

Cleary Bros (Bombo) Pty Ltd

ABN: 28 000 157 808



CLEARY BROS

Albion Park Quarry Extraction Area Stage 7 Extension

Amended Biodiversity Development Assessment Report

Prepared by

Niche Environment and Heritage Pty Ltd



July 2023

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ABN: 28 000 157 808

Albion Park Quarry Extraction Area Stage 7 Extension

Amended Biodiversity Development Assessment Report

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Ref No: 5329

July 2023

Project number	Client	Project manager	LGA
5329	Cleary Bros (Bombo) Pty Ltd	Simon Tweed	Shellharbour City
Declaration			 26/07/2023
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
Amended Project Area	The area within which direct impacts from the amended Project would occur
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method 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
Biodiversity Study Area	The amended Project Area and surrounding avoidance areas
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 amended Project Area and surrounds, nominally a 10 km radius from the amended 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
RDP	Rapid Data Point
SAII	Serious and Irreversible Impacts
TEC	Threatened Ecological Community
VI	Vegetation Integrity as calculated by the BAM Calculator

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Executive Summary

Preamble

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 as part of the Environmental Impact Statement (EIS) (the original Project). The completed BDAR (dated March 2022) was placed on public exhibition in conjunction with the EIS in May 2022. Subsequent to the exhibition of the EIS, Niche was commissioned to amend the March 2022 BDAR (original BDAR) to reflect the amendments to the exhibited Project arising from the submissions to the EIS and supporting documents.

This document is therefore referred to as the “amended BDAR” with reference to either the “original Project” or “amended Project” and the “original Project Area” or “amended Project Area”.

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 (the amended 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 amended 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 original Project as part of the Environmental Impact Statement (EIS). The primary objective of this amended BDAR is to use the Biodiversity Assessment Methodology (BAM) (DPIE 2020a) to describe and assess the ecological values within the amended 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, August 2022 and July 2023 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 15 BAM plots to quantify PCTs and their condition
- Targeted survey for flora species
- Targeted survey for fauna species
- Application of the planted native vegetation streamlined module (Appendix D) of the BAM.

Results

Native vegetation assessment

Two plant community types (PCTs) were mapped within the Study 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 Critically Endangered under the BC Act

Illawarra Subtropical Rainforest was present in five different condition classes: High, Low, Poor, Poor_planted, 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 planted native vegetation has been assessed in accordance with the native vegetation streamlined module (Appendix D) of the BAM.

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 amended Project are generally better condition well connected areas.

Threatened flora

One threatened flora species (*Zieria granulata*) was recorded within the amended Project Area, while one other (*Cynanchum elegans*) was recorded nearby.

Threatened fauna

The amended 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 amended 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 amended Project Area constituting mobile species. Five species of threatened microbat were assumed present

(recorded or potentially recorded); Eastern Coastal Free-tailed Bat, Eastern Bent-winged Bat, Little Bent-winged 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 amended Project Area.

Impacts – Native vegetation

The main impact on terrestrial biodiversity associated with the amended Project is clearing of native vegetation and removal of associated habitat. The extent of clearing of native vegetation communities is estimated at 4.37 hectares (ha) from the identified Threatened Ecological Communities (TECs) constituting:

- 3.18 ha of Illawarra Subtropical Rainforest in the Sydney Basin Bioregion listed as Endangered under BC Act and Critically Endangered under EPBC Act (PCT1300); and
- 1.19 ha of *Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion listed as Critically 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 amended Project Area) constituting five trees containing eight hollows.

One EPBC Act listed threatened fauna was considered impacted by the amended Project, the Grey-headed Flying-fox, which was likely to utilise the foraging habitat of the amended Project Area. No species credit fauna were considered to be impacted by the amended 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 amended Project have avoided or minimised impacts on biodiversity through the following actions.

- The amended Project has been designed to use existing processing and transport infrastructure which avoids impacts from the establishment of new infrastructure.
- Avoidance areas totalling 5.82 ha within land zoned for extraction were incorporated into the amended Project design targeting high quality areas of threatened TECs and *Zieria granulata* habitat.

Avoidance measures regarding the positioning of the amended 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 62 ecosystem credits are required to offset impacts to native vegetation as a result of the amended Project.

- PCT 1300 Illawarra Subtropical Rainforest - 53 credits
- PCT 720 *Melaleuca armillaris* Shrubland - 9 credits.

One threatened species requires offsetting as a result of the amended Project. Its credit requirement is:

- *Zieria granulata* (Illawarra Zieria) – 2,074 credits.

Cleary Bros intends to offset impacts from the amended Project in accordance with the credit requirements outlined above via available options under the NSW Biodiversity Offset Scheme (BOS), including the establishment of a Stewardship Site on the property.

1. Introduction

Preamble

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This document is therefore referred to as the “amended BDAR” with reference to either the “original Project” or “amended Project” and the “original Project Area” or “amended Project Area”.

1.1 Context and objectives

The primary objective of this BDAR is to use the Biodiversity Assessment Methodology (BAM) (DPIE 2020a) to describe and assess the ecological values within the amended Project Area (Figure 1) and surrounds, determine whether the amended 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 Amended 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 16.1 ha, and consists of five substages, namely Stages 7a, 7b, 7c, 7d and 7e.

After the cessation of extraction operation of Stage 7, and to permit passive discharge of accumulated water from the Southern Sump to Watercourse 3, an inclined pipeline and discharge outlet adjacent to Watercourse 3 within Cleary Bros-owned land is proposed. The pipeline and discharge outlet are proposed to be constructed as part of the rehabilitation of the final landform around 2053.

The pipeline discharge outlet will be engineered and constructed to prevent erosion and scouring, with actual configuration to be determined as part of the final landform design prior to closure, but at this stage of the development has been modelled based on:

- A pipeline diameter of 300 millimetres (mm) and a slope of 1-2%
- An outlet pipe set back from the low flow channel of the watercourse
- Installation of scour protection within Watercourse 3 and on the opposite side as required.

The area of disturbance required for the discharge outlet is likely to be around 0.0025 hectares (ha) (5 metres [m] x 5 m) and the area proposed for the helicopter drop area is 0.0025 ha (5 m x 5 m). No access track is required as part of the discharge outlet work; all personnel, materials and equipment will be

transported to the discharge point via foot or helicopter. Therefore, there will be a negligible amount of disturbance to vegetation.

See Appendix 1 of the Project's Amended Report (RWCorkery & Co 2023) for a detailed description of the proposed inclined pipeline and outlet.

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, and follow progressively through 7b, 7c, 7d, before finishing with 7e (see Figure 9). This area would be the final area extracted in order to minimise views of the extraction operations from the east. Clery 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.

The area to be cleared of vegetation for the proposed discharge outlet at Watercourse 3 (including the proposed helicopter drop area) is not planned to occur until around 2053.

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 Amended 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 14.87 ha of land zoned RU1 and 1.23 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 amended Project Area constitutes a local topographical high (ridge spur), which drops to vegetated valleys (Plate 1). The majority of the amended 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 proposed discharge outlet into Watercourse 3A occurs within a stand of remnant rainforest. The amended Project Area is approximately 4 km south-west of Shellharbour City Centre, in the Shellharbour City LGA.



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

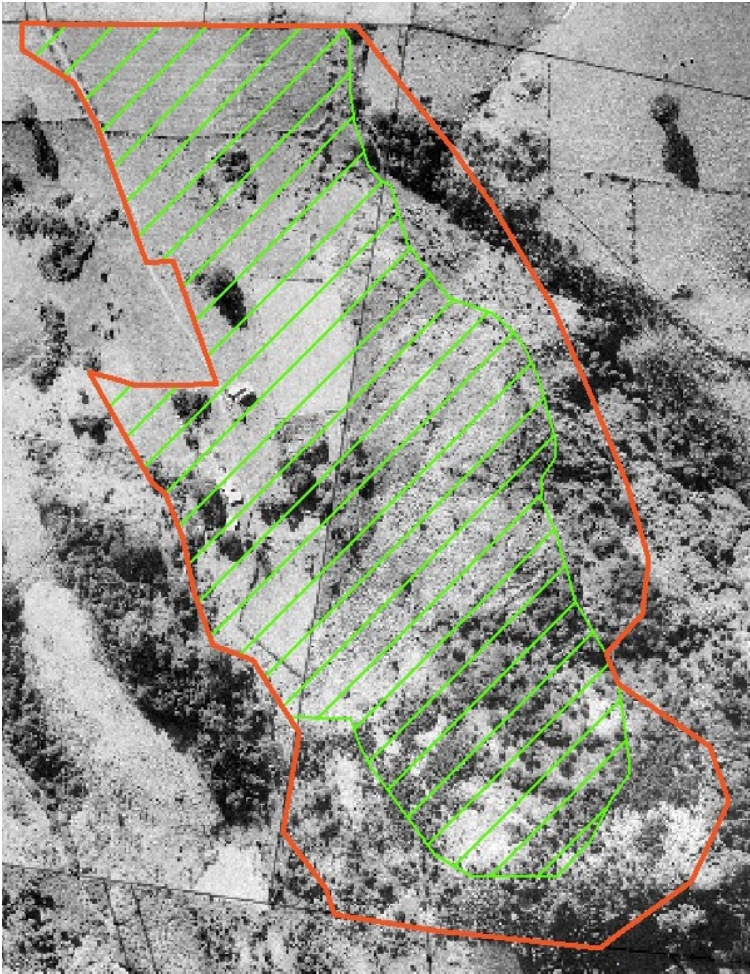


Plate 2: 1961 Aerial imagery of the Study Area and Surrounds

1.4 Approval and assessment process

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

1.4.1 Planning Secretary's Environmental Assessment Requirements (SEARS)

The key biodiversity assessment issues outlined in the SEARs for the original Project (and for the subsequent amended Project) are addressed within this report are listed in Table 1.

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.

Table 1: Address of Original 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 amended 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 4.3.

For NSW State approval, the amended 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. A 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 amended BDAR describes the biodiversity values present within the amended Project Area and identifies impacts from the amended 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 57).

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 amended 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 amended Project Area. This amended BDAR has identified threatened biodiversity listed under the EPBC Act that may be potentially impacted by the amended Project. The BAM has partly been used to perform assessment of impacts under the EPBC Act.

The amended 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 amended Project would have on biodiversity, outline avoidance and mitigation measures and then calculate the amended Project's biodiversity offset requirement.

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

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.

1.5.1 Planted native vegetation streamlined module

The full BAM and planted native vegetation streamlined module (Appendix D of the BAM) have both been applied to the amended Project Area as part of this amended BDAR. With reference to the decision making key in Appendix D of the BAM, question 5 applied to part of the planted vegetation present in the north-western portion of the amended Project Area (referred to as the 'amenity barrier planting'):

*D1. 5. Is the native vegetation (including individuals of a threatened flora species) planted for functional, **aesthetic**, horticultural or plantation forestry purposes? This includes examples such as: windbreaks in agricultural landscapes, roadside plantings (including street trees, median strips,*

roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia plantations or teatree farms?

As such, D2 of Appendix D applies, whereby Chapter 4 (assessment of native vegetation, threatened ecological communities and vegetation integrity) and Chapter 5 (assessment of habitat suitability for threatened species) of the BAM are not required to be applied as part of the BDAR. However, the suitability of the planted native vegetation for use by threatened species must be assessed and any incidental sightings or evidence (e.g. scats, stick nests) of threatened species credit species (flora and fauna) using, inhabiting or being part of the planted native vegetation recorded. Section 8.4 of the BAM (mitigate and manage impacts on biodiversity values) must be applied where evidence indicates that threatened species are using the planted native vegetation as habitat. Should this be the case, it is noted that species credits are not required to offset the proposed impacts.

This amended BDAR addresses the requirements of Table 28 (Appendix L) of the BAM. Specifically, Section 2.4 of this amended BDAR describes and assesses the planted native vegetation.

1.6 Assessment resources and assessor qualifications

This amended 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 amended BDAR are detailed in Table 3.

Table 2: Assessor qualifications and resources

Personnel	Qualifications	Tasks carried out
Simon Tweed	Senior Ecologist 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.
Stephen Bloomfield	Senior Ecologist 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 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	
Resources	<ul style="list-style-type: none"> • Biodiversity Assessment Method (BAM) (DPIE 2020a) • BAM Operational Manual – Stage 1 (DPIE 2020k) • BAM Operational Manual – Stage 2 (DPIE 2019a) • BAM Calculator User Guide (DPIE 2018)
Survey guidelines	<ul style="list-style-type: none"> • Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (DPIE 2020l). • 'Species credit' threatened bats and their habitats, NSW survey guide for the Biodiversity Assessment Method (OEH 2018). • 2004 Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (DECC 2004).

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 amended 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 amended 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 amended Project.

Table 4: Landscape features and scoring under the NSW BAM

Landscape features	Description	Figure reference
Amended Project Area	The area within which direct impacts from the amended Project will occur – 16.1 ha.	Figure 1
IBRA bioregion/ subregion	The amended Project Area 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 amended Project Area is mapped as occurring within the Kiama Coastal Slopes Mitchell Landscapes.	Figure 2
Rivers, streams and estuaries and Strahler stream order	There is a mapped 1 st order (Watercourse 5) and 2 nd order (Watercourse 3) stream within the amended Project Area. Watercourse 5 links with another stream to form a 2 nd order stream east of the amended Project Area. Watercourse 3 occurs to the west of the extraction area in association with the proposed discharge outlet, and flows in a southerly direction. All drainage from the amended Project Area runs east and south into the Rocklow Creek catchment of the Minnamurra River catchment.	Figure 1 Figure 2
Wetlands within and adjacent to development	There are no wetlands within or adjacent to the amended Project Area. Drainage from the amended 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 amended 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 amended Project Area. Connectivity south of the amended Project Area would remain, however the width of the vegetated corridor would be marginally reduced (from approximately 130m to 120m).	Figure 1 Figure 2
Buffer area (percent native vegetation cover)	A 1,500 m buffer was applied to the amended Project Area resulting in an overall buffer area of 1,062 ha. Existing vegetation mapping (DPIE 2016) identified areas of Native vegetation cover	Figure 2

Landscape features	Description	Figure reference
	<p>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 amended Project Area.</p> <p>For woody vegetation 28.9 percent of the buffer area was determined to support native woody vegetation with canopy cover (306.79 ha).</p> <p>For non-woody vegetation (grassland) 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>Total native vegetation cover</p> <p>Combining the estimated woody and non-woody vegetation cover resulted in 28.9 percent of the buffer area supporting native vegetation. This falls into the >10-30 per cent category within the BAM-C.</p>	
Amended Project Area context	Amended Project Area-based assessment	-
Geological significance and soils	There are no karst, caves, crevices, cliffs or other areas of geological significance within the amended Project Area. There are no high hazard soil areas.	-

2.2 Native vegetation and flora assessment

All clearing calculations were conducted for the amended Project Area, see Section 3.2 for more detail on avoidance and mitigation measures taken within the amended 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 Biodiversity Study Area and surrounds were undertaken over the course of eight months (April, July, August, September, October, November and December 2020). A further field survey was undertaken in August 2022 focussing on a recount of the threatened *Zieria granulata* and vegetation mapping of the western portion of the amended Project Area. A field survey was also undertaken in July 2023 to investigate the area of the proposed discharge outlet to Watercourse 3. In total, the surveys were conducted over approximately 174 hours (Table 5).

2.2.3 Survey Effort

Survey tasks and effort completed for vegetation and flora survey are provided in Table 5.

