# 181 FOREST WAY, BELROSE

## Biodiversity Development Assessment Report for a proposed Seniors Housing Development

For:

**Huntingdon Nursing Home**

November 2019

**Final**

**PO Box 2474**
**Carlingford Court 2118**

**Report No. 16222RP4**

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

| Version | Date Issued | Amended by | Details |
|---|---|---|---|
| 1 | 13/06/2019 | VO/TP | Draft for client issue |
| 2 | 19/11/2019 | VO/KW | Final for client issue |
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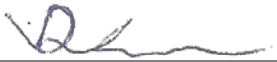
Approved by: Vanessa Orsborn

Position: Senior Project Manager/Ecologist

Signed: 

Date: *19 November, 2019*

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# Glossary of Terms

| | |
|---|---|
| AOBV | Area of Outstanding Biodiversity Value |
| Assessment area | Area of land within a 1500 m buffer around the outer boundary of the subject land |
| BAAS | Biodiversity Assessor Accreditation System |
| BAM | Biodiversity Assessment Method |
| BAMC | Biodiversity Assessment Method Calculator |
| BAR | Biodiversity Assessment Report |
| BC Act | *Biodiversity Conservation Act 2016* |
| BCT | Biodiversity Conservation Trust |
| BDAR | Biodiversity Development Assessment Report |
| BOS | Biodiversity Offset Scheme |
| DA | Development Application |
| Development Site | Area of the subject land directly impacted by the proposed development, including the development footprint, ancillary works and APZs, as shown in **Figure 1.2** |
| EEC | Endangered Ecological Community |
| EES | Environment, Energy and Science group, a division of the Department of Planning, Infrastructure and Environment (formerly the Office of Environment and Heritage) |
| EPBC Act | Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* |
| EP&A Act | NSW *Environmental Planning and Assessment Act 1979* |
| EPBC Act | Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* |
| GDEs | Groundwater Dependent Ecosystems |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| ha | Hectares |
| IBRA | Interim Biogeographic Regionalisation for Australia |
| km | kilometres |

| | |
|---|---|
| LGA | Local Government Area |
| NSW | New South Wales |
| MNES | Matters of National Environmental Significance |
| OEH | NSW Office of Environment and Heritage |
| PCT | Plant Community Type |
| the Project | Belrose Manor, Aged Care Facility |
| SAII | Serious and Irreversible Impacts |
| SEPP | State Environmental Planning Policy |
| subject land | The area subject to the proposed action (**Figure 1.1)** |
| TEC | Threatened Ecological Community |

Chapter 1

# Introduction

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been commissioned by Huntingdon Nursing Home C/- Trinity Management Services Pty Ltd, on behalf of Morrison Design Partnership Architects, to prepare a Biodiversity Development Assessment Report (BDAR) to support a Development Application (DA) for a proposed development at 181 Forest Way, Belrose (Lot 3 DP805710) ('the subject land').

The proposed development involves the construction and operation of an aged care facility and associated services, within the western portion of the subject land (referred to as the 'development site').

This BDAR will form part of the required documentation to support an amended DA for approval under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act).

## 1.1 Requirement for BDAR

The Biodiversity Offsets Scheme (BOS) applies to local developments assessed under Part 4 of the EP&A Act that triggers the BOS threshold or is likely to significantly affect threatened species based on the Test of Significance in Section 7.3 of the *Biodiversity Conservation Act 2016* (BC Act).

The *Biodiversity Conservation Regulation 2017* sets out threshold levels for when the BOS will be triggered. The threshold has two elements:

- whether the amount of native vegetation being cleared exceeds a threshold area; OR
- whether the impacts occur on an area mapped on the Biodiversity Values map published by the Minister for the Environment.

If clearing and other impacts exceeds either trigger, the BOS applies to the proposed development. For projects for which the BOS applies, a BDAR must be prepared in accordance with the Biodiversity Assessment Method (BAM).

