TRAVERS BUSHFIRE & ECOLOGY

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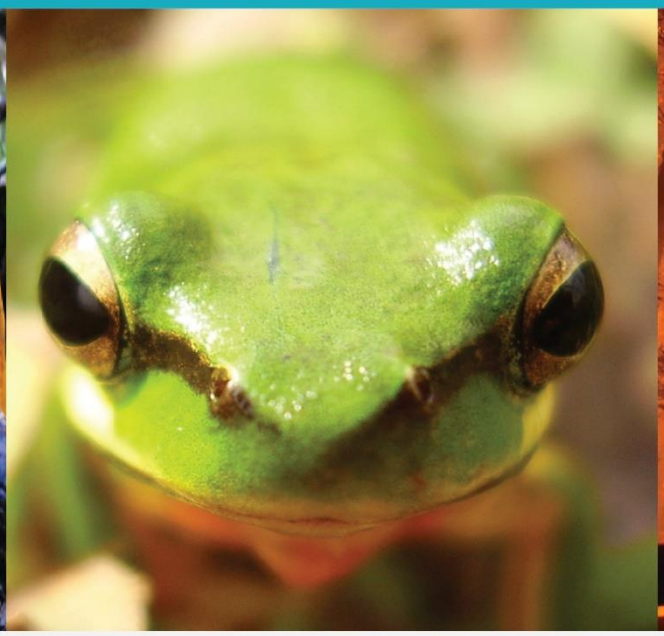

FLORA AND FAUNA ASSESSMENT

Proposed Development

Lot 808, DP 752038

70A Willandra Road

NARRAWEENA

18ALT02.2BDAR

BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

Proposed Development
Lot 808 DP 752038
70A Willandra Road
Narraweena

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Date:	20/12/21
File:	18ALT02.2BDAR

Disclaimer:

This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person, including the client, then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be interpreted without reference to the entire report.

The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

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EXECUTIVE SUMMARY

Travers bushfire & ecology has been engaged to prepare a biodiversity development assessment report (BDAR) for proposed residential building at Lot 808 DP 752038, 70A Willandra Road, Narraweena.

In accordance with the Threatened Species Assessment Guidelines (DECC 2007) the 'subject site' will hereafter refer to the area of direct impacts by the proposal and will include the development footprint

Proposal development

The proposed development is for a detached dwelling. The design intent is to leave the surrounding bushland below the escarpment wholly intact and placing three linked pavilion-style modules that generally follow the existing contour of the land to minimise cut and fill.

This design approach reduces the visual bulk of the building form and the walkway link between each pavilion allows landscaping opportunity in between. The siting of the house is as close to Lady Penrhyn Drive as possible to reduce the length of the driveway while meeting the front setback requirement of 20 m.

Avoidance measures

The following actions and designing of works have been undertaken to either avoid or minimise impacts on biodiversity values:

- The location of the dwelling and associated asset protection zone (APZ) has been located to avoid direct impacts on the Coastal Upland Swamp (CUS), *Tetratheca glandulosa* and Red-crowned Toadlet (RCT) habitat.
- A 20 m buffer surrounding the CUS is to be established as a protection zone. This buffer is to provide for the retention and protection of the CUS.
- Stormwater has been designed to continue to deliver surface and groundwater seepage into the wetland with the aim of not causing a significant change pre and post development.
- Drainage into the CUS is to be the same pre and post development and meet minimum baseline water quality standards for environmental sensitive habitats eg the hanging swamp and RCT habitat.
- Development has been located by taking advantage of the more disturbed vegetation in the north-west of the site.
- Preparation of a Biodiversity Management Plan (BMP) and specification of water quality targets to protect the CUS and RCT habitat.
- Relocating any 'good quality' habitat resources into the adjoining bushland.
- Minimise clearing particularly on steeped sloped areas.
- Undertake feral pest management including control of foxes, cats, rats, pigs, goats, avian pests, horses and any other miscellaneous species as required.
- Minimise vegetation removal in APZs.
- Integrated weed management and control of high-threat exotic plant species.

Recorded biodiversity

Ecological survey and assessment have been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979* (*EP&A Act*), the *Biodiversity Conservation Act 2016* (*BC Act*), the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) and the *Fisheries Management Act 1994* (*FM Act*).

In respect of matters required to be considered under the *EP&A Act* and relating to the species / provisions of the *BC Act*, eight (8) threatened fauna species, Red-crowned Toadlet (*Pseudophryne australis*), Giant Burrowing Frog (*Heleioporus australiacus*), Rosenberg's Goanna (*Varanus rosenbergi*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Powerful Owl (*Ninox strenua*), Eastern Pygmy Possum (*Cercartetus nanus*), Grey-headed Flying-fox (*Pteropus poliocephalus*), and Large Bent-winged Bat (*Miniopterus orianae oceanensis*), one (1) threatened flora species, *Tetratheca glandulosa*, and one (1) threatened ecological community (TEC), Coastal Upland Swamp in the Sydney Basin Bioregion, were recorded within the **study area**. Note, Large Bent-winged Bat was previously named Eastern Bentwing-bat.

Of the above recorded threatened fauna species, only the Eastern Pygmy Possum has been recorded within the **subject site** (direct impact area) by evidence of nesting material in a small hollow in the far northern reaches. This hollow will be retained within the outer APZ area and additional supplementary hollows will be placed in the remaining natural habitat areas. No threatened flora species or TECs occur within the subject site.

In respect of matters required to be considered under the *EPBC Act*, two (2) threatened fauna species including Giant Burrowing Frog (*Heleioporus australiacus*) and Grey-headed Flying-fox (*Pteropus poliocephalus)* were recorded within the study area but not within the subject site. No protected migratory bird species and no threatened flora species listed under this act were recorded within the subject site. One (1) threatened ecological community, Coastal Upland Swamp in the Sydney Basin Bioregion, listed under this Act was recorded within Lot 808 outside the subject site.

Of all threatened fauna species recorded the two nationally listed species Giant Burrowing Frog and Grey-headed Flying-fox were not recorded within Lot 808. Seasonal foraging by Grey-headed Flying-fox is expected. Giant Burrowing Frog was recorded at a breeding location over 250 m from the subject site. No likely closer breeding locations are expected based on habitat searches during survey.

In respect of matters relative to the *FM Act*, no suitable habitat for threatened marine or aquatic species was observed within the subject site.

Impact assessment

The direct, indirect and cumulative ecological impacts of the proposal have been carefully considered in Section 5.2 of this report. Recommendations have been outlined within Section 5.4 to avoid and minimise these impacts, to address threatening processes and to create a more positive ecological outcome for threatened biodiversity.

As a result of the above avoidance measures, the proposal will impact on 0.39 ha of non-TEC native vegetation.

The assessment of significance test in accordance with Section 7.3 of the *BC Act* concluded that the proposed development will not have a significant effect on any threatened species, or endangered communities, or their habitat. Therefore, a species impact statement or offsetting under the BOS are not required for the proposed activity.

The assessment of serious and irreversible impacts are set out under Section 6.7.2 of the *BC Reg 2017* to guide the determining authority on this decision. These principles have been reviewed and assessed in Appendix 3. It is considered that the proposal will not cause any serious and irreversible impacts on threatened biodiversity.

There will be no significant impact on matters listed under the *FM Act*.

The proposed development was not considered to have a significant impact on matters of national environmental significance. As such a referral to Department of Environment and Energy is not required.

Biodiversity Offsets Scheme (BOS) – Threshold Assessment

The proposed development does not exceed the nominated threshold triggers of 1) biodiversity values land and 2) the area clearing threshold as assessed in Section 4.1. Therefore, biodiversity offsets are not required under the Biodiversity Offsets Scheme (BOS).

LIST OF ABBREVIATIONS

APZ	asset protection zone
BAM	Biodiversity Assessment Method
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act (2016)*
BC Reg	*Biodiversity Conservation Regulation (2017)*
BCAR	Biodiversity Certification Assessment Report
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BOS	Biodiversity Offset Scheme
BPA	bushfire protection assessment
BSSAR	Biodiversity Stewardship Site Assessment Report
CEEC	Critically endangered ecological community
CM Act	*Coastal Management Act 2016*
CUS	Coastal Upland Swamp in the Sydney Basin Bioregion
DCP	development control plan
DEC	NSW Department of Environment and Conservation (superseded by DECC from April 2007)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from October 2009)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from April 2011)
DEWHA	Commonwealth Department of Environment, Water, Heritage & the Arts (superseded by SEWPAC)
DOEE	Commonwealth Department of Environment & Energy
DPIE	NSW Department of Planning, Industry and Environment
EEC	endangered ecological community
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act (1979)*
EPBC Act	*Environment Protection and Biodiversity Conservation Act (1999)*
EWC	endangered wetland community
FM Act	*Fisheries Management Act*
IBRA	Interim Biogeographic Regionalisation for Australia
LEP	local environmental plan
LGA	local government area
LLS Act	*Local Land Services Act (2013)*
NES	national environmental significance
NPW Act	*National Parks and Wildlife Act (1974)*
NRAR	NSW Natural Resources Access Regulator
NSW DPI	NSW Department of Industry and Investment
OEH	Office of Environment and Heritage (superseded by DPIE from August 2019)
PCT	plant community type
PFC	projected foliage cover
RCT	Red-crowned Toadlet
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SAII	Serious And Irreversible Impacts
SEPP	State Environmental Planning Policy
SEWPAC	Commonwealth Dept. of Sustainability, Environment, Water, Population & Communities (superseded by DOEE)
SIS	species impact statement

SULE	safe useful life expectancy
TEC	threatened ecological community
TPZ	tree preservation zone
TSC Act	*Threatened Species Conservation Act (1995) – Superseded by the Biodiversity Conservation Act (2016)*
VMP	vegetation management plan

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1. INTRODUCTION

Travers bushfire & ecology has been engaged to prepare a biodiversity development assessment for a proposed development within Lot 808 DP 752038, 70A Willandra Road, Narraweena.

Lot 808 is referred to as the 'subject lot' for assessment (see Figure 1.1). In accordance with the Threatened Species Assessment Guidelines (DECC 2007) the 'subject site' will hereafter refer to the area of direct impacts by the proposal and will include the development footprint out to the extent of the APZ (see Figure 1.2).

Figure 1-1 – Subject lot - Lot 808 DP 752038, 70A Willandra Road, Narraweena.

Survey has been undertaken within the subject lot but also extending beyond this lot, particularly to the north to incorporate the local surrounds. The extent of surveys referred to as the 'study area' is shown in the insert on Figure 2.1.

This report has been prepared following the guidelines from BAM 2020.

1.1 Purpose

The purpose of this Biodiversity Development Assessment Report (BDAR) is to:

- Carry out a botanical survey to describe the vegetation communities and their conditions
- Carry out a fauna habitat survey for the detection and assessment of fauna and their potential habitats
- Complete targeted surveys for threatened species, populations and ecological communities
- Prepare a biodiversity development assessment report in accordance with the requirements of the:
  a) *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*),
  b) *Biodiversity Conservation Act 2016* (*BC Act*),
  c) *Biodiversity Conservation Regulation 2017* (BC Reg.),
  d) *Fisheries Management Act 1994* (*FM Act*), and
- Prepare a Biodiversity Development Assessment Report (BDAR) in accordance with the Biodiversity Assessment Methodology (BAM)

1.1.1 Terminology

Throughout this report the terms subject site and study area are used. It is important to have a thorough understanding of these terms as they apply to the assessment.

Subject site means the area directly affected by the proposal. This is the development footprint out to the extent of the APZ.

Study area means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account.

Direct impacts are those that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.

Indirect impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development.

1.2 Site description

1.2.1 Site overview

Table 1.1 provides an overview the planning, cadastral and topographical details of the study area and an overview of the site and surrounds is shown on Figures 1.3 and 1.4 (site and location maps).

Table 1-1 – Site features

Location	Lot 808 DP 752038, 70A Willandra Road, Narraweena
Location description	The site is located approximately 1km west north west of Narraweena Public School. The site is bound to the west and south by urban development, with bushland to the east and north of the site.
Area	approx. 2.8 ha
Local government area	Northern Beaches (formerly Warringah)
Zoning	DM – Differed Matter
Grid reference MGA-56	338884 E 6264782 S
Elevation	Approximately 90–131m AHD
Topography	The site has a rocky plateau running generally in a north-south direction and dropping sharply to the east of the site.
Catchment and drainage	The site drains via overland flow which eventually flows in an easterly direction into South Creek which then flows into Narrabeen Lagoon.
Existing land use	Vacant bushland

1.2.2 Landscape features

Table 1.2 examines the landscape features of the proposed development site in accordance with the BAM.

Table 1-2 – Landscape features

Operational footprint	As shown in Figure 1.2.
Construction footprint	As shown in Figure 1.2.
IBRA bioregions and subregions	Sydney Basin bioregion – Pittwater subregion (Figure 1.5 and 1.6)
NSW landscape region and area (ha)	Belrose Coastal Slopes
Native vegetation extent in the buffer area	380.19 ha approx. and 46.76%
Cleared areas	Lot 808 has not recently been cleared
Evidence to support differences between mapped vegetation extent and aerial imagery	Regional mapping Ground truthed vegetation mapped

Rivers and streams classified according to stream order	The Site Map (Figure 1.3) and Location Map (Figure 1.4) shows the study area relative to first, second and third order streams. No recognised streams occur within the study area.
Wetlands within, adjacent to and downstream of the site	There are no dams or wetlands across the site (Figure 1.3).
Connectivity features	There is very good connectivity to the north and east. There is existing residential development to the west and south that breaks connectivity. The location map (Figure 1.4) shows an overview of the extent of native vegetation in the locality.
Areas of geological significance and soil hazard features	Geology; Hawkesbury Sandstone: Medium to coarse-grained quartz sandstone with minor shale and laminate lenses and undifferentiated Ordovician sedimentary: Soils; Lambert soil landscape is present across the entire subject site. Shallow discontinuous Earthy Sands and Yellow Earths on crests and insides of benches; shallow Siliceous Sands/Lithosols on leading edges; shallow to moderately deep Leached Sands, Grey Earths and Gleyed Podzolic Soils in poorly drained areas; localised Yellow Podzolic Soils associated with shale lenses.
Identification of method applied (i.e. linear or site-based)	Site based assessment.

1.3 Proposed development

The proposed development is for a detached dwelling. The design intent is to leave the very thick bushy area below the escarpment wholly intact and placing three linked pavilion-style modules that generally follow the existing contour of the land to minimise cut and fill. This design approach reduces the visual bulk of the building form and the walkway link between each pavilion allows landscaping opportunity in between. The siting of the house is as close to Lady Penrhyn Drive as possible to reduce the length of the driveway while meeting the front setback requirement of 20m.

The proposed development layout based on the preliminary landscape plan shows the full extent of the building and potential; landscape works. The asset protection zone is shown on Figure 1.2. The subject site is essentially all internal road reserves, building allotments, asset protection zones (APZs), and fence lines.

1.3.1 Identification of development site footprint

It is estimated that 0.39ha of native vegetation will be directly impacted through the construction of driveway, buildings and asset protection zones (APZs).

1.4 Statutory assessment requirements

1.4.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

Prior to any development taking place in New South Wales a formal assessment needs to be made of the proposed work to ensure it complies with relevant planning controls and, according to its nature and scale, confirm that it is environmentally and socially sustainable. State, regional and local planning legislation indicates the level of assessment required, and outlines who is responsible for assessing the development. The development assessment and consent system is outlined in Part 4 and the infrastructure and environmental impact assessment system is outlined in Part 5 of the *EP&A Act*.

1.4.2 Biodiversity Conservation Act 2016 (BC Act)

The *BC Act* repeals the *Threatened Species Conservation Act 1995*, the *Nature Conservation Trust Act 2001* and the animal and plant provisions of the *National Parks and Wildlife Act 1974*.

The *BC Act* and the *Biodiversity Conservation Regulation 2017* establish a regulatory framework for assessing and offsetting impacts on biodiversity values due to proposed developments and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme. Where development consent is granted, the authority may impose as a condition of consent an obligation to retire a number and type of biodiversity credits determined under the new Biodiversity Assessment Method (BAM).

For local development, the BOS includes two (2) elements to the threshold test – an area trigger and a Sensitive Biodiversity Values Land Map trigger. If clearing exceeds either trigger, the Biodiversity Offset Scheme applies to the proposed clearing.

Development consent cannot be granted for non-State significant development under Part 4 of the *EP&A Act* if the consent authority is of the opinion that it is likely to have serious and irreversible impacts (SAII) on biodiversity values. The determination of SAII is to be made in accordance with principles prescribed in Section 6.7 of the *BC Regulation 2017*. The principles have been designed to capture those impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in NSW.

The threatened species test of significance is used to determine if a development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. It is applied as part of the Biodiversity Offsets Scheme entry requirements and for Part 5 activities under the *EP&A Act, 1979*.

The test of significance is set out in s.7.3 of the *BC Act.* If the activity is likely to have a significant impact, or will be carried out in a declared area of outstanding biodiversity value, the proponent must either apply the Biodiversity Offsets Scheme or prepare a species impact statement (SIS).

The environmental impact of activities that will not have a significant impact on threatened species will continue to be assessed under s.111 of the *EP&A Act.*

1.4.3 Fisheries Management Act 1994 (FM Act)

The *FM Act* provides a list of threatened aquatic species that require consideration when addressing the potential impacts of a proposed development. Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, an SIS is required to be prepared.

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

The *EPBC Act* requires that Commonwealth approval be obtained for certain actions. It provides an assessment and approvals system for actions that have a significant impact on matters of *national environmental significance* (NES). These may include:

- World Heritage Properties and National Heritage Places
- Wetlands of International Importance protected by international treaty
- Nationally listed threatened species and ecological communities
- Nationally listed migratory species
- Commonwealth marine environment

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on an NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, then the matter needs to be referred to the Commonwealth Department of Environment and Energy (DOEE) for assessment. In the case where no listed federal species are located on site then no referral is required. The onus is on the proponent to make the application and not the Council to make any referral.

A threshold criterion applies to specific NES matters which may determine whether a referral is or is not required, such as for the *EPBC*-listed ecological communities Cumberland Plain Woodland and Shale-Gravel transition Forest. Consultation with DOEE may be required to determine whether a referral is or is not required. If there is any doubt as to the significance of impact or whether a referral is required, a referral is generally recommended to provide a definite decision under the *EPBC Act* thereby removing any further obligations in the case of 'not controlled' actions.

A significant impact is regarded as being:

> *important, notable, or of consequence, having regard to its context or intensity and depends upon the sensitivity, value, and quality of the environment which is impacted and upon the duration, magnitude, and geographical extent of the impacts. A significant impact is likely when it is a real or not a remote chance or possibility.*
>
> *Source: EPBC Policy Statement*

Guidelines on the correct interpretation of the actions and assessment of significance are located on the department's web site http://www.environment.gov.au/epbc/publications.

1.4.5 *Coastal Management Act 2016 (CM Act)*

The *Coastal Management Act* (*CM Act,* 2016) establishes the framework and overarching objects for coastal management in New South Wales. The Act commenced on 29 June 2018 and replaces the previous *Coastal Protection Act* (1979).

The purpose of the *CM Act* is to manage the use and development of the coastal environment in an ecologically sustainable way, for the social, cultural and economic well-being of the people of New South Wales.

The *CM Act* also supports the aims of the *Marine Estate Management Act 2014*, as the coastal zone forms part of the marine estate.

The *CM Act* defines the coastal zone, comprising four (4) coastal management areas:

1. coastal wetlands and littoral rainforests area; is areas which display the characteristics of coastal wetlands or littoral rainforests that were previously protected by SEPP 14 and SEPP 26
2. coastal vulnerability area; areas subject to coastal hazards such as coastal erosion and tidal inundation
3. coastal environment area; areas that are characterised by natural coastal features such as beaches, rock platforms, coastal lakes and lagoons and undeveloped headlands. Marine and estuarine waters are also included
4. coastal use area; land adjacent to coastal waters, estuaries and coastal lakes and lagoons.

The *CM Act* establishes management objectives specific to each of these management areas, reflecting their different values to coastal communities.

The Coastal Management SEPP establishes the approval pathway for coastal protection works.

1.4.6 Licences

Individual staff members of *Travers bushfire & ecology* are licensed under Clause 20 of the *National Parks and Wildlife (Land Management) Regulation 1995* and Sections 120 & 131 of the *National Parks and Wildlife Act 1974* to conduct flora and fauna surveys within service and non-service areas. NPWS Scientific Licence Numbers: SL100848.

Travers bushfire & ecology staff are licensed under an Animal Research Authority issued by the NSW Department of Primary Industries. This authority allows *Travers bushfire & ecology* staff to conduct various fauna surveys of native and introduced fauna for the purposes of environmental consulting throughout New South Wales.

DRAWING NUMBER: **L.SK.01**

DRAWING NAME: Landscape Sketch Plan - Ground

REVISION: C

PROJECT NAME AND ADDRESS: BEACON HILL 808, 70A Willandra Rd, Narraweena, NSW

CONSULTANTS

DRAWINGS BY: scape DESIGN, LANDSCAPE ARCHITECTURE, Suite 8, 37-38 East Esplanade, Manly NSW 2095, www.scapedesign.com.au

DRAWING DATE	30.09.19
DRAWN BY	TR/ZZ
CHECKED BY	DH

SCALE: 1:100@A1

SCALE BAR: 0 1 2 3 4 5M

STATUS: DRAFT

CLIENT NAME: ALTRE

PROJECT NUMBER: Proj No.168

Figure 1-2 – Proposed development layout (as shown by the landscape plan)

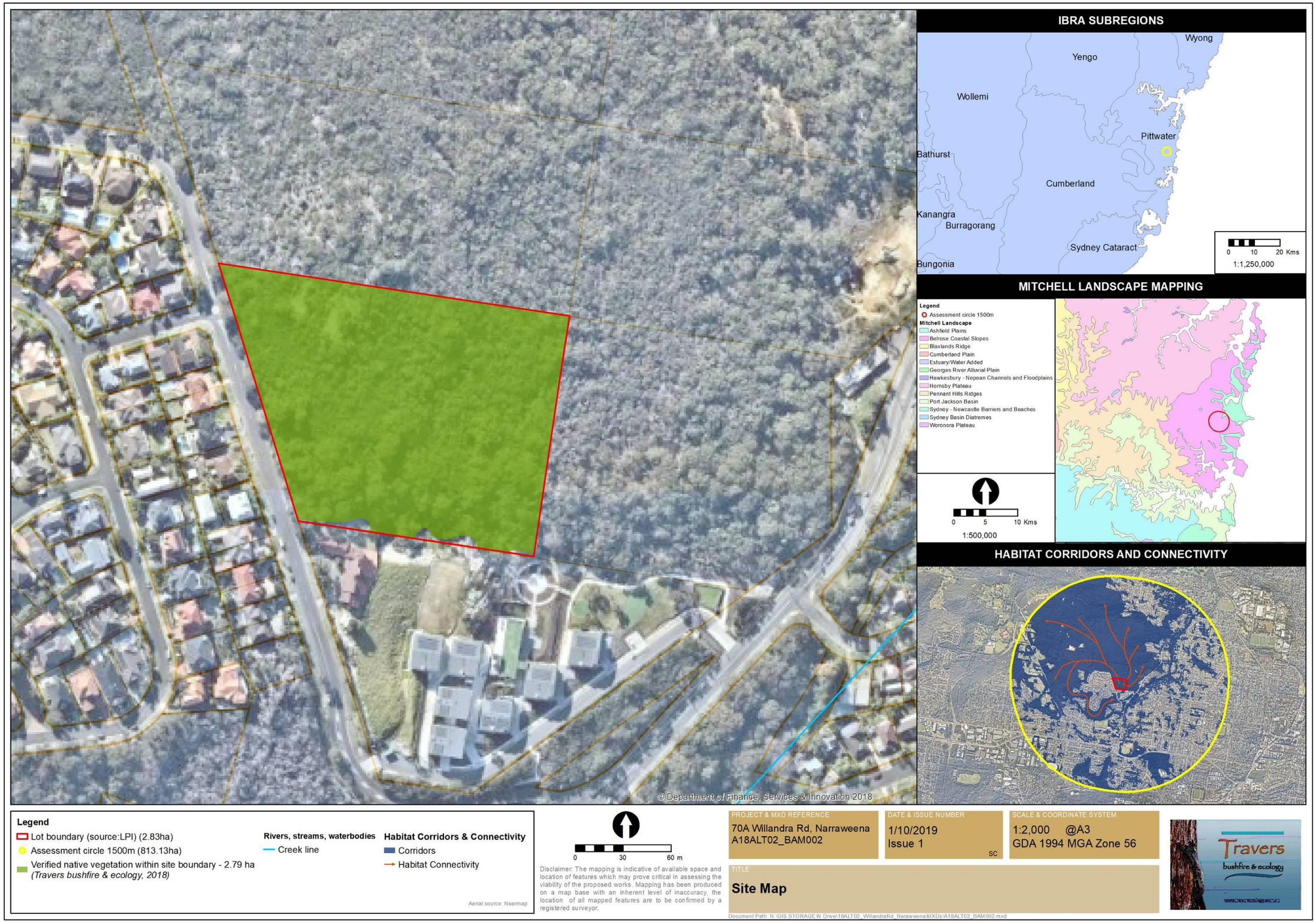
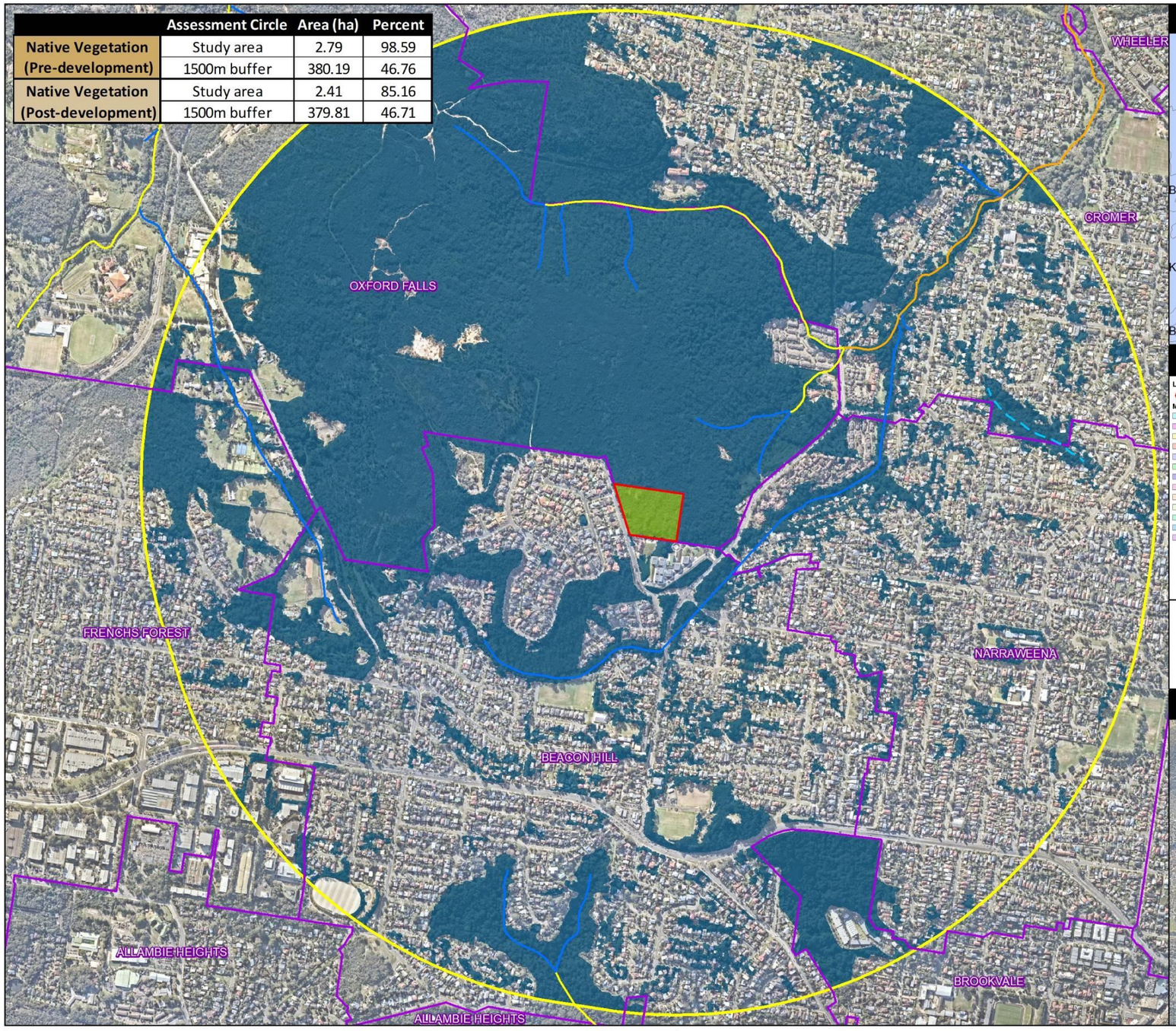
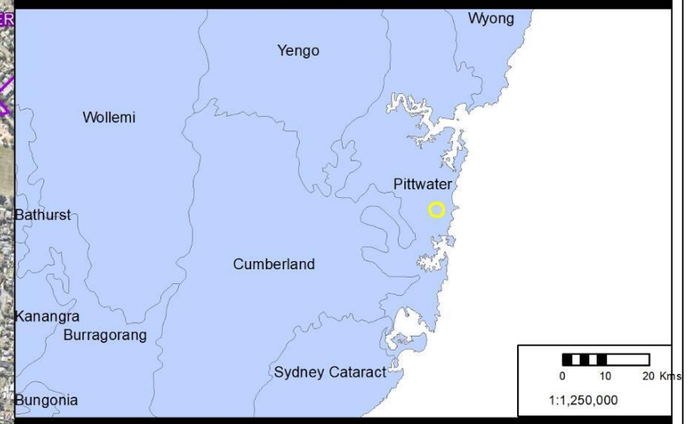