Table 5: Survey effort (flora and vegetation)

Field survey activity	Method	Effort/timing
Plant community delineation and mapping	15 BAM plots	21, 30 April 2020
	Rapid Data Points (RDPs)	10, 15, 16 & 17 July 2020
	Transects and walking meanders to record boundaries between vegetation zones	12 August 2020
	Habitat quality assessment	1 October 2020
	High threat and priority weed observation	13 November 2020
		18 December 2020
	31 August 2022	
	7 July 2023	
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"> <i>Irenepharsus trypherus</i> (Illawarra Irene) <i>Cynanchum elegans</i> (White-flowered Wax Plant) <i>Daphnandra johnsonii</i> (Illawarra Socketwood) 	21, 30 April 2020, 10, 15, 16 & 17 July 2020, 12 August 2020, 22, 30 September 2020 1, 6 and 7 October 2020 13 November 2020 18 December 2020
<i>Zieria granulata</i> (Illawarra Zieria) survey (Section 2.2.3.1)	Detailed density mapping and measurement of reproduction and size: 50 x 50m quadrats 10 x 10m ² quadrats Targeted transects	10, 15, 16 & 17 July 2020 12 August 2020 1 October 2020 31 August 2022

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 Section 2.2.6 below. The number of plots conducted for each PCT and vegetation zone is provided in Table 6.

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.

Targeted threatened flora survey – Biodiversity Study Area

The requirement for targeted survey for each candidate species surveyed to determine presence/absence from the Biodiversity Study 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 Biodiversity Study Area
- Presence of habitat constraints (as identified in the TBDC) within the Biodiversity Study Area
- Quality/suitability of habitat present as determined during the initial field survey.

Table 6: Plant Community Types present across the Amended 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	0.45	3.18	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	0.36		1	1
1300	Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	Poor_planted	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (E/CE)	Rainforests	Dry Rainforests	90	0.24		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	2.13		2	2
1300	Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile	High	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (E/CE)	Rainforests	Dry Rainforests	90	0.0025		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
	slopes, southern Sydney Basin Bioregion									
720	Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion	Poor	Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion (CE/N.A)	Heathlands	Southern Montane Heaths	75	0.35	1.19	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 (CE/N.A)	Heathlands	Southern Montane Heaths	75	0.37		1	1
720	Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion	Low (dense Lantana)	Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion (CE/N.A)	Heathlands	Southern Montane Heaths	75	0.28		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 (CE/N.A)	Heathlands	Southern Montane Heaths	75	0.19		1	2

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

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.

2.2.3.1 *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 amended 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 amended 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 original Project Area using GIS. An initial trial was conducted to count and measure plants within 50 x 50 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 original Project Area.

Subsequently, two 10 x 10 m plots within each 50 x 50 m 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 50 x 50 m plot. To allow for consistency across the original Project Area, the 50 x 50 m 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.

UPDATE note

During a site visit on 2 June 2022 with a BCD representative following the exhibition of the original BDAR submission, many *Zieria granulata* individuals were observed to be naturally dying off in certain areas. Based on later discussions with BCD, a recount and estimation of the density of mature *Z. granulata* plants within the original Project Area was suggested to recalculate the credit obligation. The results provided in this amended BDAR are based on this recount.

2.2.4 Amended Project Area values

Plant community types

The majority of the amended Project Area is cleared or has been historically cleared for agriculture or other uses at some time and now supports exotic vegetation (11.21 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 amended 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 amended Project Area to be cleared.

PCT720 is present at various condition states within the amended Project Area. A total of 1.19 ha of PCT720 would be cleared as part of the amended Project. Areas mapped as PCT720 were categorised into the following condition classes:

- Poor
- Low (regenerating midstorey – no canopy)
- Low (dense Lantana)
- Moderate – 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 3.18 ha of PCT1300 would be cleared as part of the amended Project. Only a small portion of the better condition PCT1300 (High condition class) within the Study Area will require disturbance (0.0025 ha), the remainder being avoided. The area of PCT1300 being impacted constitutes five condition classes:

- High
- Low
- Poor
- Poor_planted
- 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. PCTs are mapped in Figure 3. Overall, 4.37 ha of native vegetation within the amended Project Area is proposed to be removed.

An additional area of 0.52 ha of revegetation (including native species) occurs within the amended Project Area (Figure 3) and will be cleared as part of the amended Project. This area constitutes planted areas which have been revegetated in 2008 as part of previous extraction operations. This area has been assessed in accordance with the planted native vegetation streamlined module (Appendix D) of the BAM (see Section 2.4).

Flora

A total of 164 flora species were recorded across the 15 BAM plots, including 109 native species and 55 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.

Amended Project Area value scores

The amended 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 amended Project Area with the benchmark for the vegetation class to provide the amended 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 ha), as the native vegetation in the amended 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 amended Project Area were reduced to zero as all vegetation and habitats within these zones would be removed.

It is noted that the BAM-C has been recently updated to include the Eastern NSW PCTs (ENSW) and revised benchmark value of vegetation classes (referred to as version 1.2) and will apply to BAM-C cases as of 14 April 2023. However, the legacy benchmark data (version 1.1) can be applied up until 2 August 2023 under the transitional arrangements. It is noted that the version 1.1. benchmark data appeared inaccurate, in that it did not align with a finalised BAM-C case (version 4) prior to 14 April 2023. As such, the benchmark data as it appeared in the finalised BAM-C case (version 4) was applied for the purpose of the BDAR. Evidence to show the BAM-C assessment was finalised prior to the version 1.2 benchmark update, the legacy classification (pre-ENSW) was applied, and that the benchmark data has been modified has been provided in Annex 10.

Table 7: Vegetation zones within the Amended 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/used	Patch size (ha)	Current VI score	Future VI score	Change in VI score
1300 High	Whalebone Tree - Native Quince dry subtropical rainforest	0.0025	1	1	160	63.6	0	-63.6
1300 Low		2.13	2	2	160	44.9	0	-44.9
1300 Poor		0.36	1	1	160	21.2	0	-21.2
1300 Poor_planted		0.24	1	1	160	6	0	-6
1300 Very Degraded		0.45	1	1	160	9.1	0	-9.1
720 Mod-High	Melaleuca armillaris Tall Shrubland	0.19	1	2	160	24.5	0	-24.5
720_Low Lantana		0.28	1	1	160	10.2	0	-10.2
720 Low No Canopy		0.37	1	1	160	25.4	0	-25.4
720_Poor		0.35	1	2	160	10.3	0	-10.3
Total		4.37	10	12				

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 amended Project Area, including dense patches of Lantana.

2.2.6 Threatened ecological communities

In the BAM-C, 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.

The amended Project would impact on these TECs, further detail regarding impacts on these TECs have been completed in Annex 8 and Annex 9.

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 amended Project Area or considered absent based on survey or other means. After extensive surveys undertaken within the amended Project Area, two of the eight candidate species were observed.

Table 8: Threatened ecological communities characteristics in the amended 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 amended 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> , <i>Alphitonia excelsa</i> , <i>Ficus</i> sp., <i>Guioa semiglauc</i> , <i>Hibiscus heterophyllus</i> subsp. <i>heterophyllus</i> , <i>Streblus brunonianus</i>
720	Bracelet Honey-myrtle - Australian Indigo dry shrubland on dry volcanics, southern Sydney Basin Bioregion	Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion	Critically Endangered	N/A	<i>Commelina cyanea</i> , <i>Dichelachne</i> spp., <i>Digitaria</i> spp., <i>Einadia hastata</i> , <i>Geitonoplesium cymosum</i> , <i>Glycine clandestine</i> , <i>Leucopogon juniperinus</i> , <i>Melaleuca armillaris</i> subsp. <i>armillaris</i> , <i>Microlaena stipoides</i> , <i>Oplismenus</i> sp., <i>Plectranthus parviflorus</i> , <i>Poa labillardierei</i> var. <i>labillardierei</i> , <i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i> , <i>Themeda triandra</i> and <i>Zieria granulata</i> .

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

Scientific name	Common name	NSW BC Act	EPBC Act	Subject to SAII?	Habitat constraint (BAM)	Survey timing/effort	Species presence and justification
Candidate species							
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	No	None	All year	No – recorded beyond the limits of the amended Project Area 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 2020), with survey effort shown in Figure 3 and Figure 4.

Species credits are required for those species identified as present within the amended 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 amended 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 amended Project Area (Table 10 and Figure 4, Figure 7). The area of high, moderate and low density Zieria within the amended Project Area is estimated at 1.33ha.

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 13 mm stem diameter. The total number of plants within the amended Project Area was calculated at 3,045, of which 1,037 (34%) 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	0.3749	6480.0	2429	717
Mod	0.2749	1166.7	321	160
Low	0.6807	433.3	295	160
Total	1.3304		3045	1037

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	0.0678	439.5	606.2	216*
	Moderate	0.0823	96.0		
	Low	0.1632	70.7		
Melaleuca armillaris Shrubland - Low (dense Lantana)	Low	0.2704	117.2	117	63
Melaleuca armillaris Shrubland - Low (regen midstorey - no canopy)	High	0.1722	1116.1	1290.6	417
	Moderate	0.1377	160.7		
	Low	0.0319	13.8		
Melaleuca armillaris Shrubland - Moderate-high	High	0.0654	424.1	491.7	161
	Moderate	0.0212	24.7		
	Low	0.0990	42.9		

Vegetation Zones	Zieria density (see Table 10)	Area of Zieria (ha)	Area*density (av/ha)	Total plants calculation	Mature plant calculation	
<i>Melaleuca armillaris</i> Shrubland - Poor	High	0.0693	449.3	538.9	539	180
	Moderate	0.0337	39.3			
	Low	0.1162	50.4			

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

2.2.8 Threatened fungi

There were no threatened fungi species identified by the BAM-C 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 Biodiversity Study 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 Biodiversity Study 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-C. 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-C 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), four of which are species listed as candidate species for serious and irreversible impacts (SAIL): Large-eared Pied Bat, Little Bent-winged Bat, Large Bent-winged Bat and Brush-tailed Rock-wallaby. 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 Fruit-Dove, Spotted Emerald Dove).	August, November, December	2 x 30 minute bird surveys were conducted as well as opportunistic observations around the Biodiversity Study 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 15 days of survey

2.3.3 Fauna habitats

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

The amended 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 amended 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 amended 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 amended Project Area and these species are also expected to use other parts of the amended Project Area.

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

Aquatic habitat present within the amended Project Area is considered degraded. Two farm dams are present in the amended 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 amended Project Area which has limited ephemeral aquatic habitat (i.e. stream bed which is typically dry).

Watercourses from the amended Project Area and surrounds are described in detail within the 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 amended 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 Resilience and Hazards State Environmental Planning Policy (SEPP) 2021 (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 amended 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 Coastal Free-tailed Bat, Eastern Bentwing Bat, Little Bentwing 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 amended 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-C 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 amended Project Area. No ecosystem credit species were omitted from the BAM-C despite there being very limited habitat present within the amended Project Area for many of the predicted species.

Table 13: List of predicted and candidate threatened fauna species generated by the BAM-C for the amended Project

Common Name	Scientific Name	Status	Notes
Predicted threatened species (ecosystem credit species)			
Barking Owl	<i>Ninox connivens</i>	Assumed present	-
Dusky Woodswallow	<i>Artamus 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.
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.

Common Name	Scientific Name	Status	Notes
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	-
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 Needletail	<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).
Candidate species (species credit species)			
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 (degraded habitat)	The amended Project Area does not contain any large stands of Banksia, Eucalyptus or Callistemon or other preferred foraging habitat. Additionally, PCTs 720 and 1300 are not listed as associated PCTs for this species in the TBDC. 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 amended Project Area.
Koala (Breeding)	<i>Phascolarctos cinereus</i>	No (degraded habitat)	Koala density within the IBRA subregion is low, with only 27 records of Koala occurring since 2000, the majority of which are around 14km to the west and in association with the Illawarra Escarpment. In addition, the Shellharbour City LGA is not identified within the Biodiversity and Conservation SEPP, as Koalas are not generally known from the area. The site does not therefore constitute breeding or important habitat. Species is considered absent.

Common Name	Scientific Name	Status	Notes
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	No (surveyed)	Echolocation detectors did not detect species.
Little Eagle (Breeding)	<i>Hieraetus morphnoides</i>	No (surveyed)	No nest trees within amended Project Area - live (occasionally dead) large old trees within vegetation. The amended Project Area contains one stag in the amended 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 (degraded habitat)	The habitat present within the amended Project Area is considered substantially degraded such that this species is unlikely to utilise the amended Project Area. The water bodies within the amended Project Area consist of two small farm dams that are used by cattle, Plague-minnow affected, isolated from other permanent water sources, and have no fringing vegetation and little to no emergent vegetation. There are no creek or dams of the nature that the species prefers within or adjacent to the amended Project Area. In addition, there is no known reliable source populations within the area, with only sporadic records from 3km-5km east of the site (predominantly from the 1970s and 1980s). The species would not occur at the amended Project Area.
Little Bent-winged Bat (Breeding)	<i>Miniopterus australis</i>	No (no breeding habitat present in amended Project Area)	Although there was a possible record from the detector (Annex 4), there is no suitable breeding habitat within the amended 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)	Although there was a probable record on the detector (Annex 4),

Common Name	Scientific Name	Status	Notes
		in amended Project Area)	there is no suitable breeding habitat within the amended 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 amended Project Area. Echolocation detectors did not detect species.
Barking Owl (Breeding)	<i>Ninox connivens</i>	No (no breeding habitat present in amended 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 amended 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 amended Project Area and such areas.
Grey-headed Flying-fox (Breeding)	<i>Pteropus poliocephalus</i>	No (no breeding habitat present in amended Project Area)	No known breeding camps adjacent to amended Project Area.
Masked Owl (Breeding)	<i>Tyto novaehollandiae</i>	No (no breeding habitat present in amended Project Area)	No living or dead trees with hollow greater than 20cm diameter.

Species polygons

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

2.3.6 Connectivity

Patches of intact vegetation within and adjacent to the amended Project Area provide the main connectivity pathways to and around the amended Project Area (Figure 2). Vegetation within the amended 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 amended Project Area. Connectivity south of the amended Project Area would remain, however the width of the vegetated corridor would be slightly reduced (from approximately 130m to 120m at its narrowest point).

2.4 Planted native vegetation habitat assessment

In accordance with Table 28 (Appendix L) of the BAM a habitat assessment of the amenity barrier planting has been undertaken in regard to its suitability for use by threatened species. This involved identifying suitable habitat for threatened plants, particularly those recorded elsewhere in the amended Project Area

or with a high likelihood of occurrence, as well as habitat features considered suitable for threatened fauna (e.g. hollow-bearing trees).

The amenity barrier planting within the north-western portion of the amended Project Area is around 0.52 ha in size and consists of planted Forest Red Gum (*Eucalyptus tereticornis*) above planted Acacia species (*A. binervata* and *A. implexa*) as well as the exotic Lantana (*Lantana camara*). The groundcover is dominated by Mat Rush (*Lomandra longifolia*) and the exotic Kikuyu Grass (*Cenchrus clandestinus*). Lantana and Kikuyu Grass dominate the area. This vegetation has all been planted as part of the landscaping of the Albion Park Quarry for aesthetic purposes.

Given their relatively young age, none of the trees present contain hollows; nor did any exhibit signs of occupation (i.e. nests).

No other key habitat features were noted (i.e. rock outcrops, fallen timber of significant size, aquatic environments).

The amenity barrier planting is part of a small linear strip of vegetation that lines the top of the open quarry, however it is highly modified and is essentially fragmented and isolated from other areas of significant habitat.

The habitats present are not considered suitable for use by any threatened species credit species (flora or fauna) that have been previously recorded, or are considered to have habitat, in the locality (Table 9, Annex 9). In addition, no incidental sightings or evidence (e.g. scats, stick nests) of threatened species credit species (fauna) using, inhabiting or being part of the planted native vegetation was recorded. While some of the vegetation would technically conform to a PCT that is associated with threatened flora (i.e. Spiked Rice-flower), the degraded habitat and altered soil profile is likely to preclude the presence of any threatened flora species.

As no threatened species were observed, indicated or considered likely to use the planted native vegetation as habitat, sections 8.3 (prescribed impacts) and 8.4 of the BAM (mitigation and management of impacts on biodiversity values) does not need to be addressed as part of the streamlined module.

The proposed removal of 0.52 ha of planted native vegetation does not require offsetting for any ecosystem credit or species credit species.

