework:

*Principle 1 – species or ecological community currently in a rapid rate of decline.*

*Principle 2 – species or ecological communities with a very small population size.*

*Principle 3: Impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.*

The *Melaleuca armillaris* tall shrubland in the Sydney Basin Bioregion (PCT720) is restricted to outcrops of volcanic soils on dry rocky ridges in the Illawarra area within the Sydney Basin Bioregion. The Project requires the removal of 2.92 ha of PCT720, comprising various conditions (Table 7).

- 0.77ha of poor,
- 0.43ha of low (regenerating midstorey – no canopy),
- 0.29ha of low (dense Lantana),
- 0.47ha of moderate,
- 0.58 ha of moderate to high
- 0.38ha of High condition vegetation

*Melaleuca armillaris* Tall Shrubland has been recorded from the local government areas of Shellharbour City and Kiama Municipality (within the Sydney Basin Bioregion) and may occur elsewhere in the Bioregion.

The assessed patch is highly variable in condition throughout, having areas of good condition separated by significant areas of lantana infestation due to previous agricultural clearing activities. The area of vegetation to be impacted by the Project has poor connectivity with any other patch of *Melaleuca armillaris* tall shrubland within the locality. Remnant patches that have not been cleared (corresponding with the best condition) have been largely avoided by the Project.

| Additional impact assessment provisions  | <i>Melaleuca armillaris</i> tall shrubland in the Sydney Basin Bioregion (Endangered)  |
|--|--|
| a) the action and measures taken to avoid the direct and indirect impact on the potential entity for a SAI | The approach to avoidance measures for the Project is to utilise as much of the previously impacted low condition areas into the Project design as possible. However, The Project requires the removal of 2.92 ha of <i>Melaleuca armillaris</i> tall shrubland. |