Figure 1-3 – Site map

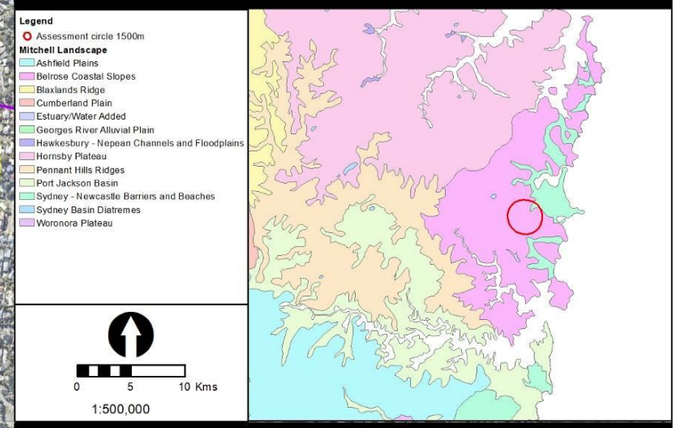
	Assessment Circle	Area (ha)	Percent
Native Vegetation (Pre-development)	Study area	2.79	98.59
	1500m buffer	380.19	46.76
Native Vegetation (Post-development)	Study area	2.41	85.16
	1500m buffer	379.81	46.71



IBRA SUBREGIONS



MITCHELL LANDSCAPE MAPPING



HABITAT CORRIDORS AND CONNECTIVITY

Legend

- Lot boundary (source:LPI) (2.83ha)
- Suburb boundary (source: LPI)
- Assessment circle 1500m (813.13ha)
- Verified native vegetation within site boundary - 2.79 ha *(Travers bushfire & ecology, 2018)*
- Native vegetation within 1500m buffer (outside study area) (377.4ha)

Rivers, streams, waterbodies

- Drainage line
- First order
- Second order
- Third order

Habitat Corridors & Connectivity

- Corridors
- Habitat Connectivity

Aerial source: Nearmap

0 200 400 m

Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

PROJECT & MXD REFERENCE	DATE & ISSUE NUMBER	SCALE & COORDINATE SYSTEM
70A Willandra Rd, Narraweena A18ALT02_BAM001	26/09/2019 Issue 1 SC	1:13,000 @A3 GDA 1994 MGA Zone 56

TITLE

Location Map

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Travers bushfire & ecology

Figure 1-4 – Location map

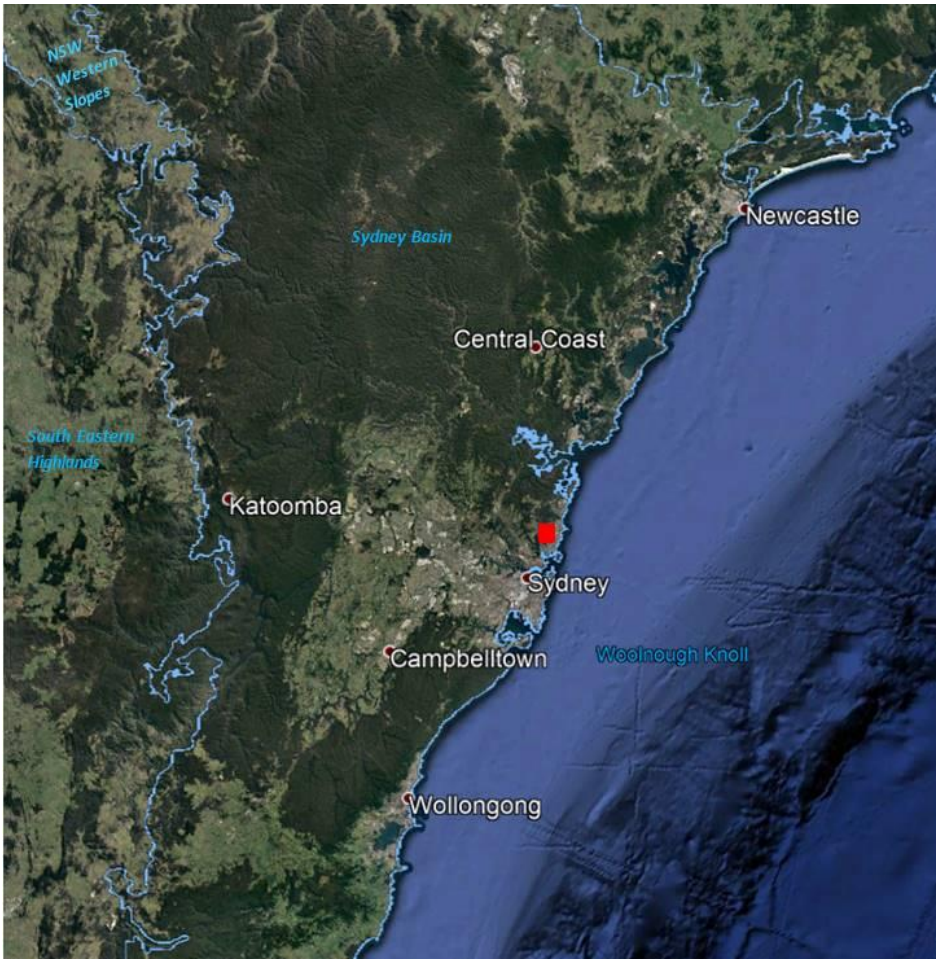


Figure 1-5 – IBRA bioregions

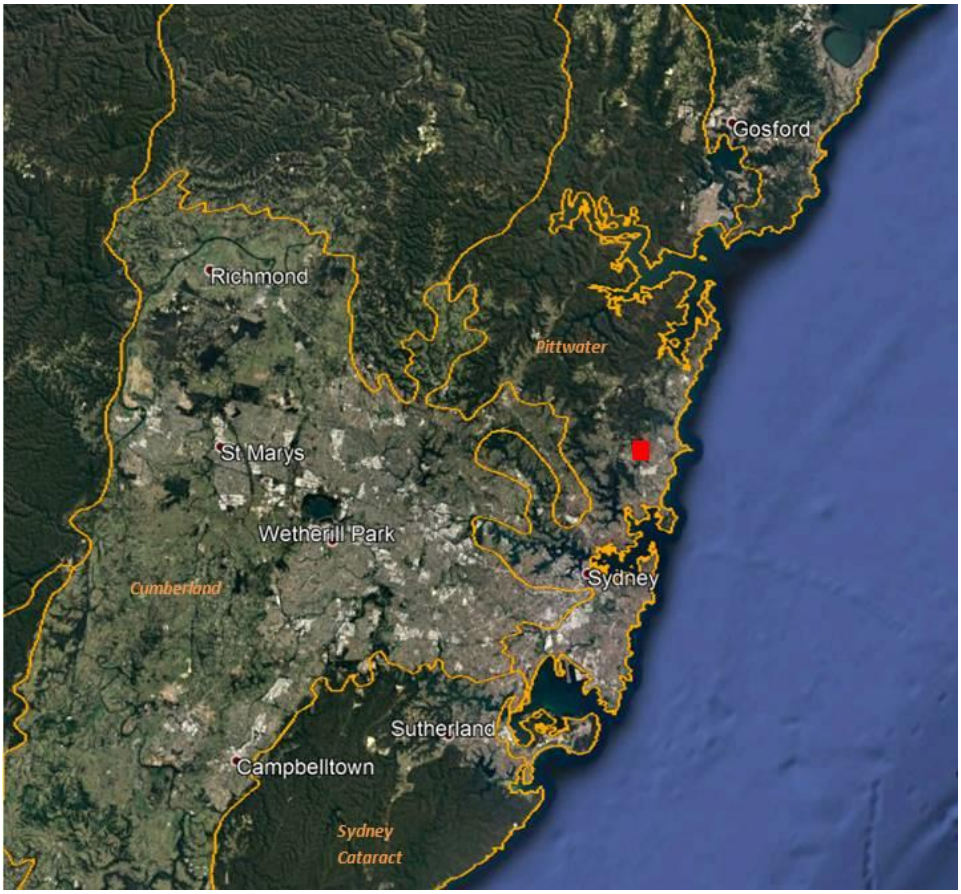


Figure 1-6 – IBRA subregions

Figure 1-7 – Mitchell Landscapes
(Source: Google Earth Pro – Mitchell Landscape layer)

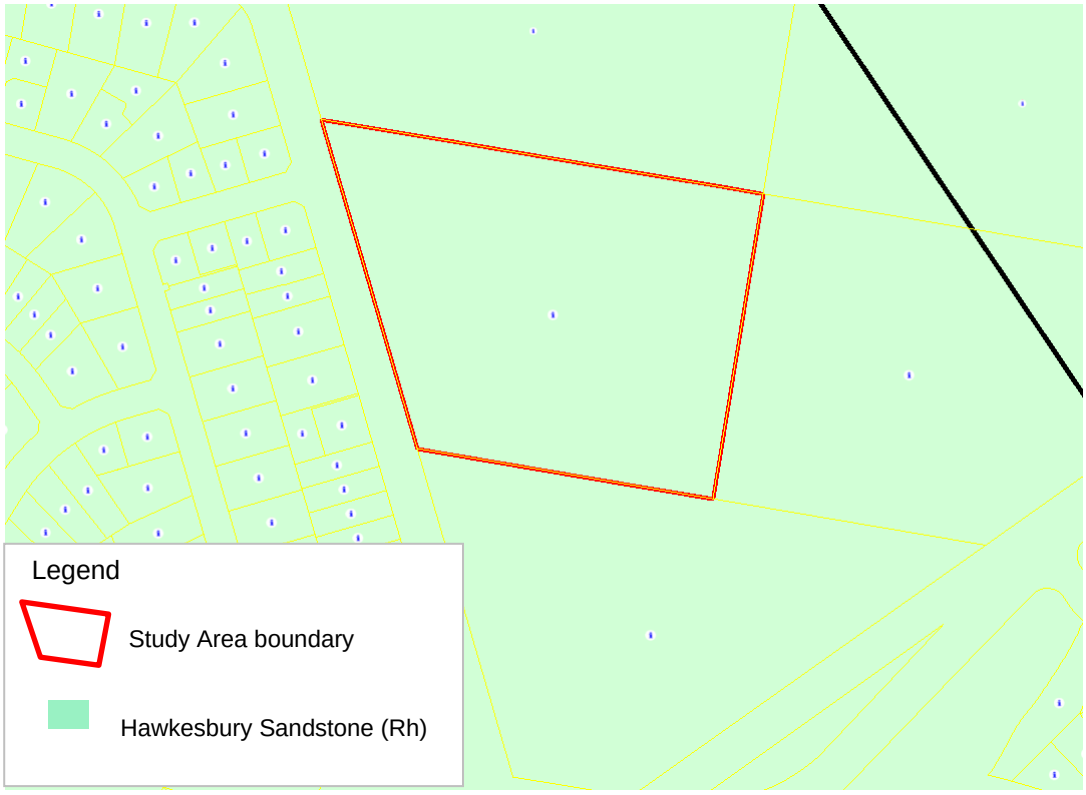


Figure 1-8 – Local geology

(Source: Google Earth Pro – Geology 1:100,000 Geological Map - Sydney)

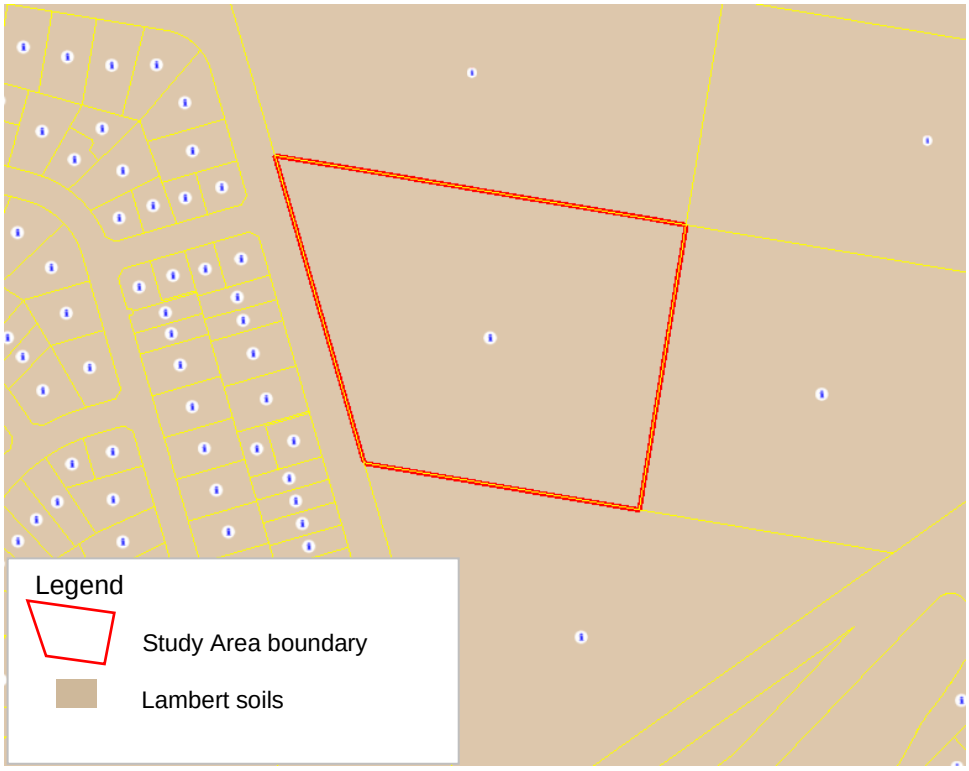


Figure 1-9 – Local soil landscapes

(Source: Google Earth Pro – Soil Landscape Sydney)

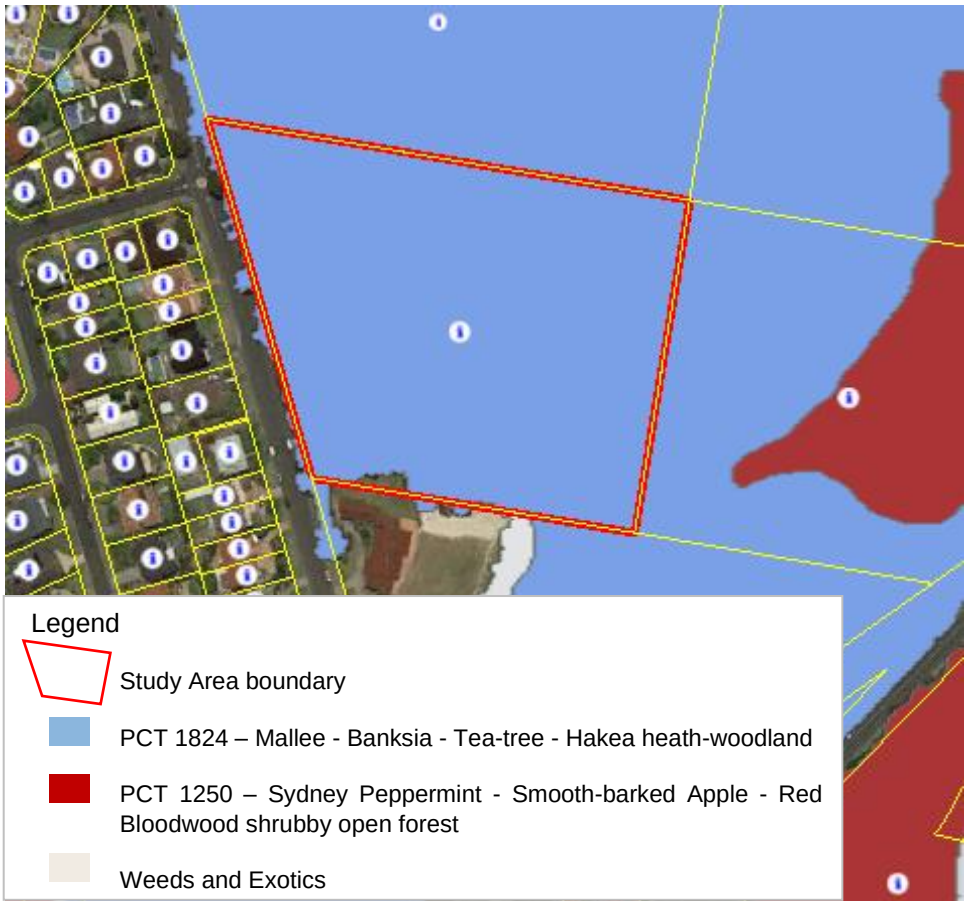


Figure 1-10 – The Native Vegetation of the Sydney Metropolitan Area

(OEH 2016)

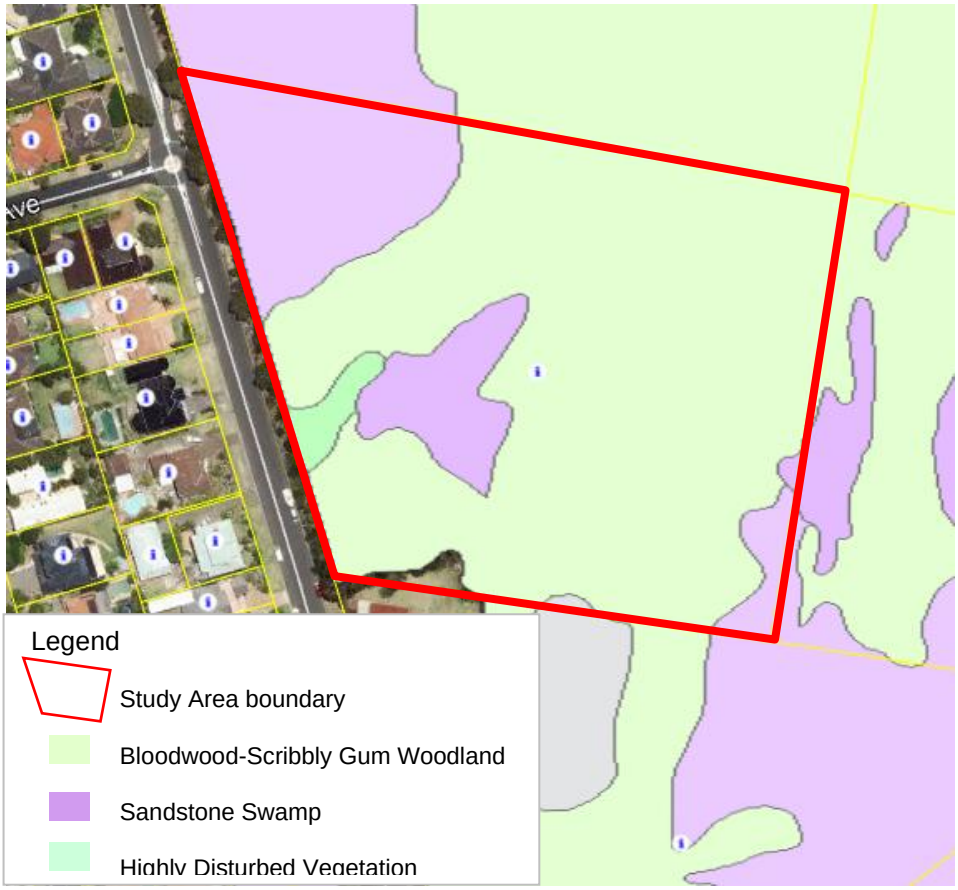


Figure 1-11 – Warringah natural Area Survey Vegetation Mapping

(P & J Smith Ecological Consultants 2005).

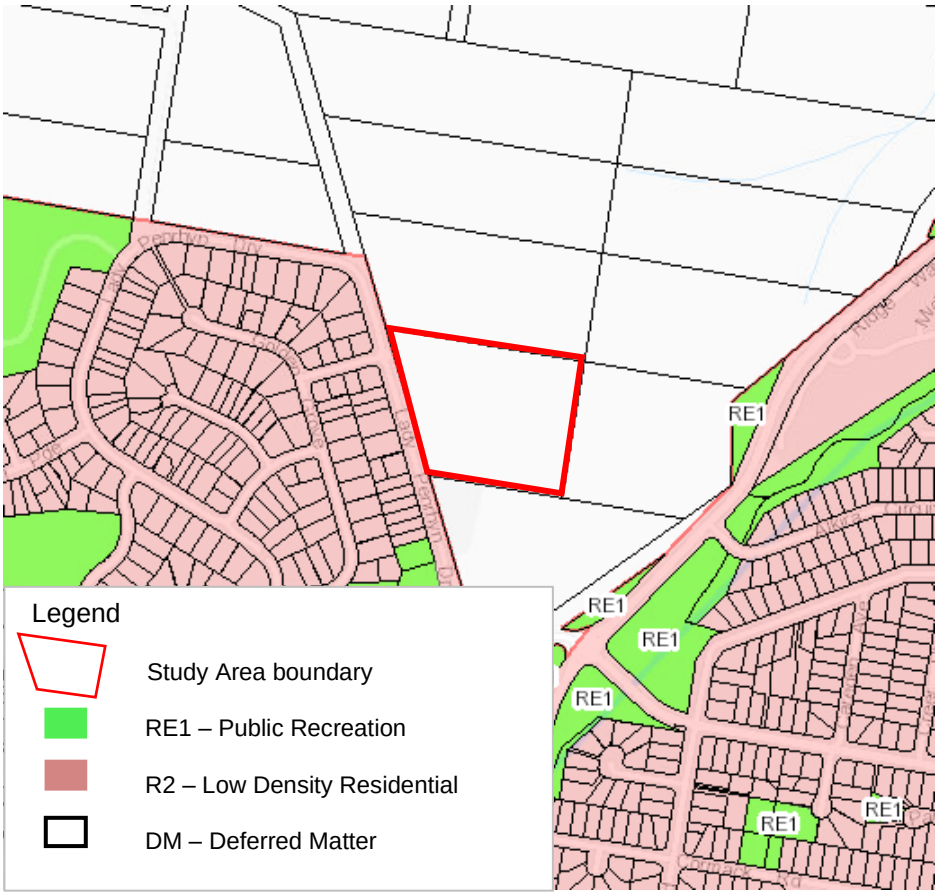


Figure 1-12 – Zoning

(Source: ePlanning Spatial Viewer, 2019, https://www.planningportal.nsw.gov.au/spatialviewer/)

2. SURVEY METHODOLOGY

2.1 Pre-survey information collation & resources

A review of the relevant information pertinent to the subject site was undertaken.

Documents reviewed include:

- Landscape Sketch Plan and Concept Site Plan by *Saturday Studio* (July 2019)
- Balise Eco Village Biobanking Assessment Report, (*Eco Logical Australia* 2011)
- Ecological Assessment – Proposed Retirement Village Development at Beacon Hill (*Eco Logical Australia* 2009)
- Species Impact Statement - Lot 806 752038, 70 Willandra Road, Beacon Hill (*Anderson Ecological Surveys* 2002)
- Ecological Assessment and Species Impact Statement, Lot 806 DP 752038 Willandra Road, Beacon Hill (*Travers bushfire & ecology* 2009)
- Flora & Fauna Assessment, Lot 807 DP 752038 72 Willandra Road, Narraweena (*Travers bushfire & ecology* 2016)
- Biodiversity Constraints Assessment, Lots 7034 & 7035 DP 93795, Lots 908-918 DP 752038 and Lots 4-6 DP 789407 off Lady Penrhyn Drive, Beacon Hill (*Travers bushfire & ecology* 2018).
- A Waterways Impact Statement, Lot 808 DP 752038, 70a Willandra Road Narraweena (*Woodlots and Wetlands Pty Ltd* July 2019)

Standard technical resources utilised:

<u>Legislation</u>

- *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*)
- *Biodiversity Conservation Act 2016* (*BC Act*)
- *Biodiversity Conservation Regulation 2017* (*BC Reg.*)
- *Fisheries Management Act 1994* (*FM Act*)

<u>Survey guidelines</u>

- *Survey guidelines for Australia's threatened birds* (DEWHA 2010)
- *Survey guidelines for Australia's threatened fish* (DEWHA 2011)
- *Survey guidelines for Australia's threatened frogs* (DEWHA 2010)
- *Survey guidelines for Australia's threatened mammals* (DEWHA 2011)
- *Survey guidelines for Australia's threatened bats* (DEWHA. 2010)
- *Survey guidelines for Australia's threatened reptiles* (DEWHA 2011)
- *Matters of National Environmental Significance* (Commonwealth of Australia 2013)
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities 2004* (working draft), Department of Environment and Conservation (DEC)
- *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians* (DECC – April 2009a)
- *Hygiene Protocol for the Control of Diseases in Frogs* (DECC 2008)
- *Region based guide to the echolocation calls of Microchiropteran bats* (DEC 2004)

- *Species credit threatened bats and their habitats* (OEH 2018)

Mapping resources

- Aerial photographs (Google Earth Pro / Spatial Information Exchange / NearMap / SixMaps)
- Topographical maps (scale 1:25,000)
- LiDAR data for contours (Land and Property Information, est. 2015 estimated)

Threatened species records

- BioNet - Atlas of NSW Wildlife (NSW DPIE), which holds data from a number of custodians. Data obtained 19 Aug 2019 and 13 Dec 2021
- *EPBC Act* Protected Matters Search Tool - *DAWE* (2021)

Vegetation mapping/resources

- Bionet Vegetation Classification System
- The Native Vegetation of the Sydney Metropolitan Area (OEH 2016)
- Warringah LGA Vegetation Mapping (P & J Smith Ecological Consultants, 2005)
- Australian Virtual Herbarium (accessed August 2019)
- NSW Guide to Surveying Threatened Plants (DPIE 2020)

Desktop assessment:

To determine the likely and actual occurrence of flora species, fauna species and plant communities on the subject site, desktop assessments were undertaken including:

- ***A literature review*** – A review of readily available literature for the area was undertaken to obtain reference material and background information for this survey.

- ***A data search*** – A search of the *Atlas of NSW Wildlife* (DPIE 2019) was undertaken to identify records of threatened flora and fauna species located within a 10 km radius of the site. Searches were also undertaken on the DAWE – 'protected matters search tool' report on national environmental significance or other matters protected by the *EPBC Act* to a 10 km radius. These two searches combined, enabled the preparation of a list of threatened flora and fauna species that could potentially occur within the habitats found on the site (Tables A2.1, A2.2 and A2.3). The search was re-done in December 2021 to ascertain if there were any further species required for consideration.

Vegetation mapping:

The Native Vegetation of the Sydney Metropolitan Area (OEH 2016), is shown in Figure 1.10. This mapping shows identifies the following communities within the study area:

- PCT 1824 Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin (equivalent to Coastal Sandstone Heath-Mallee)

Warringah Natural Area Survey Vegetation Communities and Plant Species (P & J Smith Ecological Consultants 2005) mapping is shown in Figure 1.11. This mapping identifies the following communities within the study area:

- Bloodwood-Scribbly Gum Woodland
- Sandstone Swamp
- Highly Disturbed Vegetation

2.2 Flora survey methodology

Flora survey was undertaken on several occasions in 2018 and 2019 (see Table 2.2). Parallel field transects were undertaken in accordance with Cropper (1993) to create a broad species list.

A review of the Atlas of NSW Wildlife, BioNet (DPIE, Aug 2019) was undertaken prior to the botanical survey to identify threatened species previously recorded within 10 km of the subject site. Target searches for threatened species were restricted to the development footprint and APZ area, undertaken over several periods as shown in Table 2.2.

All observed plant species are listed in Section 3.1.2 – Table 3.1.

The following information was collected at each of four (4) BAM plots:

- Native overstorey, mid-storey and ground cover recorded for all observed species and an estimate of stems (20 m x 20 m plot)
- Stratum (and layer): stratum and layer in which each species occurs (20 m x 20 m plot)
- Growth form: growth form for each recorded species (20 m x 20 m plot)
- Species name: scientific name and common name (20 m x 20 m plot)
- Percent projected foliage cover of the understorey strata and exotic vegetation (20 m x 20 m plot)
- Number of trees with hollows visible from the ground (20 m x 50 m plot)
- The total length of fallen logs >10 cm in diameter (20 m x 50 m plot)
- The proportion of regenerating overstorey species within the vegetation zone
- Number of large trees (20 m x 50 m)
- Estimates of leaf litter cover, bare ground, cryptograms and rocks in 1 m x 1 m subplots at five locations along the 50 m central transect

2.3 Fauna survey methodology

Site survey effort accounting for techniques deployed, duration, and weather conditions are outlined in Table 2.1 and are depicted on Figure 2.1. A description of fauna survey techniques that have been tailored to the study area are described below.

Diurnal birds

Four (4) diurnal bird census points have been undertaken within the study area. A minimum of 30 minutes of survey was undertaken at each census point in an area radiating out to between 30–50 m. Bird census points were selected to give an even spread and representation across the site and its communities (see Figure 1). Census points were also commenced in locations where bird activity was apparent, as often different small bird species

are found foraging together. Opportunistic diurnal bird survey was conducted between census points and whilst undertaking all other diurnal surveys.

Given the previous recording of Glossy Black-Cockatoo (*Calyptorhynchus lathami*) by *Travers bushfire & ecology* within adjacent lots beyond the study area target searches for signs of activity were carried out. Seeding *Allocasuarina* trees encountered were searched for chewed cones indicating previous foraging activity. This included searches within groves of *Allocasuarina distyla* which is not typically known as a foraging tree yet previously recorded locally utilised by *Travers bushfire & ecology*.