2.5 Aquatic habitat assessment

Watercourse 3 occurs within PCT1300 (High condition class), and the portion of this drainage line within the study area is almost entirely shaded by the canopy trees of the rainforest. The riparian vegetation consists of 50% canopy cover, with a 20% shrub cover. The groundcover is sparse and consists of 15% cover of grasses, herbs and ferns. No emergent aquatic vegetation is present within the creek.

The creek bank is steep and stable and of earthen material with some loose rocks/small boulders present.

The creek had low flow at the time of the field survey, however did contain small pools of water. An unidentified fish was detected within one of the small pools.

The creek line is affected by minimal disturbance including some erosion and presence of weeds.

Watercourse 3 in the vicinity of the proposed discharge outlet is identified as Key Fish Habitat.

3. Impact Assessment

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

3.1 Potential impacts of the amended 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 14.

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

Impact within the amended Project Area development footprint	Likelihood of impact as a result of the amended Project
Direct impacts	
Removal or modification of native vegetation	<p>Known: approximately 4.37 ha of native vegetation, including areas of two EECs (Illawarra Subtropical Rainforest and Melaleuca armillaris Shrubland) would be removed as part of the amended 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 0.05% after removal of 3.18 ha. The total extent of MAS (PCT 720) is estimated to be 164.36 ha (Ecoplanning 2021); therefore the extent would be reduced by approximately 0.7% after removal of 1.19 ha.</p>
Loss of individuals of a threatened species	<p>Known: An area of 1.33 ha of <i>Z. granulata</i> habitat will be removed by the amended Project with an area of approximately 2.92 ha to be retained within areas zoned for extraction. The amended Project amounts to the clearing of 31% and retention of 69% of the habitat within the Study Area, noting this figure overestimates the proportion of habitat to be cleared on the property, with additional habitat present outside of the Study Area.</p> <p>The area to be removed supports an estimated 3,045 plants comprising 1,037 mature plants and 2,008 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. Additional information and assessment under the EPBC Act is provided for <i>Z. granulata</i> in Annex 8. The amended Project is considered to have a significant impact on the species.</p>

Impact within the amended Project Area development footprint	Likelihood of impact as a result of the amended Project
	One <i>Cynanchum elegans</i> individual recorded in the Study Area will not be directly or indirectly impacted as a result of the amended Project.
Removal or modification of threatened species habitat other than native vegetation (micro-habitat features)	Low/Moderate: the area to be impacted contains limited tree hollows or other important habitat features which are recognised important habitat for threatened species. The amended Project Area does however provide foraging habitat for a range of threatened fauna.
Death through trampling or vehicle strike	Low: clearing is the main impact from the amended Project, there would be limited increased risk from trampling or vehicle strike.
Death through poisoning	Low: no poisons are proposed to be used as part of the amended Project other than as required to control exotic species to meet obligations under the Biosecurity Act 2015.
Fragmentation	Moderate: Vegetation within the amended Project Area is already fragmented. Clearing proposed would increase fragmentation impacts, however the majority of impacts would impact lesser quality remnant vegetation.
Indirect impacts	
Predation by domestic and/or feral animals	Low: the amended Project is not likely to increase the presence of domestic or feral animals in the local area as the amended Project is within a semi-rural area with nearby agricultural farms.
Loss of shade/shelter	Known: the removal of 4.37 ha of native vegetation in the amended 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 amended Project.
Loss of individuals through starvation	Low: the habitat to be removed in the amended Project Area is considered unlikely to cause loss of individuals through starvation.
Loss of individuals through exposure	Low: habitat to be removed in the amended Project Area occurs primarily as stands of previously disturbed native vegetation. Areas of habitat nearby would not be impacted by the amended Project. Therefore the amended Project is considered unlikely to cause a loss of individuals through exposure.
Edge effects (noise, light, traffic)	Moderate: the amended Project is unlikely to increase traffic although will increase light and noise levels within the amended 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	Low: the amended Project is likely to cause some alteration to existing flow regimes of 1 st and 2 nd order ephemeral watercourses within and adjacent to the amended Project Area. The amended Project has avoided the first and second order watercourse to the north-east of the amended Project Area. Hydrological impacts from the amended 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)</i>

Impact within the amended Project Area development footprint	Likelihood of impact as a result of the amended Project
	<i>following the settlement of any fines, resulting in minimal change in overall flows.</i>
Aquatic habitat impacts	<p>Low: The amended Project has the potential to indirectly impact aquatic habitats outside of the amended 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 amended Project are wetland and river floodplain habitats approximately 1.5 km to the south-east of the amended 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 amended 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	Moderate: 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.
Increased human activity within or directly adjacent to sensitive habitat areas	Known: the amended 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 amended Project Area.

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 design of the amended Project or will employ during construction, operation or completion of the amended 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 amended 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 amended 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* Critically Endangered Ecological Community (EEC) under the BC Act.
- 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 amended Project are detailed below.

Location

The amended 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 amended Project Area. Avoidance measures regarding the positioning of the Extraction Area 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. It is noted that areas to the east of the amended Project Area that contain *Melaleuca armillaris* Tall Shrubland, as well as the sought after hard-rock resource, were avoided and not included within the amended Project Area.

Design

The design of the amended Project was developed and amended taking into account biodiversity surveys and consultation with the NSW BCD. Avoidance areas totalling 5.82 ha within land zoned for extraction were incorporated into the amended Project design (Figure 3). The avoidance areas include higher condition threatened ecological communities (PCT720 high and moderate condition; PCT1300 moderate and high condition) present within the southern and north-eastern parts of the amended Project Area and areas supporting better condition habitat of the threatened plants *Zieria granulata* and *Cynanchum elegans*. *C. elegans* species and its immediate habitat has been completely avoided, while the better condition PCT1300 (High condition class) has been avoided apart from 0.0025 ha in association with the proposed discharge outlet.

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

3.2.2 Mitigation measures (construction and post construction)

Mitigation measures that would be implemented during the construction and operational phases of the amended Project would be documented within an appropriate Quarry Environmental Management Plan (QEMP). The objective of the QEMP would be on maintaining current site values in retained areas and preventing clearing that would increase threats to biodiversity in better-condition areas (e.g. prevent far-field movements of high-threat weeds).

The QEMP would include a Biodiversity Management Plan (BMP), which will be prepared in consultation with DPE / BCD prior to the commencement of construction works. The BMP and/or other parts of the QEMP would include delineation of the amended Project Area to ensure there are no impacts outside of the amended Project Area boundary and provide discussion on staff training, threatened species management, erosion and sediment controls, weed control measures, and management and removal of waste (see Table 15). Measures within the QEMP would include standard construction environmental management measures and, where performed by experienced practitioners, are considered to be reliable (low risk of failure). Given the existing environment, the consequence of impacts after mitigation measures have been carried out is considered low.

Table 15: Mitigation measures

Mitigation measure and timing	Responsibility	Timing
Pre-construction		
<i>Preparation of a Biodiversity Management Plan</i> – to include measures listed below.	Environmental Officer	Plan to be developed and approved by DPE prior to site clearing
<i>Delineation of the site</i> – establish exclusion zone around the amended Project Area to ensure clearing does not occur outside those boundaries. A robust fence, with well-marked posts, would be erected and maintained for the life of the amended Project.	Quarry Manager	Prior to clearing
<i>Pre-clearing inspections</i> 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).	Environmental Officer	Prior to clearing
<i>Staff training and amended project briefings</i> – e.g. communicate the importance of exclusion zones, threatened species (e.g. <i>Z. granulata</i>) and ecological communities on site, erosion and sediment controls, unexpected species finds procedure.	Environmental Officer	Prior to clearing
<i>Weed Management Strategy</i> – designed to control prevalent weeds, particularly HTW, identified in the amended Project Area and within a 50 m buffer area. This would include mapping the location of HTW (e.g. Lantana) at a minimum and other problematic weeds, as well as providing hygiene measures for all vehicles and plant during construction.	Environmental Officer	Prior to clearing
Preparation and application of a Vegetation Management Plan (VMP) for the life of the amended Project. The VMP would form part of the BMP and would include the amended Project Area and all areas within a 50 m buffer of its 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.	Environmental Officer	Prior to clearing

Mitigation measure and timing	Responsibility	Timing
Operation		
<i>Erosion and sediment controls</i> – Implementation of erosion and sediment controls for the duration of construction works and until excavated or disturbed areas are vegetated (detailed in QEMP).	Quarry Manager	Prior to clearing and maintained until affected areas return to their present state or better
<i>Hygiene protocols</i> - prevent the spread of weeds or pathogens between affected areas and unaffected areas.	Quarry Manager	Throughout amended Project life
<i>Weed control</i> - measures would form part of operational maintenance to manage the potential dispersal and establishment of weeds during operation in accordance with the <i>Biosecurity Act 2015</i> . Such measures would include: <ul style="list-style-type: none"> physical or chemical removal (via the cut and paint method) of African Boxthorn and <i>Prosopis velutina</i>, and any other problematic weeds present vehicle clean/wash prior to and before exiting the construction site. 	Quarry Manager/ Weed contractor	Throughout amended Project life
Stockpiling of topsoil for use in any rehabilitation areas.	Quarry Manager	During topsoil stripping
All waste would be appropriately managed.	Quarry manager	Throughout amended Project life
Adopting adaptive dust management and monitoring programs to control air quality in accordance with the Air Quality Management Plan.	Quarry manager	Throughout amended Project life
Amended Project Area, and adjacent buffer, to be monitored for weed invasion and managed according to the Weed Management Strategy.	Quarry manager	Annual inspections throughout amended Project life.

Regarding the weed management mitigation measures, Table 16 provides further guidance on the timing and performance criteria required. This information would be included in the amended Project’s BMP.

Table 16: Performance and completion criteria for weed management

Action	Performance Criteria	Method	Completion Criteria
Control of HTW: For example, Lantana, Moth Vine, African Olive, and any other problematic weeds or weeds with high cover	Eradication of existing HTW. Infestation areas to be equal or less than the baseline dataset i.e. weed data recorded as part of the survey and mapping undertaken prior to commencement of works. Per cent cover of weed species in each vegetation zone equal to or less than baseline dataset. No new weed species or infestations.	Survey at existing infestation locations. For the purpose of obtaining native versus exotic species cover and abundance data, monitoring transects are to be conducted throughout the amended Project Area and in randomly selected locations in adjacent native vegetation. Opportunistic observations by quarry personnel.	Annual inspections and reporting during operation of the amended Project.

In addition, Cleary Bros are aware that the *Melaleuca armillaris* Tall Shrubland TEC is highly fragmented and under critical threat, and as part of the amended Project would commit to improving and extending mapped areas of this TEC on adjoining parts of the property.

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 amended 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 consideration for these TECs has been completed in Annex 9.

3.4 Cumulative impacts

This section briefly discusses the cumulative impacts of the amended Project; that is, the combined impacts of the amended Project with other relevant future projects on, in this case, matters pertaining to ecology.

This proposal is a continuation to previous quarrying activities in land owned and operated by not only Cleary Bros, but also Boral and Holcim. In addition, the Princes Highway Albion Park Rail Bypass has recently been completed, as have numerous residential subdivisions in recent times.

Future projects in the Shellharbour City LGA, and neighbouring LGAs, include

- the Tullimbar subdivision
- the Illawarra Escarpment mountain bike trail network.

Impacts associated with the amended Project add to the cumulative impacts of the locality, namely relating to vegetation clearance. The amended Project would result in the additional permanent loss of approximately 4.37 ha of native vegetation. Of this, 3.18 ha consists of the ISR TEC (PCT1300) and 1.19 ha conforms to the Melaleuca armillaris Tall Shrubland TEC (PCT720). The removal of this vegetation will reduce the known extent of the ISR and Melaleuca armillaris Tall Shrubland TECs by 0.05% and 0.7%, respectively.

It is acknowledged that the presence of the sought after hard-rock resource quarried by Cleary Bros, Boral and Holcim in the locality also occurs in association with some of the remaining remnants of *Melaleuca armillaris* Tall Shrubland (e.g. east of the amended Project Area). As such, there is potential for an increased cumulative impact on this TEC.

3.5 Impacts to Watercourse 3

To minimise any impacts to Watercourse 3, its water quality and physical nature as a result of the discharge of accumulated water from the Southern Sump, the following is proposed to ensure no material impacts to surface water quality in Watercourse 3:

- Erosion risks during construction will be managed in accordance with *Managing Urban Stormwater* or the relevant guideline in place at the time of construction (around 2053).
- Erosion risks during operation will be managed through passive control of water flows at the pipeline inlet, with flood peaks post-construction predicted to be lower than pre-development flood peaks.
- Regular, risk based inspections to ensure the discharge outlet is functioning as required. Where necessary and/or required, obstructions (i.e. accumulation of veg) will be removed and remediation carried out. Until the completion of rehabilitation of the final landform, water will be test prior to being discharged. Water will only be discharged when testing indicates it is consistent with required criteria to minimise impacts to water quality.

Therefore, it is expected that the construction of the proposed discharge outlet and discharge of water will have no material erosion related impacts or result in an increased flooding risk downstream of the Amended Project Area. As Watercourse 3 is identified as Key Fish Habitat, it is recommended an Aquatic Assessment Report that assesses the creekline for threatened species in accordance with the *NSW Fisheries Management Act 1994* be prepared within five years of construction of the discharge outlet.

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 amended Project has been undertaken using the BAM-C.

4.1 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 17.

Impacts to native vegetation communities within the amended Project Area generate a requirement for 53 PCT1300 ecosystem credits and 9 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 17: 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	0.0025	3.18	63.6	2	1	53
1300_Low		2.13		44.9	2	48	
1300_Poor		0.36		21.2	2	4	
1300_Poor_Planted		0.24		6	2	0	
1300_Very Degraded		0.45		9.1	2	0	
720_Mod-High	Melaleuca armillaris Shrubland	0.19	1.19	24.5	2.5	3	9
720_Low_Lant		0.28		10.2	2.5	0	
720_Low_NoCanop		0.37		25.4	2.5	6	
720_Poor		0.35		10.3	2.5	0	
Total	-	4.37	-	-	-	62	

4.2 Summary of species credits required

The results of the BAM-C species offset credit requirements are shown in Table 18. Threatened species identified or assumed to be present within the amended Project Area and likely to be impacted by the amended Project generate a requirement for one 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 18: Species credits required

Threatened species	Area or Count	Habitat impacted (ha) or number mature individuals	Required credits
<i>Zieria granulata</i> / Illawarra Zieria	Count	1037	2074

4.3 Approach to offset requirements

Cleary Bros intends to offset impacts from the amended Project in accordance with the credit requirements outlined in Table 17 and Table 18 above via available options under the BOS including:

- Retiring credits based on the like-for-like rules via either:
 - establishment of a Stewardship Site (further information is provided below)
 - 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.

Proposed Stewardship Site

As mentioned above, establishment of a Stewardship Site is one of the ways in which Cleary Bros will seek to meet their offset obligation for the amended Project. A Stewardship Site is proposed to be established wholly within Lot 7 DP3709, and adjacent to the amended Project Area (Figure 8). The proposed Stewardship Site is approximately 8.4 ha in size and contains the necessary like-for-like threatened biodiversity required for the amended Project. Apart from comprising vegetation to the east of the amended Project Area, a large amount of vegetation to be included within the proposed Stewardship Site consists of the vegetation that was avoided through further site design. Table 19 provides the credit satisfaction for MAS only based on BAM plots within Study Area, and a rapid assessment of the MAS community to the east of the Study Area. Through discussions with BCD and Shellharbour City Council, MAS was a critical entity identified to avoid and protect in the locality, and therefore was the primary driver of creating the proposed Stewardship Site.