The proposed development occurs on Lot 3 DP805710, which is mapped as a 'deferred matter' (unzoned) under the *Warringah Local Environmental Plan 2011*. No minimum lot size is specified for unzoned land and therefore the minimum lot size is taken to be the

actual size of the lot in accordance with Clause 7.2(2)(b) of the BC Act. The subject land is approximately 2.12 ha. Based on the actual lot size of approximately 2 ha, the area threshold would be exceeded if the development involved the clearing of 0.5 ha or more of native vegetation. Although the development footprint does not exceed this clearing threshold (with a total of 0.11 ha of native vegetation proposed to be cleared), additional areas are proposed for modification within the Asset Protection Zone (APZ) and the total clearing are will be approximately 1.02 ha. As the total area proposed to be cleared or modified is over 0.5 ha, the BOS is triggered by this mechanism.

## 1.2 Purpose

The purpose of this BDAR is to document the findings of an assessment undertaken for the Project in accordance with Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the BAM. Specifically, the objectives of this BDAR are to:

- Identify the landscape features and site context (native vegetation cover) within the subject land and assessment area;
- Assess native vegetation extent, plant community types (PCTs), threatened ecological communities (TECs) and vegetation integrity (site condition) within the subject land;
- Assess habitat suitability for threatened species that can be predicted by habitat surrogates (ecosystem credits) and for threatened species that cannot be predicted by habitat surrogates (species credit species);
- Identify potential prescribed biodiversity impacts on threatened species;
- Describe measures to avoid and minimise impacts on biodiversity values and prescribed biodiversity impacts during project planning;
- Describe impacts to biodiversity values and prescribed biodiversity impacts and the measures to mitigate and manage such impacts;
- Identify the thresholds for the assessment and offsetting of impacts, including:
    - Impact assessment of potential entities of serious and irreversible impacts (SAII);
    - Impacts for which an offset is required;
    - Impacts for which no further assessment is required;
- Describe the application of the no net loss standard, including the calculation of the offset requirement.

## 1.3 Project Description

### *1.3.1 Location*

The subject land comprises Lot 3 DP805710, and is located at 181 Forest Way, Belrose, in the Northern Beaches Council Local Government Area (LGA) (**Figure 1.1**). The subject land is unzoned under the *Warringah Local Environmental Plan 2011*. The subject land is bound by Forest Way to the west and residential dwellings to the north, east and south. It is approximately 2.12 ha in area and contains an existing residential dwelling in the west. The majority of the vegetation has been cleared previously so that the subject land comprises mostly open cleared ground. The topography of the subject land varies, and the land slopes down towards the east.

A location map and site map have been prepared in accordance with the BAM and are presented in **Figure 1.1** and **Figure 1.2**, respectively.

### *1.3.2 Project Overview*

*i. Previous Development Application*

A DA was submitted to Warringah Council (now part of Northern Beaches Council) in 2017 for development of a 140 bed residential aged care facility on the subject land. Council provided feedback, and requested additional information on bushfire protection, traffic and access management, and biodiversity. Supplementary surveys were undertaken in response to Council's request for additional assessment of impacts to threatened flora known to occur in an unformed road reserve to the north of the subject land. Following consultation with Council, the development layout was modified, to allow access from the south of the subject land, and avoid use of the road reserve to the north. The previous DA was withdrawn, on advice from Council (Cumberland Ecology 2017). A revised DA is now being prepared for an alternative development footprint.

*ii. Description of the Proposed Development*

The subject land is currently proposed to be developed into a 105 bed residential aged care facility. The building footprint will be confined to the elevated building platform towards Forest Way (**Figure 1.3**). An access driveway to Forest Way is proposed via the south of the subject land. A deceleration lane is also proposed for construction on Forest Way, with land along the western boundary (shown on **Figure 1.3**) to be acquired by RMS.