Two (2) sessions of song-meters deployed during February-March and September 2019 were targeting frog breeding calls, however these also contributed to additional bird call surveys. The February-March recordings were from the dusk and nocturnal period only so only birds calling going to nocturnal roosts were recorded. Song-meters recording for 1 week in September were recording for the entire diurnal period.

Nocturnal birds

No breeding habitat for threatened nocturnal birds was found present within the study area. Nonetheless Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*) and Barking Owl (*Ninox connivens*) were targeted during nocturnal call-playback survey.

Two sessions of song-meters deployed during February-March and September 2019 were targeting frog breeding calls, however given that these both recorded throughout the nocturnal period they also contributed to the presence of owls by calls.

Arboreal and terrestrial mammals

Arboreal and terrestrial hair tubes, surveillance cameras and Eastern Pygmy Possum denning tubes (made of both timber and PVC) were used to remotely target the presence of both arboreal and terrestrial mammals. These were all placed over a pre-determined trapping grid planned across the study area. A trail was constructed through the dense heath along the gridlines in a spiral so that every vertex on the grid accessed but not all lines between the vertices were accessed.

Large (90 mm) terrestrial hair tubes were placed at central points along the traplines in between each vertex point. These contained a standard bait mixture of rolled oats (70%), peanut butter (20%) and honey (10%) in a bait canister within one end. Double sided tape was placed around the inside lip at the other end to collect hair samples. A few drops of White Truffle Oil are tipped into the base of the tube to provide an additional attractant targeting Southern Brown Bandicoot.

Small (40 mm) arboreal hair tubes with the same standard bait mix were placed in trees (mostly flowering banksias where present) along the same traplines. These were placed at ¼ and ¾ along each line between vertices. Honey water was splayed around the tube as an additional lure targeting Eastern Pygmy Possum.

Specially constructed denning (nesting) tubes made out of both timber and PVC and in accordance to findings from *Rueegger et al* (2012) and approved by Dr Ross Goldingay were deployed to target presence of Eastern Pygmy Possum, particularly nesting females.

The PVC tubes (80 mm diameter x 240 mm long) have both ends covered and sealed with PVC caps. A 60 mm diameter cardboard post-pack tube wrapped in bubble wrap for insulation and capped at the base is placed inside the PVC pipe. A 33 mm drill hole on the side at one end permits access and Velcro tape stuck down the internal cylinder allows the animal to climb down to the base. Cut lines around the outer surface of the tube permit small mammals to climb up the outside. Denning tubes are placed vertically in shrub trees (preferably flowering banksias). If no animals are found residing within the tube after a prolonged survey period (generally 6 weeks) use may then instead also be identified from bedding material present. Pygmy Possums use fine bedding material such as *Isopogon* and *Banksia ericifolia* by comparison to Feather-tail Gliders and Antechinus which use eucalypt leaves.

The timber tubes were constructed from either sourced naturally hollow and cleaned didgeridoos or thick bamboo sections; all of similar internal diameter, insulation and 33 mm entry hole.

Timber EPP denning tubes were placed at each vertex on the trap grid as well as half way between these on the traplines. The PVC denning tubes were placed at ¼ and ¾ along each line between vertices.

Surveillance cameras were placed at each vertex on the trapping grid. A bait canister containing the standard bait mixture was placed in front of every camera. Every second camera was supplemented with sardines and jellymeat cat food smeared around nearby trees to target Spotted-tailed Quoll. Every other camera was supplemented with a few drops of truffle oil targeting Southern Brown Bandicoot.

Whilst not ideally suitable habitat and not expected to occur, Koala (*Phascolarctos cinereus*) and Squirrel Glider (*Petaurus norfolcensis*) were targeted during nocturnal call-playback survey.

Bats

Detailed searches of the nearby sandstone rocky escarpments was undertaken to locate any potential subterranean bat roosting habitat. Where small overhangs and caves were located and no roosting was observed, searches of the floor was undertaken for any guano indicating previous roosting activity by microbats.

Microbats were remotely surveyed by placement of passive ultrasonic recorders over three consecutive nights. One was placed at the top of the rocky plateau the other at the southern edge of vegetation clearing along the escarpment drop-off, both targeting foraging lines.

Amphibians

Diurnal habitat searches for suitable Red-crowned Toadlet and Giant Burrowing Frog breeding habitat was undertaken during deployment and pickup of mammal survey traps. Two (2) song-meters were placed out recording the dusk and first ¾ nocturnal period for 19 consecutive nights from mid-February in the northern portions of the study area. The two locations were the only ephemeral-perennial pools located in the study area at this time.

Later survey located a Coastal Upland Swamp close to the subject site footprint and a previous Red-crowned Toadlet record was referenced to this location by Eco-Logical in 2011. Subsequently following 43mm of rainfall over 5 days in mid-September, two (2) additional

song-meters were placed out close to ephemeral soaks at either end of this perched swamp area.

Nocturnal spotlighting surveys focused on searches for drainage edges and soaks around rocky edges close to the subject site for calling Red-crowned Toadlet. Where any moist habitat was encountered an attempt to provoke calls by clapping and loud calls was undertaken. This included effort around the Coastal Upland Swamp area.

Reptiles

Given the known local presence of Rosenberg's Goanna, important habitat searches were undertaken throughout the upper plateau area within and surrounding the subject site within Lot 808 and nearby to the north. Searches were specifically for termite mounds (which are potentially utilised by females for nesting) as well as burrow locations. Expected burrows, other burrows as well as potential temporary shelters were identified by GPS. Burrows are generally found below rocky slabs where a sandy substrate exists along a north-eastern to north-western aspect. No north-western aspects providing late day basking opportunity in front of burrows is present within the study area.

Rosenberg's Goanna was targeted also by surveillance cameras deployed over two separate sessions in December 2018 (x12) and September 2019 (x2). This is most particularly every second camera in the first session which was baited with sardines and scented with jellymeat cat food on surrounding trees.

Habitat trees

Hollow-bearing trees were identified and recorded above the escarpment edge within Lot 808 surrounding the subject site on a *Trimble* handheld GPS unit during surveys. All data such as hollow types, hollow size, tree species, diameter at breast height, canopy spread and overall height were collected and a metal tag with the habitat tree number placed on the trunk for field relocation purposes. This is not to be confused with the tree number also provided on tree tags as part of the tree health assessment (SULE).

All tree hollows were considered for potential use by Eastern Pygmy Possum. Suitable hollows were, where possible, then inspected with a videoscope for presence or signs of presence such as fine bedding material indicative of Eastern Pygmy Possum.

A summary of hollow-bearing tree results is provided in Table 3.6.

2.4 Field survey effort

Tables 2.1 and 2.2 below detail the flora and fauna survey effort undertaken for the subject site.

Table** 2-1 – **Fauna survey effort

Fauna group	Date	Weather conditions	Survey technique(s)	Time effort (24hr)
Diurnal birds	11/12/18	8/8 cloud, light SE wind, no rain, temp 20°C	Diurnal opportunistic	5hrs 15min 1245 - 1800
	12/12/18	8-4/8 cloud, light NE wind, no rain, temp 22°C	Diurnal opportunistic	5hrs 1100 - 1600
	9/1/19	0/8 cloud, mod SW-SE wind, no rain, temp 29-24°C	Diurnal opportunistic	6hrs 25min 1235 - 1900
	1/2/19	8/8 cloud, mod SE wind, fine late rain, temp 21°C	Diurnal opportunistic / census x2	4hrs 30min 1200 - 1630
	20/8/19	0/8 cloud, gusty W wind, no rain, temp 16-18°C	Diurnal opportunistic / census x2	5hrs 25min 1110 - 1635
Nocturnal birds	13/2-4/3/19	Various	Song-meters x2	38 song-meter nights
	18/9/19	0/8 cloud, no wind, no rain, no moon, temp 15-14°C	Dusk listening / Spotlighting	1hr 1800 - 1900
	18/9-25/9/19	Various	Song-meters x2 (together)	14 song-meter nights
	30/9/19	8/8 cloud, light S wind, prev light rain, temp 15°C	Dusk listening / Spotlighting	1hr 15min 1815 - 1930
			Call playback (Section 2.5 species)	Commenced @ 2040
Arboreal mammals	11/12/18-9/1/19	Various	EPP denning tubes (timber) x24	696 tube nights
			EPP denning tubes (PVC) x24	696 tube nights
			Hair tube (PVC small) x24	696 tube nights
	18/9/19	0/8 cloud, no wind, no rain, no moon, temp 15-14°C	Dusk listening / Spotlighting	1hr 1800 - 1900
	30/9/19	8/8 cloud, light S wind, prev light rain, temp 15°C	Dusk listening / Spotlighting	1hr 15min 1815 - 1930
			Call playback (Section 2.5 species)	Commenced @ 2040
Terrestrial mammals	11/12/18-9/1/19	Various	Hair tube (PVC large) x12	348 tube nights
			Surveillance cameras x12	348 camera nights
	18/9/19	0/8 cloud, no wind, no rain, no moon, temp 15-14°C	Spotlighting	1hr 1800 - 1900
	27-30/9/19	Various, mostly fine	Surveillance cameras x2	6 camera nights
	30/9/19	8/8 cloud, light S wind, prev light rain, temp 15°C	Spotlighting	1hr 15min 1815 - 1930
Bats	20/8/19	0/8 cloud, gusty W wind, no rain, temp 16-18°C	Diurnal opportunistic	5hrs 25min 1110 - 1635
	18/9/19	0/8 cloud, no wind, prev rain, no moon, temp 15-14°C	Spotlighting / habitat & tadpole searches	1hr 1800 - 1900
	27-30/9/19	Various, mostly fine	Ultrasonic recorders x2	6 recorder nights
	30/9/19	8/8 cloud, light S wind, prev light rain, temp 15°C	Spotlighting	1hr 15min 1815 - 1930

Fauna group	Date	Weather conditions	Survey technique(s)	Time effort (24hr)
Reptiles	11/12/18	8/8 cloud, light SE wind, no rain, temp 20°C	Diurnal opportunistic	5hrs 15min 1245 - 1800
	11/12/18-9/1/19	Various	Surveillance cameras x12	348 camera nights
	12/12/18	8-4/8 cloud, light NE wind, no rain, temp 22°C	Diurnal opportunistic	5hrs 1100 - 1600
	9/1/19	0/8 cloud, mod SW-SE wind, no rain, temp 29-24°C	Diurnal opportunistic	6hrs 25min 1235 - 1900
	1/2/19	8/8 cloud, mod SE wind, fine late rain, temp 21°C	Diurnal census x4	4hrs 30min 1200 - 1630
	20/8/19	0/8 cloud, gusty W wind, no rain, temp 16-18°C	Diurnal opportunistic / RG nesting & burrow habitat searches	5hrs 25min 1110 - 1635
	27-30/9/19	Various, mostly fine	Surveillance cameras x2	6 camera nights
Amphibians	12/12/18	8-4/8 cloud, light NE wind, no rain, temp 22°C	Breeding & tadpole habitat searches	~1hr 1100 - 1600
	1/2/19	8/8 cloud, mod SE wind, fine late rain, temp 21°C	Breeding & tadpole habitat searches	~1hr 30min 1200 - 1630
	13/2-4/3/19	Various with 40+mm rain over 5 consecutive days in this period	Song-meters x2	38 song-meter nights
	18/9/19	0/8 cloud, no wind, 40+mm prev days rain, no moon, temp 15-14°C	Spotlighting / habitat & tadpole searches	1hr 1800 - 1900
	18/9-25/9/19	Various with 100+mm rain over 3 days from 17/9/19	Song-meters x2 (together)	14 song-meter nights
	30/9/19	8/8 cloud, light S wind, prev light rain, temp 15°C	Spotlighting	1hr 15min 1815 - 1930

Table 2-2 – Flora survey effort

Flora survey	Survey technique(s)	Dates
Vegetation communities	• Survey of the boundaries of all communities – field verification, plotting vegetation boundaries on aerial photographs	6–7 Dec 2018 26 August 2019
Stratified sampling	- Four (4) 20m x 50m BAM plots - Opportunistic observations of flora species during all on-foot traverses of the subject site - One (1) 20m x 50m BAM plots	6–7 Dec 2018 20 March 2019 26 August 2019
Targeted searches	- Targeted searches in known or potential habitats - Opportunistic searches during all on-foot traverses across the site	20–21 Nov 2018 19 March 2019 21 August 2019 26 August 2019 9 December 2021

2.5 Survey limitations

It is important to note that field survey data collected during the survey period is representative of species occurring within the subject site for that occasion. Due to effects of fire, breeding cycles, migratory patterns, camouflage, weather conditions, time of day, visibility, predatory and / or feeding patterns, increased species frequency or richness may be observed within the subject site outside the nominated survey period. Habitat assessments based on the identification of micro-habitat features for various species of interest, including regionally significant and threatened species, have been used to minimise the implications of this survey limitation.

Flora survey limitations

The species list does not include all household or exotic garden / landscaping species and those species which could not be identified at the time of the survey past genus level. Cryptic species not flowering at the time of the survey may not be observed during survey outside of peak flowering periods. Likewise cryptic orchid species are generally only recognisable when flowering.

Threatened flora species survey has been undertaken within the recommended survey period for all species with potential to occur. Detailed survey was limited to the area directly within and surrounding the subject site and has been undertaken throughout the remainder of the site only at an opportunistic level. This limitation is not likely to influence the outcomes of this assessment as impacts from the proposal will be restricted to the building footprint and APZ.

Fauna survey limitations

Given the separate seasonal effort undertaken across the study area inclusive of song-meters, surveillance cameras, detailed hollow tree surveys and inspections of cavities (where possible) all combined with knowledge of adjacent habitat and surveys undertaken in the locality by *Travers bushfire & ecology*, fauna survey is not considered to be limited. This is particularly in respect to the size of the proposed development footprint.

A higher degree of rainfall prior to nocturnal surveys may have benefitted to potential to stimulate Red-crowned Toadlet breeding activity. The species is nonetheless considered to occur in the Coastal Upland Swamp community based on a previous record and the hydrology of this area with potential to retain longer-term pools after such considerable rainfall.

2.6 Accuracy of identification

Structural descriptions of the vegetation were made according to Specht *et al* (1995).

Scats and hair samples were sent to Barbara Triggs for identification.

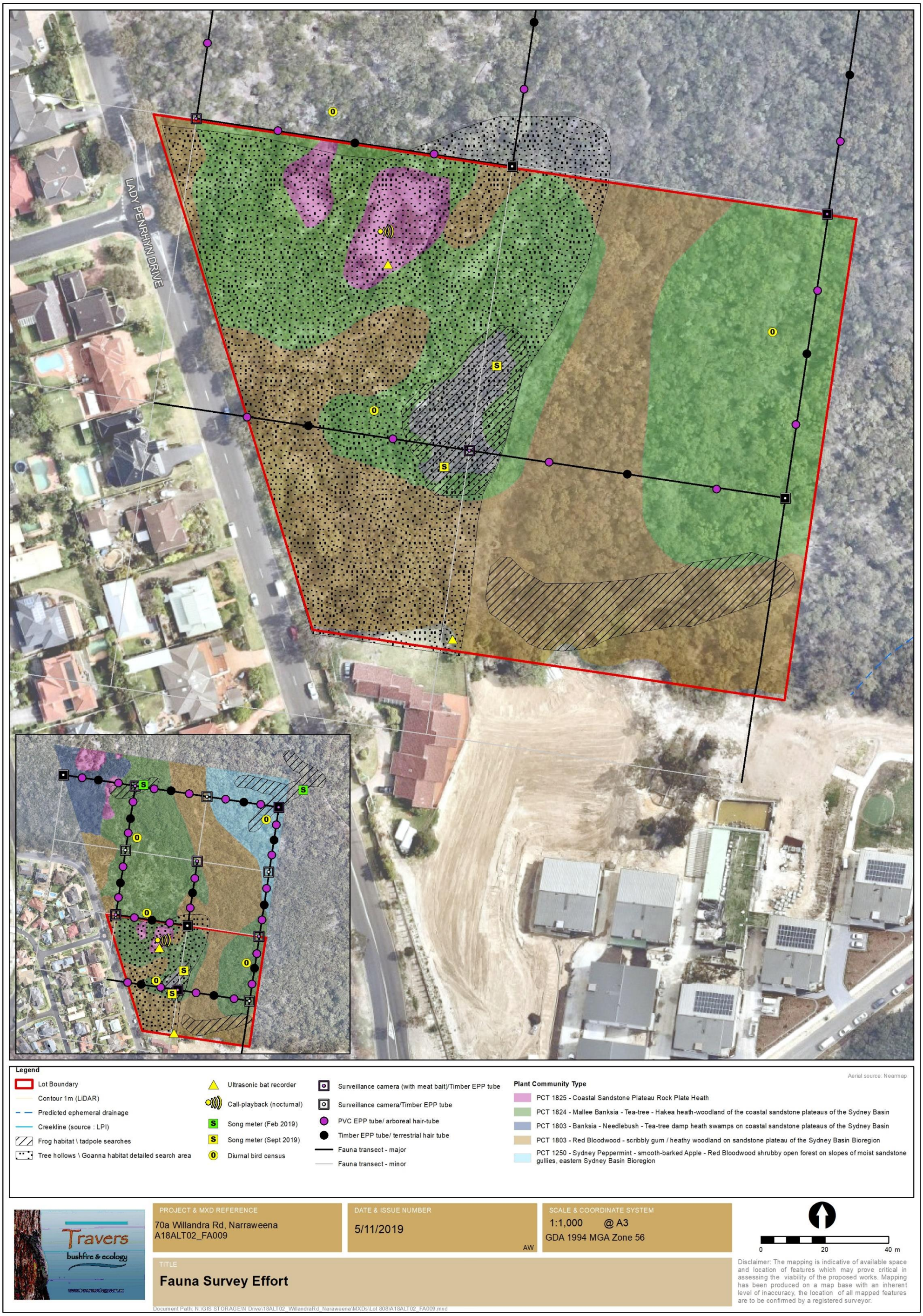


Figure 2-1 – Fauna survey effort

Figure 2-2 – Flora survey effort & results

3. SURVEY RESULTS

3.1 Flora results

3.1.1 Native vegetation extent

The native vegetation extent within the study area has been extensively ground-truthed.

The native vegetation to be impacted measures 0.39 ha. This is a combination of impacts from driveway, building envelope and APZs.

3.1.2 Flora species

The plants observed within the vegetation communities of the study area are listed in the Table 3.1 below.

Table 3-1 – Flora observations for the study area

Family	Scientific name	Common name
TREES		
Myrtaceae	*Angophora costata*	Smooth-barked Apple
Myrtaceae	*Angophora crassifolia*	-
Myrtaceae	*Angophora hispida*	Dwarf Apple
Proteaceae	*Banksia serrata*	Old Man Banksia
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Myrtaceae	*Eucalyptus globoidea*	White Stringybark
Myrtaceae	*Eucalyptus haemastoma*	Broad-leaved Scribbly Gum
Myrtaceae	*Eucalyptus punctata*	Grey Gum
Myrtaceae	*Eucalyptus sieberi*	Silvertop Ash
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
SHRUBS		
Fabaceae	*Acacia longifolia*	
Fabaceae	*Acacia suaveolens*	Sweet Scented Wattle
Casuarinaceae	*Allocasuarina distyla*	-
Myrtaceae	*Baeckea imbricata*	-
Proteaceae	*Banksia ericifolia*	Heath-leaved Banksia
Proteaceae	*Banksia oblongifolia*	Fern-leaf Banksia
Rutaceae	*Boronia ledifolia*	Sydney Boronia
Rutaceae	*Boronia pinnata*	Pinnate Boronia
Fabaceae	*Bossiaea scolopendria*	-

Family	Scientific name	Common name
Myrtaceae	*Callistemon linearis*	Narrow-leaved Bottlebrush
Malaceae	*Cotoneaster* sp.*	
Myrtaceae	*Darwinia fascicularis* subsp. *fascicularis*	-
Fabaceae	*Dillwynia floribunda* var. *floribunda*	Parrot Pea
Sapindaceae	*Dodonaea triquetra*	Hop-bush
Epacridaceae	*Epacris longiflora*	Fucshia Heath
Epacridaceae	*Epacris microphylla*	Coral Heath
Rutaceae	*Eriostemon australasius*	Pink Wax Flower
Proteaceae	*Grevillea buxifolia* subsp. *buxifolia*	Grey Spider Flower
Proteaceae	*Grevillea speciosa*	Red Spider Flower
Proteaceae	*Hakea sericea*	Needlebush
Proteaceae	*Hakea teretifolia*	Dagger Hakea
Dilleniaceae	*Hibbertia rufa*	Brown Guinea Flower
Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart
Myrtaceae	*Kunzea ambigua*	Tick Bush
Proteaceae	*Lambertia formosa*	Mountain Devil
Verbenaceae	*Lantana camara**	Lantana
Sterculiaceae	*Lasiopetalum ferrugineum*	-
Myrtaceae	*Leptospermum arachnoides*	-
Myrtaceae	*Leptospermum squarrosum*	-
Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree
Epacridaceae	*Leucopogon lanceolatus*	Lance-leaf Beard-heath
Epacridaceae	*Lissanthe strigosa*	Peach Heath
Proteaceae	*Lomatia silaifolia*	Crinkle Bush
Nandinaceae	*Nandina domestica**	Japanese Sacred Bamboo
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Proteaceae	*Persoonia pinifolia*	Pine-leaved Geebung
Rutaceae	*Phebalium squamulosum*	Scaly Phebalium
Apiaceae	*Platysace linearifolia*	Narrow-leafed Platysace
Fabaceae	*Pultenaea rosmarinifolia*	-
Fabaceae	*Pultenaea stipularis*	Handsome Bush-pea
Fabaceae	*Pultenaea tuberculata*	-
Euphorbiaceae	*Ricinocarpos pinifolius*	Wedding Bush
Rosaceae	*Rubus fruticosus* sp. agg.*	Blackberry complex
Fabaceae	*Senna pendula* var. *glabrata**	-
Apiaceae	*Trachymene incisa*	Trachymene
Epacridaceae	*Woollsia pungens*	-
Apiaceae	*Xanthosia tridentata*	Rock Xanthosia
Rutaceae	*Zieria laevigata*	Smooth Zieria
GROUNDCOVERS		
Asteraceae	*Actinotus minor*	Lesser Flannel Flower

Family	Scientific name	Common name
Asteraceae	*Ageratina adenophora**	Crofton Weed
Poaceae	*Anisopogon avenaceus*	Oat Speargrass
Asteraceae	*Coreopsis lanceolata**	Coreopsis
Orchidaceae	*Cryptostylis erecta*	Bonnet Orchid
Orchidaceae	*Cryptostylis subulata*	Large Tongue Orchid
Cyperaceae	*Cyathochaeta diandra*	-
Poaceae	*Cynodon dactylon*	Common Couch
Goodeniaceae	*Dampiera stricta*	Blue Dampiera
Phormiaceae	*Dianella caerulea*	Blue Flax-lily
Restionaceae	*Empodisma minus*	-
Poaceae	*Entolasia stricta*	Wiry Panic
Restionaceae	*Eurychorda complanata*	-
Cyperaceae	*Gahnia sieberiana*	Red-fruited Saw-sedge
Gleicheniaceae	*Gleichenia dicarpa*	Pouched Coral Fern
Gleicheniaceae	*Gleichenia rupestris*	Coral Fern
Haloragaceae	*Gonocarpus teucroides*	Raspwort
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower
Dilleniaceae	*Hibbertia linearis*	-
Asteraceae	*Hypochaeris radicata**	Flatweed
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern
Poaceae	*Imperata cylindrica*	Blady Grass
Cyperaceae	*Lepidosperma concavum*	-
Cyperaceae	*Lepidosperma filiforme*	-
Restionaceae	*Leptocarpus tenax*	Slender Twine-rush
Restionaceae	*Lepyrodia scariosa*	Scale Rush
Lindsaeaceae	*Lindsaea linearis*	Screw Fern
Lomandraceae	*Lomandra glauca*	Pale Mat-rush
Lomandraceae	*Lomandra obliqua*	Twisted Mat-rush
Rubiaceae	*Opercularia hispida*	Hairy Stinkweed
Poaceae	*Phyllostachys aurea**	Fishpole Bamboo
Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Selaginallaceae	*Selaginella uliginosa*	Swamp Selaginella
Restionaceae	*Sporadanthus gracilis*	Slender Scale-rush
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass
Tremandraceae	*Tetratheca glandulosa*[TS] (outside subject site)	Black-eyed Susan
Tremandraceae	*Tetratheca thymifolia*	Black-eyed Susan
Xanthorrhoaceae	*Xanthorrhoea media*	Forest Grass Tree
Apiaceae	*Xanthosia pilosa*	Woolly Xanthosia
VINES		
Pittosporaceae	*Billardiera scandens*	Hairy Apple berry
Lauraceae	*Cassytha glabella*	Dodder Laurel

Family	Scientific name	Common name
Fabaceae	*Glycine clandestina*	Twining Glycine
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower
Passifloraceae	*Passiflora edulis**	Common Passionfruit
Smilacaceae	*Smilax glyciphylla*	Sarsaparilla
*** denotes exotic species** **TS denotes threatened species**		

3.1.3 Plant community types (PCTs)

Evidence used to identify a PCT

Evidence used to identify the PCTs within the site: the entire list of PTCs was exported from the online BioNet Vegetation Classification Tool. Dominant canopy species, mid-stratum species, ground cover species, and Interim Biogeographic Regionalisation for Australia (IBRA) region and sub-region (Pittwater) information were utilised to produce a short list of potential PCTs (Table 3.2). Final PCTs were then chosen based on species composition and presence, and similarity to descriptive attributes and landscape position information provided in the BioNet Vegetation Classification Tool. Justification for inclusion or exclusion of each shortlisted PCT is provided in Table 3.2.

Table 3.3 provides a summary of the PCT occurring within the development site, including vegetation formation, percent cleared within and extent within the development site.

Table 3-2 – PCT shortlist and justification

Zone	Short-listed PCTs	PCT name	Closest match	Justification
1	**1825**	**Coastal Sandstone Plateau Rock Plate Heath**	✓	**Correct vegetation type and location: coastal heath on rock slabs. Correct species assemblage.**
2	1822	Heath-leaved Banksia - Scrub She-oak heath on sandstone headlands in the Sydney basin	*x*	No canopy species listed as diagnostic; fewer midstorey and groundlayer diagnostic species.
	1824	**Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin**	✓	**Emergent *Eucalyptus haemastoma.* Diagnostics: *Banksia ericifolia, Allocasuarina distyla, Leptospermum squarrosum, Lepyrodia scariosa, Cyathochaeta diandra.* Correct position and elevation.**
3	**1083**	**Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion**	✓	**Correct landscape position. Additional diagnostic canopy species *Angophora costata, Eucalyptus sieberi, Eucalyptus oblonga.* "Heathy woodland" describes vegetation.**

Zone	Short-listed PCTs	PCT name	Closest match	Justification
	1782	Dwarf Apple - Broad-leaved Scribbly Gum - Sydney Peppermint low open woodland on sandstone ridges with subtle enrichment in northern Sydney	*x*	No observed shale influence / enrichment
	1783	Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	*x*	Restricted to elevations 200–500 m ASL (the site is at 90–131 m). Vegetation is not an “open forest”.
4	**1803**	**Banksia - Needlebush - Tea-tree damp heath swamps on coastal sandstone plateaus of the Sydney basin**	✓	**Correct landscape position. Many diagnostic species present: *Leptospermum squarrosum, Banksia ericifolia, Empodisma minus, Lepyrodia scariosa, Hakea teretifolia, Baeckea imbricata, Epacris obtusifolia, Actinotus minor, Selaginella uliginosa***

Zone 1:

The identification of the most suitable PCT was based upon filtering PCTs within the Sydney Coastal Heath Vegetation Class with “rock” in the PCT name. This produced one PCT: 1825. This PCT is a close match for Zone 1, containing several diagnostic species (*Kunzea ambigua, Leucopogon microphyllus, Banksia ericifolia, Darwinia fascicularis, Epacris microphylla, Lepyrodia scariosa, Empodisma minus*) and a correct landscape position (rock platforms).

Zone 2:

The identification of the most suitable PCT was based upon filtering for PCTs within the Pittwater IBRA sub-region and Warringah LGA, with *Banksia ericifolia, Allocasuarina distyla* and *Leptospermum squarrosum* in the mid strata, and *Lepyrodia scariosa* in the groundlayer. This produced two PCTs: 1822 and 1824. Both PCTs are potentially representative. PCT 1824 is a better match due to the presence of emergent Eucalypts such as *E. haemastoma*, and *Cyathochaeta diandra* in the groundlayer. The landscape position (wetter zones of the sandstone plateau) and elevation (50–250 m ASL) of PCT 1824 are correct for Zone 2.

Zone 3:

The identification of the most suitable PCT was based upon filtering for PCTs within the Pittwater IBRA sub-region with *Eucalyptus haemastoma* and *Corymbia gummifera* in the upper strata, *Leptospermum trinervium* and *Banksia ericifolia* in the mid strata, and *Entolasia stricta* and *Cyathochaeta diandra* in the ground layer. This produced a shortlist of three PCTs: 1083, 1782 and 1783. PCT 1783 can be excluded as it is restricted to elevations above 200 m ASL (the site is 90–131 m ASL). PCT 1782 is common to landscapes with subtle shale influence, which was not observed within Zone 3. PCT 1083 is the best match for the Zone 3 vegetation as the landscape position, on crests, ridges and exposed slopes on coastal sandstone plateaux, describes Zone 3, and many diagnostic species for PCT 1083 were present (Table 3.2).