| Additional impact assessment provisions  | <i>Melaleuca armillaris</i> tall shrubland in the Sydney Basin Bioregion (Endangered)  |                 |                  |                 |                    |                 |                    |          |      |     |      |   |       |              |      |     |      |   |       |              |      |     |      |   |       |                 |      |     |      |   |       |                  |      |     |      |   |       |          |      |     |      |   |       |
|--|--|-----------------|------------------|-----------------|--------------------|-----------------|--------------------|----------|------|-----|------|---|-------|--------------|------|-----|------|---|-------|--------------|------|-----|------|---|-------|-----------------|------|-----|------|---|-------|------------------|------|-----|------|---|-------|----------|------|-----|------|---|-------|
|  | The Project will be retaining 0.73 ha of remnant and good condition habitat on the Project Area, adjacent to higher quality vegetation to the west.  |                 |                  |                 |                    |                 |                    |          |      |     |      |   |       |              |      |     |      |   |       |              |      |     |      |   |       |                 |      |     |      |   |       |                  |      |     |      |   |       |          |      |     |      |   |       |
| b) the area (ha) and condition of the threatened ecological community (TEC) to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone | <p>The extent of direct impacts for MAS via relevant condition zones is tabled below:</p> <table border="1"> <thead> <tr> <th style="background-color: #c6e0b4;">Vegetation zone</th> <th style="background-color: #c6e0b4;">Area (ha)</th> <th style="background-color: #c6e0b4;">Patch size (ha)</th> <th style="background-color: #c6e0b4;">Current VI score</th> <th style="background-color: #c6e0b4;">Future VI score</th> <th style="background-color: #c6e0b4;">Change in VI score</th> </tr> </thead> <tbody> <tr> <td>720_High</td> <td>0.38</td> <td>160</td> <td>23.3</td> <td>0</td> <td>-23.3</td> </tr> <tr> <td>720_Mod-High</td> <td>0.58</td> <td>160</td> <td>24.5</td> <td>0</td> <td>-24.5</td> </tr> <tr> <td>720_Moderate</td> <td>0.47</td> <td>160</td> <td>15.9</td> <td>0</td> <td>-15.9</td> </tr> <tr> <td>720_Low_Lantana</td> <td>0.29</td> <td>160</td> <td>10.2</td> <td>0</td> <td>-10.2</td> </tr> <tr> <td>720_Low_NoCanopy</td> <td>0.43</td> <td>160</td> <td>25.4</td> <td>0</td> <td>-25.4</td> </tr> <tr> <td>720_Poor</td> <td>0.77</td> <td>160</td> <td>10.3</td> <td>0</td> <td>-10.3</td> </tr> </tbody> </table> <p>See Section 2.2.4 for more detail</p> | Vegetation zone | Area (ha)        | Patch size (ha) | Current VI score   | Future VI score | Change in VI score | 720_High | 0.38 | 160 | 23.3 | 0 | -23.3 | 720_Mod-High | 0.58 | 160 | 24.5 | 0 | -24.5 | 720_Moderate | 0.47 | 160 | 15.9 | 0 | -15.9 | 720_Low_Lantana | 0.29 | 160 | 10.2 | 0 | -10.2 | 720_Low_NoCanopy | 0.43 | 160 | 25.4 | 0 | -25.4 | 720_Poor | 0.77 | 160 | 10.3 | 0 | -10.3 |
| Vegetation zone  | Area (ha)  | Patch size (ha) | Current VI score | Future VI score | Change in VI score |                 |                    |          |      |     |      |   |       |              |      |     |      |   |       |              |      |     |      |   |       |                 |      |     |      |   |       |                  |      |     |      |   |       |          |      |     |      |   |       |
| 720_High   | 0.38   | 160             | 23.3             | 0               | -23.3              |                 |                    |          |      |     |      |   |       |              |      |     |      |   |       |              |      |     |      |   |       |                 |      |     |      |   |       |                  |      |     |      |   |       |          |      |     |      |   |       |
| 720_Mod-High   | 0.58   | 160             | 24.5             | 0               | -24.5              |                 |                    |          |      |     |      |   |       |              |      |     |      |   |       |              |      |     |      |   |       |                 |      |     |      |   |       |                  |      |     |      |   |       |          |      |     |      |   |       |
| 720_Moderate   | 0.47   | 160             | 15.9             | 0               | -15.9              |                 |                    |          |      |     |      |   |       |              |      |     |      |   |       |              |      |     |      |   |       |                 |      |     |      |   |       |                  |      |     |      |   |       |          |      |     |      |   |       |
| 720_Low_Lantana  | 0.29   | 160             | 10.2             | 0               | -10.2              |                 |                    |          |      |     |      |   |       |              |      |     |      |   |       |              |      |     |      |   |       |                 |      |     |      |   |       |                  |      |     |      |   |       |          |      |     |      |   |       |
| 720_Low_NoCanopy   | 0.43   | 160             | 25.4             | 0               | -25.4              |                 |                    |          |      |     |      |   |       |              |      |     |      |   |       |              |      |     |      |   |       |                 |      |     |      |   |       |                  |      |     |      |   |       |          |      |     |      |   |       |
| 720_Poor   | 0.77   | 160             | 10.3             | 0               | -10.3              |                 |                    |          |      |     |      |   |       |              |      |     |      |   |       |              |      |     |      |   |       |                 |      |     |      |   |       |                  |      |     |      |   |       |          |      |     |      |   |       |
| c) a description of the extent to which the impact exceeds the threshold for the potential entity  | There is not a defined threshold specified in the TBDC for MAS.  |                 |                  |                 |                    |                 |                    |          |      |     |      |   |       |              |      |     |      |   |       |              |      |     |      |   |       |                 |      |     |      |   |       |                  |      |     |      |   |       |          |      |     |      |   |       |
| d) the extent and overall condition of the potential TEC within an area of 1000 ha, and then 10,000 ha, surrounding the proposed development footprint   | <p>MAS has been largely cleared for agriculture, development and quarrying. The remaining extent of the community has been recently estimated at between 200 and 276 hectares (NSW Threatened Species Scientific Committee 2020).</p> <p>For the SAII assessment, the Illawarra PCT mapping (DPIE 2016) was combined with mapping across the Project Area. Map units from DPIE 2016 included within the calculations for MAS included PCT 720 which is directly equivalent to the MAS TEC.</p>   |                 |                  |                 |                    |                 |                    |          |      |     |      |   |       |              |      |     |      |   |       |              |      |     |      |   |       |                 |      |     |      |   |       |                  |      |     |      |   |       |          |      |     |      |   |       |