Table 19: A summary of the MAS credits required by the amended Project and generated by the proposed Stewardship Site

Vegetation Zone (MAS only)	Impact Area (ha)	Credits required	Offset Area (ha)	Credits generated ¹
Low (dense Lantana)	0.28	0	0.02	1
Low (regen midstorey - no canopy)	0.37	6	1.37	5
Moderate	0.00	0	1.18	1
Shrubland - Moderate-high	0.19	3	0.41	1
Shrubland - Poor	0.35	0	0.47	1
High	0.00	0	0.81	1
Total	1.19	9	4.26	10

The establishment of the proposed Stewardship Site is likely to meet the offset obligation of the amended Project for the MAS community. Cleary Bros commits to establishing a Stewardship Site generally consistent with that shown in Figure 8, however, to reiterate, the proposed Stewardship Site may be one of the permissible options available for retiring credits.

¹ The credits generated are estimates only. BAM plots to be conducted as part of a Biodiversity Stewardship Site Assessment Report may result in different values to those in Table 19.

It is noted that the estimates provided in Table 19 are preliminary and based on a rapid assessment. The vegetation was assigned condition based on the zoning conventions used for the amended Project Area. No BAM plots were conducted to inform the credit calculations, rather the VI scores from the amended Project Area were used. In addition, the five credits generated for the Low (regen midstorey – no canopy) vegetation zone is based on the assumption that active restoration (i.e. planting of species characteristic of the MAS CEEC) will be undertaken as part of the Stewardship Site’s management (the methodology to be documented as part of a Stewardship Site’s Management Plan). Finally, the rapid assessment has indicated a potential for the expansion of the mapped area of MAS on the ridgeline to the east of the amended Project Area within the proposed Stewardship Site, through the restoration of an area of low quality MAS currently not included within the mapped area of this community. The restoration of this community will enable the total area of MAS to be approximately maintained despite the removal of the 1.19 ha of MAS to be impacted by the amended Project.

4.4 Staged credit requirement application

Impacts from the amended 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 amended Project commensurate with the timing of impacts. Four broad impact stages for the amended Project have been identified, around which it is considered appropriate to structure the offset requirements. The proposed impact and offsetting stages are identified within Table 20 and Figure 9. All offset credit requirements would be satisfied prior to disturbing any vegetation within the relevant stage, under the staged offset proposal.

Table 20: Proposed impact and offset stages for the amended 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* ²	Proportion of offset requirement for zone	Sum of PCT credits for stage	<i>Zieria granulata</i> proposed staged offset credit requirement
One (0-5 years)	1300 - Illawarra Subtropical Rainforest - Low	0.18	8.45	4	8	8	0
	1300 - Illawarra Subtropical Rainforest - Poor	0.36	100.00	4	100		
	1300 - Illawarra Subtropical Rainforest - Poor_Planted	0.24	100.00	0	n/a		
Two (5-15 years)	720 - Melaleuca armillaris Shrubland - Low (dense Lantana)	0.28	100.00	0	100	9	2074
	720 - Melaleuca armillaris Shrubland - Low (regen midstorey - no canopy)	0.37	100.00	6	100		

² 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.

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* 2	Proportion of offset requirement for zone	Sum of PCT credits for stage	<i>Zieria granulata</i> proposed staged offset credit requirement
	720 - Melaleuca armillaris Shrubland – Moderate-high	0.19	100.00	3	100		
	720 - Melaleuca armillaris Shrubland - Poor	0.35	100.00	0	100		
Three (15-30 years)	1300 - Illawarra Subtropical Rainforest - Low	1.95	91.55	44	92	44	0
	1300 - Illawarra Subtropical Rainforest - Very degraded	0.45	99.5	0	n/a		
Four (30 years)	1300 - Illawarra Subtropical Rainforest - High	0.0025	100	1	100	1	0
	1300 - Illawarra Subtropical Rainforest - Very degraded	0.0025	0.5	0	n/a		
Total		4.37	-	62	-	62	2,074

5. Summary

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

- Direct removal of 4.37 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 amended Project where possible through detailed design of the amended Project and implementation of actions aimed at mitigating and managing potential indirect impacts of the amended Project as detailed in Section 3.

A Referral for the original Project was 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 the threatened *Zieria granulata*, which concluded a significant impact as a result of the original Project is likely for due to the number of *Zieria granulata* individuals being removed. As the *C. elegans* individual occurs beyond the limits of the amended Project Area and will not be directly, or indirectly impacted, an assessment of significance under the EPBC Act was not considered necessary. 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 amended Project was likely.

Offset requirements for impacts from the amended 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.

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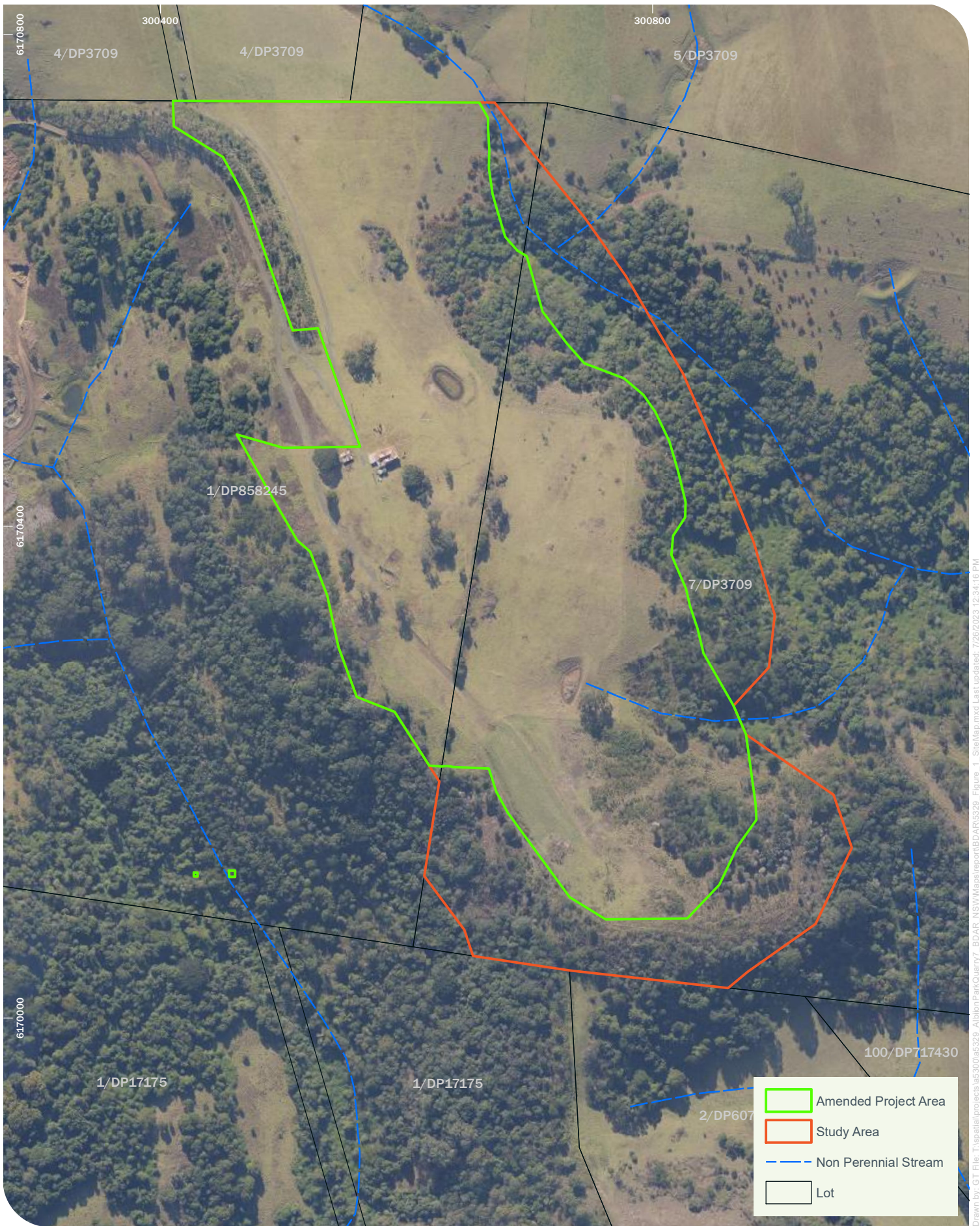
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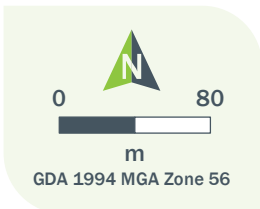
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Figures



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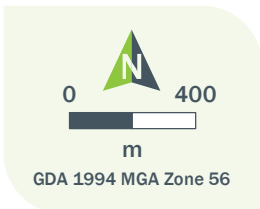
Site Map
Albion Park Quarry - Stage 7 BDAR

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Figure 1



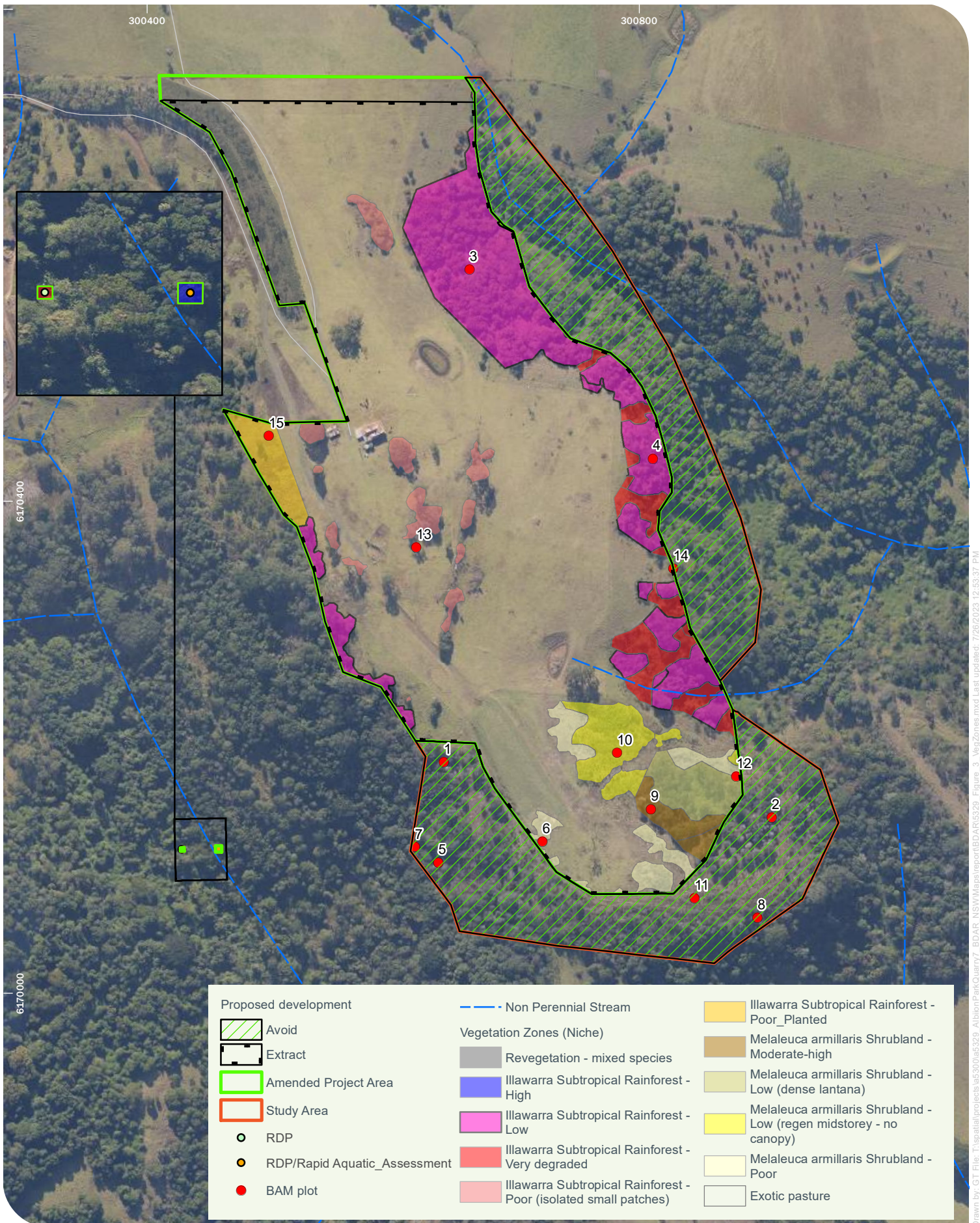
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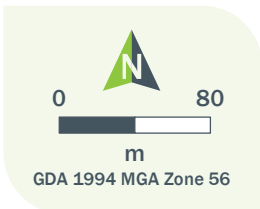
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Location Map
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Figure 2