Zone 4:

The identification of the most suitable PCT was based upon filtering for PCTs with *Leptospermum squarrosum* and *Banksia ericifolia* in the mid strata, and *Empodisma minus* and *Lepyrodia scariosa* in the ground layer. This produced a shortlist of one PCT: 1803. This PCT is a close match for the vegetation within Zone 4, with several further diagnostic species present, such as *Hakea teretifolia, Baeckea imbricata, Epacris obtusifolia, Actinotus minor* and *Selaginella uliginosa.* The landscape position is correct for this PCT: impeded soils in seepage zones associated with the elevated sandstone plateau of the Sydney Basin Bioregion.

Table 3-3 – PCTs

PCT code	PCT name	Species relied upon	Vegetation formation	Vegetation class	Landscape position	Occurs in Pittwater IBRA subregion?	% Cleared	Area within development site (ha)	TEC status
1083	Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion	*Eucalyptus haemastoma, Corymbia gummifera Angophora costata, Eucalyptus sieberi, Eucalyptus oblonga, Leptospermum trinervium Banksia ericifolia, Entolasia stricta, Cyathochaeta diandra*	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	Crests, ridges and exposed slopes on coastal sandstone plateaux.	yes	17	1.28 on site, 0.1 to be impacted	not a TEC
1803	Banksia - Needlebush - Tea-tree damp heath swamps on coastal sandstone plateaus of the Sydney basin	*Leptospermum squarrosum, Banksia ericifolia, Empodisma minus, Lepyrodia scariosa, Hakea teretifolia, Baeckea imbricata, Epacris obtusifolia, Actinotus minor, Selaginella uliginosa*	Freshwater Wetlands	Coastal Heath Swamps	Impeded soils in creek headwaters and other seepage zones associated with the elevated sandstone plateau	yes	10	0.08 on site, none to be impacted	TEC: Coastal Upland Swamp in the Sydney Basin Bioregion
1824	Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin	*E. haemastoma, Banksia ericifolia, Allocasuarina distyla, Leptospermum squarrosum, Lepyrodia scariosa, Cyathochaeta diandra*	Heathlands	Sydney Coastal Heaths	Exposed skeletal soils along narrow ridges and exposed slopes	yes	10	1.31 on site, 0.25 to be impacted	not a TEC

PCT code	PCT name	Species relied upon	Vegetation formation	Vegetation class	Landscape position	Occurs in Pittwater IBRA subregion?	% Cleared	Area within development site (ha)	TEC status
1825	Coastal Sandstone Plateau Rock Plate Heath	*Kunzea ambigua, Leucopogon microphyllus, Banksia ericifolia, Darwinia fascicularis, Epacris microphylla, Lepyrodia scariosa, Empodisma minus*	Heathlands	Sydney Coastal Heaths	Rock platforms on sandstone ridgetops	yes	unknown	0.11 on site, 0.04 to be impacted	not a TEC

3.1.4 Vegetation descriptions of observed communities

The following vegetation communities were identified within the subject site through ground truthing.

- Zone 1 – PCT 1825 – Coastal Sandstone Plateau Rock Plate Heath (0.11 ha)
- Zone 2 – PCT 1824 – Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin (1.31 ha)
- Zone 3 – PCT 1083 – Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion (1.28 ha)
- Zone 4 – PCT1803 – Banksia - Needlebush - Tea-tree damp heath swamps on coastal sandstone plateaus of the Sydney basin (0.08 ha)

PCT 1825 – Coastal Sandstone Plateau Rock Plate Heath

This is the vegetation community covers 0.11 ha of the lot where it is restricted to the exposed rock platforms in the north-western corner.

Photo 1 – PCT 1825 – Coastal Sandstone Plateau Rock Plate Heath

Canopy – Occasional emergent *Eucalyptus punctata* and *E. obstans* provide up to 4% projected foliage cover (PFC).

Mid - storey – Common species include *Allocasuarina distyla, Angophora hispida, Banksia ericifolia, Bossiaea scolopendria, Phebalium squamulosum, Darwinia fascicularis, Hakea sericea, Kunzea ambigua, Epacris longiflora, Boronia ledifolia* and *Leptospermum arachnoides* providing a PFC of c. 10%.

Groundcovers – Lepidosperma concavum s. str., Actinotus minor, Platysace linearifolia, Cyathochaeta diandra, Trachymene incisa, Lepyrodia spp., *Xanthorrhoea minor* and *Empodisma minor* providing up to 5% PFC.

PCT 1824 – Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin

This vegetation occurs within the north-eastern and north-western portions of the lot, occupying an area of 1.31 ha.

Photo 2 – PCT 1824 – Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin

Canopy – Eucalyptus punctata, E. haemastoma, Angophora hispida and *E. sieberi* provide up to 50% PFC.

Mid-storey – Very dense in places. Common species include *Banksia ericifolia, Leptospermum trinervium, Allocasuarina distyla, Grevillea* spp., *Hakea teretifolia, Acacia suaveolens, Hibbertia linearis, Phebalium squamulosum, Kunzea ambigua* and *Darwinia fascicularis* providing a PFC of 60–80%.

Groundcovers – Common species include *Chordifex fastigiatus, Xanthosia pilosa, Schoenus ericetorum, Cyathochaeta diandra, Eurychorda complanata, Entolasia stricta, Anisopogon avenaceus, Dianella caerulea, Lepidosperma laterale, Lomandra glauca, Patersonia sericea, Imperata cylindrica,* and *Actinotus helianthus.*

Photo 3 – PCT 1824 – Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin to the south-east of the main rock platform

PCT 1083 – Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion

This vegetation occurs predominantly within the southern and central parts of the lot and occupies 1.28 ha.

Canopy – Common species are *E. haemastoma, Corymbia gummifera, Eucalyptus globoidea* and *E. punctata* providing 20–30% PFC.

Mid-storey – Includes *Banksia ericifolia, B. serrata, Acacia longifolia, Angophora hispida, Pittosporum undulatum, Hakea* spp.*, Leptospermum* spp.*, Kunzea ambigua*, *Allocasuarina distyla, Persoonia pinifolia* and *Elaeocarpus reticulatus* providing 75–82% PFC. Occasional exotic species are present but provide less than 1% PFC, and include *Lantana camara, Passiflora edulis* and *Ochna serrulata.*

Groundcovers – Dominated by a mixture of sedges, restiads, ferns and grasses providing 46–80% PFC. Common species are *Anisopogon avenaceus, Xanthorrhoea media, Entolasia stricta, Lepyrodia scariosa, Dampiera stricta, Pteridium esculentum, Empodisma minus, Gleichenia dicarpa, Gahnia sieberiana, Cyathochaeta diandra, Chordifex fastigiatus,* and *Lepidosperma latens*.

Photo 4 – PCT 1083 – Red Bloodwood - scribbly gum heathy woodland

PCT 1803 – Banksia - Needlebush - Tea-tree damp heath swamps on coastal sandstone plateaus of the Sydney basin

This vegetation occurs in the centre of the site and occupies 0.08 ha.

Canopy – Occasional emergent *E. haemastoma* at the margins of this Zone, providing up to 10% PFC.

Mid-storey – Includes *Leptospermum squarrosum, Banksia ericifolia, Hakea teretifolia, Baeckea imbricata, Epacris obtusifolia, Actinotus minor, Selaginella uliginosa Persoonia levis, Acacia suaveolens, Bossiaea scolopendria* and *Woollsia pungens* providing up to 90% PFC.

Groundcovers – Dominated by sedges and restiads including *Chordifex fastigiatus, Empodisma minus* and *Lepyrodia scariosa* which provide up to 80%. Other species include *Gleichenia dicarpa, Gleichenia rupestris, Actinotus minor, Selaginella uliginosa, Sporadanthus gracilis* and *Eurychorda complanata.*

Classification:

This vegetation is ecotonal and is likely to vary in composition depending on time since fire and fluctuations in soil saturation. PCT 1803 is a recognised as equivalent to Coastal Upland Swamp in the Sydney Basin Bioregion (CUS), which is listed as an endangered ecological community under the *BC Act* and *EPBC Act*. This vegetation on site and was previously mapped by *Ecological Australia* (2011) as PCT 1804, which is also equivalent to CUS. Within the PCT 1803, 19 species out of 32 recorded are listed in the final determinations for CUS.

The structure of CUS is generally more open than that observed, however this TEC also includes tall closed scrubs and closed heaths. Aerial imagery shows that a large portion of the study area, including Zone 4, was burnt between 2005 and 2006 and that the vegetation remained quite open for several years before reaching the high shrub density currently seen. It is likely that the vegetation structure fluctuates depending on fire regime from open sedgeland to closed heath and scrubland.

Photo 5 – PCT1803 – Banksia - Needlebush - Tea-tree damp heath swamp

Photo 6 – PCT1803 – Banksia - Needlebush - Tea-tree damp heath swamp understorey

3.2 Fauna results

Fauna species observed throughout the duration of fauna surveys are listed below.

Table 3-4 – Fauna observations for the study area

Common name	Scientific name	Method observed
Birds		**2018/19**
Australian Brush-turkey	*Alectura lathami*	Q
Australian Raven	*Corvus coronoides*	O W
Bar-shouldered Dove	*Geopelia humeralis*	O W
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O W
Brown Thornbill	*Acanthiza pusilla*	O W
Crested Pigeon	*Ocyphaps lophotes*	O W
Eastern Spinebill	*Acanthorhynchus tenuirostris*	O W
Eastern Whipbird	*Psophodes olivaceus*	O W
Eastern Yellow Robin	*Eopsaltria australis*	O W
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	W
Glossy Black-Cockatoo TS	*Calyptorhynchus lathami*	G
Golden Whistler	*Pachycephala pectoralis*	O W
Grey Butcherbird	*Cracticus torquatus*	W

Common name	Scientific name	Method observed
Grey Fantail	*Rhipidura albiscapa*	O W
Laughing Kookaburra	*Dacelo novaeguineae*	O W
Lewin's Honeyeater	*Meliphaga lewinii*	O W
Little Wattlebird	*Anthochaera chrysoptera*	O W
Masked Lapwing	*Vanellus miles*	W
New Holland Honeyeater	*Phylidonyris novaehollandiae*	O W
Noisy Miner	*Manorina melanocephala*	O W
Pied Currawong	*Strepera graculina*	W
Powerful Owl TS	*Ninox strenua*	W
Rainbow Lorikeet	*Trichoglossus haematodus*	O W
Red-browed Finch	*Neochmia temporalis*	O W
Red Wattlebird	*Anthochaera carunculata*	O W
Red-whiskered Bulbul *	*Pycnonotus jocosus*	W
Rock Dove *	*Columba livia*	W
Scarlet Honeyeater	*Myzomela sanguinolenta*	W
Silvereye	*Zosterops lateralis*	O W
Southern Boobook	*Ninox novaeseelandiae*	W
Spotted Pardalote	*Pardalotus punctatus*	W
Spotted Turtle-Dove *	*Streptopelia chinensis*	W
Striated Thornbill	*Acanthiza lineata*	O W
Sulphur Crested Cockatoo	*Cacatua galerita*	O W
Superb Fairy-wren	*Malurus cyaneus*	O W
Superb Lyrebird	*Menura novaehollandiae*	Q W
Variegated Fairy-wren	*Malurus lamberti*	O W
Welcome Swallow	*Hirundo neoxena*	O
White-browed Scrubwren	*Sericornis frontalis*	O W
White-cheeked Honeyeater	*Phylidonyris niger*	O W
Yellow-faced Honeyeater	*Caligavis chrysops*	O W
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	W
Mammals		
Black Rat *	*Rattus rattus*	O
Brown Antechinus	*Antechinus stuartii*	T Q
Bush Rat	*Rattus fuscipes*	T Q
Cat *	*Felis catus*	Q
Common Brushtail Possum	*Trichosurus vulpecula*	O Q H
Common Ringtail Possum	*Pseudocheirus peregrinus*	O
Large Bent-winged Bat TS	*Miniopterus orianae oceanensis*	U
Eastern Freetail-bat	*Mormopterus ridei*	U PR
Eastern Pygmy Possum TS	*Cercartetus nanus*	T E
European Red Fox *	*Vulpes vulpes*	Q
Gould's Wattled Bat	*Chalinolobus gouldii*	U
Grey-headed Flying-fox TS	*Pteropus poliocephalus*	W

Common name	Scientific name	Method observed
House Mouse *	*Mus musculus*	H
Long-nosed Bandicoot	*Perameles nasuta*	W
Short-beaked Echidna	*Tachyglossus aculeatus*	O
Sugar Glider	*Petaurus breviceps*	T
Swamp Wallaby	*Wallabia bicolor*	Q H
White-striped Mastiff-bat	*Austronomus australis*	U
Reptiles		
Blackish Blind Snake	*Ramphotyphops nigrecens*	O
Copper-tailed Skink	*Ctenotus taeniolatus*	O
Cream-striped Shining Skink	*Cryptoblepharus virgatus*	O
Diamond Python	*Morelia spilota*	O
Eastern Blue-tongue Skink	*Tiliqua scincoides*	Y
Eastern Water Skink	*Eulamprus quoyii*	O
Lace Monitor	*Varanus varius*	O
Rosenberg's Goanna TS	*Varanus rosenbergi*	O
Amphibians		
Common Eastern Froglet	*Crinia signifera*	W
Giant Burrowing Frog TS	*Heleioporus australiacus*	W
Red-crowned Toadlet TS	*Pseudophryne australis*	O W

Note: * indicates introduced species
TS indicates threatened species
MS indicates Migratory species

All species listed are identified to a high level of certainty unless otherwise noted as:

PR indicates species identified to a 'probable' level of certainty – more likely than not
PO indicates species identified to a 'possible' level of certainty – low-moderate level of confidence

E - Nest/roost	H - Hair/feathers/skin	P - Scat	W - Heard call
F - Tracks/scratchings	K - Dead	Q - Camera	X - In scat
FB - Burrow	O - Observed	T - Trapped/netted	Y - Bone/teeth/shell
G - Crushed cones	OW - Obs & heard call	U - Anabat/ultrasound	Z - In raptor/owl pellet

3.3 Habitat results

3.3.1 Fauna habitat observations

The fauna habitats present within the site are identified within the following table.

Table 3-5 – Observed fauna habitat

Topography				
Flat ✓	Gentle ✓	Moderate ✓	Steep ✓	Drop-offs ✓
Vegetation structure				
Closed Forest	Open Forest ✓	Woodland	Heath ✓	Grassland
Disturbance history				
Fire ✓	Under-scrubbing ✓ edges	Cut and fill works		
Tree clearing ✓	Grazing			
Soil landscape				
DEPTH:	Deep	Moderate	Shallow ✓	Skeletal ✓
TYPE:	Clay	Loam ✓	Sand ✓	Organic ✓
VALUE:	Surface foraging ✓	Sub-surface foraging ✓	Denning/burrowing ✓	
WATER RETENTION:	Well Drained ✓	Damp / Moist ✓	Water logged ✓	Swamp / Soak ✓
Rock habitat				
CAVES:	Large	Small ✓	Deep	Shallow ✓
CREVICES:	Large ✓	Small ✓	Deep ✓	Shallow ✓
ESCARPMENTS:	Winter / late sunny aspects		Shaded winter / late aspects ✓	
OUTCROPS:	High Surface Area Hides	Med. Surface Area Hides	Low Surface Area Hides ✓	
SCATTERED / ISOLATED:	High Surface Area Hides	Med. Surface Area Hides	Low Surface Area Hides	
Feed resources				
FLOWERING TREES:	Eucalypts ✓	Corymbias ✓	Melaleucas	
	Banksias ✓	Acacias ✓		
SEEDING TREES:	Allocasuarinas ✓	Conifers		
WINTER FLOWERING EUCALYPTS:	C. maculata	E. crebra	E. globoidea ✓	E. sideroxylon
	E. squamosa	E. grandis	E. multicaulis	E. scias
	E. robusta	E. tereticornis	E. agglomerata	E. siderophloia
FLOWERING PERIODS:	Autumn	Winter ✓	Spring ✓	Summer ✓
OTHER:	Mistletoe	Figs / Fruit	Sap / Manna ✓	Termites ✓
Foliage protection				
UPPER STRATA:	Dense	Moderate	Sparse ✓	
MID STRATA:	Dense ✓	Moderate ✓	Sparse	
PLANT / SHRUB LAYER:	Dense ✓	Moderate ✓	Sparse	
GROUNDCOVERS:	Dense	Moderate	Sparse ✓	
Hollows / logs				
TREE HOLLOWS:	Large	Medium	Small ✓	
TREE HOLLOW TYPES	Spouts / branch ✓	Trunk ✓	Broken Trunk ✓	Basal Cavities ✓	Stags ✓
GROUND HOLLOWS:	Large	Medium	Small	
Vegetation debris				
FALLEN TREES:	Large	Medium	Small ✓	
FALLEN BRANCHES:	Large	Medium	Small ✓	
LITTER:	Deep	Moderate ✓	Shallow ✓	

HUMUS:	Deep		Moderate ✓		Shallow ✓	
Drainage catchment						
WATER BODIES	Wetland(s)	Soak(s) ✓	Dam(s)	Drainage line(s) ✓	Creek(s)	River(s)
RATE OF FLOW:	Still ✓		Slow ✓		Rapid	
CONSISTENCY:	Permanent		Perennial		Ephemeral ✓	
RUNOFF SOURCE:	Urban / Industrial	Parkland		Grazing	Natural ✓	
RIPARIAN HABITAT:	High quality ✓	Moderate quality		Low quality	Poor quality	
Artificial habitat						
STRUCTURES:	Sheds		Infrastructure		Equipment	
SUB-SURFACE	Pipe / culvert(s)		Tunnel(s)		Shaft(s)	
FOREIGN MATERIALS:	Sheet ✓		Pile / refuse			

3.3.2 Habitat tree data

Hollow-bearing trees recorded within and immediately surrounding the subject site, above the escarpment drop off within Lot 808, are tabled below. Habitat tree locations are shown on Figure 3.1.

Table 3-6 – Habitat tree data

Tree no	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour (%)	Hollows & other habitat features recorded
HT1 (T74)	Scribbly Gum	*Eucalyptus haemastoma*	26	7	9	35	1x 0-5cm trunk (suitable for EPP), 1x 0-5cm broken trunk (suitable for EPP)
HT2	Scribbly Gum	*Eucalyptus haemastoma*	45	7	9	75	2x 0-5cm shallow trunk
HT3 (T82)	Scribbly Gum	*Eucalyptus haemastoma*	7,9,7,7	7	5	75	1x 0-5cm trunk
HT4	stag		5	2.5	0	0	1x 5-10cm shallow trunk
HT5 (T64)	Scribbly Gum	*Eucalyptus umbra*	26,24	11	8	80	1x 0-5cm trunk spout (EPP bedding material)
HT6 (T63)	Stringybark	*Eucalyptus umbra*	33,5,16,35	17	15	70	1x 0-5cm shallow trunk, 1x 0-5cm shallow branch spout
HT7 (T87)	Scribbly Gum	*Eucalyptus haemastoma*	26	14	7	75	1x 0-5cm shallow trunk (EPP bedding material)
HT8a (T48)	Scribbly Gum	*Eucalyptus haemastoma*	27,20	17	8	70	1x 0-5cm shallow trunk (sap stain/fills with water)
HT8 (T38)	Scribbly Gum	*Eucalyptus haemastoma*	24,28,16	17	12	80	1x 0-5cm trunk (suitable for EPP)
HT9 (T19)	stag		35,35	12	8	0	1x 0-5cm shallow trunk
HT10 (T23)	Scribbly Gum	*Eucalyptus racemosa*	15,23,6,6	7	8	80	1x 0-5cm shallow trunk
HT11 (T17)	stag		24	8	6	0	1x 5-10cm trunk (Antechinus bedding)
HT12 (T16)	Scribbly Gum	*Eucalyptus racemosa*	22	7	9	70	1x 0-5cm trunk (suitable for EPP), 1x 0-5cm shallow trunk

Tree no	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour (%)	Hollows & other habitat features recorded
HT13 (T14)		*Angophora hispida*	29	6	10	85	1x 0-5cm trunk (EPP bedding material)
HT14	Red Bloodwood	*Corymbia gummifera*	26,8	6	3	60	1x 0-5cm shallow trunk
HT15	Red Bloodwood	*Corymbia gummifera*	15,20	6	3	80	1x 0-5cm trunk (suitable for EPP)

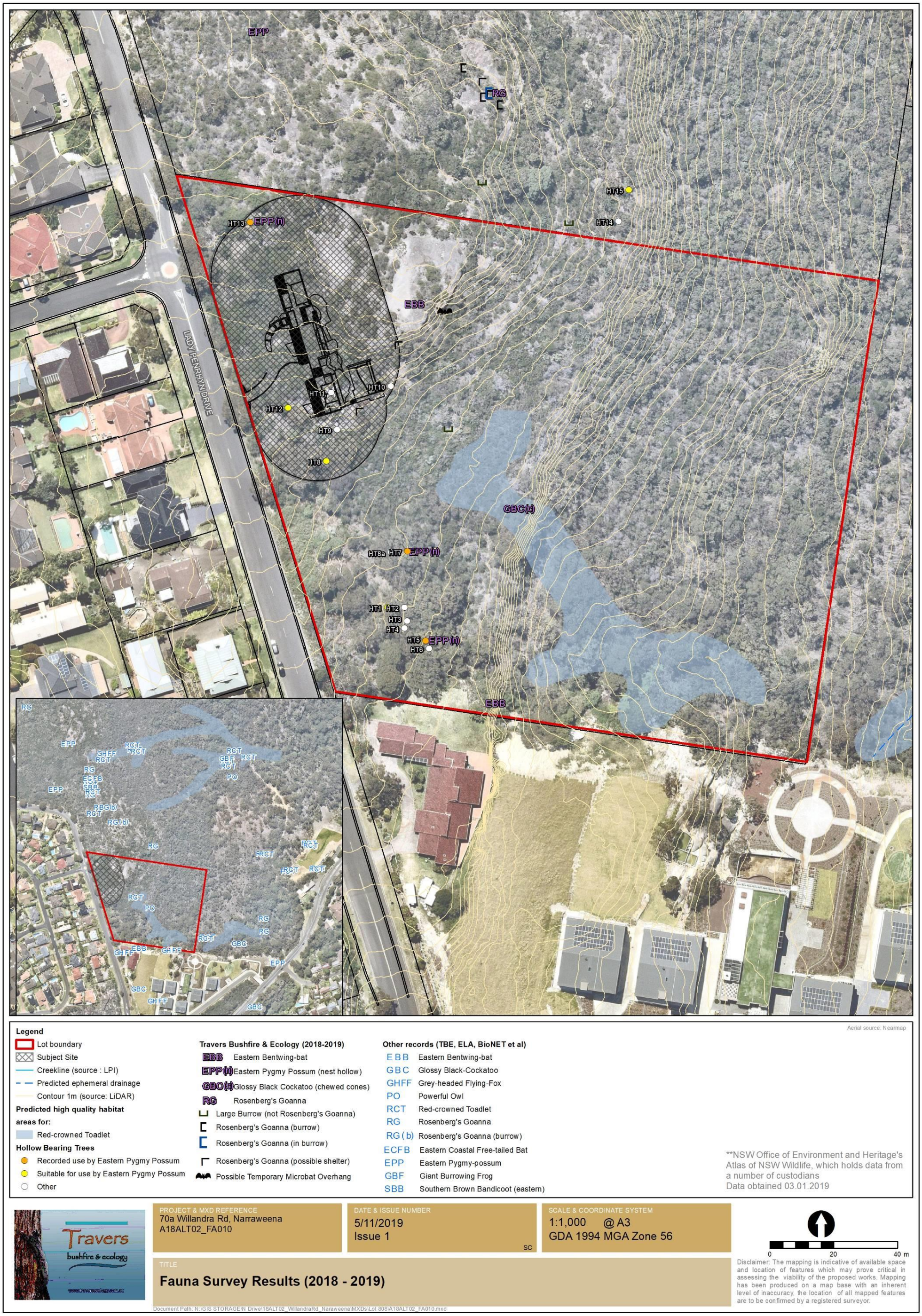


Figure 3-1 – Fauna survey results

4. BIODIVERSITY ASSESSMENT

4.1 BOS thresholds

The BOS includes two (2) elements to the threshold test – an area trigger and a Biodiversity Values Land Map trigger. If clearing exceeds either trigger, the Biodiversity Offset Scheme applies to the proposed clearing.

4.1.1 Biodiversity Values Land

The study area is not located on lands mapped as Biodiversity Values Land (refer to Figure 4.1) – therefore an offset is not required as an outcome of this threshold test.

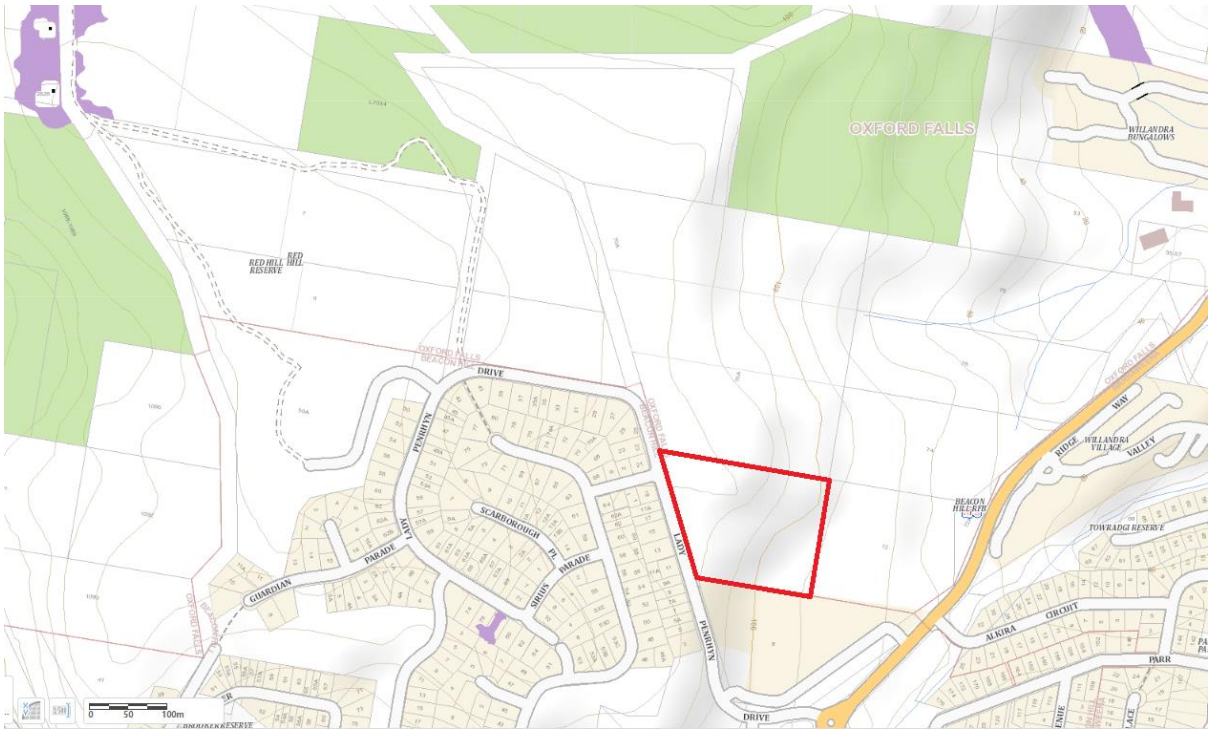


Figure 4-1– Biodiversity Values Land Map (purple) relative to the Lot 808 (yellow)

(source: https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BosetMap)

4.1.2 Area clearing threshold

The area threshold varies depending on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan (LEP)), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP).

The area threshold applies to all proposed native vegetation clearing associated with a development proposal – for example in the case of a subdivision; all future clearing across the lots subject to the subdivision, must be considered. Thresholds outlined under the BOS are outlined in the table below.

The Warringah LEP (2011) does not specify a minimum lot size for the site, therefore the BOS entry threshold report is based on the actual lot size of 2.83 ha. The clearing area threshold for which the BOS applies is 0.5 ha (Table 4.1). Based on the preliminary concept plans (Figure 1.2), *TBE* concludes that the proposed development will remove or modify 0.39 ha of native vegetation. As this is less thant he threshold of 0.5 ha, offsetting under BOS is not required.

Table 4-1 – BOS entry threshold report

Date of Calculation	15/12/2021 11:24 AM		**BDAR Required***
Total Digitised Area	1.04	ha	
Minimum Lot Size Method	Lot size		
Minimum Lot Size	2.83	ha	
Area Clearing Threshold	0.5	ha	
Area clearing trigger Area of native vegetation cleared	Unknown #		Unknown #
Biodiversity values map trigger Impact on biodiversity values map(not including values added within the last 90 days)?	no		no
Date of the 90 day Expiry	N/A		

The Development proposal does not exceed the nominated clearing thresholds therefore offsetting is not required as an outcome of this test.

4.2 Serious and Irreversible Impacts

An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community most at risk of extinction. Threatened species and communities that are potential for serious and irreversible impacts are outlined in Appendix 2 of *Guidance to assist a decision-maker to determine a serious and irreversible impact* (OEH 2017). The principles for determining serious and irreversible impacts are set out under Section 6.7.2 of the *Biodiversity Conservation Regulation 2017*.

Candidate species recorded or with potential to occur within the study area include:

Table 4-2 – Candidate SAII species

Species / EEC (Scientific name)	Species (Common name)	*BC Act*	Potential to occur
Miniopterus schreibersii subsp. oceanensis	Large Bent-winged Bat	E	recorded
Chalinolobus dwyeri	Large-eared pied-bat	V	potential
Miniopterus australis	Little bentwing-bat	E	potential
Lathamus discolor	Swift parrot	E	unlikely

The additional impact assessment provisions for threatened species are outlined under Section 10.2.3 of the BAM (2017) and have been applied to the recorded Large Bent-winged Bat within Appendix 3.