| Additional impact assessment provisions   | <i>Melaleuca armillaris</i> tall shrubland in the Sydney Basin Bioregion (Endangered)  |                 |   |  |                 |  |  |  |  |                  |                 |                                   |                  |                 |                                   |     |      |       |       |      |        |      |
|---|--|-----------------|---|--|-----------------|--|--|--|--|------------------|-----------------|-----------------------------------|------------------|-----------------|-----------------------------------|-----|------|-------|-------|------|--------|------|
|   | <p>The percentage decrease of MAS from the Project is approximately 15.9 % and 2.0 % across 1,000 and 10,000 hectare circles respectively (Table 20).</p> <p><b>Table 20: <i>Melaleuca armillaris</i> Shrubland extent around the Project Area</b></p> <table border="1"> <thead> <tr> <th>PCT ID</th> <th colspan="3">1,000 ha circle around the Project Area</th> <th colspan="3">10,000 ha circle around the Project Area</th> </tr> <tr> <th></th> <th>Impact Area (ha)</th> <th>Hectares of MAS</th> <th>% of MAS vegetation being removed</th> <th>Impact Area (ha)</th> <th>Hectares of ISR</th> <th>% of MAS vegetation being removed</th> </tr> </thead> <tbody> <tr> <td>720</td> <td>2.92</td> <td>18.45</td> <td>15.88</td> <td>2.92</td> <td>145.16</td> <td>2.02</td> </tr> </tbody> </table>  | PCT ID          | 1,000 ha circle around the Project Area |  |                 | 10,000 ha circle around the Project Area |  |  |  | Impact Area (ha) | Hectares of MAS | % of MAS vegetation being removed | Impact Area (ha) | Hectares of ISR | % of MAS vegetation being removed | 720 | 2.92 | 18.45 | 15.88 | 2.92 | 145.16 | 2.02 |
| PCT ID  | 1,000 ha circle around the Project Area  |                 |   | 10,000 ha circle around the Project Area |                 |  |  |  |  |                  |                 |                                   |                  |                 |                                   |     |      |       |       |      |        |      |
|   | Impact Area (ha)   | Hectares of MAS | % of MAS vegetation being removed       | Impact Area (ha)                         | Hectares of ISR | % of MAS vegetation being removed        |  |  |  |                  |                 |                                   |                  |                 |                                   |     |      |       |       |      |        |      |
| 720   | 2.92   | 18.45           | 15.88                                   | 2.92                                     | 145.16          | 2.02                                     |  |  |  |                  |                 |                                   |                  |                 |                                   |     |      |       |       |      |        |      |
| e) an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration  | <p>All known MAS occurs within the Illawarra IBRA Subregion. The overall impact on the community is therefore the same as the impact within the subregion and region.</p> <p>An estimate before the proposed impact extent of the TEC is 250 ha, the estimated impact to the TEC after the proposed Project is therefore 1.2% of the total area in the IBRA subregion and IBRA region.</p>   |                 |   |  |                 |  |  |  |  |                  |                 |                                   |                  |                 |                                   |     |      |       |       |      |        |      |
| f) an estimate of the area of the candidate TEC that is in the reserve system within the IBRA region and the IBRA subregion   | <p>Small stands of <i>Melaleuca armillaris</i> Tall Shrubland occur in Killalea State Park (DPIE 2020i) estimated to represent approximately 8 hectares or approximately 5% of the overall extent.</p>   |                 |   |  |                 |  |  |  |  |                  |                 |                                   |                  |                 |                                   |     |      |       |       |      |        |      |
| g) the development, clearing or biodiversity certification proposal's impact on: <ul style="list-style-type: none"> <li>i. abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns</li> <li>ii. characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants</li> <li>iii. the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become</li> </ul> | <ul style="list-style-type: none"> <li>i. The removal of 2.92 ha of <i>Melaleuca armillaris</i> Tall Shrubland would not result in the reduction of groundwater levels or the substantial alteration of surface water patterns. There is one minor perennial watercourse in the Project Area that would experience some alteration to existing flow.</li> <li>ii. The functionality of important species would not be influenced through impacts such as inappropriate fire or flooding regimes. Although the removal of understorey species would impact the functionality of the areas to be removed. There would be no harvesting of plants further to the removal of the 2.92 ha as part of the clearing for the Project.</li> <li>iii. The Project will not largely reduce the quality and integrity of an occurrence of the TEC through threats; with mitigation measures to assisting with reducing potential spread of invasive flora beyond current levels within the Project Area at least for the life of the Project.</li> </ul> |                 |   |  |                 |  |  |  |  |                  |                 |                                   |                  |                 |                                   |     |      |       |       |      |        |      |

| Additional impact assessment provisions   | <i>Melaleuca armillaris</i> tall shrubland in the Sydney Basin Bioregion (Endangered)  |
|---|--|
| <p>established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC</p> | <p>There is not a perceived risk of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC in the adjacent areas remaining.</p>   |
| <p>h) direct or indirect fragmentation and isolation of an important area of the potential TEC</p>  | <p>Vegetation within the Project Area is already fragmented. Clearing proposed would increase fragmentation impacts, however the majority of impacts would impact lesser quality remnant vegetation.</p>   |
| <p>i) the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.</p>   | <p>Monitoring and management of adjacent remnant vegetation would be undertaken for the life of the Project should adverse impacts such as weed spread be detected. Offset requirements are likely to result in recovery of the TEC within the IBRA subregion given the distribution of the TEC.</p> |

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Sydney  
Brisbane  
Cairns  
Port Macquarie  
Illawarra  
Coffs Harbour  
Central Coast  
Gold Coast  
Canberra



## Our services

### Ecology and biodiversity

Terrestrial  
Freshwater  
Marine and coastal  
Research and monitoring  
Wildlife Schools and training

### Heritage management

Aboriginal heritage  
Historical heritage  
Conservation management  
Community consultation  
Archaeological, built and landscape values

### Environmental management and approvals

Impact assessments  
Development and activity approvals  
Rehabilitation  
Stakeholder consultation and facilitation  
Project management

### Environmental offsetting

Offset strategy and assessment (NSW, QLD, Commonwealth)  
Accredited BAM assessors (NSW)  
Biodiversity Stewardship Site Agreements (NSW)  
Offset site establishment and management  
Offset brokerage  
Advanced Offset establishment (QLD)