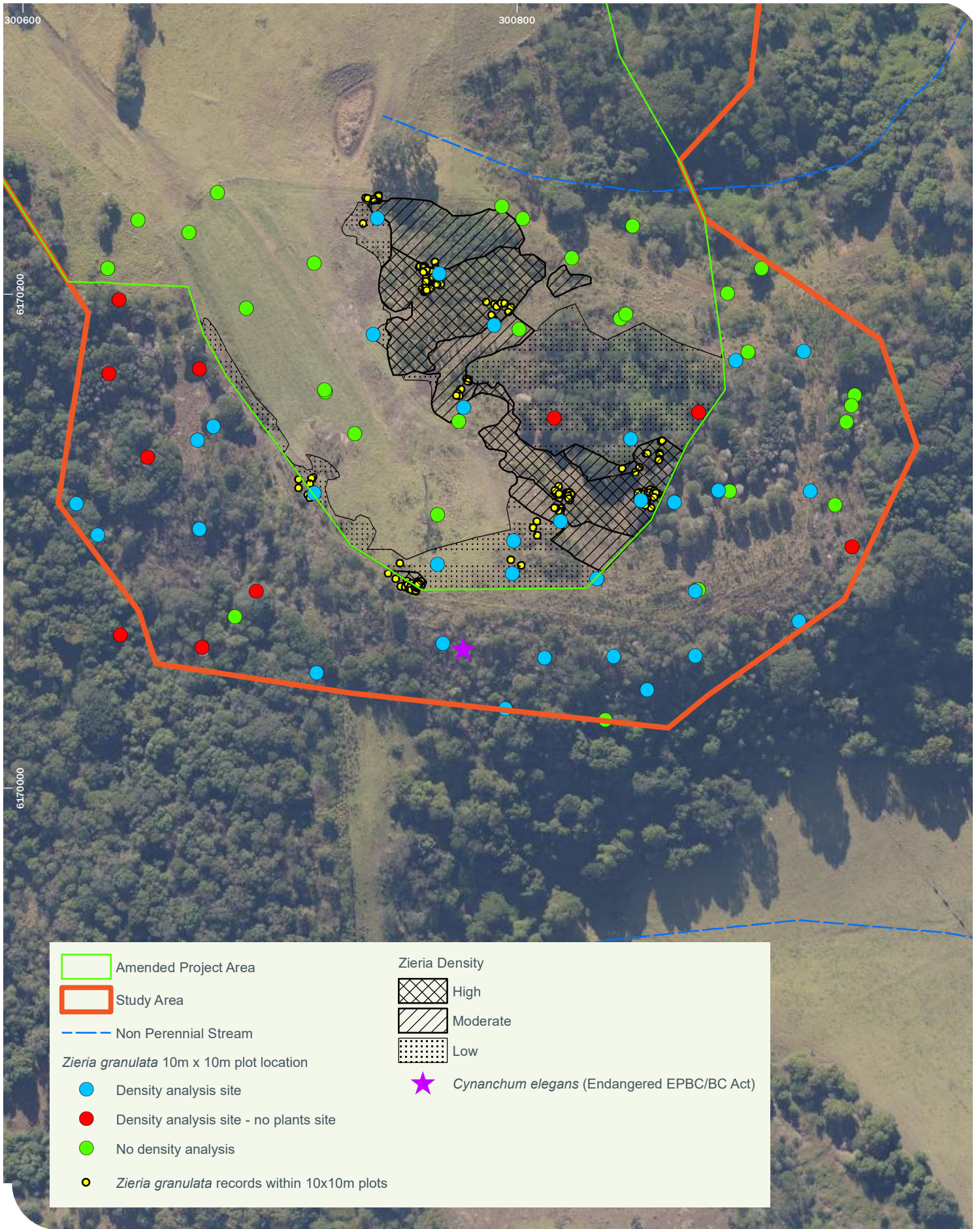
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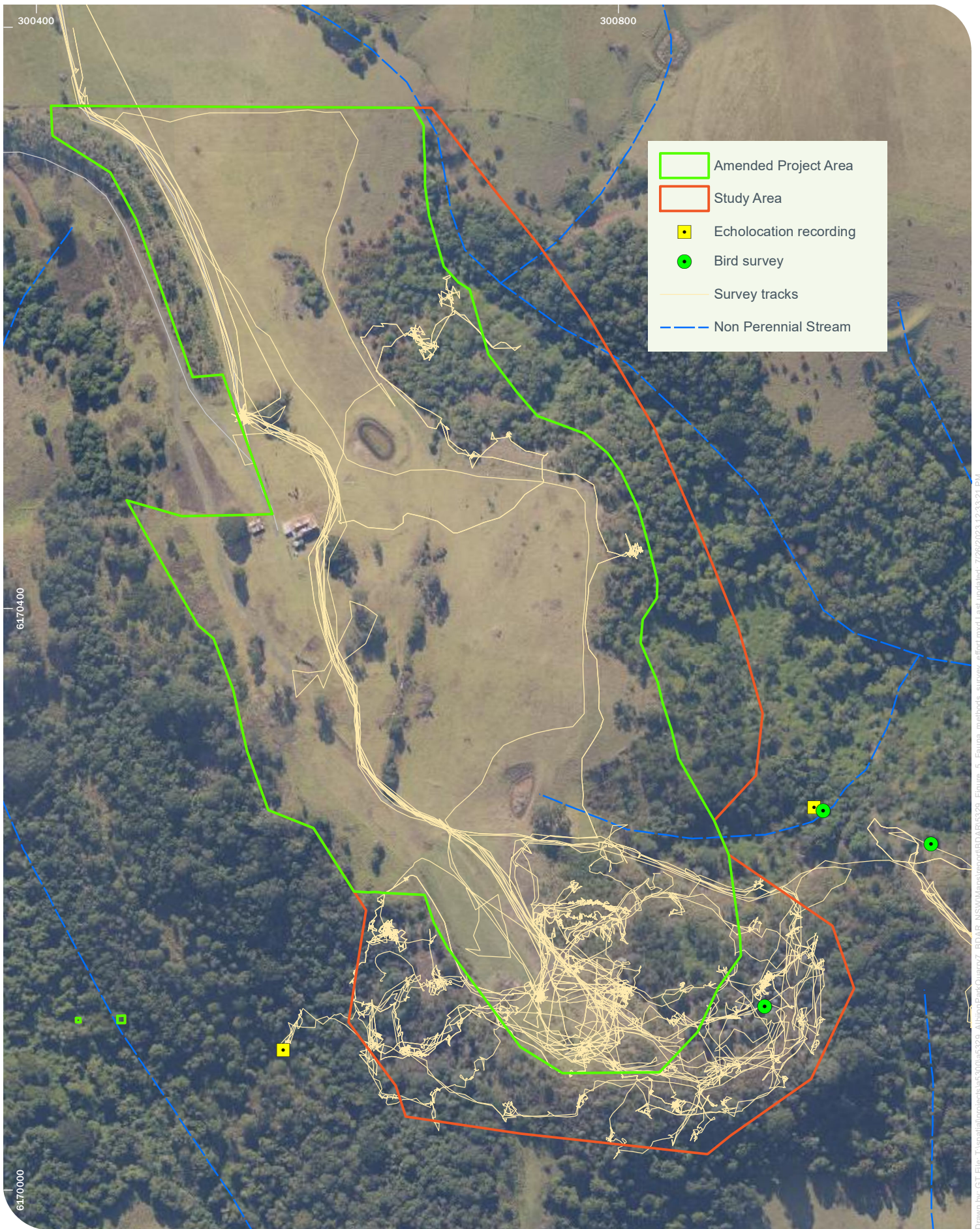
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**Vegetation zones and plot locations
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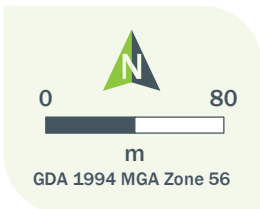
Figure 3



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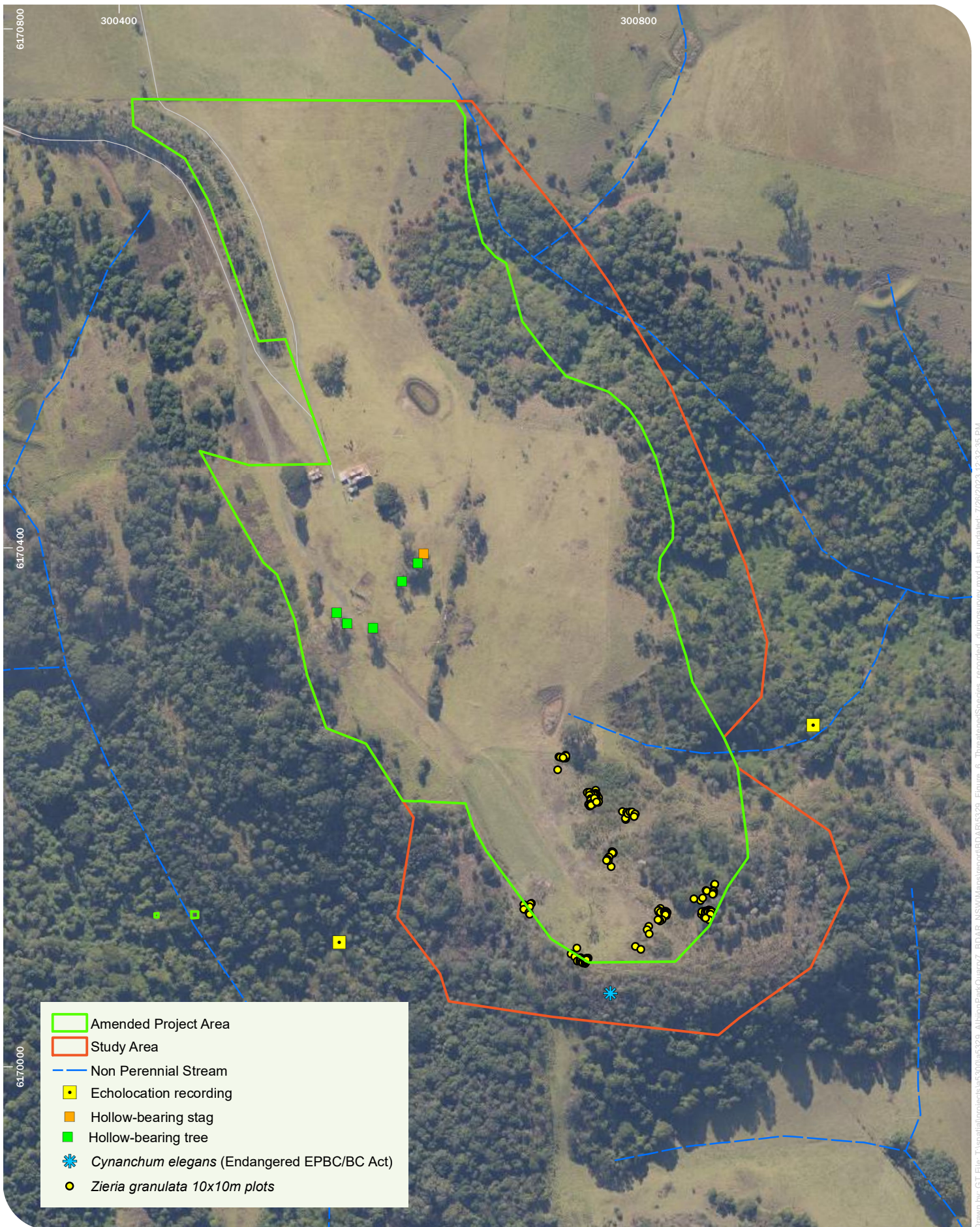
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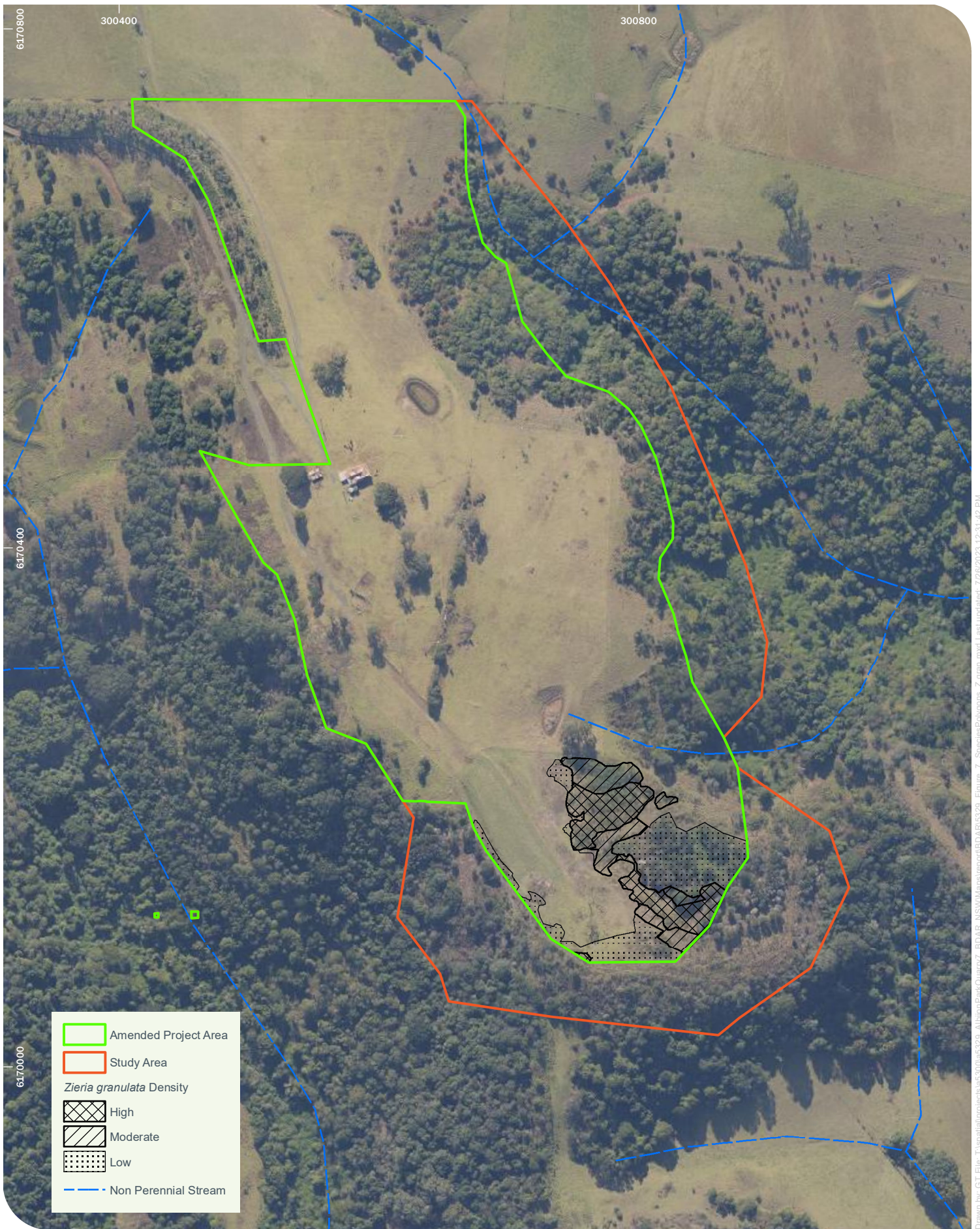
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**Fauna methods/survey effort
Albion Park Quarry - Stage 7 BDAR**

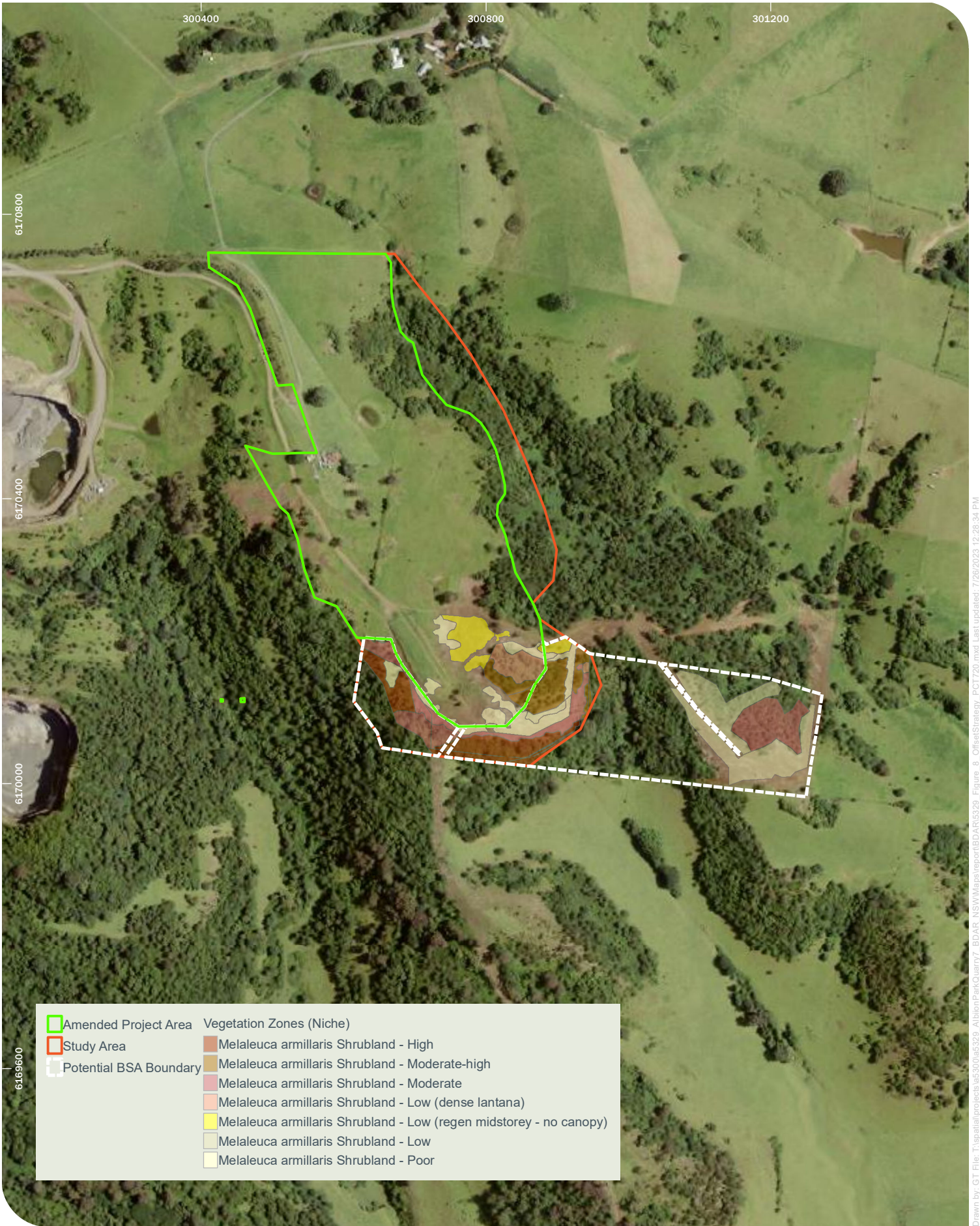
Figure 5



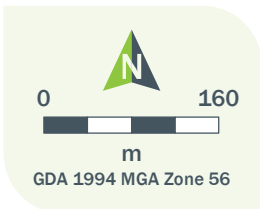
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- Study Area
- Non Perennial Stream
- Echolocation recording
- Hollow-bearing stag
- Hollow-bearing tree
- ✱ *Cynanchum elegans* (Endangered EPBC/BC Act)
- *Zieria granulata* 10x10m plots