The ecological data profiles of each of the remaining above listed candidate species has been reviewed to determine any habitat constraints present for breeding and foraging. There is no presence of these constraints.

4.3 Previous surveys reviewed

The following regional vegetation mapping and reports were examined to identify the potential vegetation communities and other threatened biodiversity with potential to occur for assessment.

The Native Vegetation of the Sydney Metropolitan Area (*OEH 2016*) identified the vegetation as Coastal Sandstone Heath-Mallee equivalent to PCT 1824 Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin (Figure 1.10).

Current study area:

A Waterways Impact Statement, Lot 808 DP 752038, 70a Willandra Road Narraweena (*Woodlots and Wetlands Pty Ltd* July 2019)

This report was prepared for the same proposal as this BDAR. It states that there are minor creases and depressions in Lot 808 however these are not continuous and become indiscernible. They do not have defined beds or banks. They are therefore not considered to be 'waterways'. The nearest recognised watercourse is over 380 m away. Development means there will be minimal risk of impact to any waterway or wetland buffer.

Balise Eco Village Biobanking Assessment Report (*Eco Logical Australia (June 2011)*)

This report assessed the current study area (Lot 808) plus the four lots directly to the north. Red-crowned Toadlet (*Pseudophryne australis*) was recorded within Lot 808. This lot was also considered to provide high potential foraging and shelter habitat for Rosenberg's Goanna (*Varanus rosenbergi*). Three (3) individuals of *Tetratheca glandulosa* were recoded within Lot 809.

Nearby locality:

Biodiversity Constraints Assessment, Lots 7034 & 7035 DP 93795, Lots 908-918 DP 752038 and Lots 4-6 DP 789407 off Lady Penrhyn Drive, Beacon Hill (*Travers bushfire & ecology* 2018).

Seven (7) threatened fauna species including Rosenberg's Goanna (*Varanus rosenbergi*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Turquoise Parrot (*Neophema pulchella*), Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Eastern Pygmy Possum (*Cercartetus nanus*), and Large Bent-winged Bat (*Miniopterus orianae oceanensis*), two (2) threatened flora species including *Pimelea curviflora* var. *curviflora* and *Tetratheca glandulosa*, and two (2) EECs, Coastal Upland Swamp and Duffys Forest were recorded within the study area. This report notes that there are previous recordings of *Persoonia hirsuta* within these lots but none were observed during survey.

Flora & Fauna Assessment, Lot 807 DP 752038 72 Willandra Road, Narraweena (*Travers bushfire & ecology* 2016)

Five (5) threatened fauna species, Red-crowned Toadlet (*Pseudophryne australis*), Powerful Owl (*Ninox strenua*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis*), were recorded within Lot 807. Extensive target survey for Eastern Pygmy Possum utilising surveillance cameras, hair tubes and nesting tubes all in a trapping grid at a density of 10 cameras / ha throughout the study area did not record any presence. No threatened flora species were observed.

Ecological Assessment and Species Impact Statement, Lot 806 DP 752038 Willandra Road, Beacon Hill (*Travers bushfire & ecology* 2009)

Three (3) specimens of *Pimelea curviflora* var. *curviflora* were located near the centre of Lot 806. Three (3) threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*), Glossy Black-Cockatoo (*Calyptorhychus lathami*) and Large Bent-winged Bat (*Miniopterus schreibersii oceansis*) were recorded within the subject site. A feather and small degree of whitewash found to the north of the subject site indicated use by Powerful Owl (*Ninox strenua*) in this area for roosting.

The vegetation communities present were not considered to be representative of any endangered ecological communities.

Species Impact Statement - Lot 806 752038, 70 Willandra Road, Beacon Hill (*Anderson Ecological Surveys* 2002)

This SIS followed a preliminary flora and fauna assessment by *Anderson Ecological Surveys* (April 2000).

- The SIS recorded one specimen of *Epacris purpurascens* var. *purpurascens* to the north of Lot 806 nearer the Beacon Hill Rural Fire Station.

- Rosenberg's Goanna was also detected to the north of Lot 806 nearer the Beacon Hill Rural Fire Station.

Ecological Assessment – Proposed Retirement Village Development at Beacon Hill (*Eco Logical Australia* 2009)

This assessment was conducted on lands to the immediate north of the subject site. The results found the following:

- A total of 46 fauna species were recorded during the surveys of the study area, including 45 native and one introduced species, 3 threatened species listed under the *TSC Act*, Red-crowned Toadlet (*Pseudophryne australis*), Rosenberg's Goanna (*Varanus rosenbergi)*, and Large Bent-winged Bat (*Miniopterus schreibersii oceanensis*), and one species Peaceful Dove (*Geopelia placida*) regarded as regionally significant in the Warringah area. Additional threatened species, such as the threatened Giant Burrowing Frog (*Heleioporus australiacus*), Glossy Black Cockatoo (*Calyptorhynchus lathami*), Powerful Owl (*Ninox strenua*), and Southern Brown Bandicoot *(Isoodon obesulus obesulus*) that have been recorded in the study area may utilise habitat features in the study site based on the habitat noted on site; however, only signs of Glossy Black-Cockatoo were detected (chewed Allocasuarina distyla cones), with no other visual or auditory confirmations made. Intensive survey effort was undertaken for the Southern Brown Bandicoot; however, no observations were made.

- A total of 152 flora species were recorded during field survey. No threatened species listed under the *TSC Act* or *EPBC Act* were recorded at the site during surveys. However, two species considered to be threatened in the Warringah area, *Lepyrodia muelleri* and *Gonocarpus salsoloides*, were recorded.

4.4 Flora

One (1) threatened flora species, *Tetratheca glandulosa*, was observed in the north of the study area outside of the subject site.

All species are listed in Table 3.1.

4.4.1 Local / Regional flora matters

Angophora crassifolia is a unique species geographically restricted to the Northern Beaches area of Sydney. The species was not targeted during the surveys, but two (2) individuals were noted in the northern portion of the study area. One (1) of these trees will be impacted by the proposed APZ.

Telopea speciosissima (Waratah) is a ROTAP species and occurs in sandstone communities. This species was not observed within the study area.

Lomandra brevis is a ROTAP groundcover with good populations recorded on sandstone in the Northern Beaches area, and also in the lower Blue Mountains. Suitable habitat exists for the species within the study area and one individual was observed within Quadrat 1.

The Warringah LEP and DCP do not list any species of local or regional significance.

4.4.2 State legislative flora matters

(a) Threatened flora species (NSW)

BC Act – A search of the *Atlas of NSW Wildlife* (DPIE 2019 / 2021) indicated a list of species that have been recorded within a 10 km radius of the study area. Those species are considered for suitable habitat and potential to occur in Table A1.1 (Appendix 1).

Based on the habitat assessment within Appendix 1, it is considered that the subject site provides varying levels of potential habitat for the following state listed threatened flora species:

Table 4-3 – State listed threatened flora species with suitable habitat present

Scientific name	*BC Act*	Potential to occur
Tetratheca glandulosa	V	recorded outside subject site
Persoonia hirsuta	E1	potential
Pimelea curviflora var. *curviflora*	V	potential
Callistemon linearifolius	V	low
Eucalyptus camfieldii	V	low
Genoplesium baueri	E1	low
Acacia bynoeana	E1	unlikely
Epacris purpurascens var. *purpurascens*	V	unlikely
Leptospermum deanei	V	unlikely

Note: Full habitat descriptions for these species are provided in Appendix 1.

One (1) state listed threatened flora species, *Tetratheca glandulosa*, was observed during surveys undertaken. This species is restricted the far north of Lot 808 and was not recorded within the subject site. A detailed test of significance has been applied to this species within Appendix 3 in accordance with Section 7.2 of the *BC Act*. The significance of impact test for threatened flora species has concluded a not significant impact.

(b) Endangered flora populations (NSW)

There are no endangered populations listed as occurring within the Northern Beaches or Warringah LGAs.

(c) Threatened ecological communities (NSW)

One (1) endangered ecological community (EEC), *Coastal Upland Swamp in the Sydney Basin Bioregion*, was observed within the study area in association with PCT 1803 - Needlebush - Tea-tree damp heath swamp. This EEC occurs outside the subject site to the south-east (Figure 2.2).

(d) Endangered wetland communities

A number of wetland communities have been listed as TECs under the NSW *BC Act*. TECs that are considered to be an endangered protected wetland are as follows:

- Artesian springs ecological community
- Castlereagh Swamp Woodland Community
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions
- Coastal Upland Swamp in the Sydney Basin bioregion
- Coolibah–Black Box woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands bioregions
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
- Kurri sand swamp woodland in the Sydney Basin Bioregion
- Lagunaria swamp forest on Lord Howe Island
- Maroota Sands swamp forest
- Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
- The shorebird community occurring on the relict tidal delta sands at Taren Point
- Upland wetlands of the drainage divide of the New England Tableland Bioregion
- Wingecarribee Swamp

Coastal Upland Swamp in the Sydney Basin bioregion (CUS) is an EWC and was observed within the study area.

- *Impact on the extent of wetland vegetation*

A 20 m conservation buffer is to be placed around the CUS within the study area. This buffer is to exclude all development and APZs. With the implementation of this buffer, the extent of CUS will not be reduced or directly impacted.

- *Impact on Acid Sulfate soils*

The Warringah LEP does not map any acid sulfate soils within the study site, or nearby (see: https://services.northernbeaches.nsw.gov.au/icongis/index.html).

- *Indirect impacts*

Indirect impacts may include potential sedimentation, nutrient pollution, dumping of rubbish and garden waste, accidental spillages post development, and weed incursions.

A biodiversity management plan (BMP) has been prepared that specifies the strategies and works required to manage this vegetation community within the study area and to limit and minimise indirect impacts on endangered wetland vegetation.

- *Impacts due to stormwater quality or quality*

An increase in the areas of sealed and partially sealed surfaces associated with this development on site may lead to increases in the volume, velocity and nutrient content of water runoff into this community. This may subsequently lead to increase rates of erosion, sedimentation and eutrophication, resulting in damage to swamp soils and native vegetation, creating substrates that are susceptible to weed invasion, and transporting weed propagules into the swamps from disturbed areas. The design of buildings, services and infrastructure should aim to avoid any changes in runoff into the CUS community. A BMP has been prepared for this site that accounts for the effect of these changes in runoff through sediment control. Water quality within the watercourse within the site is to be measured before, during and after development at regular intervals, as defined in the BMP, to ensure that ground and surface water quality is maintained

- *Impacts on groundwater*

The proposal is not expected to impact on groundwater.

- *Proposed mitigation measures*

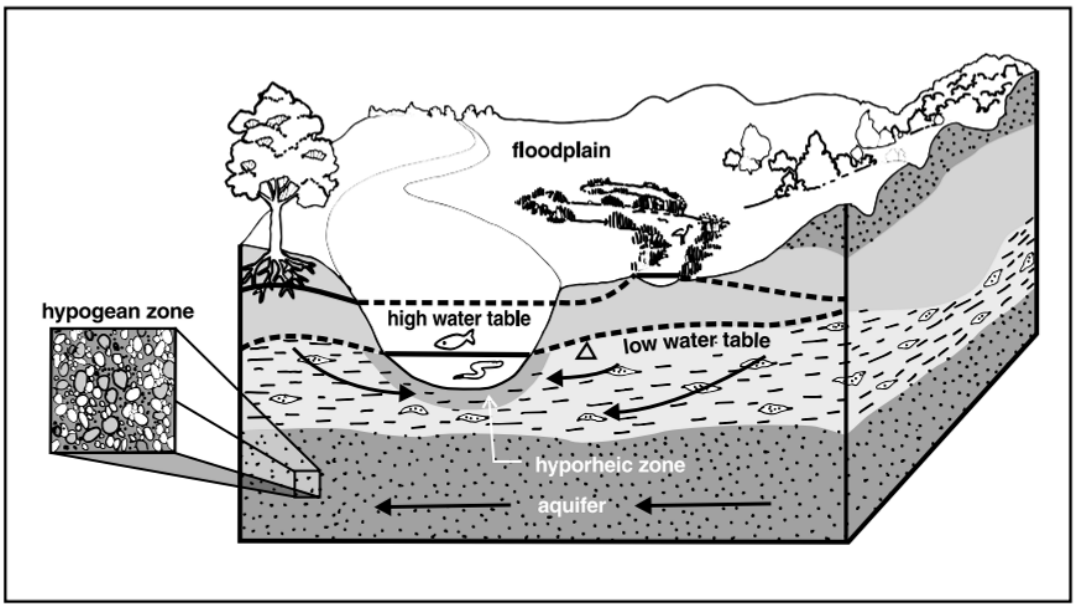
A BMP has been prepared that specifies the strategies and works required to manage this vegetation community within the study area.

In accordance with the *Water Management Act 2000*, endangered wetland communities are through the definition of ‘lakes’ potentially classed as waterfront land. Referral to NRAR may be required for determination under the *Water Management Act 2000* as a controlled activity. As well as protection, a buffer may be applied to these communities as specified by NRAR.

(e) Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater. Some examples of ecosystems which depend on groundwater are:

- wetlands;
- red gum forests, vegetation on coastal sand dunes and other terrestrial vegetation;
- ecosystems in streams fed by groundwater;
- limestone cave systems;
- springs; and
- hanging valleys and swamps.



Alluvial groundwater system discharging into a river

GDEs are therefore ecosystems which have their species composition and their natural ecological processes determined by groundwater (NSW State Groundwater Dependent Ecosystems Policy April 2002).

The CUS is a GDE as it is likely fed from a shallow groundwater aquifer within the sandstone. In addition, this vegetation community may be situated on a humic or peaty substrate which is also capable of holding large quantities of water.

The CUS vegetation will be wholly retained within the study area. The proposed development will provide a 20 m wide buffer around this vegetation community, in order to retain, improve and manage it. A BMP has been prepared that specifies the strategies and works required to manage this vegetation community within the study area.

Water quality targets are to be set based on the baseline quality of water from the CUS discharge at the associated rock drop off.

(f) Coastal wetlands

The Interactive Mapping Tool does not identify any coastal wetlands or proximity areas within the study area or nearby.

(g) State Environmental Planning Policy (Coastal Management) 2018

State Environmental Planning Policy (Coastal Management) 2018 updates and consolidates into one integrated policy SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5 of the Standard Instrument – Principal Local Environmental Plan. These policies are now repealed.

The Coastal Management SEPP gives effect to the objectives of the *CM Act* from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone.

An integrated and coordinated approach to land use planning is promoted by the new SEPP. It defines the four coastal management areas in the Act through detailed mapping and specifies assessment criteria that are tailored for each coastal management area. Councils and other consent authorities must apply these criteria when assessing proposals for development that fall within one or more of the mapped areas. The Coastal Management SEPP identifies development controls for consent authorities to apply to each coastal management area to achieve the objectives of the *CM Act*.

The Coastal Management SEPP establishes the approval pathway for coastal protection works.

4.4.3 Matters of national environmental significance - flora

(a) Threatened flora species (national)

A review of the schedules of the *EPBC Act* indicated the potential for a list of threatened flora species to occur within a 10 km radius of the site. These species have been considered for habitat presence and potential to occur within Appendix 1.1.

Based on the habitat assessment within Appendix 1.1, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened flora species:

Table 4-4 – Nationally listed threatened flora species with suitable habitat present

Scientific name	*EPBC Act*	Potential to occur
Persoonia hirsuta	E	potential
Pimelea curviflora var. curviflora	V	potential
Eucalyptus camfieldii	V	low
Genoplesium baueri	E	low
Acacia bynoeana	V	unlikely
Leptospermum deanei	V	unlikely

No nationally-listed threatened flora species were observed within the study area.

(b) Threatened ecological communities (national)

One (1) endangered ecological community (EEC), *Coastal Upland Swamp in the Sydney Basin Bioregion*, was observed within the study area in association with PCT 1803 - Needlebush - Tea-tree damp heath swamp. This EEC occurs outside the subject site to the south-east (Figure 2.2).

4.5 Fauna

All fauna species recorded during surveys, key fauna habitat observations and habitat tree data are provided in Section 3.

4.5.1 Key fauna habitat

Most notable habitat features for threatened fauna species considered with most potential to occur (see Sections 4.5.3 & 4.5.4) include:

- Small hollows (<10 cm) suitable for use by Eastern Pygmy Possum with some with recorded use.
- Seeding Allocasuarinas with recorded utilisation by Glossy Black-Cockatoo.
- Rock on rock habitat.
- Shallow caves and overhangs along the rocky escarpment, some with possible temporary roosting use by microbats.
- Ephemeral drainages and hanging swamp above the escarpment draining down to more perennial water holes below.
- Diverse seasonal flowering opportunities for nectivorous species including Eucalypts, Corymbias and Banksias.
- Winter flowering trees.
- High quality and expansive areas of low open forest and heath.
- Nearby north-eastern rocky plateau on sandy substrate of importance to winter burrowing by Rosenberg's Goanna. Subsequent nearby foraging habitat.

A complete assessment of the location of habitat trees and the size of hollows within each was undertaken as part of surveys above the escarpment edge within Lot 808. Table 3.7 provides hollow-bearing tree data. Figure 3.1 provides locations of all important fauna habitat within and close to the subject site, including habitat trees.

No large hollows suitable for threatened owls or cockatoos were recorded present within the habitat tree survey area. No small hollows recorded present are expected to be of importance to threatened parrots or hollow-dependent microbats, given none of these were recorded present.

Fourteen (14) hollows were recorded within Lot 808 above the escarpment drop off, which passes north-south through the centre of the lot. Three (3) of these showed recorded use by Eastern Pygmy Possum given fine bedding material placed at the base. Three (3) others are considered suitable for use by Eastern Pygmy Possum. Within the subject site, which includes the extent of the proposed APZ, one (1) hollow of recorded use and two (2) hollows of potential use occur.

The hollow of recorded use by Eastern Pygmy Possum within the subject site occurs at the outer northern extent of the APZ. This is the only hollow-bearing tree within the subject site that will be retained as identified by the Tree Assessment Report (TBE 2019). Eastern Pygmy Possum have demonstrated to take up artificially constructed housing for constructing their nests, as long as they provide the appropriate entry, internal chamber and thermal characteristics. Therefore, all hollows to be removed by the proposal may be prepared (or even improved) for reuse by the species in another part of the study area. Therefore, this process as well as construction of additional nesting boxes is recommended to compensate for the loss of hollows within the subject site habitat area.

A strict removal of hollows process is also recommended in Section 5.4 to prevent impacts on hollow-dependent fauna at the time of removal.

4.5.2 Local fauna matters

The Northern Beaches Council website provides a list of only threatened species known to the LGA. A list of otherwise rare or locally significant fauna species has not been compiled. Aside from the threatened species recorded, the remaining fauna species are not considered locally uncommon or of conservation significance.

4.5.3 State legislative fauna matters

(a) Threatened fauna species (NSW)

BC Act – A search of the *Atlas of NSW Wildlife* (DPIE, 2019 / 2021) provided a list of threatened fauna species previously recorded within a 10 km radius of the subject site. These species are listed in Table A1.2 (Appendix 1) and are considered for potential habitat within the subject site. Strictly estuarine and oceanic threatened species found within 10 km have not been included as no marine / aquatic habitats occur within the subject site.

Based on the habitat assessment within Appendix 1, it is considered that the subject site provides varying levels of potential habitat for the following state listed threatened fauna species:

Table 4-5 – State listed threatened fauna species with suitable habitat present

Common name	*BC Act*	Potential to occur
Giant Burrowing Frog	V	Recorded (in study area)
Red-crowned Toadlet	V	Recorded (in study area)
Rosenberg's Goanna	V	Recorded (in study area)
Glossy Black-Cockatoo	V	Recorded (in study area)
Powerful Owl	V	Recorded (in study area)
Eastern Pygmy Possum	V	Recorded (in subject site)
Grey-headed Flying-fox	V	Recorded (in study area)
Large Bent-winged Bat	V	Recorded (in study area)
Square-tailed Kite	V	potential
Little Lorikeet	V	potential
Barking Owl	V	potential
Varied Sittella	V	potential
East-coast Freetail Bat	V	potential
Large-eared Pied Bat	V	potential
Little Bentwing-bat	V	potential
Little Eagle	V	unlikely
Gang-gang Cockatoo	V	unlikely
Swift Parrot	E	unlikely
Dusky Woodswallow	V	unlikely

Common name	*BC Act*	Potential to occur
Scarlet Robin	V	unlikely
Spotted-tailed Quoll	V	unlikely
Southern Brown Bandicoot	E	unlikely
Yellow-bellied Sheathtail-bat	V	unlikely
Eastern Falsistrelle	V	unlikely
Greater Broad-nosed Bat	V	unlikely

Note: Full habitat descriptions for these species are provided in Appendix 1.

Eight (8) state listed threatened fauna species including Giant Burrowing Frog (*Helioporous astraliacus*), Red-crowned Toadlet (*Pseudophryne australis*), Rosenberg's Goanna (*Varanus rosenbergi*), Glossy Black-Cockatoo (*Calytorhynchus lathami*), Powerful Owl (*Ninox strenua*), Eastern Pygmy Possum (*Cercartetus nanus*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis*) were recorded within the study area during surveys.

A detailed significance of impact assessment has been applied to these species within Appendix 2 in accordance with Section 7.2 of the *BC Act.* The significance of impact test for threatened fauna species has concluded a not significant impact.

FM Act – No habitats suitable for threatened aquatic species were observed within the subject site and as such the provisions of this act do not require any further consideration.

(b) Endangered fauna populations (NSW)

There are three (3) endangered fauna populations known within 10 km of the study area. These include the Long-nosed Bandicoot population at North Head, the Koala in the Pittwater LGA and the Little Penguin in the Manly Point Area. The study area is not located within the recognised habitat areas for any of these populations.

(c) State Environmental Planning Policy (Koala Habitat Protection) 2021

State Environmental Planning Policy (Koala Habitat Protection) 2021 (Koala SEPP 2021) applies to land within LGAs listed under Schedule 1 of the Policy. As the study area falls under the Northern Beaches LGA, it is considered that Koala SEPP 2021 applies to this development proposal.

Land to which this policy applies in accordance with Clause 6 of the SEPP 2021 is as follows:

(1) This Policy applies to each local government area listed in Schedule 1.

(2) The whole of each local government area is—

(a) in the koala management area specified in Schedule 1 opposite the local government area, or

(b) if more than 1 koala management area is specified, in each of those koala management areas.

(3) Despite subclause (1), this Policy does not apply to—

(a) land dedicated or reserved under the National Parks and Wildlife Act 1974, or acquired under Part 11 of that Act, or

(b) land dedicated under the Forestry Act 2012 as a State forest or a flora reserve, or
(c) land on which biodiversity certification has been conferred, and is in force, under Part 8 of the Biodiversity Conservation Act 2016, or Land use zone Permitted land uses RU1 Primary Production Primary production, including agriculture and a diverse range of primary industry enterprises RU2 Rural Landscape Compatible rural land uses, including extensive agriculture RU3 Forestry Forestry land uses and other development compatible with forestry land uses
*(d) land in the following land use zones, or an equivalent land use zone, unless the zone is in a local government area marked with an * in Schedule 1—*
(i) Zone RU1 Primary Production,
(ii) Zone RU2 Rural Landscape,
(iii) Zone RU3 Forestry.

The land is listed in **Schedule 1 Northern Beaches* LGA and is zoned DM**, therefore SEPP 2021 applies. Please Note that SEPP 2020 applies in lands zoned as RU1, RU2 and RU3 in accordance with SEPP 2020.

There is currently no approved Koala Plan of Management (KPoM) for the LGA that this site is located in. Therefore, before council may grant consent to a development application for consent to carry out development on the land, the council must assess whether the development is likely to have any impact on Koalas or Koala habitat.

If the council is satisfied that the development is likely to have low or no impact on koalas or Koala habitat, the council may grant consent to the development application. If the council is satisfied that the development is likely to have a higher level of impact on Koalas or Koala habitat, the council must, in deciding whether to grant consent to the development application, take into account a koala assessment report for the development.

As of December 2021, the nearest Koala record to the study area was a rehabilitation record in 1967 approximately 1.6 km to the west of site which was released from Muogamarra Nature Reserve. The most recent record is from 2020 and occurs approximately 3.2km to the north on Mona Vale. Within a 10 km radius, Koala records are sporadic, with the highest concentration of records near Mona Vale to the north with the earliest record dating back to 1972.

Under Schedule 1 of Koala SEPP 2021, Northern Beaches LGA falls within the Central Coast Koala Management Area. Two (2) tree species were recorded in the study area which are considered to be Koala use tree species within this Management Area under Schedule 2 of Koala SEPP 2021. These species are Scribbly Gum (*Eucalyptus haemastoma*) and Grey Gum (*Eucalyptus punctata*). No Koalas were directly observed at the time of fauna survey, which included diurnal searches of trees and spotlighting. In addition, there was no secondary evidence of Koala habitation in the area including characteristic scratches on trees and scats beneath trees.

A search of the Atlas of NSW Wildlife (DPIE 2021) found forty-five (45) records of Koala habitation within a 10 km radius of the subject site. There are no nearby or recent Koala records within the connective woodland and open forest landscapes extending north from the study area that would suggest any potential presence of resident Koalas. Therefore, the study area is not likely to support CKH. As the land is not considered to comprise CKH a Koala Plan of Management is not considered to be required.

4.5.4 Matters of national environmental significance - fauna

(a) Threatened fauna species (National)

EPBC Act – A review of the schedules of the *EPBC Act* identified a list of threatened fauna species or species habitat likely to occur within a 10 km radius of the subject site.

Based on the habitat assessment within Appendix 1, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened fauna species:

Table 4-6 *– Nationally listed threatened fauna species with suitable habitat present*

Common name	*EPBC Act*	Potential to occur
Giant Burrowing Frog	V	recorded
Grey-headed Flying-fox	V	recorded
White-throated Needletail	V	potential
Large-eared Pied Bat	V	potential
Swift Parrot	E	unlikely
Spotted-tailed Quoll	E	unlikely
Southern Brown Bandicoot	E	unlikely
New Holland Mouse	V	unlikely

Two (2) nationally listed threatened fauna species, Giant Burrowing Frog (*Helioporous australiacus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*), were recorded within the study area during surveys undertaken. These are both state listed threatened fauna species and a detailed assessment under state legislation (*EP&A Act*) is undertaken within the state impact of significance test (Appendix 2).

Giant Burrowing Frog

Calls of Giant Burrowing Frog were recorded on a song-meter placed at suitable breeding habitat just outside of the north-eastern corner of the study area, where the species has been previously recorded. No suitable breeding habitat is present within or close to the subject site within the upper portions of Lot 808. The subject site drains to the south-east and is not likely to cause any indirect impacts on the recorded breeding location.

This species can disperse several hundred meters away from breeding locations to take up active burrowing, shelter and foraging habitat. Therefore, it must be considered that the subject site and immediate surrounds provides such potential habitat. There is a steep edge to the escarpment directly east of the subject site in which Giant Burrowing Frogs are not expected to make passage. It is unknown if the steep edge continues north bisecting the subject site and the recorded breeding area along a more direct path.

Provided that the proposal can demonstrate no indirect impacts of altered water quality and quantity on lower drainages then the proposal is not likely to cause a significant impact on this species.

Grey-headed Flying-fox

Grey-headed Flying-fox was recorded by calls on both song-meters deployed in the northern study area during mid-February to early March. This is likely to be from individuals foraging within the study area at this time, possibly on Red Bloodwood. Foraging is expected to occur within the site and vary on a seasonal basis. There is no likelihood of this species utilising the site for roosting and subsequent breeding habitat.

The Significant Impact Criteria for vulnerable species listed under the *EPBC Act* (Appendix 4) was reviewed to assess the impacts on these two species as a result of the proposed development within the subject site. As the subject site does not contain any likely breeding

habitat and foraging (and shelter & burrowing) habitat will remain well represented in the locality, it is concluded that there will not be any significant impact on these species, or other nationally listed threatened fauna species with potential to occur, as a result of the proposal.

(b) Protected migratory species (National)

The EPBC Act Protected Matters Report provides additionally listed terrestrial, wetland and marine migratory species of national significance likely to occur, or with habitat for these species likely to occur, within a 10 km radius of the subject site. The habitat potential of migratory species that have not been considered in the threatened species habitat assessment are considered in Table A1.3 (Appendix 1).

No nationally protected migratory bird species were recorded present during the surveys. The impact assessment for nationally protected migratory species with potential to occur has concluded a not significant impact.

4.6 Vegetation connectivity

The subject site is located at the southern edge of local connectivity which continues into extensive natural vegetation to the north (refer to Figure 4.3). Wakehurst Parkway cuts across this connectivity at approximately 3 km to the north providing a road barrier between the local connectivity and further extensive habitats of Garigal National Park.

Within Lot 808 the subject site (development footprint inclusive of APZ) has been located up against Lady Penrhyn Drive to prevent any fragmentation of habitats. There is a steep sandstone escarpment drop-off which runs north-south through the centre of Lot 808 (indicated by a black line on Figure 4.2). Whilst some arboreal connectivity exists between trees on either side of this edge, permitting movement by Eastern Pygmy Possum etc., it does provide a barrier to movement of the majority of terrestrial fauna. This steep edge tapers off to the north.

The subject site is located on the upper plateau side of the escarpment and is set back approximately 50 m from the edge which will permit terrestrial fauna to continue to access the southernmost portions of habitat on the plateau. Within this connectivity is the Coastal Upland Swamp community which may be utilised for breeding by Red-crowned Toadlet (only after very heavy rainfalls).

An area supporting Rosenberg's Goanna winter burrowing habitat is located nearby at just over 50 m to the north of the subject site (refer to Figure 3.1). Whilst the subject Lot 808 itself starts to slope its aspect more towards the south-east, making it less suitable for such core burrowing habitat, it does still likely contribute to immediate foraging habitat along the plateau close to these burrows. This foraging opportunity will continue also within the 50 m natural plateau habitat area.

Also retained within the upper plateau connective strip is a small overhang of potential temporary use by microbats. The location of the proposed development footprint will permit a setback of approximately 20 m from the hanging swamp as well as retention of all three recorded Eastern Pygmy Possum hollows containing bedding material. Therefore, the

placement of the subject site is in consideration to both connectivity and potentially important habitat features within.

Figure 4-2 – Local connectivity

5. CONCLUSION

Travers bushfire & ecology has been engaged to prepare a biodiversity development assessment for a proposed development at Lot 808 DP 752038, 70A Willandra Road, Narraweena.

Ecological survey and assessment have been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979*, the *Biodiversity Conservation Act 2016*, the commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the *Fisheries Management Act 1994*.

5.1 Legislative compliance

Ecological survey and assessment have been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979* (*EP&A Act*), the *Biodiversity Conservation Act 2016* (*BC Act*), the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) and the *Fisheries Management Act 1994* (*FM Act*).

In respect of matters required to be considered under the *EP&A Act* and relating to the species / provisions of the *BC Act,* eight (8) threatened fauna species, Red-crowned Toadlet (*Pseudophryne australis*), Rosenberg's Goanna (*Varanus rosenbergi*), Glossy Black-Cockatoo (*Calytorhynchus lathami*), Powerful Owl (*Ninox strenua*), Eastern Pygmy Possum (*Cercartetus nanus*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis*), one (1) threatened flora species, *Tetratheca glandulosa*, and one (1) threatened ecological community (TEC), Coastal Upland Swamp in the Sydney Basin Bioregion, were recorded within the **study area**.

Of the above recorded threatened fauna species, only the Eastern Pygmy Possum has been recorded within the **subject site** (direct impact area) by evidence of nesting material in a small hollow in the far northern reaches. This hollow will be retained within the outer APZ area and additional supplementary hollows will be placed in the remaining natural habitat areas. No threatened flora species or TECs occur within the subject site.

The state assessment of significance has concluded that the proposed development will not likely have a significant impact on any threatened species, populations or TECs. Therefore, a Species Impact Statement is not required for the proposal.

In respect of matters required to be considered under the *EPBC Act*, two (2) threatened fauna species including Giant Burrowing Frog (*Heleioporus australiacus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) were recorded within the study area but not within the subject site nor the rest of Lot 808. No protected migratory bird species, no threatened flora species were recorded within the subject site. One (1) threatened ecological community, Coastal Upland Swamp in the Sydney Basin Bioregion, listed under this Act was recorded within the subject site.

The proposed development was not considered to have a significant impact on matters of national environmental significance. As such a referral to DAWE is not required.

In respect of matters relative to the *FM Act*, no suitable habitat for threatened marine or aquatic species was observed within the subject site.

Offsetting under the Biodiversity Offsets Scheme (BOS) is not required for the development associated with the proposed dwelling as:

- The study area is not located on lands mapped as Biodiversity Values Land.
- The proposed clearing of vegetation (0.39 ha) is less than the area threshold of 0.5 ha.

The SAII assessments in Appendix 3 concluded that there will not be a significant impact upon the assessed species, Large Bent-winged Bat.

5.2 Potential ecological impacts

The direct, indirect and cumulative ecological impacts have been considered in respect to recorded biodiversity, threatening processes and extent of impact as a result of the proposed works:

The direct impacts of the proposal within the subject site are considered as:

- Removal or modification of 0.39 ha of non-TEC vegetation,
- Subsequent removal of threatened fauna species habitat,
- Removal of seasonal flowering resources providing foraging habitat for the recorded Eastern Pygmy Possum and Grey-headed Flying-fox (recorded by call over 150 m to the north of the subject site),
- Removal of seeding *Allocasuarina* spp. for the recorded Glossy Black-Cockatoo,
- Prey species habitat for recorded Powerful Owl, Giant Burrowing Frog, Rosenberg's Goanna, Eastern Pygmy Possum and Large Bent-winged Bat,
- Removal of hollows suitable for shelter and nesting by the recorded Eastern Pygmy Possum,
- Removal of foraging habitat close to winter burrowing areas for Rosenberg's Goanna,
- Removal of dead trees for perching use by some raptors and owls, and
- Removal of rocky habitat areas along a southern aspect hill side (less valuable for herpetofauna)

The potential indirect impacts of the proposal are considered as:

- Altered hydrology (specifically water quality and quantity) of the adjacent Coastal Upland Swamp which may support Red-crowned Toadlet breeding opportunity following high rainfall events,
- Removal of Red-crowned Toadlet foraging and shelter habitat close to breeding habitat (if used the Coastal Upland Swamp is in fact used for breeding),
- Reduced width of habitat passage above the steep escarpment edge,
- Increased potential presence of pets and subsequent impacts on native wildlife and especially Eastern Pygmy Possum,
- Edge effects such as weed incursions caused from soil disturbance, repeated clearing and landscaping species becoming a nuisance in the adjacent remnant bushland,

- Increased spill-over from noise, activity, scent and lighting effects into the adjacent natural habitat areas,
- Increased soil nutrients from changes to runoff that may provide further opportunities for weed plumes, and
- Concentrated stormwater runoff from solid surfaces and subsequent increased flows.

The potential cumulative impacts (combined results of past, current and future activities) of the proposal are considered as:

- Increased risk of weed invasion and fungal mobilisation or infections,
- Cumulative loss of native vegetation within the locality supporting the abovementioned important habitat for local threatened species,
- Cumulative loss of rock on rock habitat,
- Increased varied human presence and activity within the remaining native vegetation, and
- Edge effects from inappropriate use of remaining native vegetation areas such as additional clearing, dumping of materials, dumping of faecal, food or general waste and building refuse.

5.3 Avoid and minimise impacts

The following actions and designing of works have been undertaken to either avoid or minimise impacts on biodiversity values:

Avoid

- The location of the development and associated asset protection zone (APZ) has been located to avoid impacts on the Coastal Upland Swamp (CUS), *Tetratheca glandulosa* and Red-crowned Toadlet (RCT) habitat.
- The amount of impacts has been reduced through re-design of the dwelling and consequential APZs to ensure the impacts are below the 0.5 ha threshold.
- The final sighting of the dwelling typically avoids important potential breeding habitat for most species.

Minimise

- A 20 m buffer surrounding the CUS is to be established as a conservation zone. This buffer is to provide for the retention and protection of the CUS.
- Stormwater has been designed to continue to deliver surface and groundwater seepage into the wetland with the aim of not causing a significant change pre and post development.
- Drainage into the CUS is to be the same pre and post development and meet minimum baseline water quality standards for environmental sensitive habitats eg the hanging swamp and RCT habitat.
- Development has been located by taking advantage of the more disturbed vegetation in the north-west of the site.
- Preparation of a Biodiversity Management Plan (BMP) and specification of water quality targets to protect the CUS and RCT habitat.

- Relocating any ‘good quality’ habitat resources into the adjoining bushland.
- Minimise clearing particularly on steeped sloped areas.
- Undertake feral pest management including control of foxes, cats, pigs, goats, avian pests, horses and any other miscellaneous species as required.
- Minimise vegetation removal in APZs.
- Integrated weed management and control of high threat exotics.

5.4 Recommendations

The following recommendations are made to avoid, minimise or ameliorate the above potential ecological impacts, address threatening processes and to guide a more positive ecological outcome for threatened species and their associated habitats.

- A 20 m buffer surrounding the CUS is to be established as a protected zone along with adjoining native bushland not affected by the proposed building and asset protection zone. This buffer is to provide for the retention and protection of the CUS.

- The boundary of the asset protection zone will be fenced for the entire perimeter along its interface with the adjoining bushland. As Rosenberg Goanna is present, ‘ring lock’ style fencing will be required to restrict the access into habitat by household dogs. The APZ boundary is to be clearly marked out prior to vegetation clearance and allow installation of fencing as part of the landscaping works.

- After completion of vegetation clearance but prior to any cut and fill works the construction impact zone is to be fenced with 1.8 m high construction proof fence or fencing panels to ensure that areas outside of the construction zone are not damaged during the construction phase.

- A drainage and sediment swale is to be built prior to commencement of the cut and fill associated with the building as a primary sediment control measure. This swale is to be stabilised with open weave jute mesh and or turfed to entrap any fine sediments from being delivered to the CUS. This measure is tie be included into the approved sediment and erosion control plan and the stormwater treatment plan

- Landscaping within the property is to use a minimum of 50% locally occurring native plants and species commensurate with the existing vegetation on site increasing in density at the APZ and bushland interface. Native groundcovers are to be retained and slashed within the APZ where there is no cut and fill works. With exception to a drainage swale on the low side of surface runoff for water detention/infiltration, lawns are to be avoided on aspects draining to the CUS. This is because fertilisers used in maintenance may cause excess nutrients, weed incursion and degradation of Red Crowned Toadlet (RCT) habitat in the adjacent CUS community.

- All stormwater and surface water quality and quantity is to be effectively managed within the subject site such that pre and post development stormwater quality and quantity remain unchanged within the CUS community. The target quality is to be set by undertaking a baseline sample from the CUS.

- External lighting is to be directed downwards and away from any natural habitat areas by use of baffles to prevent lighting spill-over into retained threatened species natural habitat areas.

- The BMP is to address the following actions to mitigate impacts. The BMP aims to retain and protect the CUS community and RCT habitat on site.

  a) Targeted weed control is to be undertaken throughout the site and prioritised within the conservation zone.

  b) Construction activities should be intermittently supervised on-site and monitored by a project ecologist to ensure that the recommendations of this report are implemented.

  c) All staff involved with the development shall undergo an induction and training program to reinforce the ecological and environmental objectives of the development

  d) Baseline environmental water quality samples (minimum of three samples) is to be undertaken by sampling from the CUS drainage as a reference target, water quality sampling is to be undertaken before, during and after development to ensure that groundwater seepage and surface water quality is maintained and to avoid eutrophication of the CUS on site. The BMP is to incorporate periodic water quality sampling for set periods post development. Parameters to measure include:

     (i) pH
     (ii) EC
     (iii) DO
     (iv) Temperature
     (v) nutrients NO2, NO3, NH3, NH4, PO4, TKN and TP
     (vi) turbidity
     (vii)hardness
     (viii) salinity

  e) Erosion control measures are to be in place to reduce temporary erosion and sedimentation risks to adjacent vegetation.

  f) Hollow-bearing trees will be directly or indirectly impacted by the proposal. One of these (HT13) has recorded use by Eastern Pygmy Possum and two others (HT8 & HT12) are considered suitable for use by this species. The felling of hollow-bearing trees is to be conducted under the supervision of a fauna ecologist to ensure appropriate animal welfare procedures are taken, particularly if threatened species are present. Hollows of high quality or with fauna recorded residing within should be carefully dismantled and prepared for relocation into an appropriate retained tree within the site. All hollows removed should be inspected for occupation, signs of previous activity and potential for reuse. All hollow sections considered suitable for Eastern Pygmy Possum should where possible be recovered and prepared for placement into an appropriate retained tree.

  g) Any hollow section that is not able to be relocated will be compensated by the placement of ten (10) nest boxes placed throughout the conserved habitat areas as guided by the project ecologist. These are to target the Eastern Pygmy Possum but also Powerful Owl prey species Common Ringtail Possum and

Sugar Glider. Constructed nest boxes are to be constructed wholly of weatherproof timber (marine ply), fasteners and two coats of external paint and then appropriately affixed to a recipient tree.

h) The relocated hollow section and nest boxes should be well secured in the recipient tree in a manner that will not compromise the current or future health of that tree.

i) Similarly with hollows, rocky shelter habitat and quality terrestrial shelter logs are to be relocated from development areas into conserved habitat. This is to be done under the supervision of a fauna ecologist to ensure best habitat outcomes, such as high surface area rock on rock shelter outcomes.

j) If any fauna species, a nest or roost is located during development works, then works should cease until safe relocation can be advised by a contract fauna ecologist.

k) Pest species management is to be undertaken based on the recording of cat, fox and Black Rats during surveys.

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APPENDIX 1. THREATEND SPECIES HABITAT ASSESSMENT

Table A1.1 provides an assessment of potential habitat within the subject site for state and nationally listed threatened flora species recorded within 10 km on the Atlas of NSW Wildlife (DPIE) or indicated to have potential habitat present within 10 km on the *EPBC Act* Protected Matters Tool.

Table A 1-1 – Threatened flora habitat assessment

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) Refer to Appendix 2**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Acacia bynoeana DPIE EPBC	E1	V	Erect or spreading shrub to 0.3m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides. *Distribution limits N-Newcastle S-Berrima.*	x	✓	5 km W	2008	unlikely	✓
Acacia pubescens EPBC	V	V	Spreading shrub 1-4m high open sclerophyll growing in open forest and woodlands on clay soils. *Distribution limits N-Bilpin S-Georges River.*	x	x	-	-	x	x
Acacia terminalis subsp. *terminalis* DPIE EPBC	E1	E	Erect shrub to 2m tall, flowers from March to July. Occurs in eucalypt woodland or forest, usually in sandy soil on creek banks, hillslopes or in shallow soil in rock crevices and sandstone platforms on cliffs. *Typically restricted to the Port Jackson and eastern suburbs of Sydney.*	x	✓	4 km SE	2017	Considered to be just outside of known range	x
Allocasuarina glareicola EPBC	E1	E	Small shrub 1-2m high growing in open sclerophyll forest on lateritic soils derived from tertiary alluviums. *Distribution limits Castlereagh NR region.*	x	x	-	-	x	x
Allocasuarina portuensis DPIE	E1	E	A shrub of 3-5m tall, similar to other *Casuarinaceae* species. Grows in tall shrubland on sandstone headland at Nielsen Park, Vaucluse.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) Refer to Appendix 2**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Asterolasia buxifolia DPIE	E1	-	A spindly shrub with hairy stems to 2 m tall. *Known from a single site associated with granite geology in the riparian zone of the Lett River.*	x	x	-	-	x	x
Asterolasia elegans DPIE EPBC	E1	E	Erect shrub 1-3m high growing in moist sclerophyll forests on Hawkesbury sandstone slopes hillsides. *Distribution limits Maroota region.*	x	x	-	-	x	x
Caladenia tessellata DPIE EPBC	E1	V	Terrestrial orchid. Clay-loam or sandy soils. LHCCREMS guidelines suggest the species grows in Map Unit 34 – Coastal Sand Wallum Woodland - Heath. Flowers in September – November. *Distribution limits N-Swansea S-south of Eden.*	x	x	-	-	x	x
Callistemon linearifolius DPIE	V	-	Shrub to 4m high. Dry sclerophyll forest on coast and adjacent ranges. *Distribution limits N-Nelson Bay S-Georges River.*	x	✓	2 km SW	2010	low	✓
Camarophyllopsis kearneyi DPIE	E1	-	Small gilled fungus. *Known only from Lane Cove Bushland Park in Sydney.*	x	x	-	-	x	x
Chamaesyce psammogeton DPIE	E1	-	Prostrate herb. Coastal dunes. *Distribution limits N-Tweed Heads S-Jervis Bay.*	x	x	-	-	x	x
Cryptostylis hunteriana EPBC	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. *Distribution limits N-Gibraltar Range S-south of Eden.*	x	x	-	-	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) Refer to Appendix 2**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Cynanchum elegans EPBC	E1	E	Climber or twiner to 1m. Grows in rainforest gullies, scrub & scree slopes. *Distribution limits N-Gloucester S-Wollongong.*	x	x	-	-	x	x
Darwinia biflora DPIE EPBC	V	V	Erect or spreading shrub to 0.8m high. Grows in heath or understorey of woodland on or near shale-capped ridges underlain by Hawkesbury sandstone. *Distribution limits N-Gosford S-Cheltenham.*	x	x	-	-	x	x
Deyeuxia appressa DPIE EPBC	E1	E	Erect grass to 0.9m high. Grows on wet ground. *Distribution limits N-Hornsby S-Bankstown.*	x	x	-	-	x	x
Diuris bracteata DPIE	E1	Ext.	An orchid that grows in dry sclerophyll woodland. Was thought to be extinct until approximately 10yrs ago. *Found in the Sydney Basin Bioregion.* Flowers in September.	x	x	-	-	x	x
Epacris purpurascens var. *purpurascens* DPIE	V	-	Erect shrub to 1.5m high growing in sclerophyll forest and scrub and near creeks and swamps on sandstone. *Distribution limits N-Gosford S-Blue Mountains.*	x	marginal	2.5 km NE	2018	unlikely	✓
Eucalyptus camfieldii DPIE EPBC	V	V	Stringybark to 10m high. Grows on coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone. *Distribution limits N-Norah Head S-Royal NP.*	x	✓	2 km N	2019	low	✓

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) Refer to Appendix 2**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Eucalyptus nicholii DPIE	V	-	This species is widely planted as an urban street tree and in gardens but is quite rare in the wild. *It is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property.*	x	x	-	-	x	x
Eucalyptus scoparia DPIE	E1	V	Smooth-barked tree only known from vicinity of Bald Rock.	x	x	-	-	x	x
Genoplesium baueri DPIE EPBC	E1	E	A terrestrial orchid that grows in sparse sclerophyll forest and moss gardens over sandstone. Flowers Feb–Mar. *Distribution limits N – Hunter Valley S – Nowra.*	x	✓	2 km N	2017	low	✓
Grammitis stenophylla DPIE	E1	-	A small lithophytic fern with fronds generally <5cm. *Occurs in rainforest and wet sclerophyll forest in the coastal divisions of NSW.* Usually grown on rocks.	x	x	-	-	x	x
Grevillea caleyi DPIE EPBC	E1	E	Shrub mostly 1-3m high. Grows in laterite. *Distribution limits Terrey Hills-Belrose area.*	x	x	-	-	x	x
Grevillea shiressii EPBC	V	V	Shrub 2-5m high. Flowers mainly spring. Grows along creek banks in wet sclerophyll forest. Sandy soil on Hawkesbury Sandstone. *Restricted to the Gosford area. CC.*	x	x	-	-	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) Refer to Appendix 2**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Haloragodendron lucasii DPIE EPBC	E1	E	Straggling shrub to 1.5m high. Grows in open forest on sheltered slopes near creeks. *Distribution limits Ku-ring-gai Plateau and Mt Wilson.*	x	x	-	-	x	x
Hibbertia puberula DPIE	E1	-	Shrublets with branches up to 30cm long. It favours dry sclerophyll woodland or low heath on sandy soils or rarely in clay, with or without rocks underneath. *It extends from Wollemi National Park south to Morton National Park and the south coast near Nowra. Early records are from Hawkesbury River area in Sydney and the Blue Mountains.*	x	✓	1 record 4 km W	1946	not likely	x
Hibbertia superans DPIE	E1	-	Small spreading shrub to 0.3m high. Grows on sandstone, usually in or near SSTF. *Distribution limits N-Glenorie S-Kellyville disjunct Mt Boss.*	x	x	-	-	x	x
Hygrocybe austropratensis DPIE	E1	-	Small gilled fungus known only from Lane Cove Bushland Park.	x	x	-	-	x	x
Hygrocybe anomala var. *inanthinomarginata* DPIE	V	-	Small gilled fungus known only from Lane Cove Bushland Park, Blue Mountains National Park and Royal National Park.	x	x	-	-	x	x
Hygrocybe aurantipes DPIE	V	-	Small gilled fungus known only from Lane Cove Bushland Park and Blue Mountains National Park.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) Refer to Appendix 2**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Hygrocybe collucera DPIE	E1	-	Small gilled fungus known only from Lane Cove Bushland Park.	x	x	-	-	x	x
Hygrocybe griseoramosa DPIE	E1	-	Small gilled fungus known only from Lane Cove Bushland Park.	x	x	-	-	x	x
Hygrocybe lanecovensis DPIE	E1	-	Small gilled fungus known only from Lane Cove Bushland Park.	x	x	-	-	x	x
Hygrocybe reesiae DPIE	V	-	Small gilled fungus known only from Lane Cove Bushland Park and Blue Mountains National Park on moss covered banks under closed canopy.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) Refer to Appendix 2**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Hygrocybe rubronivea DPIE	V	-	Known in a few locations including in Lane Cove Bushland Park and the Blue Mountains in NSW and in areas of south-east Queensland. Little information exists for populations outside Lane Cove Bushland Park. Occurs in gallery warm temperate forests dominated by *Acmena smithii, Backhousia myrtifolia, Glochidion ferdinandi* and *Pittosporum undulatum*. *Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes.* Occur as individuals or in groups, terrestrial rarely on wood and only if extremely rotten; substrates include soil, humus, or moss. Does not produce above ground fruiting bodies (fungus) all year round. Fruiting bodies begin appearing mid-May to mid-July sometimes to August.	x	x	-	-	x	x
Kunzea rupestris DPIE EPBC	V	V	Shrub to 1.5m high. Grows in cracks and fissures on Hawkesbury Sandstone rock platforms. *Distribution limits N-Maroota S-Glenorie.*	x	✓	x	2007	x	x
Lasiopetalum joyceae DPIE	V	V	Erect shrub to 2m high. Grows in heath and open forest on Hawkesbury sandstone. *Distribution limits Hornsby Plateau.*	x	x	-	-	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) Refer to Appendix 2**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Leptospermum deanei DPIE EPBC	V	V	Shrub to 5m high. Grows on forested slopes. *Distribution limits near watershed of Lane Cove River.*	x	✓	6 km SW	2013	unlikely	✓
Melaleuca biconvexa DPIE EPBC	V	V	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. *Distribution limits N-Port Macquarie S-Jervis Bay.*	x	x	-	-	x	x
Melaleuca deanei DPIE	V	V	Shrub to 3m high. Grows in heath on sandstone. *Distribution limits N-Gosford S-Nowra.*	x	✓	x	2008	x	x
Microtis angusii DPIE EPBC	E1	E	Terrestrial orchid which is known from one population at Ingleside. Associated with the Duffy's Forest vegetation community. Flowers May-Oct.	x	x	-	-	x	x
Persicaria elatior EPBC	V	V	Herb to 90cm tall which grows in damp places especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. *Varied distribution from SE NSW to QLD.*	x	x	-	-	x	x
Persoonia hirsuta DPIE EPBC	E1	E	Erect to decumbent shrub. Grows in dry sclerophyll forest and woodland on Hawkesbury sandstone with infrequent fire histories. *Distribution limits N-Glen Davis S-Hill Top.*	x	✓	500 m NE	2007	✓	✓
Persoonia mollis subsp. *maxima* EPBC	E1	E	Erect to prostrate shrub. Grows in moist to wet sclerophyll forests on Hawkesbury sandstone. *Distribution limits N-Cowan S-Hornsby.*	x	x	-	-	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) Refer to Appendix 2**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Pimelea curviflora var. *curviflora* DPIE EPBC	V	V	Woody herb or sub-shrub to 0.2-1.2m high. Grows on Hawkesbury Sandstone near shale outcrops. *Distribution Sydney.*	x	✓	100 m S	2017	✓	✓
Pimelea spicata EPBC	E1	E	Decumbent or erect shrub to 0.5m high. Occurs principally in woodland on soils derived from Wianamatta Shales. *Distribution limits N-Lansdowne S-Shellharbour.*	x	x	-	-	x	x
Prasophyllum fuscum DPIE	CE	V	Terrestrial orchid up to 45cm tall. Flowers from Oct-Dec and *restricted in distribution to the Georges River and Wingecaribee Swamp near Burrawang at an altitude of 50-200m.*	x	x	-	-	x	x
Prostanthera densa DPIE	V	V	Erect shrub 0.5-2m. Grows in sclerophyll forest and shrubland. *Distribution limits N-Nelson Bay S-Beecroft Peninsula.*	x	x	-	-	x	x
Prostanthera junonis DPIE EPBC	E1	E	Small shrub. Grows in sclerophyll forest and heath in shallow soil on sandstone. *Distribution limits Somersby region.*	x	x	-	-	x	x
Prostanthera marifolia DPIE EPBC	CE	CE	Erect shrub to 0.3m high. Woodland dominated by Eucalyptus sieberi and Corymbia gummifera. In deeply weathered clay soil with ironstone nodules. *Has been recorded previously in the Sydney Harbour region.*	x	x	-	-	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) Refer to Appendix 2**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Rhodamnia rubescens DPIE	E4A	-	Shrub or small tree to 25 m high found in rainforest and riparian vegetation along the coast and up to 600m ASL. Flowers in late winter through to spring, with a peak in October, and fruits typically begin to appear in December in the Sydney region. Distribution limits N-Tweed Heads S-Batemans Bay.	x	x	-	-	x	x
Sarcochilus hartmannii DPIE	V	V	An orchid which grows on volcanic rocks, often in shallow soil in sclerophyll forest or exposed sites usually at an elevation above 500m. *Distribution – north from the Richmond River in the far north of NSW.*	x	x	-	-	x	x
Senecio spathulatus DPIE	E1	-	A low growing daisy that prefers primary dunes. *Known to occur at Cape Howe and between Kurnell north to Myall Lakes National Park. Also occurs in coastal locations in eastern Victoria.*	x	x	-	-	x	x
Syzygium paniculatum DPIE EPBC	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. *Distribution limits N-Forster S-Jervis Bay.*	x	x	-	-	x	x
Tetratheca glandulosa DPIE	V	-	Spreading shrub to 0.2m high. Sandy or rocky heath or scrub. *Distribution limits N-Mangrove Mountain S-Port Jackson.*	✓ (2018 - outside subject site)	-	-	-	-	✓
Tetratheca juncea DPIE	V	V	Prostrate shrub to 1m high. Dry sclerophyll forest and heath. *Distribution limits N-Bulahdelah S-Port Jackson.*	x	marginal	x	2008	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) Refer to Appendix 2**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Thesium australe DPIE EPBC	V	V	Erect herb to 0.4m high. Root parasite. Themeda grassland or woodland often damp. *Distribution limits N-Tweed Heads S-south of Eden.*	x	x	-	-	x	x
Triplarina imbricata DPIE	E1	E	A shrub to 2.8m tall, flowers from Nov-Dec. Occurs in heath, often in damp places along creek lines; coast and adjacent ranges. *Known from the Tabulum and Nymboida districts in NE NSW.*	x	x	-	-	x	x

DPIE	- Denotes species listed within 10 km of the subject site on the *Atlas of NSW Wildlife*
EPBC	- Denotes species listed within 10 km of the subject site in the *EPBC Act* habitat search
V	- Denotes vulnerable listed species under the relevant Act
E or E1	- Denotes endangered listed species under the relevant Act
E4a or CE	- Denotes critically endangered listed species under the relevant Act
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the *Atlas of NSW Wildlife* 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle

Table A1.2 provides an assessment of potential habitat within the subject site for state and nationally listed threatened fauna species recorded within 10 km on the *Atlas of NSW Wildlife* (DPIE) or indicated to have potential habitat present within 10 km on the *EPBC Act* Protected Matters Tool.