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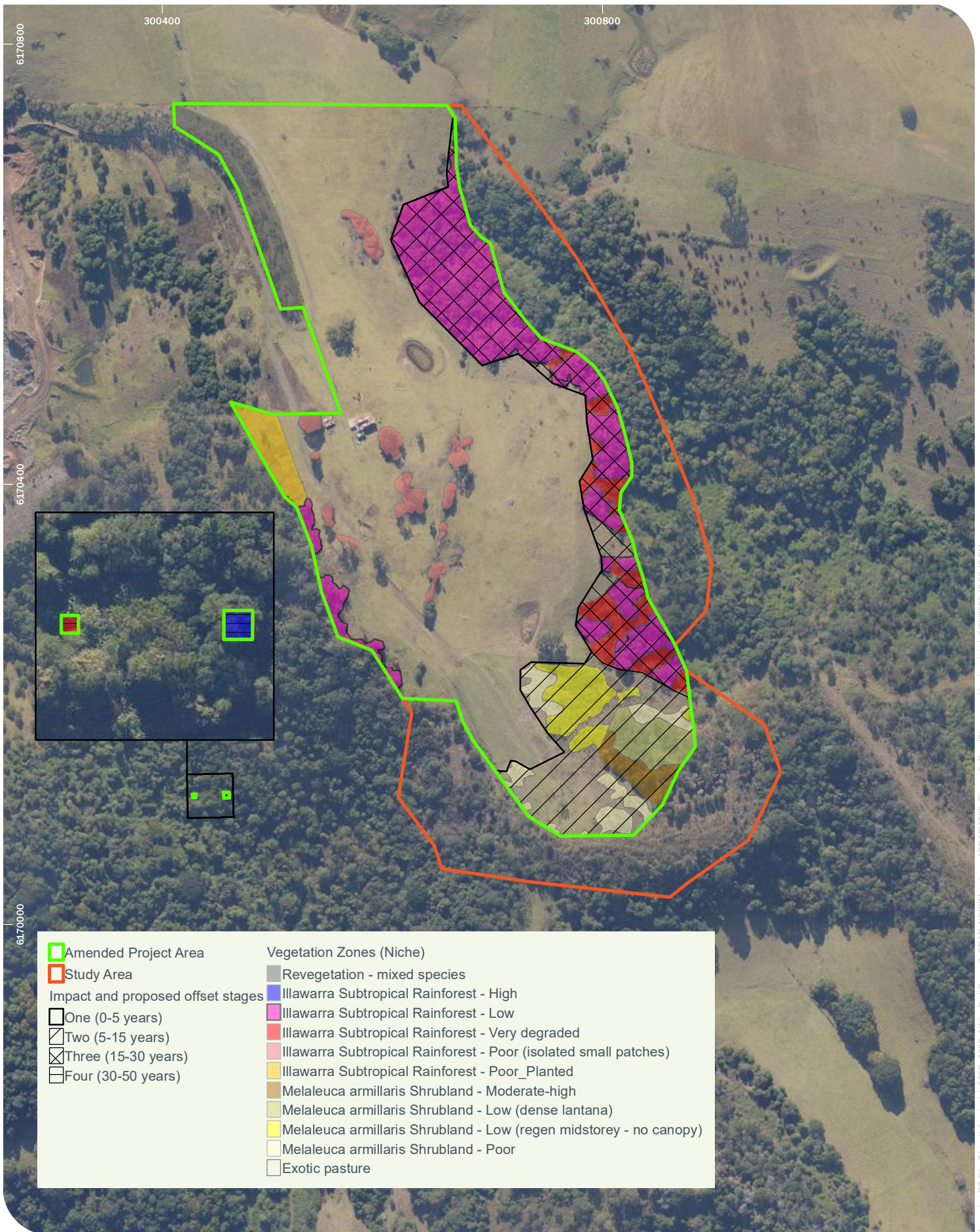
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Offset strategy
Albion Park Quarry - Stage 7 BDAR

Figure 8



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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 amended Project Area including the vegetated southern parts of the amended 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 amended Project Area. A total of 1.19 ha of PCT720 would be cleared as part of the amended Project.

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

- Poor
- Low (regenerating midstorey – no canopy)
- Low (dense Lantana)
- Moderate – 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 amended 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 Critically 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 amended 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 amended 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 amended Project Area including the vegetated eastern and southern margins of the amended 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 amended Project Area constitutes five condition classes of PCT1300:

- High
- Low
- Poor (isolated small patches)
- Poor-planted (small single patch)
- 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 amended Project Area has been disturbed with clearing having taken place historically and some clearing of regrowth in more recent times.

The high condition area of rainforest to be impacted occurs in association with the discharge outlet at Watercourse 3 to the east of the Stage 7 extraction area.

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 amended 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 amended Project Area. A total of 3.18 ha of ISR would be cleared as part of the amended Project.



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

Annex 2. Floristic plot data

Table 21: Floristic Plot cover (%) data

Family	Species	Common Name	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
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	0.1
Apocynaceae	<i>Cynanchum elegans</i>	White-flowered Wax Plant							2								
Apocynaceae	<i>Gomphocarpus fruticosus*</i>	Narrow-leaved Cotton Bush													0.1		1
Apocynaceae	<i>Gomphocarpus physocarpus*</i>	Balloon Cotton Bush						0.2									
Apocynaceae	<i>Marsdenia rostrata</i>	Milk Vine							2								
Apocynaceae	<i>Parsonsia 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	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		0.2
Asteraceae	<i>Conyza bonariensis*</i>	Flaxleaf Fleabane		0.2						0.1	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	

Family	Species	Common Name	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Asteraceae	<i>Hypochaeris radicata</i> *	Catsear		0.2								0.1					
Asteraceae	<i>Hypochaeris 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		0.1
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>Sonchus oleraceus</i> *	Sowthistle															0.1
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 Vine			4	0.2	0.4		5							1	0.1
Blechnaceae	<i>Blechnum ambiguum</i>									0.1						0.1	
Boraginaceae	<i>Ehretia spp.</i>								8								
Cactaceae	<i>Opuntia stricta</i> *	Common Prickly Pear, 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					

Family	Species	Common Name	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
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															
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				0.1
Fabaceae (Mimosoideae)	<i>Acacia linifolia</i>	White Wattle	0.2														

Family	Species	Common Name	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Fabaceae (Mimosoideae)	<i>Acacia maidenii</i>	Maiden's Wattle			0.2				10							0.5	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			
Fabaceae (Mimosoideae)	<i>Pararchidendron pruinosum var. pruinosum</i>	Snow Wood							3								
Gentianaceae	<i>Centaurium erythraea*</i>	Common Centaury										0.1	0.1				
Geraniaceae	<i>Geranium homeanum</i>																0.1
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium													0.1		
Iridaceae	<i>Patersonia spp.</i>			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 spp.</i>	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 spp.</i>								5								
Malaceae	<i>Pyracantha angustifolia*</i>	Orange Firethorn			60	12											

Family	Species	Common Name	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Malvaceae	<i>Brachychiton acerifolius</i>	Illawarra Flame Tree															0.1
Malvaceae	<i>Hibiscus heterophyllus</i> <i>subsp. 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	0.5
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								
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>Acmena smithii</i>	Lilly Pilly															0.1
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum													8		
Myrtaceae	<i>Leptospermum juniperinum</i>	Prickly Tea-tree								2							
Myrtaceae	<i>Melaleuca armillaris</i> <i>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														

Family	Species	Common Name	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
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	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													
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							

Family	Species	Common Name	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
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	95
Poaceae	<i>Pentameris airoides*</i>	False Hairgrass											0.1				
Poaceae	<i>Poa labillardierei var. labillardierei</i>	Tussock		0.2						7	2	1	0.1				
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								

Family	Species	Common Name	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Sapindaceae	<i>Cardiospermum grandiflorum*</i>	Balloon Vine								4							
Sapindaceae	<i>Cupaniopsis anacardioides</i>	Tuckeroo															0.1
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	0.1
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
15	1300	Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion_Poor_planted	7.0	0.0	0.0	2.0	0.0	1.0	5.6	0.0	0.0	0.2	0.0	0.1	95.4

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
15	Present	0	0	6.4	0.0	Absent	Present	Present	Absent	Absent

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
Amphibia	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	
Aves	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
Mammalia	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 Free-tailed 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 Sheath-tailed bat	<i>Saccolaimus flaviventris</i>	Echolocation Probable	
Reptilia	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
Amphibians						
<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. Habitat is confined to small farm dams that are used by cattle, Plague-minnow affected, isolated from other permanent water sources, and have no fringing vegetation and little to no emergent vegetation. There is no known reliable source populations within the area with only sporadic records from 3km-5km east of the site (predominantly from the 1970s and 1980s).
<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	Low	None – no heathland or other preferred vegetation types. No swamps or permanent

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
				the Central Coast down into Victoria. Individuals have been collected from a wide range of water bodies that includes 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.		pools within streams or connecting/ limiting habitat.
<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.
Birds						
<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</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 amended 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 amended Project Area. Dams small isolated and highly degraded at amended 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 amended Project Area. Very limited foraging habitat. Not detected during survey. Assumed present under BAM.
<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

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
<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 amended 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 grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	Low	None – no heath or open woodland with dense understorey habitat present in amended Project Area. No records within the locality.
<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	None	None – no limiting habitat, migratory species.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
				numbers off the NSW south coast from Green Cape to Newcastle during winter where they feed on cuttlefish.		
<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
<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

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
<i>Fregatta 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>Hieraetus 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.
<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 amended 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 amended 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	Low	Low – very limited foraging habitat in amended Project Area. No breeding habitat.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
				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.		
<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</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 <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 ² . 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.	Low	Low – no breeding habitat, few large trees for nesting. Potential foraging habitat but not detected during survey and limited records.
<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

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
<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
<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	None	None – no limiting habitat, migratory species

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
				without vegetation or cover. Breeds in the northern hemisphere.		
<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 in which to nest. Burrows may be dug below mat forming herbs.	None	None – no limiting habitat
<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,	Low	Low - Not observed during survey. Preferred habitat primarily avoided.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
				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.		
<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, spending the majority of its time at sea, and rarely occurs in continental shelf waters.	None	None – no limiting habitat
<i>Pterodroma 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</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	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>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 timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	None	None – no limiting habitat, migratory species
<i>Sternula 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

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
<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
<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

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
<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 shelves, around continents and may enter harbours and bays. It breeds mostly on small, bare rocky islands.	None	None – no limiting habitat, migratory species
<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 m. 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 amended 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
Mammals						
<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</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>Isoodon 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 Free-tailed 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 coastal banksia scrub where it forages below the canopy for insects.	Known	High – recorded during survey near to proposed development areas. Amended Project Area limited to foraging habitat.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
<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. Amended 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 amended 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 ha 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 amended 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 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.	Low	None – no smooth bark Eucalypts or large stands of Banksias, with only small scattered hollows across the amended 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
<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</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	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.	Known	Known. 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 Sheath-tail-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 country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	High	High likelihood of some localised impacts. Probable calls recorded and known from area.
<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	High	High likelihood of some localised impacts. Probable calls recorded and known from area.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
				opening in the forest for flight paths. Creeks and small rivers are favoured foraging habitat. This species roosts in hollow tree trunks and branches.		
Reptiles						
<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
Plants						
<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-Morisset 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 soil. Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct.	Low	None – no limiting habitat
<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>	Low	None – not known from habitat prevalent within the amended Project Area.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
				and-or <i>E. longifolia</i> . At Austinmer, the species is recorded from a coastal headland.		
<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 amended Project Area.
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	Recorded from rainforest gullies scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar.	None	None. No individuals detected within amended Project Area during surveys. Species occurs beyond the limits of the amended Project Area.
<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 extending onto the upper escarpment slopes. Associated vegetation includes rainforest and moist eucalypt forest.	Moderate	Low – no individuals found during targeted survey within the very small area (0.0025 ha) of high condition rainforest being impacted as a result of the proposed discharge outlet.
<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, O'Hares, Metropolitan and Warragamba Catchments.	Low	None – not known from habitat prevalent at the amended Project Area.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
<i>Haloragis exalata</i> <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 amended 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 amended Project Area.
<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 amended 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 amended Project Area.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
<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 amended 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 amended 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 the plants then persist as underground tubers until they resprout the following winter.	Low	None – not known from habitat prevalent at the amended Project Area.
<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 amended 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 amended Project Area.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
<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 amended 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 temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	Low	Low – not detected during targeted survey.
<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 amended 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	Low	None – not known from habitat prevalent at the amended Project Area.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence	Potential for impact
				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.		
<i>Zieria granulata</i>	Illawarra Zieria	E	E	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.	Known – threatened species surveys conducted	Known – see EPBC Act assessment of significance.

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



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 pre-update benchmarks from Rev4 and stormwater outlet	22/06/2023
Assessor Name	Assessor Number	BAM Data version *
Simon Tweed	BAAS17040	61
Proponent Names	Report Created	BAM Case Status
Mark Hammond	26/07/2023	Finalised
Assessment Revision	Assessment Type	Date Finalised
8	Major Projects	26/07/2023

* 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		



BAM Biodiversity Credit Report (Like for like)

Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT

1300-Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion

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

Predicted Threatened Species Not On Site

Name

No Changes

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



BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1300-Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	3.2	4	49	53
720-Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion	Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion	1.2	0	9	9

720-Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin 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 This includes PCT's: 720, 3872	-	720_Mod-High	No	3	Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts. or 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 This includes PCT's: 720, 3872	-	720_Low_Lant	No	0	Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts. or 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 This includes PCT's: 720, 3872	-	720_Low_NoCa nop	No		6 Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts. or 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 This includes PCT's: 720, 3872	-	720_Poor	No		0 Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1300-Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	Like-for-like credit retirement options					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion This includes PCT's: 906, 1300, 3013, 3077, 3078	-	1300_Low	No	48	Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

	<p>Illawarra Subtropical Rainforest in the Sydney Basin Bioregion This includes PCT's: 906, 1300, 3013, 3077, 3078</p>	-	1300_Poor	Yes	<p>4 Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</p>
	<p>Illawarra Subtropical Rainforest in the Sydney Basin Bioregion This includes PCT's: 906, 1300, 3013, 3077, 3078</p>	-	1300_Very_Degraded	No	<p>0 Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</p>
	<p>Illawarra Subtropical Rainforest in the Sydney Basin Bioregion This includes PCT's: 906, 1300, 3013, 3077, 3078</p>	-	1300_Poor_Planted	No	<p>0 Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</p>

BAM Biodiversity Credit Report (Like for like)

	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion This includes PCT's: 906, 1300, 3013, 3077, 3078	-	1300_High	No	1 Illawarra, Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
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Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Zieria granulata / Illawarra Zieria	720_Mod-High, 720_Poor, 720_Low_Lant, 720_Low_NoCanop, 1300_Poor_Planted	1037.0	2074.00

Credit Retirement Options

Like-for-like credit retirement options

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 amended 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, Jervis 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 amended Project

The rainforest patch considered within this assessment and impacted by the amended Project constitutes the area of rainforest along the eastern part of the amended Project Area, extending 400 m to the east and approximately 3.5 km to the south-west of the amended Project Area encompassing approximately 160 ha. 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 amended 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 amended Project.

A total of 3.18 ha of ISR would be cleared as part of the amended Project according to the condition classes below. All the clearing is of low condition areas with the better condition areas of ISR having been avoided via the redesign of the amended Project, with the exception of a small area (0.0025ha) of high condition for the proposed pipeline discharge outlet. Offsetting requirements for the amended 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 amended Project.

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

Vegetation zone	Condition description	Area
Illawarra Subtropical Rainforest - High	Intact rainforest with native species forming a good canopy cover and diversity – low weed occurrence.	0.0025 ha
Illawarra Subtropical Rainforest - Low	Regenerating rainforest with native species forming a moderate canopy cover and diversity – high weed occurrence in most areas.	2.13 ha
Illawarra Subtropical Rainforest - Very degraded	Vast majority of cover is from thick lantana and other weeds. Previously cleared	0.45 ha
Illawarra Subtropical Rainforest - Poor	Small isolated rainforest in paddocks (most does not meet EPBC Act condition thresholds)	0.6 ha

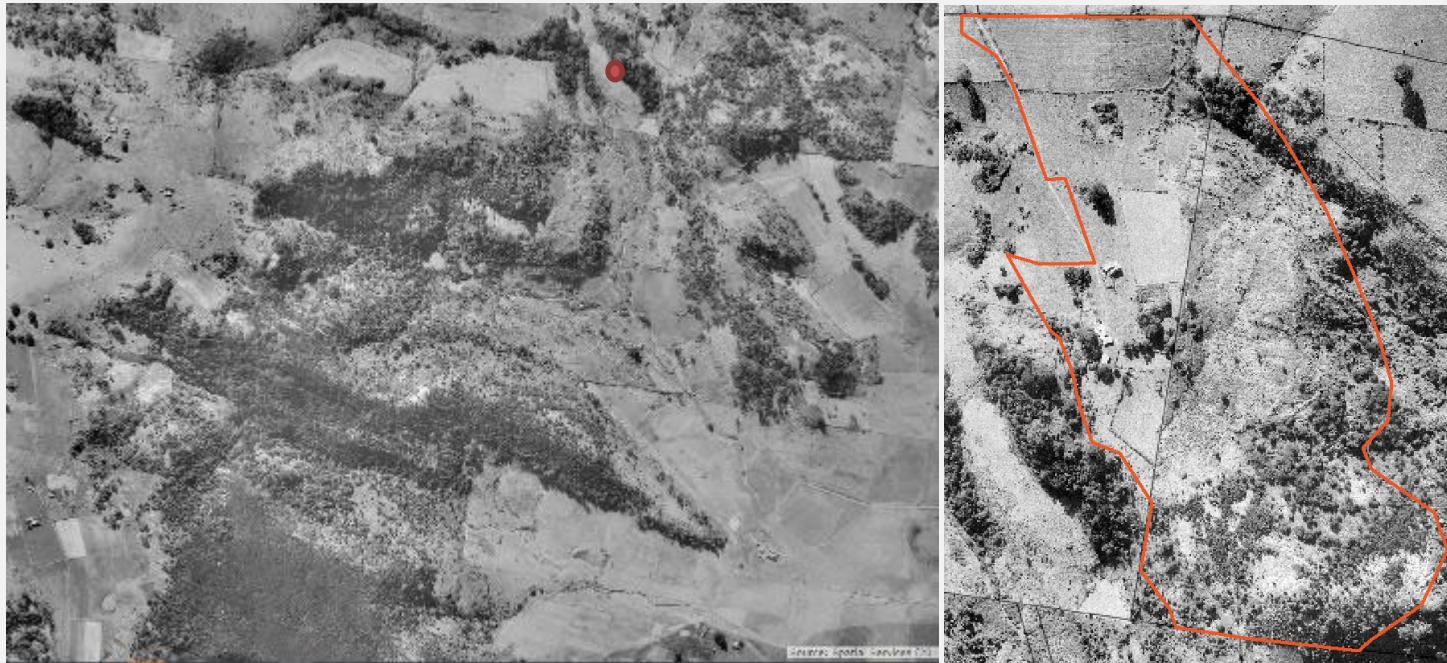


Plate 4: Historic (1961) imagery showing areas of previous clearing within and around the Study Area

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"> reduce the extent of an ecological community 	<p>The amended Project would involve the removal of 3.18 ha of 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 0.05%, not accounting for any increased extent which may result from offset requirements for the amended 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 amended Project Area. Therefore, the amended 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"> fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines 	<p>The amended 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 amended 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 amended Project Area would remain. The majority of the ISR patch is to the south-west of the amended Project Area.</p>	<p>Likely – relatively small increase.</p>
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of an ecological community 	<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). Only a small area of ISR in good condition that may be considered critical habitat would be disturbed as a result of the amended Project (the proposed drainage outlet at 30+ years). This area will require disturbance of 0.0025 ha of sparsely vegetated groundcover and isolated shrubs. No canopy trees will require removal at this location. The majority of rainforest disturbance as part of the amended Project is unlikely to meet the condition thresholds to be considered critical habitat. Therefore, the amended Project would adversely affect an insignificant amount of habitat critical to the survival of ISR.</p>	<p>Minimal/negligible</p>
<ul style="list-style-type: none"> 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 	<p>Some potential indirect impacts via edge effects may occur from the amended Project on adjacent areas of ISR that remain to the east, south-east, south and south-west of the amended Project Area after areas are extracted. Areas of ISR downslope of the extraction area constitute approximately 5-10 ha. 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 amended Project Area which is predominantly lower condition ISR.</p> <p>Increased light and heat penetration may occur around the boundaries of the amended Project Area which may have some impacts on remnant ISR surrounding the amended Project Area via desiccation and increased risk of weed invasion. These impacts would be managed via rehabilitation efforts within ISR adjacent to the amended Project Area. Given the current high concentrations of weeds adjacent to large parts of the amended Project Area,</p>	<p>Potential impacts which would be managed.</p>

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

	any increased light/heat impacts would likely be balanced via rehabilitation which would increase canopy cover to facilitate lower weed concentrations and desiccation tolerance.	
<ul style="list-style-type: none"> 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 	<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 amended 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 amended Project.</p>	Unlikely
<ul style="list-style-type: none"> 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"> – assisting invasive species, that are harmful to the listed ecological community, to become established, or – causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or 	<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 amended 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 amended Project.</p>	Unlikely
<ul style="list-style-type: none"> interfere with the recovery of an ecological community. 	<p>The amended 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 amended Project are unlikely to recover as the present threats via weed invasion are a significant barrier to their recovery if left unmanaged.</p>	Unlikely

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 amended Project. Therefore, based on EPBC Act guidelines, the amended 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 amended 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 amended Project

An area of 1.33 ha of *Z. granulata* habitat will be removed by the amended Project with an area of approximately 0.31 ha to be retained within areas zoned for extraction. The area to be removed supports an estimated 3,045 plants (both mature and immature) including an estimated 1,037 mature plants. Habitat to be removed is predominantly *Melaleuca armillaris* shrubland (1.02 ha) with the remainder exotic pasture (0.31 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	0.313
Low or poor	0.831
Moderate-high	0.186
Total	1.33

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

Surveys within the Biodiversity Study 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

Illawarra Zieria (*Zieria granulata*) (Endangered)

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 amended 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 Biodiversity Study 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 amended 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"> lead to a long-term decrease in the size of a population 	The population within the amended 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 amended 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"> reduce the area of occupancy of the species 	The species is known from the locality and immediate surrounds utilising the rocky outcrops and cliffs in the area. The amended Project is likely to reduce the area of occupancy of the species by approximately 1.33 ha. 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"> fragment an existing population into two or more populations 	The area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the amended Project since areas of habitat around the disturbance area will be retained and managed. The amended Project layout will not break linkages between areas of <i>Z. granulata</i> around the amended 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 amended Project is not likely to fragment an existing population into two or more populations.	Unlikely
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of a species 	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. Given these restrictions the type of habitat within the amended 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.	Possible
<ul style="list-style-type: none"> disrupt the breeding cycle of a population 	The species is known from the locality and immediate surrounds utilising the rocky outcrops and cliffs in the area. Important habitat utilised by the Illawarra Zieria will be removed as part of the amended Project although the breeding cycle in the broader population is unlikely to be impacted such that the population cannot persist.	Unlikely
<ul style="list-style-type: none"> modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 	Limiting habitat utilised by the Illawarra Zieria will be reduced but not completely removed in the amended Project Area. Extensive areas of habitat will remain within the amended Project Area and its surrounds. Given the number of plants to be removed by the amended Project the overall population is expected to decline at some level. Any such	Likely

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

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 amended Project Area. In the amended 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 amended Project

An area of 4.37 ha of GHFF habitat (native vegetation) will be removed by the amended Project, although the condition of the total area is variable, the GHFF will utilise the flowering Eucalypts and fig trees throughout the amended Project Area. There are approximately eight large trees within the amended 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 amended 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"> lead to a long-term decrease in the size of an important population of a species 	There is no known population within the amended 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 amended Project Area. The amended 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
<ul style="list-style-type: none"> reduce the area of occupancy of the species 	The species is known from the locality and surrounds and travels extensively to forage. The amended Project is likely to reduce the area of occupancy of the species by approximately 4.37 ha however would not change the size over which this mobile species forages.	Unlikely
<ul style="list-style-type: none"> fragment an existing population into two or more populations 	The area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the amended Project since areas of habitat around the disturbance area will be retained.	Unlikely

Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>) (Vulnerable)		
	Populations for this species have been considered as the same population when within 20km of each other (DPIE 2020e), therefore, the amended Project is not likely to fragment an existing population into two or more populations.	
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of a species 	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 amended Project Area are likely to be productive in terms of foraging output, however impacts from the amended Project would be limited as most of these areas would be retained.	Unlikely – modification to foraging habitat, no breeding camps in the amended Project Area.
<ul style="list-style-type: none"> disrupt the breeding cycle of an important population 	<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"> Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. amended Project Area fidelity to camps is high; some camps have been used for over a century. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops. It is uncertain whether mating occurs early in winter or in spring <p>The amended Project is located approximately 4.6km away from the nearest known breeding camp in the Dunmore region.</p>	Unlikely – modification to foraging habitat, no breeding camps in the amended Project Area.
<ul style="list-style-type: none"> modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 	<p>There is no limiting habitat utilised by the GHFF that will be removed in the amended Project Area. Extensive areas of habitat will remain within the amended Project Area and its surrounds.</p> <p>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.</p>	Unlikely in isolation
<ul style="list-style-type: none"> result in invasive species that are harmful to a critically endangered or endangered species 	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-	Unlikely

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

<p>becoming established in the endangered or critically endangered species' habitat</p>	<p>headed Flying-fox. The main threats to the species are listed on the OEH threatened species profile (DPIE 2020e) as:</p> <ul style="list-style-type: none"> • Loss of roosting and foraging sites. • Electrocutation on powerlines, entanglement in netting and on barbed-wire. • Heat stress. • Conflict with humans. • Incomplete knowledge of abundance and distribution across the species' range • Illegal shooting 	
<ul style="list-style-type: none"> • introduce disease that may cause the species to decline 	<p>The amended Project in not expected to cause an increased risk of any bat diseases.</p>	<p>Unlikely</p>
<ul style="list-style-type: none"> • interfere substantially with the recovery of the species. 	<p>Overall objectives of the Draft National Recovery Plan for this species are (DAWE 2021):</p> <ul style="list-style-type: none"> • 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 • To assist communities and Grey-headed Flying-foxes to coexist through better education, stakeholder engagement, research, policy and continued support to fruit growers. <p>While the amended 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>	<p>Unlikely</p>

Conclusion: The amended 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 amended 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 of ISR 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 Annex 1). The area of rainforest to be impacted by the amended 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 amended Project.

Additional impact assessment provisions	<i>Illawarra Subtropical Rainforest (Endangered)</i>
<p>1. <i>the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAI</i></p>	<p>Refer to section 3.2.1 of the amended BDAR.</p> <p>The approach to avoidance measures for the amended Project is to utilise as much of the previously impacted low condition areas into the design of the amended Project as possible. However, the amended Project requires the removal of 3.18 ha of ISR. The majority of the clearing is of lower condition areas with the better condition areas of ISR having been largely avoided via redesign of the amended project. This better condition ISR also supports suitable habitat for the threatened plant, <i>Zieria granulata</i> and <i>Cynanchum elegans</i>.</p>
<p>2. <i>report on the current status of the TEC including:</i></p> <p>a. <i>evidence of reduction in geographic distribution as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal)</i></p> <p>b. <i>extent of reduction in ecological function for the TEC using evidence that describes the degree of</i></p>	<p>DPIE (2016) estimates the remaining extent of the ISR TEC at 6,357 ha. The TEC is considered to have undergone a 90% reduction since its pre-European estimate (DPIE 2019b).</p> <p>Approximately 570 ha of ISR remains in reserved areas and is potentially underrepresented in conservation reserves (DPIE 2020g). Small areas of ISR 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>The ecological function of the majority of the ISR TEC present in the Study Area has been impacted as a result of past clearing and weed invasion, and is indicated as follows:</p>

Additional impact assessment provisions	Illawarra Subtropical Rainforest (Endangered)
<p><i>environmental degradation or disruption to biotic processes indicated by:</i></p> <ul style="list-style-type: none"> i. <i>change in community structure</i> ii. <i>change in species composition</i> iii. <i>disruption of ecological processes</i> iv. <i>invasion and establishment of exotic species</i> v. <i>degradation of habitat, and</i> vi. <i>fragmentation of habitat</i> <p>c. <i>evidence of restricted geographic distribution, based on the TEC's geographic range in NSW according to the:</i></p> <ul style="list-style-type: none"> i. <i>extent of occurrence</i> ii. <i>area of occupancy, and</i> iii. <i>number of threat-defined locations</i> <p>d. <i>evidence that the TEC is unlikely to respond to management.</i></p>	<ul style="list-style-type: none"> i. The average structure of the of the shrub layer of the TEC, represented as an average score across all vegetation zones, is 24.1%. This is significantly lower when compared to the benchmark of 83%, and indicates a highly modified shrub structure throughout the local occurrence of this TEC. Similarly, the fern cover in the Study Area (0.7%) is significantly lower than benchmark (16%). Apart from the grass cover, which is slightly higher than benchmark, all other growth form groups are below benchmark. ii. The average species composition of the shrub layer of the TEC, represented as an average score across all vegetation zones, is 6. This is significantly lower when compared to the benchmark of 14, and indicates a modified shrub layer species composition throughout the local occurrence of this TEC. The fern and other growth form group composition scores for the TEC are also significantly lower than benchmark. iii. The removal of 3.18 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 Study Area that would experience some alteration to existing flow. On the whole, the ecological processes of the TEC in the Study Area are not considered to have been significantly disrupted. iv. Exotic species are established in all vegetation zones in the amended Project Area, with all plots recording one or more exotic plants. The most common weeds are <i>Lantana camara</i> (14 of 15 plots), <i>Bidens pilosa</i> (all plots) and <i>Tagetes minuta</i> (10 of 14 plots). The average HTW cover, represented as an average score across all vegetation zones of ISR, is 18.4%. v. 81% of the TEC within the amended Project Area is in a low to very degraded condition. With the highest VI score across the Study Area being 63.6, the ISR represented in the amended Project Area is in a less than optimal condition and provides limited habitat. vi. The ISR TEC in the locality has been largely cleared for agriculture, development and quarrying. The TEC within the amended Project Area is already fragmented, and the clearing proposed would increase this impact, however the majority of impacts would impact lesser quality remnant vegetation and the higher-quality native vegetation would be largely avoided. In addition, large areas of ISR are conserved in the surrounding conservation network. <p>PCT 1300 occurs mainly on dry slopes on fertile soils below about 300 m in the Illawarra-Kiama and Milton areas (DPIE 2019b). This is evidenced by the following:</p> <ul style="list-style-type: none"> i. Extent of occurrence: 586 km² ii. Area of occupancy: 700 km². iii. While no specific data is provided in regard to threat defined locations, remnants are small and fragmented and their long-term viability is threatened. <p>The TBDC does not provide any data regarding this item. However, weed management is likely to improve the condition of the TEC.</p>

Additional impact assessment provisions	Illawarra Subtropical Rainforest (Endangered)
<p>3. <i>the impact on the geographic extent of the TEC by estimating the total area of the TEC to be impacted by the proposal:</i></p> <ul style="list-style-type: none"> a. <i>in hectares, and</i> b. <i>as a percentage of the current geographic extent of the TEC in NSW.</i> 	<ul style="list-style-type: none"> a. The amended Project is expected to impact 3.18 ha of ISR. b. The removal of 3.18 ha of ISR represents approximately 0.05% of the remaining TEC in NSW.
<p>4. <i>the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes of the TEC by:</i></p> <ul style="list-style-type: none"> a. <i>estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals</i> b. <i>describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:</i> <ul style="list-style-type: none"> i. <i>distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and</i> ii. <i>estimated maximum dispersal distance for native flora species characteristic of the TEC, and</i> iii. <i>other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development</i> 	<p>With reference to the vegetation mapping undertaken for the locality (OEH 2016), large patches of ISR have been mapped within 500 m of the subject land, totalling approximately 65.5 ha.</p> <ul style="list-style-type: none"> i. Of the remnants in the surrounding 500m of the amended Project Area, where the TEC in the amended Project Area is retained, the average distance between remnants is 230 m; conversely, where the TEC in the Study Area is removed, the average distance increases to 350 m. It is noted, however, that the amended Project is unlikely to sever any ISR connectivity in the 500m buffer area due to the retention of ISR around the south of the amended Project Area. ii. The retention of corridors of ISR as well as vegetation between TEC remnants in the locality will permit the movement of pollinator vectors and enable other dispersal mechanisms. iii. The removal of the TEC in the Study Area will contribute to the reduction and fragmentation of the TEC locally. However, in the context of its occurrence in the Illawarra IBRA subregion, given the already highly fragmented nature of this TEC, the proposal is not considered to significantly impact on the connectivity of the remaining remnants of ISR.