Table A 1-2 – Threatened fauna habitat assessment

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded in study area (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) (Refer to Appendix 2)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Giant Burrowing Frog *Heleioporus australiacus* DPIE EPBC	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. *Distribution limit: N-Near Singleton S-South of Eden.*	✓	-	-	-	-	✓
Stuttering Frog *Mixophyes balbus* EPBC	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. *Distribution limit: N-near Tenterfield S-South of Bombala*.	x	x	-	-	x	x
Red-crowned Toadlet *Pseudophryne australis* DPIE	V	-	Prefers sandstone areas, breeds in grass and debris beside non-perennial creeks or gutters. Individuals can also be found under logs and rocks in non-breeding periods. *Distribution limit: N-Pokolbin. S-near Wollongong.*	✓	-	-	-	-	✓

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded in study area (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) (Refer to Appendix 2)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Green and Golden Bell Frog *Litoria aurea* DPIE EPBC	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. *Distribution limit: N-Byron Bay S-South of Eden.*	x	x	-	-	x	x
Littlejohn's Tree Frog *Litoria littlejohnii* EPBC	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1,000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. *Distribution limit: N-Hunter River S-Eden.*	x	x	-	-	x	x
Rosenberg's Goanna *Varanus rosenbergi* DPIE	V	-	Hawkesbury sandstone outcrop specialist. Inhabits woodlands, dry open forests and heathland sheltering in burrows, hollow logs, rock crevices and outcrops. *Distribution limit: N-Nr Broke. S-Nowra Located in scattered patches near Sydney, Nowra and Goulburn.*	✓	-	-	-	-	✓
Broad-headed Snake *Hoplocephalus bungaroides* EPBC	E	V	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. *Distribution limit: N-Mudgee Park. S-Nowra.*	x	✓	x	x	Not likely	x

Common name *Scientific name* Database source	*BC Act*	*EPBC Act*	Preferred habitat *Distribution limit*	Recorded in study area (✓)	If not recorded on site				Considered in assessment of significance test (✓) (Refer to Appendix 2)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Magpie Goose *Anseranas semipalmata* DPIE	V	-	A strongly nomadic species found in tropical through to sub-tropical wetlands, flood plains, large swamps, dams and wet grasslands with dense growths of rushes and sedges. *Distribution limit: N-Tweed Heads. S-Mulwala.*	x	x	-	-	x	x
Wompoo Fruit-dove *Ptilinopus magnificus* DPIE	V	-	Inhabits large undisturbed patches of lowland and adjacent highland rainforest and moist eucalypt forests where it feeds on fruit. *Distribution limit: N-Tweed Heads. S-Sydney.*	x	x	-	-	x	x
Rose-crowned Fruit-dove *Ptilinopus regina* DPIE	V	-	Occurs in dense rainforests with a substantial understorey where it feeds entirely on fruit. *Distribution limit: N-Tweed Heads. S-Wollongong.*	x	x	-	-	x	x
Superb Fruit-dove *Ptilinopus superbus* DPIE	V	-	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits. *Distribution limit: N-Border Ranges National Park. S-Batemans Bay.*	x	x	-	-	x	x

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded in study area (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) (Refer to Appendix 2)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Australasian Bittern *Botaurus poiciloptilus* DPIE EPBC	E	E	Found in or over water of shallow freshwater or brackish wetlands with tall reedbeds, sedges, rushes, cumbungi, lignum and also in ricefields, drains in tussocky paddocks, occasionally saltmarsh, brackish wetlands. *Distribution limit: N-North of Lismore. S- Eden.*	x	x	-	-	x	x
Black Bittern *Ixobrychus flavicollis* DPIE	V	-	Found in shadowy, leafy waterside trees such as callistemons, casuarinas, paperbarks, eucalypts, mangroves and willows along tidal creeks, freshwater and brackish streams and ponds, sheltered mudflats and oyster slats. *Distribution limit: N-Tweed Heads. S-South of Eden.*	x	x	-	-	x	x
White-bellied Sea Eagle (*Haliaeetus leucogaster*) DPIE	V	-	Occupies coasts, islands, estuaries, inlets, large rivers, inland lakes and reservoirs. *Sedentary; dispersive. N-Tweed Heads. S-South of Eden.*	x	x	-	-	x	x
Little Eagle *Hieraaetus morphnoides* DPIE	V	-	Utilises plains, foothills, open forests, woodlands and scrublands; river red gums on watercourses and lakes. *Distribution limit - N-Tweed Heads. S-South of Eden.*	x	marginal	x	✓	unlikely	✓

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded in study area (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) (Refer to Appendix 2)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Square-tailed Kite *Lophoictinia isura* DPIE	V	-	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds. *Distribution limit: N-Goondiwindi. S-South of Eden.*	x	✓	✓	✓	✓	✓
Eastern Osprey *Pandion cristatus* DPIE	V	-	Utilises waterbodies including coastal waters, inlets, lakes, estuaries and offshore islands with a dead tree for perching and feeding. *Distribution limit: N-Tweed Heads. S-South of Eden.*	x	x	-	-	x	x
Bush Stone-curlew *Burhinus grallarius* DPIE	E	-	Utilises open forests and savannah woodlands, sometimes dune scrub, savannah and mangrove fringes. *Distribution limit: N-Border Ranges National Park. S-Near Nowra.*	x	x	-	-	x	x
Australian Painted Snipe *Rostratula australis* EPBC	E	E	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. *Distribution limit: N-Tweed Heads. S-South of Eden.*	x	x	-	-	x	x

Common name *Scientific name* Database source	*BC Act*	*EPBC Act*	Preferred habitat *Distribution limit*	Recorded in study area (✓)	If not recorded on site				Considered in assessment of significance test (✓) (Refer to Appendix 2)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Gang-gang Cockatoo *Callocephalon fimbriatum* DPIE	V	-	Prefers wetter forests and woodlands from sea level to > 2,000m on the Great Dividing Range, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. *Distribution limit: mid north coast of NSW to western Victoria.*	x	Sub-optimal	x	✓	unlikely	✓
Glossy Black-Cockatoo *Calyptorhynchus lathami* DPIE	V	-	Open forests with *Allocasuarina* species and hollows for nesting. *Distribution limit: N-Tweed Heads. S-South of Eden.*	✓	-	-	-	-	✓
Little Lorikeet *Glossopsitta pusilla* DPIE	V	-	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. *Distribution limit: N-Tweed Heads. S-South of Eden*.	x	Sub-optimal	✓	✓	✓	✓
Swift Parrot *Lathamus discolour* DPIE EPBC	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. *Distribution limit: N-Border Ranges National Park. S-South of Eden*.	x	Sub-optimal	✓	x	unlikely	✓

Common name *Scientific name* Database source	*BC Act*	*EPBC Act*	Preferred habitat *Distribution limit*	Recorded in study area (✓)	If not recorded on site				Considered in assessment of significance test (✓) (Refer to Appendix 2)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Turquoise Parrot *Neophema pulchella* DPIE	V	-	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands. *Distribution limit: N-Near Tenterfield. S-South of Eden.*	x	x	-	-	x	x
Barking Owl *Ninox connivens* DPIE	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. *Distribution limit: N-Border Ranges National Park. S-Eden.*	x	✓	✓	✓	✓	✓
Powerful Owl *Ninox strenua* DPIE	V	-	Forests containing mature trees for shelter or breeding and densely vegetated gullies for roosting. *Distribution limits: N-Border Ranges National Park. S-Eden.*	✓	-	-	-	-	✓
Masked Owl *Tyto novaehollandiae* DPIE	V	-	Open forest and woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. *Distribution limit: N-Border Ranges National Park. S-Eden.*	x	x	-	-	x	x
Sooty Owl *Tyto tenebricosa* DPIE	V	-	Tall, dense, wet forests containing trees with very large hollows. *Distribution limit: N-Border Ranges National Park. S-South of Eden.*	x	x	-	-	x	x

Common name *Scientific name* Database source	*BC Act*	*EPBC Act*	Preferred habitat *Distribution limit*	Recorded in study area (✓)	If not recorded on site				Considered in assessment of significance test (✓) (Refer to Appendix 2)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
White-throated Needletail *Hirundapus caudacutus* EPBC	-	V	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies often forage along favoured hilltops and timbered ranges. Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia. *Distribution limit: N-Tweed Heads. S-South of Eden.*	x	✓	✓	✓	✓	✓
Brown Treecreeper *Climacteris picumnus victoriae* DPIE	V	-	Occupies eucalypt woodlands, open woodland lacking a dense understorey with fallen dead timber. *Distribution limit: (Sub species victoriae) Central NSW west of Great Div. Cumberland Plains, Hunter Valley, Richmond, Clarence, and Snowy River Valleys.*	x	x	-	-	x	x
Eastern Bristlebird *Dasyornis brachypterus* EPBC	E	E	Coastal woodlands, dense scrubs and heathlands, especially where low heathland borders taller woodland or dense tall tea-tree. *Distribution limit: N-Tweed Heads. S-South of Eden.*	x	✓	x	x	Not likely	x
Regent Honeyeater *Xanthomyza Phrygia* DPIE EPBC	E4A	CE	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. *Distribution limit: N-Urbanville. S-Eden.*	x	Sub-optimal	x	x	Not likely	x

Common name *Scientific name* Database source	*BC Act*	*EPBC Act*	Preferred habitat *Distribution limit*	Recorded in study area (✓)	If not recorded on site				Considered in assessment of significance test (✓) (Refer to Appendix 2)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Painted Honeyeater *Grantiella picta* EPBC	V	V	A nomadic bird occurring in low densities within open forest, woodland and scrubland feeding on mistletoe fruits. Inhabits primarily Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. *Distribution limit: N-Boggabilla. S-Albury with greatest occurrences on the inland slopes of the Great Dividing Range.*	x	x	-	-	x	x
Black-chinned Honeyeater *Melithreptus gularis gularis* DPIE	V	-	Found in woodlands containing box-ironbark associations and River Red Gums, also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence. *Distribution limit: N-Cape York Pen. Qld. S-Victor H. Mt Lofty Ra & Flinders Ra. SA.*	x	x	-	-	x	x
Varied Sittella *Daphoenositta chrysoptera* DPIE	V	-	Open eucalypt woodlands / forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golf courses, shelterbelts, orchards, parks, scrubby gardens. *Distribution limit: N-Border Ranges National Park. S-South of Eden.*	x	✓	✓	x	✓	✓

Common name *Scientific name* Database source	*BC Act*	*EPBC Act*	Preferred habitat *Distribution limit*	Recorded in study area (✓)	If not recorded on site				Considered in assessment of significance test (✓) (Refer to Appendix 2)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Dusky Woodswallow *Artamus cyanopterus cyanopterus* DPIE	V	-	Found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. Prefers habitat with an open understorey. Often observed in farmland tree patches or roadside remnants. *Widespread in eastern, southern and south-western Australia.*	x	Sub-optimal	✓	x	unlikely	✓
Scarlet Robin *Petroica boodang* DPIE	V	-	Found in foothill forests, woodlands, watercourses; in autumn-winter, more open habitats: river red gum woodlands, golf courses, parks, orchards, gardens. *Distribution limit: N-Tweed Heads. S-South of Eden.*	x	Sub-optimal	✓	x	unlikely	✓
Diamond Firetail *Stagonopleura guttata* DPIE	V	-	Found in eucalypt woodlands, forests and mallee where there is grassy understorey west of the Great Div. also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence River Valleys. *Distribution limit: N-Rockhampton Q. S-Eyre Pen Kangaroo Is. SA.*	x	x	-	-	x	x

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded in study area (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) (Refer to Appendix 2)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Spotted-tailed Quoll *Dasyurus maculatus* DPIE EPBC	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. *Distribution limit: N-Mt Warning National Park. S-South of Eden.*	x	✓	x	✓	unlikely	✓
Southern Brown Bandicoot *Isoodon obesulus* DPIE EPBC	E	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. *Distribution limit: N-Kempsey. S-South of Eden.*	x	✓	✓	x	unlikely	✓
Koala *Phascolarctos cinereus* DPIE EPBC	V	V	Inhabits both wet and dry eucalypt forest on high nutrient soils containing preferred feed trees. *Distribution limit: N-Tweed Heads. S-South of Eden.*	x	Sub-optimal	x	x	Not likely	x
Eastern Pygmy Possum *Cercartetus nanus* DPIE	V	-	Found in a variety of habitats from rainforest through open forest to heath. Feeds on insects but also gathers pollen from banksias, eucalypts and bottlebrushes. Nests in banksias and myrtaceous shrubs. *Distribution limit: N-Tweed Heads. S-Eden.*	✓	-	-	-	-	✓

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded in study area (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) (Refer to Appendix 2)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Squirrel Glider *Petaurus norfolcensis* DPIE	V	-	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. *Distribution limit: N-Tweed Heads. S-Albury.*	x	Sub-optimal	x	x	Not likely	x
Greater Glider *Petauroides volans* EPBC	-	V	Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. Population density is optimal at elevation levels at 845 m above sea level. Prefer overstorey basal areas in old-growth tree stands. Highest abundance typically in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows *Distribution limit: N-Border Ranges National Park. S- South of Eden.*	x	Sub-optimal	x	x	Not likely	x
Parma Wallaby *Macropus parma* DPIE	V	-	Inhabits rainforests and wet and dry sclerophyll forests with a dense understorey and associated grassy patches. *Distribution limit: N-Border Ranges National Park. S-Morton National Park.*	x	x	-	-	x	x
Brush-tailed Rock-wallaby *Petrogale penicillata* EPBC	E	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. *Distribution limit: N-North of Tenterfield. S-Bombala.*	x	✓	x	x	Not likely	x

Common name *Scientific name* Database source	*BC Act*	*EPBC Act*	Preferred habitat *Distribution limit*	Recorded in study area (✓)	If not recorded on site				Considered in assessment of significance test (✓) (Refer to Appendix 2)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Grey-headed Flying-fox *Pteropus poliocephalus* DPIE EPBC	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. *Distribution limit: N-Tweed Heads. S-Eden.*	✓	-	-	-	-	✓
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris* DPIE	V	-	Rainforests, sclerophyll forests and woodlands. *Distribution limit: N-North of Walgett. S-Sydney.*	x	✓	x	✓	unlikely	✓
East-coast Freetail Bat *Micronomus norfolkensis* DPIE	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. *Distribution limit: N-Woodenbong. S-Pambula.*	x	Sub-optimal	✓	✓	✓	✓
Large-eared Pied Bat *Chalinolobus dwyeri* DPIE EPBC	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. *Distribution limit: N-Border Ranges National Park. S-Wollongong.*	x	✓	x	✓	✓	✓

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded in study area (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) (Refer to Appendix 2)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Eastern Falsistrelle *Falsistrellus tasmaniensis* DPIE	V	-	Recorded roosting in caves, old buildings and tree hollows. *Distribution limit: N-Border Ranges National Park. S-Pambula.*	x	✓	x	✓	unlikely	✓
Little Bentwing-bat *Miniopterus australis* DPIE	V	-	Roosts in caves, old buildings and structures in the higher rainfall forests along the south coast of Australia. *Distribution limit: N-Border Ranges National Park. S-Sydney.*	x	✓	✓	✓	✓	✓
Large Bent-winged Bat *Miniopterus orianae oceanensis* OEH	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains and well-timbered areas. *Distribution limit: N-Border Ranges National Park. S-South of Eden.*	✓	-	-	-	-	✓
Southern Myotis *Myotis macropus* DPIE	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. *Distribution limit: N-Border Ranges National Park. S-South of Eden.*	x	x	-	-	x	x

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded in study area (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) (Refer to Appendix 2)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Greater Broad-nosed Bat *Scoteanax rueppellii* DPIE	V	-	Inhabits areas containing moist river and creek systems, especially tree lined creeks. *Distribution limit: N-Border Ranges National Park. S-Pambula.*	x	✓	x	✓	unlikely	✓
Eastern Cave Bat *Vespadelus troughtoni* DPIE	V	-	Inhabits drier open forests and woodlands. Roosts in well-lit parts of caves and mineshafts. *Distribution limit: Along GDR from N-Tweed Heads. S-Kempsey.*	x	✓	x	x	Not likely	x
New Holland Mouse *Pseudomys novaehollandiae* DPIE EPBC	-	V	Occurs in heathlands, woodlands, open forest and paperbark swamps and on sandy, loamy or rocky soils. Coastal populations have a marked preference for sandy substrates, a heathy understorey of leguminous shrubs less than 1m high and sparse ground litter. Recolonise of regenerating burnt areas. *Distribution limit: N-Border Ranges National Park. S-South of Eden.*	x	✓	x	x	unlikely	N/A
Dural Land Snail *Pommerhelix duralensis* EPBC	E	E	Occurs on shale-sandstone transitional forest landscapes within the Blue Mountains, Penrith, The Hills, Wollondilly, Hornsby and Parramatta LGA's. Occurs in low abundance and shelters under rocks or inside curled-up bark, beneath leaves and light woody debris. *Distribution limit: St Albans to Mulgoa with most records from The Hills LGA.*	x	x	-	-	x	x

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded in study area (✓)**	**If not recorded on site**				**Considered in assessment of significance test (✓) (Refer to Appendix 2)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Macquarie Perch *Macquaria australasica* EPBC	V (*FM Act 1994*)	E	Occurs in south east Australia at moderate to high altitudes in rivers and reservoirs. Historical records show the species was widespread and abundant in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers and their tributaries. Allen (1989) states that introduced populations are present in Nepean River and water supply dams in the Sydney area. Occurs in lakes and flowing streams, usually in deep holes.	x	x	-	-	x	x
Australian Greyling *Prototroctes maraena* EPBC	Part 2, Section 19 – Protected Fish (*FM Act 1994*)	V	Clear, moderate to fast flowing water in the upper reaches of rivers (sometimes to altitudes above 1,000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (e.g. weirs, waterfalls).	x	x	-	-	x	x

DPIE	Denotes species listed within 10 km of the subject site on the *Atlas of NSW Wildlife*
EPBC	Denotes species listed within 10 km of the subject site in the *EPBC Act* habitat search
V	Denotes vulnerable listed species under the relevant Act
E or E1	Denotes endangered listed species under the relevant Act
E4a or CE	Denotes critically endangered listed species under the relevant Act
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the *Atlas of NSW Wildlife* 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle

Common name *Scientific name* Database source	*BC Act*	*EPBC Act*	Preferred habitat *Distribution limit*	Recorded in study area (✓)	If not recorded on site				Considered in assessment of significance test (✓) (Refer to Appendix 2)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Unlikely	Represents such a low margin but not enough to 100% rule it one. A significance of impact test is required.								
Not likely	Means 0% change of occurring, despite there being potential habitat. A significance of impact test is not applied to these species.								

Table A1.3 provides an assessment of potential habitat within the subject site for nationally *protected* migratory fauna species recorded within 10 km on the *EPBC Act* Protected Matters Tool. Nationally *threatened* migratory species are considered in Table A1.2.

Table A 1-3– Migratory fauna habitat assessment

Common name *Scientific name*	Preferred habitat *Migratory breeding*	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Oriental Cuckoo (*Cuculus optatus*)	Mainly inhabits forests, occurring in coniferous, deciduous and mixed forest. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground.	✓	x	-
White-throated Needletail (*Hirundapus caudacutus*)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies often forage along favoured hilltops and timbered ranges. *Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia.*	✓	x	-
Fork-tailed Swift (Apus pacificus)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. Breeds Siberia, Himalayas, east to Japan south east Asia. Summer migrant to east Australia. Mass movements associated with late summer low pressure systems into east Australia. Otherwise uncommon.	✓	x	-
Black-faced Monarch (*Monarcha melanopsis*)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. *Summer breeding migrant to coastal south east Australia, otherwise uncommon*.	x	-	-

Common name *Scientific name*	Preferred habitat *Migratory breeding*	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Spectacled Monarch (*Monarcha trivirgatus*)	Understorey of mountain / lowland rainforest, thickly wooded gullies, waterside vegetation, mostly well below canopy. *Summer breeding migrant to south-east Qld and north-east NSW down to Port Stephens from Sept / Oct to May. Uncommon in southern part of range.*	x	-	-
Satin Flycatcher (*Myiagra cyanoleuca*)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. *Breeds mostly south-east Australia and Tasmania over warmer months, winters in north east Qld.*	x	-	-
Rufous Fantail (*Rhipidura rufifrons*)	Undergrowth of rainforests / wetter eucalypt forests / gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. *Breeding migrant to south-east Australia over warmer months. Altitudinal migrant in north-east NSW in mountain forests during warmer months.*	x	-	-
Yellow Wagtail (*Motacilla flava*)	The yellow wagtail typically forages in damp grassland and on relatively bare open ground at edges of rivers, lakes and wetlands, but also feeds in dry grassland and in fields of cereal crops.	x	-	-

APPENDIX 2. SIGNIFICANCE OF IMPACT TEST

Section 7.2 of the *BC Act* requires a determination as to whether a development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. Henceforth this is referred to as the 'Significance of Impact Test'.

For the purposes of this part, development or an activity 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.

Section 7.3 of the *BC Act* provides the terms of the test for determining whether proposed development or activity likely to significantly affect threatened species or ecological communities, or their habitats.

The following significance of impact test relies on the biodiversity assessment provided in this report and should be read making reference to the relevant discussion on each threatened species or their habitats, endangered population and ecological community.

Flora investigations and fauna habitat assessments of the study area have resulted in the identification of suitable habitat for the following threatened species and populations with varying potential to occur. Species recorded or with a considered potential to occur have been noted. The potential for any direct or indirect impacts on these species has also been considered and noted.

Threatened flora

Scientific name	*BC Act*	Potential to occur	Potential impact
Tetratheca glandulosa	V	recorded outside subject site	Removal / modification of 0.39 ha of potential habitat
Persoonia hirsuta	E1	✓	Removal / modification of 0.39 ha of potential habitat
Pimelea curviflora var. *curviflora*	V	✓	Removal / modification of 0.39 ha of potential habitat
Callistemon linearifolius	V	low	Removal / modification of 0.39 ha of potential habitat
Eucalyptus camfieldii	V	low	Removal / modification of 0.39 ha of potential habitat
Genoplesium baueri	E1	low	Removal / modification of 0.39 ha of potential habitat
Acacia bynoeana	E1	unlikely	Removal / modification of 0.39 ha of potential habitat
Epacris purpurascens var. *purpurascens*	V	unlikely	Removal / modification of 0.39 ha of marginal habitat
Leptospermum deanei	V	unlikely	Removal / modification of 0.39 ha of potential habitat

Threatened ecological communities

Coastal Upland Swamp in the Sydney Basin Bioregion

Threatened fauna

Common name	*BC Act*	Potential to occur	Potential impact
Giant Burrowing Frog	V	recorded	Direct – on potential burrowing, shelter and foraging habitat
Red-crowned Toadlet	V	recorded	Indirect – on nearby breeding, shelter & foraging habitat
Rosenberg's Goanna	V	recorded	Direct – on foraging habitat close to core winter shelter habitat
Glossy Black-Cockatoo	V	recorded	Direct – on potential foraging habitat
Powerful Owl	V	recorded	Direct – on potential foraging habitat
Eastern Pygmy Possum	V	recorded	Direct – on recorded nesting, shelter, breeding & foraging habitat
Grey-headed Flying-fox	V	recorded	Direct – on potential seasonal foraging habitat
Large Bent-winged Bat	V	recorded	None anticipated
Square-tailed Kite	V	✓	Direct – on sub-optimal foraging habitat
Little Lorikeet	V	✓	Direct – on low potential roosting breeding and potential seasonal foraging habitat
Barking Owl	V	✓	Direct – on potential foraging habitat
Varied Sittella	V	✓	Direct – on potential foraging habitat
East-coast Freetail Bat	V	✓	Direct – on potential foraging habitat
Large-eared Pied Bat	V	✓	Direct – on potential foraging habitat
Little Bentwing-bat	V	✓	Direct – on potential foraging habitat
Little Eagle	V	unlikely	Direct – on unlikely foraging habitat
Gang-gang Cockatoo	V	unlikely	Direct – on unlikely foraging habitat
Dusky Woodswallow	V	unlikely	Direct – on unlikely foraging, roosting & breeding habitat
Scarlet Robin	V	unlikely	Direct – on unlikely foraging habitat
Spotted-tailed Quoll	V	unlikely	Direct – on unlikely foraging habitat
Southern Brown Bandicoot	E	unlikely	Direct – on unlikely foraging, shelter & breeding habitat
Yellow-bellied Sheathtail-bat	V	unlikely	Direct – on unlikely foraging habitat
Eastern Falsistrelle	V	unlikely	Direct – on unlikely foraging habitat
Greater Broad-nosed Bat	V	unlikely	Direct – on unlikely foraging habitat

Endangered populations

- None for flora
- None for fauna

BC ACT 2016 - SECTION 7.3 – SIGNIFICANCE OF IMPACT TEST

Test for determining whether proposed development or activity likely to significantly affect threatened species or ecological communities, or their habitats. The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The direct and indirect impacts of the proposal are considered within Section 5.2.

With consideration to the relative direct and indirect impacts on all threatened species with varying potential to occur, it is considered that the proposal is unlikely to disrupt the life cycle for any of these listed species such that a viable local population would be placed at risk of extinction. Species recorded present during survey, previously recorded nearby or with high potential to occur and requiring further discussion given potential impacts are further discussed in detail below.

Summary of threatened species recorded

Tetratheca glandulosa

Several individuals of *T. glandulosa* were observed within the site close to the centre of the northern boundary of Lot 808. Additional individuals were found in the two lots to the north. All observed *T. glandulosa* occur outside the impact area of the development / APZ and will not be affected by the proposal.

Red-crowned Toadlet (*Pseudophryne australis*)

Red-crowned Toadlets use small ephemeral drainage lines, which feed water from the top of ridges to perennial creeks below. This species is totally confined to the Hawkesbury sandstone formation and is not usually found in the vicinity of permanent water (Ehmann, 1997). Breeding habitat is small puddles or depressions where rock or leaf litter holds back water temporarily (Ehmann, 1997; State Forests Threatened Species Protocol, 1997). Breeding congregations can occur deep in grass and debris beside such non-perennial creeks, gutters etc. They have also been noted to be very partial to damp shelves and cracks in sandstone where they have been observed emerging at dusk (NPWS 1997). At other times individuals disperse and are found under rocks, logs etc. on sandstone ridges. (Cogger, H. G. 2000).

The Coastal Upland Swamp (CUS) located near the subject site to the south-east provides potential breeding habitat for the Red-crowned Toadlet. This is suspected given that a record of Red-crowned Toadlet is provided from this location in previous survey and reporting undertaken by Eco-Logical in 2011.

Recent survey included nocturnal survey at the CUS location as well as two song-meters left out for 7 nights at either end of the CUS. The recording period commenced during a >100 mm of rainfall period over 3 days. No Red-crowned Toadlets were recorded calling in the CUS

during these surveys. Nonetheless, the species will be assessed as occurring within the CUS for breeding and then potentially in the nearby surrounds for core activity close to breeding habitat.

Following the recorded extent of the CUS the proposal has been relocated in order to provide a vegetated buffer of 20 m between the outer APZ extent and the wetland edge. Given that Red-crowned Toadlets occupy areas close to breeding habitat and the species has limited dispersal capability, this setback is considered sufficient to maintain existing breeding opportunity provided that the proposal can also demonstrate effective stormwater management. Stormwater is to be controlled to prevent hydrological changes to the CUS, namely altered water quality and quantity for Red-crowned Toadlet breeding opportunity.
Red-crowned Toadlet was also recorded to the north-east of the study area during surveys, where the species has been previously recorded. Red-crowned Toadlet is also well known to occur in other ephemeral drainages across the extensive connective natural habitats extending to the north toward The Wakehurst Parkway.

Therefore, the proposed development is considered unlikely to significantly impact on a local population of Red-crowned Toadlet such that it would lead to the possibility of local extinction.

Giant Burrowing Frog (*Heleioporus australiacus*)

This species is found most predominantly in habitats on Hawkesbury sandstone and to a much lesser degree on the Narrabeen Group of sandstones, both of Triassic origin (Thumm and Mahony 1999). Their habitat occurs in closed forest, open forest, woodland and various heath types. Ground story cover is generally greater than 50% with a mean height of 0.3 to 0.6 m and a diversity classification of 5 to 19 species.

As its name suggest the Giant Burrowing Frog requires suitable sites in which to burrow and seek shelter. These burrowing sites are typically well away from the breeding site and are usually in sandy moist soils that are at least 0.2 m deep (Stauber 2006) and can be found in open forest and heath vegetation communities and less commonly in closed forest. Adult and juvenile frogs forage on the forest floor at times when the weather conditions are suitable (i.e. moist and humid with low wind so that the animals do not desiccate) (Penman 2005).

Breeding sites occur in pools and soaks associated more typically with upper-level drainages located in the upper parts of the topography, i.e. found associated with plateaus and slopes and not the valley floor. Males call from beside smaller semi-permanent to permanent streams or dams or from burrows within the bank of streams or dams. (Anstis M., 2002). They call mainly in spring and late autumn, but also after rain in late summer. Foamy egg mass laid in a burrow such as an old crayfish hole in a stream bank, or concealed under dense vegetation. (Anstis M, 2002).

A breeding location was recorded by song-meter just beyond the north-eastern study area boundary, approximately 300m to the north-east of the subject site. This is the site of a previous recording in 1994 (*Bionet* 2019). This location is well beyond any potential for indirect impacts from the proposal. It is actually located below a separate upper plateau ephemeral drainage catchment and as such indirect impacts of water quality and quantity are not of concern. No other suitable breeding habitat was located within or close to the subject site within the upper portions of Lot 808.

This species can disperse several hundred meters away from breeding locations to take up active burrowing, shelter and foraging habitat areas. Therefore, it must be considered that the subject site and immediate surrounds provides such potential habitat. There is a steep edge to the escarpment directly east of the subject site in which Giant Burrowing Frogs are not expected to make passage. It is unknown if the steep edge continues north bisecting the subject site and the recorded breeding area along a more direct path.

Given the small extent of the development area along the existing cleared edge of Lady Penrhyn Drive by comparison to the remaining available habitat for core burrowing habitat by individuals in the remaining locality, the proposal is considered unlikely to impact on habitat, such that it would potentially threaten local extinction.

Although the recorded breeding area is not within the same drainage catchment as the proposal, the proposal should still demonstrate no indirect impacts of altered water quality and quantity on lower drainages, as there may be other breeding opportunities below the escarpment edge.

Rosenberg's Goanna (*Varanus rosenbergi*)

On the east coast of NSW the Rosenberg's Goanna (also known as Heath Monitor) is a Hawkesbury / Narrabeen sandstone outcrop specialist (State Forests of NSW, 1995). Rosenberg's Goannas are largely restricted to heath (NPWS 1997); inhabiting humid woodlands, dry hardwood forests and heathland where it shelters in self-dug burrows, hollow logs, rock crevices and sandstone outcrops (Cogger 1992), usually with a sandy substrate (State Forests of NSW, 1997). Eggs are generally laid within a terrestrial termite mound.

The Rosenberg's Goanna is also commonly known as the Heath Monitor due to its associations within this vegetation. Such habitat and the occurrences of these goannas in Northern Sydney corresponds with plateau heath typically on Lambert (sandy) soils surrounded by terracing sandstone escarpments that support more low open forest communities on Hawkesbury Sandstone geology. Such areas eventually grade down into lower deeper sandstone gully forests where the species is unlikely to occur, perhaps just during wider summer forays.

Whilst limited studies have been undertaken for the eastern NSW population of this species, much work has been undertaken on the Kangaroo Island population in South Australia. It is expected that individuals would have a number of burrows over a wider foraging range during the warmer summer months. The species has a surprising tolerance to cooler temperatures (occurring at the lowest latitudes of Australian goannas) and thus remains active during warmer winter days. Albeit this activity is restricted and generally around a single winter burrow.

Travers bushfire & ecology has undertaken an extensive search of burrows and terrestrial termite mounds within Lot 808 above the escarpment edge (refer to Figure 2.1 for search area). No termite mounds were located within the Lot 808 search area or nearby within the neighbouring area to the north. We have also undertaken termite mound searches further north along the local plateaus and have combined our knowledge of these mound locations with findings by reptile expert Gerry Swan and Land and Environment Court reporting on Rosenberg's Goanna habitat prepared by Ross Wellington in 2009 for the study area (and an additional lot to the north). The closest known termite mound likely suitable for nesting is located approximately 150 m away to the north.

No burrows were located within the proposed development area. Some burrows located closest to the subject site were not considered typical of Rosenberg's Goanna given that they were not constructed below a rock edge, they were not located on a northern aspect, they were well shaded and they went straight down. Surveillance cameras were placed on the two of these burrows located closest to the subject site for three days in late September 2019. No activity was recorded.

An area of active monitor burrows was located nearby to the north of Lot 808 during habitat searches (refer to Figure 3.1 for locations). A small burrow within this area showed recent sand excavations below; videoscope analysis of this chamber subsequently found a sub-adult Rosenberg's Goanna present on the 20/8/19. Therefore, this burrow area within ideal north aspect and open rocky habitat is considered important as it contains a number of burrows including a winter burrow. A photo from the burrowcam is shown below.

These burrows are located more than 50 m from the proposed development footprint. The development is not likely to cause any indirect impacts at this distance provided no pet dogs encroach on this area. Foraging from the burrow area will continue along the remaining upper plateau within Lot 808 which includes the hanging swamp community.

Rosenberg's Goanna was initially recorded in the study area by Eco-Logical (prior to 2009). A record from *Bionet* is also referenced to a point within the study area from 2002, however this has an accuracy of 1000 m. Two separate adults were recorded during recent survey on two surveillance cameras (on 17/12/18, 24/12/18 & 25/12/18) and an individual was also observed during botanical survey. Figure 3.1 shows locations of all recordings.

It is expected that the better-quality habitat on the plateau within Lot 808 is large enough to support activity by one and perhaps 2 individuals. Having said this Lot 808 does not support any ideal nesting habitat (termite mounds) or winter burrowing. Therefore, the value of the plateau in Lot 808 for Rosenberg's Goanna is 'south-eastern aspect foraging habitat somewhat close to a winter burrowing area'. The vegetation within the proposed development

footprint is currently denser and provides less current basking opportunity. As observed from aerial photography of the area from 1943 (showing extensive open rocky terrain along the northern beaches) this may well change after a fire event.

Given that no likely breeding or important burrowing habitat will be impacted and such habitat is known to be well represented in the remaining plateau habitats extending to the north, where the species is well recorded, the proposal is unlikely to cause a significant impact on the local population. The proposal may contribute to reducing indirect impacts by ensuring no cats or dogs are permitted into the surrounding plateau habitats. A cat was observed on surveillance camera during survey. Cats may take juvenile goannas. Therefore, feral pest management protocols are recommended as part of the Biodiversity Management Plan.

Glossy Black-Cockatoo *(Calyptorhynchus lathami)*

The Glossy Black-Cockatoo inhabits mountain forests, coastal woodland, open forest and trees bordering watercourses where there are substantial stands of *Allocasuarina*. They feed almost exclusively on the fruit of *Allocasuarina* species (*Lindsey* 1992). They choose trees with larger cone crops but show no sign of selecting trees on the basis of cone size – concentrating foraging in trees with a high ratio of total seed weight to cone weight. (Clout 1989). They breed in hollow trees or stumps usually in Eucalypts.

The Glossy Black-Cockatoo was previously recorded by TBE whilst undertaking surveys in the adjacent lot to the south in 2010. At this time three birds were observed to fly in and perch on trees which have since been removed. During these surveys foraging evidence was also observed by chewed *Allocasuarina distyla* cones.

Recent survey again found evidence of habitat use by chewed *Allocasuarina distyla* cones. These cones were found directly below the Coastal Upland Swamp community. This habitat will be retained by the proposal however some similar suitable foraging opportunities will be removed by the proposal. The study area does not contain any suitable large breeding hollows.

The suitable foraging habitat to be removed has not been found to be utilised and is otherwise well represented in the locality. Therefore, the habitat removal is not likely to significantly impact on a local population of Glossy Black-Cockatoo.

Powerful Owl *(Ninox strenua)*

The Powerful Owl inhabits mature rainforest and wet and dry eucalypt forest. Optimal habitat includes a tall shrub layer and abundant hollows supporting high densities of arboreal mammals. Roosting is generally within dense foliage of mid-canopy trees in sheltered gullies. Large trees with hollows at least 45cm in diameter and 100cm deep are required for nesting. Mated pairs of Powerful Owl roost together or separately, maintaining several roost sites throughout their territory, which are used in rotation (Lindsey 1992), shifting with the availability of prey. A pair is generally faithful to a traditional nesting hollow. Powerful Owls form pairs for life, and are strongly territorial. Estimates of the home range of this species vary greatly, but territories are thought to range from 800 to 1500 hectares (Kavanagh 1997).

The study area provides suitable foraging habitat throughout, particularly given the recorded presence of Sugar Gliders, Grey-headed Flying-fox and Common Ringtail Possum. The study area also provides suitable roosting habitat opportunities, mostly in the lower areas below the

escarpment edge (where the species was recorded by TBE in 2010), but also in some dense mid-storey areas above. The recording in 2010 in the lower areas of Lot 808 was from whitewash and a feather below a dense roosting perch. This was directly below the escarpment drop-off. Powerful Owl was also later recorded during surveys along Willandra Road by calls in early winter suggesting that a breeding site was located further down the gully.

No large hollows considered suitable for nesting by Powerful Owl have been observed within the study area. Therefore, the suitable roosting habitat available within the subject site area would not support male roosting close to any breeding areas.

Powerful Owl was recorded as part of recent survey by a call on the song-meter located in the far north-eastern extent of the study area in February 2019. The recordings were of both the male and female indicating pairing had commence early in the season before the winter breeding. Given that breeding is expected to occur lower within the same gully the study area may support foraging by the male during the breeding period.

In summary, the proposed development will not impact on breeding habitat but will remove potential foraging and roosting (non-breeding) habitat.

Given the study area does not support breeding habitat and no recent roosting evidence was found during the current survey, it is concluded that the removal of habitat within the study area is not significant to the local breeding pair and therefore not likely to significantly impact a local population. Given however that the study area likely supports periodic foraging it is recommended that the remaining habitat areas are maintained to support prey species habitat. Nest boxes should be constructed targeting the Common Ringtail Possum which has recorded dreys within the subject site area.

Eastern Pygmy Possum *(Cercartetus nanus)*

The Eastern Pygmy-possum is found from rainforest through sclerophyll forest to tree heath. The habitats of particular importance are those in which certain species of banksia dominate because they provide an important winter food source (Ward 1990; Bladon et al. 2002; Tulloch 2004; Rueegger et al. 2012). Eastern Pygmy-possums usually shelter alone in tree cavities, rotten stumps, holes in the ground, disused bird nests and possum dreys and in vegetation thickets such as *Xanthorrhoea* species (Menkhorst, 1996). Although the EPP may use a range of different shelter types, it appears that it is the tree hollows that are required for breeding (Tulloch 2004; Harris 2008; Rueegger et al. 2012). In particular, tree cavities of sufficient size (>5 cm diameter) appear critical for a female pygmy-possum to raise a litter.

Female EPPs build nests from various native plant species using fresh leaf material (Ward 1990; Rueegger et al. 2012). This distinguishes EPP nests from other small mammals such as the brown antechinus which builds nests mostly from dead eucalypt leaves (Goldingay personal observations).

Detailed investigation in New South Wales has revealed that home ranges are typically 3-7 ha in area (Law et al. 2013), and this is likely to hold true elsewhere because all studies report overnight movements of up to 300-500 m (Ward 1990; Bladon et al. 2002; Tulloch & Dickman 2006; Law et al. 2013). Law et al. (2013) estimated mean home range size for males and females to be 3.1 ha.

Apart from females with young in the nest, individuals may utilise a number of nest sites within the home range (Turner and Ward, 2008; Menkhorst, 1996). An important determinant of habitat quality may be the proportion of the year in which pollen is available and the species is usually associated with floristically diverse shrub community, especially those including Banksia species. However, populations also occur in box-ironbark associations where the understorey is sparse but relatively diverse (Menkhorst, 1996).

A small hollow located in the northern extent of the subject site area was found to contain fine bedding material indicative of an Eastern Pygmy Possum constructed nest. Two other hollows outside of the subject site but also within the habitat tree survey area were found to contain bedding material placed by Eastern Pygmy Possum. This indicates that the impact area (subject site) will impact on recorded shelter and nesting habitat and subsequent foraging habitat.

Eastern Pygmy Possum records prior to recent target survey techniques utilising denning tubes (nesting boxes) were somewhat deficient throughout the locality. Recent records from this more successful survey technique have however demonstrated that the species presence is extensive from the immediate local suburbs and extending into Garigal and Ku-Ring-Gai National Parks to the north.

Throughout this connective landscape within the Northern Beaches LGA, habitat is most notably represented by low open forest where prolific small hollows in Scribbly Gum trees combines with diverse seasonal flowering opportunities, most notably *Banksia ericifolia* which is known to drive breeding events in Royal National Park. Habitat extends from these core habitat communities out to surrounding heath (where hollows are deficient) and more open forest habitats.

Therefore, despite the removal of recorded habitat containing nest trees, this habitat is otherwise extensive throughout the locality, such that a local population is well secure. The proposal will therefore not like cause a significant impact on the species. It is recommended that hollows to be removed within the development area are relocated to remaining habitat above the escarpment within Lot 808. These are to be affixed to living trees. Use of such relocated habitat, as well as artificial nesting boxes has been well demonstrated by the species. Subsequently, further nesting boxes are also recommended for placement within the remaining natural habitat areas as further habitat supplementation.

Grey-headed Flying-fox

Grey-Headed Flying-foxes are canopy feeding frugivores and nectarivores, inhabiting a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. This species roosts in camps, which may contain tens of thousands of individuals.

Camps are commonly formed in gullies, typically not far from water and usually in vegetation with a dense canopy (Tidemann 1998). Camps can be found in riparian rainforest patches, Melaleuca stands, mangroves, riparian woodland or modified vegetation in urban areas. Loyalty to a site is high and some camps in NSW have been used for over a century (NSW NPWS 2001). Some camps are used at the same time every year by hundreds of thousands of flying-foxes while others are used sporadically by a few hundred individuals (Strahan 1995). Generally foraging is within 20 km of camps but individuals are known to commute up to 50 km to a productive food source.

It is considered that the study area provides only seasonal foraging habitat for the Grey-headed Flying-fox.

Grey-headed Flying-fox was recorded by calls on both song-meters deployed in the northern study area during mid-February to early March. This is likely to be from individuals foraging within the study area at this time, possibly on Red Bloodwood. Foraging is expected to occur within the site and vary on a seasonal basis. There is no likelihood of this species utilising the site for roosting and subsequent breeding habitat.

As the subject site does not contain any likely breeding habitat and foraging habitat will otherwise remain well represented in the locality, it is concluded that there will not be any likely significant impact on this species as a result of the proposal.

Large Bent-winged Bat

The Large Bent-winged Bat forages above and below the canopy within open forests and woodlands, feeding on small flying insects, predominantly moths (Dwyer 1995). The Large Bent-winged Bat is known to roost in a range of habitats including stormwater channels, under bridges, occasionally in buildings, old mines and, in particular, caves (Dwyer 1995). Caves are an important resource for this species, particularly for breeding where maternity caves must have suitable temperature, humidity and physical dimensions to permit breeding (Dwyer 1995). Roost sites in tree hollows have not been reported within the literature reviewed. This species has not been identified as utilising culverts for maternity roosts. Maternity roosts rather are occupied by up to 100 000 females with only 12 maternity roosts known throughout the complete range (Hoy & Hall 2008).

It is considered that the subject site provides suitable foraging only habitat for the Large Bent-winged Bat. Concentrated activity is likely in some locations such as along the vegetation cleared edges and escarpment drop-offs.

A small overhang approximately 10 m beyond the proposed APZ extent was searched for any signs of activity by subterranean roosting microbats, such as the Large Bent-winged Bat. Only a sing scat consistent with microbat guano was found at the base of the overhang. If this scat belonged to a microbat, or more specifically an Large Bent-winged Bat, then this roosting behaviour is clearly very infrequent and not of high value. Such an overhang certainly is not suitable for breeding by this species.

As no important roosting or breeding habitat is likely present within or close to the subject site, their ability to move across and utilise urban landscapes and that the proposed development will not inhibit local movements and dispersal, the Large Bent-winged Bat will not be likely significantly impacted by the proposed habitat clearance and development.

b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

One (1) TEC – Coastal Upland Swamp in the Sydney Basin Bioregion (CUS) – was observed within the subject site. This TEC occurs within the northern portion of the subject site associated with PCT 1803 - Needlebush - Tea-tree damp heath swamp. This community occupies approximately 0.08 ha of the site. The proposal will not impact upon any of this community's extent within the subject site.

It is therefore considered that the proposed development is unlikely to have an adverse effect on the extent of any ecological community such that its local occurrence is likely to be placed at risk of extinction.

ii. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The proposed development and APZ has been specifically located to avoid direct impacts on the CUS within a 20 m buffer from the edge of the community.

An increase in the areas of sealed and partially sealed surfaces, and the clearing of vegetation to comply with APZ requirements associated with this development on site may lead to increases in the volume, velocity and nutrient content of water runoff into this community. This may subsequently lead to increase rates of erosion, sedimentation and eutrophication, resulting in damage to swamp soils and native vegetation, creating substrates that are susceptible to weed invasion, and transporting weed propagules into the swamps from disturbed areas. The design of buildings, services and infrastructure should aim to avoid any changes in runoff into the CUS community. A BMP has been prepared for this site that accounts for the effect of these changes in runoff through sediment control. Water quality within the watercourse within the site is to be measured before, during and after development at regular intervals, as defined in the BMP, to ensure that ground and surface water quality is maintained

With these preventative measures, and through implementation of the BMP, it is unlikely that the proposed development will adversely modify the composition of this community such that its local occurrence is likely to be placed at risk of extinction.

c) In relation to the habitat of threatened species or ecological community:

It is considered that the habitat attributes of the subject site provide known or potential habitat for *Tetratheca glandulosa, Coastal Upland Swamp in the Sydney Basin Bioregion,* Giant Burrowing Frog, Red-crowned Toadlet, Rosenberg's Goanna, Little Eagle, Square-tailed Kite, Gang-gang Cockatoo, Glossy Black-Cockatoo, Little Lorikeet, Barking Owl, Powerful Owl, White-throated Needletail, Varied Sittella, Dusky Woodswallow, Scarlet Robin, Spotted-tailed Quoll, Southern Brown Bandicoot, Eastern Pygmy Possum, Grey-headed Flying-fox, Yellow-bellied Sheathtail-bat, East-coast Freetail Bat, Large-eared Pied Bat, Eastern Falsistrelle, Little Bentwing-bat, Large Bent-winged Bat, Greater Broad-nosed Bat and New Holland Mouse.

i. The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The study area contains 2.78 ha of generally good quality native vegetation. The planning proposed development is likely to remove or modify approximately 0.39 ha of native vegetation providing habitat for the aforementioned species.

ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The subject site is located at the southern edge of local connectivity which continues into extensive natural vegetation to the north (refer to Figure 4.2). Wakehurst Parkway cuts across this connectivity at approximately 3 km to the north providing a road barrier between the local connectivity and further extensive habitats of Garigal National Park.

Within Lot 808 the subject site (development footprint inclusive of APZ) has been located up against Lady Penrhyn Drive to prevent any fragmentation of habitats. There is a steep sandstone escarpment drop-off which runs north-south through the centre of Lot 808 (indicated by a black line on Figure 4.2). Whilst some arboreal connectivity exists between trees on either side of this edge, permitting movement by Eastern Pygmy Possum etc., it does provide a barrier to movement of the majority of terrestrial fauna. This steep edge tapers off to the north.

The subject site is located on the upper plateau side of the escarpment and is set back approximately 50 m from the edge which will permit terrestrial fauna to continue to access the southernmost portions of habitat on the plateau. Within this connectivity is the Coastal Upland Swamp community which may be utilised for breeding by Red-crowned Toadlet (only after very heavy rainfalls).

An area supporting Rosenberg's Goanna winter burrowing habitat is located just over 50 m to the north. Whilst the subject Lot 808 itself starts to slope its aspect more towards the south-east, making it less suitable for such core burrowing habitat, it does still likely contribute to immediate foraging habitat along the plateau close to these burrows. This foraging opportunity will continue also within the 50 m natural plateau habitat area.

Also retained within the upper plateau connective strip is a small overhang of potential temporary use by microbats. The location of the proposed development footprint will permit a setback of approximately 20 m from the hanging swamp as well as retention of all three recorded Eastern Pygmy Possum hollows containing bedding material. Therefore the placement of the subject site is in consideration to both connectivity and potentially important habitat features within.

Therefore, it is considered that known habitat for a threatened species, population or ecological community within the local area and region is unlikely to become isolated or fragmented as a result of the proposal.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The proposed development is likely to impact approximately 0.39 ha or 14% of the site's existing natural habitats.

In respect to threatened fauna species the proposed area of impact provides:

- High quality and recorded denning, shelter, nesting and foraging habitat for the Eastern Pygmy Possum.
- Foraging habitat for the Rosenberg's Goanna close to winter denning areas.
- Habitat close to a hanging Swamp community that has potential to support Red-crowned Toadlet breeding habitat and thus may be utilised for nearby foraging and shelter.

This similar habitat continues for several hundred hectares in the connective remaining natural habitat areas along the local plateau and north towards Wakehurst Parkway. All three species have been recorded extensively in these remaining local habitat areas that will continue to support viable populations. Whilst the proposal will contribute to the accumulated loss of quality habitat for these species the extent of habitat to be removed is not likely important to the long-term survival of any of these species in the locality.

The proposal will not impact on any of the recorded individuals of *Tetratheca glandulosa*, all of which occur outside the subject site.

The proposal will not directly impact on the CUS TEC, and indirect impacts will be mitigated through the establishment of the 20 m conservation buffer and implementation of the prepared BMP.

Given the occurrence of several hundred hectares of contiguous vegetation adjoining the subject site, and the retention of 86% of the exiting habitats within the site, the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population and ecological communities in the locality is considered to be minimal.

d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The subject site is not within any declared area of outstanding biodiversity value. Therefore the proposal will not have any adverse effects on any declared area of outstanding biodiversity value (either directly or indirectly).

e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A key threatening process is defined as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities.

The current list of key threatening processes, and whether the proposed activity is recognised as a threatening process, is shown below.

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
	Likely	**Possible**	**Unlikely**
Aggressive exclusion of birds by Noisy Miners (*Manorina melanocephala*)		✓	
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			✓
Anthropogenic Climate Change		✓	
Bushrock removal	✓		
Clearing of native vegetation	✓		
Competition and habitat degradation by feral goats			✓
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)			✓
Competition from feral honeybees			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments			✓
Forest Eucalypt dieback associated with over-abundant psyllids and bell miners			✓
High frequency fire resulting in the disruption of life-cycle processes in plants and animals and loss of vegetation structure and composition			✓
Herbivory and environmental degradation caused by feral deer			✓
Importation of red imported fire ants into NSW			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Infection of native plants by *Phytophthora cinnamomi*			✓
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of *Lantana camara*		✓	

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
	Likely	**Possible**	**Unlikely**
Invasion of native plant communities by bitou bush & boneseed *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses		✓	
Invasion of native plant communities by African Olive (*Olea europaea* subsp. *cuspidata*)			✓
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*)			✓
Loss of Hollow-bearing trees	✓		
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	✓		
Loss and/or degradation of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)		✓	
Predation by the European Red Fox (*Vulpes vulpes*)			✓
Predation by the Feral Cat (*Felis catus*)		✓	
Predation by Gambusia holbrooki Girard, 1859 (plague minnow or mosquito fish)			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition & disease transmission from Feral pigs (*Sus scofa*)			✓
Removal of dead wood and dead trees	✓		

The above key threatening processes have been considered in reference to the proposal. It was considered that the proposal may contribute to a small degree to a number these processes as described below. It was not considered that the proposal will have a large or significant impact on any of the following key threatening processes. Some mitigation measures have been listed under each process to minimise or reduce such impacts upon those processes.

Summary of "likely" or "possible" Key Threatening Processes

This section identifies what mitigation measures can be implemented to address threatening processes.

Aggressive exclusion of birds by Noisy Miners (Manorina melanocephala)

Noisy Miners have been recorded present within the study area. It is likely that the proposal will cause a larger edge clearing ratio providing more suitable habitat for Noisy Miners to occupy and dominate other birds into the natural habitat edges.

Human-caused Climate Change

The proposal will require the removal of a small amount of vegetation which will result in a negative or positive contribution to climate change. Vegetation is considered to act as a sink for a range of greenhouse gases but in particular Carbon Dioxide. The maintenance of native vegetation cover is a key strategy to combat the contributing impacts of the proposed action on Climate Change. Whilst almost insignificant in size, the proposal is part of the accumulative effect and thus should be considered as contributing to this threatening process.

Bushrock removal

The proposed building footprint and APZ extends over some rocky outcrops, some of which contain valued rock on rock habitat. The proposal will therefore remove or expose naturally occurring surface bushrock within the development areas and as such would be a class of development or activity that is recognised as a threatening process. The proposal should where possible maintain bush rock cover onsite. Bushrock slabs providing potential shelter opportunity for invertebrates, frogs and retiles within the development area are to be relocated over other locations where surface outcrops occur in the nearby adjacent remaining natural terrestrial habitats.

The bush rock present within proposed development areas is not expected to support any important burrowing habitat for Rosenberg's Goanna given the southern aspects of this area. The clearing within the outer APZ areas may in fact lead to greater potential for use by Rosenberg's Goanna for burrowing below large embedded slabs close to more open basking opportunity.

Clearing of native vegetation

The proposal is of a class of development recognised as a threatening process. It is generally recommended that all sites should aim to achieve a maintain-or-improve outcome on the quality and quantity of native vegetation cover through protection and restoration measures. The vegetation management process is to be undertaken in accordance with the conditions of consent and any required vegetation and tree management plans for the proposed development. Offsetting the loss of native vegetation including trees is to be considered as part of the proposed works. The removal of native vegetation on the subject site is not likely to significantly affect the biodiversity of the local area due to the great extent of similar quality vegetation within the local area and the small area of vegetation to be removed.

Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae

'Myrtle Rust' may be spread via machinery, animals and humans as well as by environmental factors such as wind. The presence of machinery and construction works is likely to slightly increase the potential for spread of this key threatening process.

Invasion, establishment and spread of Lantana camara

The site currently contains this species, however it is expected that the proposed development will provide an opportunity to remove, control and manage this species throughout the whole of the site by the application of the prepared BMP.

Invasion of native plant communities by exotic perennial grasses

This threatening process is possible due to the possible incursions of exotic grasses such as *Stenotaphrum secundatum* (buffalo grass) and the potential for exotic turf used in landscaping to become established in areas of native vegetation surrounding the development. It is therefore recommended that native ground covers be utilised as part of the future landscaping works and weed control is applied to reduce spread and establishment of exotic perennial grasses into remnant native vegetation.

Loss of hollow-bearing trees

Hollow-bearing tree surveys identified six hollow-bearing trees containing small (0-10cm) sized hollows within the subject site. The proposal will require the removal of five of these hollow-bearing trees and as such is of a class of development recognised as a threatening process.

Threatened species with suitable habitat within the site and dependant on hollows of this nature include Eastern Pygmy Possum and Little Lorikeet. Little Lorikeet is not expected to utilise such hollows based on survey findings within the study area and local surrounds to date. One hollow found to be utilised by Eastern Pygmy Possum within the outer extent of the APZ will be retained. This tree is within 4 m of the APZ extent so there is some potential for its continued use. Two of the hollows to be removed are also considered quite suitable for Eastern Pygmy Possum. These hollows, as well as the other recorded hollows to be removed will be cut out of the tree, prepared, relocated and attached onto a similar tree within the remaining natural habitat areas to reduce the loss of natural hollows impact.

Nest boxes are also recommended for placement in the nearby natural surrounds to supplement this habitat with potential further denning and nesting opportunity by Eastern Pygmy Possum.

Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants

The proposed subdivision may provide opportunities for escaped garden plants to establish in native habitat, particularly if invasive exotic species are used for landscaping purposes. Currently there are some escaped garden species within the site, such as Fishpole Bamboo and Coreopsis, but these are restricted to the disturbed western edge along Lady Penrhyn Drive. The proposal will provide an opportunity to remove, control and manage these species throughout the whole of the site by the application of the BMP.

Predation and hybridisation by feral dogs (Canis lupus familiaris)

The proposed development may alter impacts on adjoining lands by increasing the numbers of domestic dog ownership and as such the action proposed may increase the potential of this threatening process.

Predation by feral cat (Felis catus)

The proposed development may alter impacts on adjoining lands by increasing the numbers of domestic cat ownership and as such the action proposed may increase the impact of this threatening process.

Removal of dead wood and dead trees

The proposal will require the removal of deadwood and dead trees and as such is of a class of development recognised as a threatening process. Threatened fauna species with potential habitat within the subject site and likely dependent on dead wood or dead trees include Varied Sittella, Scarlet Robin, and Dusky Woodswallow. These species have not been recorded to date within the study area. Given the low-quality habitat associated with deadwood and dead trees present within the development areas, the removal of dead wood and dead trees is not considered likely to impact on threatened species or the biodiversity of the local area.

APPENDIX 3. SAII IMPACT ASSESSMENT - SPECIES

The additional impact assessment provisions for threatened species to determine a Serious and Irreversible Impact (SAII) are outlined under Section 9.2 of the BAM (2020) and have been applied to the recorded Large Bent-winged Bat as follows below.

Measures taken to avoid the direct and indirect impact on species at risk of SAII are outlined in 5.2 Potential ecological impacts. We have consulted the Threatened Biodiversity Data Collection (TBDC) and other sources to enable the application of the four principles set out in clause 6.7 of the *BC Reg*. For the species considered this is summarized as follows:

Common Name	Principle				Justification	Reference
	1	2	3	4		
Large Bent-winged Bat				✓	The species is dependent on non-responding attribute (breeding habitat only)	TBDC

The criteria as specified in Section 9.1.2.4 of the BAM required to be considered for candidate SAII species nominated is with respect to Principles 1–3 only. As these do not apply to the recorded microbat species a summary is provided below:

Large Bent-winged Bat– This species is allocated to species credit class for breeding habitat only. Species sensitivity to loss is indicated by the TBDC as 'moderate'. Species sensitivity to potential gain for breeding is 'very high'. Species sensitivity to potential gain for foraging is 'high'. The Large Bent-winged Bat was recorded foraging at one of the passive ultrasonic recording devices within the study area during 2019 survey. The recorded locations are shown on Figure 2-1 – Fauna survey effort and Figure 2-2 – Flora survey effort & results.

Potential breeding habitat' as defined by *The BAM Bat Guide* for these species includes "caves, tunnels, mines or other structures known or suspected to be used". One small cave was recorded within the study area but no likely roosting will be directly impacted. The overhang (approximately 16 m beyond the proposed APZ boundary) showed a single scat which may be microbat. If it is microbat and is the Large Bent-winged Bat this overhang would only be a very temporary roost option as it is open to daylight and weather. Any regular use would be indicated by several scats and insect remains. Impacts on this overhang may be indirect such as lighting and from cats or dogs. No breeding or roosting microbats were recorded during surveys undertaken within the study area or nearby, therefore there will be no likely SAII on the Large Bent-winged Bat.

APPENDIX 4. EPBC IMPACT CRITERIA

Under the *EPBC Act* an action will require approval from the Australian Government Environment Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance. The following significant impact criteria were sourced from the *EPBC Act* Policy Statement 1.1 (May 2006):

CRITICALLY ENDANGERED AND ENDANGERED SPECIES

Significant impact criteria

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

- Lead to a long-term decrease in the size of a population;
- Reduce the area of occupancy of the species;
- Fragment an existing population into two or more populations;
- Adversely affect habitat critical to the survival of a species;
- Disrupt the breeding cycle of a population;
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- Introduce disease that may cause the species to decline; or
- Interfere with the recovery of the species.

>> What is a population of a species?

A 'population of a species' is defined under the *EPBC Act* as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- a geographically distinct regional population, or collection of local populations; or
- a population, or collection of local populations, that occurs within a particular bioregion.

>> What is habitat critical to the survival of a species or ecological community?

'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal;
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- To maintain genetic diversity and long term evolutionary development; or
- For the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the *EPBC Act.*

VULNERABLE SPECIES

Significant impact criteria

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

- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

>> What is an important population of a species?

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

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

CRITICALLY ENDANGERED AND ENDANGERED ECOLOGICAL COMMUNITIES

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- Reduce the extent of an ecological community;
- Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- Adversely affect habitat critical to the survival of an ecological community;
- 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;
- 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;
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
  - assisting invasive species, that are harmful to the listed ecological community, to become established; or
  - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or
- Interfere with the recovery of an ecological community.

MIGRATORY SPECIES

Significant impact criteria

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

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

>> What is important habitat for a migratory species?

An area of 'important habitat' for a migratory species is:

a) Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
b) Habitat that is of critical importance to the species at particular life-cycle stages; and/or
c) Habitat utilised by a migratory species which is at the limit of the species range; and/or
d) Habitat within an area where the species is declining.

>> What is an ecologically significant proportion?

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species-specific behavioural patterns (for example, site fidelity and dispersal rates).

>> What is the population of a migratory species?

'Population', in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.