Additional impact assessment provisions	Illawarra Subtropical Rainforest (Endangered)																																				
<p>c. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.</p>	<p>ISR occurs as five vegetation zones of differing conditions: High, Very degraded, Poor, Poor_planted and Low. The Very Degraded and Poor_planted vegetation zones have VI scores of 9.1 and 6 respectively, which, in accordance with the BAM (DPIE 2020a), do not need to be offset. The remaining vegetation zones have a VI of >15 and must therefore be offset in accordance with the BAM (DPIE 2020a).</p> <p>The floristic composition, structure and function data obtained during the field assessment is provided in Annex 3, while the VI score, composition, structure and function condition scores are provided below.</p> <table border="1" data-bbox="869 501 2063 751"> <thead> <tr> <th>Vegetation zone</th> <th>Area (ha)</th> <th>Current VI score</th> <th>Composition</th> <th>Structure</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>1300_High</td> <td>0.0025</td> <td>63.6</td> <td>75.9</td> <td>82.7</td> <td>41</td> </tr> <tr> <td>1300_Low</td> <td>2.13</td> <td>44.9</td> <td>51</td> <td>37.8</td> <td>46.8</td> </tr> <tr> <td>1300_Poor</td> <td>0.36</td> <td>21.2</td> <td>30</td> <td>15</td> <td>21.1</td> </tr> <tr> <td>1300_Poor_planted</td> <td>0.24</td> <td>6</td> <td>19.2</td> <td>0.5</td> <td>24.1</td> </tr> <tr> <td>1300_Very Degraded</td> <td>0.45</td> <td>9.1</td> <td>35.4</td> <td>2.1</td> <td>10.4</td> </tr> </tbody> </table>	Vegetation zone	Area (ha)	Current VI score	Composition	Structure	Function	1300_High	0.0025	63.6	75.9	82.7	41	1300_Low	2.13	44.9	51	37.8	46.8	1300_Poor	0.36	21.2	30	15	21.1	1300_Poor_planted	0.24	6	19.2	0.5	24.1	1300_Very Degraded	0.45	9.1	35.4	2.1	10.4
Vegetation zone	Area (ha)	Current VI score	Composition	Structure	Function																																
1300_High	0.0025	63.6	75.9	82.7	41																																
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<p>5. Provision of new information that demonstrates that the principle identifying that the TEC is at risk of an SAI is not accurate.</p>	<p>N/A</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 amended Project requires the removal of 1.19 ha of PCT720, comprising various conditions ():

- 0.35 ha of poor
- 0.37 ha of low (regenerating midstorey – no canopy),
- 0.28 ha of low (dense Lantana),
- 0.19 ha of moderate to high

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 amended 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 amended Project.

Additional impact assessment provisions	<i>Melaleuca armillaris</i> tall shrubland in the Sydney Basin Bioregion (Critically Endangered)
1. <i>the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAI</i>	Refer to section 3.2.1 of the amended BDAR. The approach to avoidance measures for the amended Project is to utilise as much of the previously impacted low condition areas into the design of the amended Project as possible. However, the amended Project requires the removal of 1.19 ha of <i>Melaleuca armillaris</i> tall shrubland. The amended Project will be retaining 0.85 ha of remnant and good condition MAS habitat in the amended Project Area, adjacent to higher quality vegetation to the west.

Additional impact assessment provisions	<i>Melaleuca armillaris</i> tall shrubland in the Sydney Basin Bioregion (Critically Endangered)
<p>2. report on the current status of the TEC including:</p> <ul style="list-style-type: none"> a. evidence of reduction in geographic distribution as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal) b. extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes indicated by: <ul style="list-style-type: none"> i. change in community structure ii. change in species composition iii. disruption of ecological processes iv. invasion and establishment of exotic species v. degradation of habitat, and vi. fragmentation of habitat 	<p>While the Threatened Species Scientific Committee (2020) estimates the remaining extent of the <i>Melaleuca armillaris</i> tall shrubland TEC at between 200 and 276 ha, condition mapping of the TEC conducted by EcoPlanning (2021) estimates it at 164.36 ha. The TEC is considered to have undergone a 75% reduction since its pre-European estimate (DPIE 2019b).</p> <p>The ecological function of the majority of the <i>Melaleuca armillaris</i> Tall Shrubland TEC present in the Study Area has been impacted as a result of past clearing and weed invasion, and is indicated as follows:</p> <ul style="list-style-type: none"> i. The average structure of the of the shrub layer of the TEC, represented as an average score across all vegetation zones is, 29.9%. This is significantly lower when compared to the benchmark of 113%, and indicates a highly modified shrub structure throughout the local occurrence of this TEC. The grass cover in the Study Area (15%) is significantly higher than benchmark (4%), while the cover for forb, fern and other are all slightly higher than benchmark. These scores are presumably as a result of the lower shrub/canopy cover). ii. The average species composition of the shrub layer of the TEC, represented as an average score across all vegetation zones, is 5.5. This is significantly lower when compared to the benchmark of 15, and indicates a modified shrub layer species composition throughout the local occurrence of this TEC. All other composition scores for the TEC are comparable with benchmark. iii. The removal of 1.19 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 Study Area that would experience some alteration to existing flow. On the whole, the ecological processes of the TEC in the Study Area are not considered to have been significantly disrupted. iv. Exotic species are established in all vegetation zones in the Study Area, with all plots recording one or more exotic plants. The most common weeds are <i>Lantana camara</i> (14 of 15 plots), <i>Bidens pilosa</i> (all plots) and <i>Tagetes minuta</i> (10 of 14 plots). The average HTW cover, represented as an average score across all vegetation zones, is 30.6%. v. Approximately 54% of the TEC within the amended Project Area is in a <i>Melaleuca armillaris</i> Tall Shrubland in poor or low condition. With the highest VI score across the Study Area being 25.4, it can be inferred that the TEC represented in the amended Project Area is in a degraded condition and provides limited habitat. vi. The <i>Melaleuca armillaris</i> Tall Shrubland TEC in the locality has been largely cleared for agriculture, development and quarrying. The TEC within the Study Area is already fragmented, and the clearing proposed would increase this impact, however the majority of impacts would impact lesser quality remnant vegetation.

Additional impact assessment provisions	<i>Melaleuca armillaris</i> tall shrubland in the Sydney Basin Bioregion (Critically Endangered)
<p>c. evidence of restricted geographic distribution, based on the TEC's geographic range in NSW according to the:</p> <ul style="list-style-type: none"> i. extent of occurrence ii. area of occupancy, and iii. number of threat-defined locations <p>d. evidence that the TEC is unlikely to respond to management.</p>	<p>PCT 720 is restricted to exposed rocky ridgetops on volcanic substrates between 100-200m in the Kiama and Milton hinterlands in the Illawarra IBRA subregion (DPIE 2019b). This is evidenced by the following:</p> <ul style="list-style-type: none"> i. Extent of occurrence: 56 km² ii. Area of occupancy: 100 km². iii. While no specific data is provided in regard to threat defined locations, most remnants are small and fragmented and their long-term viability is threatened. <p>The TBDC does not provide any data regarding this item. However, Ecoplanning (2021) state that treatment of <i>L. camara</i>* is the most direct way to improve the condition of the TEC.</p>
<p>3. the impact on the geographic extent of the TEC by estimating the total area of the TEC to be impacted by the proposal:</p> <ul style="list-style-type: none"> a. in hectares, and b. as a percentage of the current geographic extent of the TEC in NSW. 	<ul style="list-style-type: none"> a. The amended Project is expected to impact 1.19 ha of <i>Melaleuca armillaris</i> Tall Shrubland. b. The removal of 1.19 ha of <i>Melaleuca armillaris</i> Tall Shrubland represents approximately 0.7% of the remaining TEC in NSW.
<p>4. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes of the TEC by:</p> <ul style="list-style-type: none"> a. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals b. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by: <ul style="list-style-type: none"> i. distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and ii. estimated maximum dispersal distance for native flora species characteristic of the TEC, and 	<p>With reference to the vegetation mapping undertaken for the locality (OEH 2016), one patch of <i>Melaleuca armillaris</i> Tall Shrubland has been mapped within 500 m of the subject land. This area totals approximately 1.7 ha and is located approximately 254 m to the east of the Study Area and is connected by another TEC vegetation type.</p> <ul style="list-style-type: none"> i. Of the remnants in the surrounding 2 km of the study area, where the TEC in the Study Area is retained, the average distance between remnants is 350m; conversely, where the TEC in the Study Area is removed, the average distance increases to 400 m. Other stands of <i>Melaleuca armillaris</i> Tall Shrubland occur beyond the 2 km buffer, such as in Killalea State Park, where (DPIE 2020i) estimates the presence of this patch to represent approximately 8 ha, or 5%, of the overall extent. ii. The retention of vegetation between TEC remnants in the locality will permit the movement of pollinator vectors and enable other dispersal mechanisms. iii. The removal of the TEC in the Study Area will contribute to the reduction and fragmentation of the TEC locally. However, in the context of its occurrence in the Illawarra IBRA subregion, given the already highly fragmented

Additional impact assessment provisions	<i>Melaleuca armillaris</i> tall shrubland in the Sydney Basin Bioregion (Critically Endangered)																														
<p>iii. other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development</p> <p>c. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.</p>	<p>nature of this TEC, the proposal is not considered to significantly impact on the connectivity of the remaining remnants of <i>Melaleuca armillaris</i> Tall Shrubland</p> <p>MAS within the amended Project Area occurs as four vegetation zones of differing conditions: Poor, Low (no canopy), Low (Lantana) and Mod-high. The Low (Lantana) and Poor vegetation zones have VI scores of 10.2 and 10.3, respectively, which, in accordance with the BAM (DPIE 2020a), do not need to be offset. The remaining vegetation zones have a VI of >15 and must therefore be offset in accordance with the BAM (DPIE 2020a).</p> <p>The floristic composition, structure and function data obtained during the field assessment is provided in Annex 3, while the VI score, composition, structure and function condition scores are provided below.</p> <table border="1" data-bbox="869 667 2065 877"> <thead> <tr> <th>Vegetation zone</th> <th>Area (ha)</th> <th>Current VI score</th> <th>Composition</th> <th>Structure</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>720_Mod-High</td> <td>0.19</td> <td>24.5</td> <td>49.8</td> <td>12.1</td> <td>n/a</td> </tr> <tr> <td>720_Low_Lantana</td> <td>0.28</td> <td>10.2</td> <td>39.4</td> <td>2.6</td> <td>n/a</td> </tr> <tr> <td>720_Low_NoCanopy</td> <td>0.37</td> <td>25.4</td> <td>55.5</td> <td>11.6</td> <td>n/a</td> </tr> <tr> <td>720_Poor</td> <td>0.35</td> <td>10.3</td> <td>42</td> <td>2.5</td> <td>n/a</td> </tr> </tbody> </table>	Vegetation zone	Area (ha)	Current VI score	Composition	Structure	Function	720_Mod-High	0.19	24.5	49.8	12.1	n/a	720_Low_Lantana	0.28	10.2	39.4	2.6	n/a	720_Low_NoCanopy	0.37	25.4	55.5	11.6	n/a	720_Poor	0.35	10.3	42	2.5	n/a
Vegetation zone	Area (ha)	Current VI score	Composition	Structure	Function																										
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720_Low_Lantana	0.28	10.2	39.4	2.6	n/a																										
720_Low_NoCanopy	0.37	25.4	55.5	11.6	n/a																										
720_Poor	0.35	10.3	42	2.5	n/a																										
<p>5. Provision of new information that demonstrates that the principle identifying that the TEC is at risk of an SAI is not accurate.</p>	<p>N/A</p>																														

Annex 10. Evidence of benchmark modification in the BAM-C

Assessment ID	Proposal Name	Status	Revision	Created on	Updated on	Reference Data Version
00031549/BAAS17040/22/00031550	Albion Park Quarry Stage 7 BDAR pre-update benchmarks from Rev4 and stormwater outlet	Finalised	8	17/07/2023 20:37:50	26/07/2023 11:51:27	Legacy Classification (pre-ENSW)
00031549/BAAS17040/22/00031550	Albion Park Quarry Stage 7 BDAR pre-update benchmarks from Rev4	Finalised	5	11/01/2023 13:32:10	27/04/2023 11:57:05	Legacy Classification (pre-ENSW)
00031549/BAAS17040/22/00031550	Albion Park Quarry Stage 7 BDAR Archived Default benchmarks	Locked	7	15/02/2023 12:07:52	15/02/2023 12:29:25	Current classification (live - default)
00031549/BAAS17040/22/00031550	Albion Park Quarry Stage 7 BDAR v1_2 benchmarks	Locked	6	15/02/2023 11:26:16	15/02/2023 11:26:48	Current classification (live - default)
00031549/BAAS17040/22/00031550	Albion Park Quarry Stage 7 BDAR	Finalised	4	11/10/2022 15:41:51	02/11/2022 11:17:03	Current classification (live - default)



BAM Calculator

App last updated: 13/04/2023 10:00 (Version: 1.4.0.00)
BAM data last updated *: 22/06/2023 (Version: 61) * Disclaimer

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- 1. Assessment details
- 2. Site context
- 3. Vegetation
- 4. Habitat suitability: Predicted
- 5. Habitat suitability: Candidate
- 6. Habitat survey
- 7. Credits
- 8. Credit classes
- 9. Price

All fields marked with an asterisk (*) are mandatory

Message!

You have selected 'Sydney Basin' as the 'IBRA Region' so we now have enough information to proceed.

Interim Biogeographic Regionalisation for Australia (IBRA) *

Sydney Basin

IBRA Sub Region *

Illawarra

NSW (Mitchell) Landscape *

Kiama Coastal Slopes

% Native vegetation cover *

29

Linear Development

Reference data version

Legacy Classification (pre-ENSW)



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- 1. Assessment details
- 2. Site context
- 3. Vegetation
- 4. Habitat suitability: Predicted
- 5. Habitat suitability: Candidate
- 6. Habitat survey
- 7. Credits
- 8. Credit classes
- 9. Price

All fields marked with an asterisk (*) are mandatory

Plant community types (PCT) & ecological communities

Formation *	Class *	Plant community type *	PCT % cleared	Associated TEC *	BC Act listing status	EPBC Act listing status	Action	Delete
Rainforests	Dry Rainforests	1300 - Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	90	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	Endangered Ecological Community	Critically Endangered	ADD VEG ZONE Default benchmarks modified	✕
Heathlands	Southern Montane Heaths	720 - Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion	75	Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	Not Listed	ADD VEG ZONE Default benchmarks modified	✕

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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)