Since the lodgement of the current DA in 2018, feedback has been provided by Council (Memo dated 13 February 2019). This has resulted in further amendments to the development layout, in relation to building form, bushfire protection requirements and impacts to biodiversity, in particular to Duffys Forest endangered ecological community (EEC). Consequently, the footprint of the proposed development has been reduced, and re-configured, to provide and appropriate bushfire set-backs, and retain the entire patch of Duffys Forest EEC, as shown in **Figure 1.3**.

Additional to the consultation with Council, a meeting with the Rural Fire Service (RFS) was attended by the proponent and bushfire consultants on 13 June 2019 to discuss the proposed changes to the development layout, and changes to exclude the Duffys Forest patch as unmanaged vegetation. The meeting resulted in a number of further changes to the development layout, including a reduction in the scale of the main building, resulting in a greater set-back from the northern and southern boundaries, and retained bushland on the adjoining properties. In order to respond to concerns from the RFS, the development layout was further modified to reduce the footprint of the main building, and increase the landscaped/paved areas at the northern and southern boundary.

The subject land will retain a large area of undeveloped land to the north and east, which will be managed as an Asset Protection Zone (APZ) (Travers Bushfire & Ecology 2019). The APZ has been divided into an Inner Protection Zone (IPA) and Outer Protection Zone (OPA), as shown in Schedule 1, Bushfire Protection Measures (Travers Bushfire and Ecology, 2019). A portion of the APZ will be landscaped, as per the amended Landscape Management Plan (Stuart Noble Associates 2019), while the remainder of the subject land will be retained as managed bushland, according to a Biodiversity Management Plan (Cumberland Ecology 2018a) that has been prepared for the Project.

### *1.3.3 Identification of the Development Site*

The development impacts are defined as the 'development footprint' and 'APZ/Landscaping', and are wholly contained within the 'development site', as shown in **Figure 1.2**. The development footprint will result in complete clearing, while the APZ/landscaped zone will result in partial clearing and modification of the vegetation present. Duffys Forest is located within the subject land (defined as the lot boundary), but outside of the development footprint and APZ/landscaping, as shown in **Figure 1.2**.

The layout of the Project is shown in **Figure 1.3**. The development site comprises the area of land directly impacted by the Project including:

- A 105 bed aged care facility;
- Landscaping;
- APZ establishment and maintenance; and
- Ancillary works including;
    - Water-cycle management structures, including; pipes, detention basin, and bio-retention basin;
    - Internal access ways;
    - Parking for 45 vehicles; and
    - Fencing

### 1.3.4 General Description of the Subject Land

*i. Historical and Present Land Use*

The subject land is currently maintained as a residential property, and contains two large houses, which are currently occupied. A past landowner has undertaken extensive clearing of vegetation in the eastern portion of the subject land, which is regenerating since the first survey by Cumberland Ecology in 2016 (Cumberland Ecology 2017).

*ii. Topography and Soils*

The subject land is located on a steep slope from the edge of the ridgeline that extends along Forest Way. The top of the ridge contains soils derived from shale that overlay sandstone. Large sandstone outcrops are present in the centre of the subject land. The subject land is mapped as being within the Belrose Coastal Slopes Mitchells Landscape, which is characterised by Benched hill slopes and deep valleys of the coastal fall on horizontal Triassic quartz sandstone, lithic sandstone and shales. High proportion of rock outcrop with discontinuous cliffs to 5m high. General elevation 0 to 180m, local relief 80m. Shallow uniform or gradational sands and earthy sands on ridges, deeper sands, loamy sands and organic sands on wet benches and in hanging swamps, grey or yellow texture-contrast soils on shale benches (DECC, 2002).

*iii. Hydrology*

No watercourses are present on the subject land, but a second order stream; Snake Creek occurs in the valley to the east of the subject land, located within retained bushland that extends towards Oxford Falls to the east. Informal overland flow paths occur on the subject land from Forest Way in the west to the bushland in the south.

*iv. Vegetation*

The vegetation of Belrose and the surrounding urban landscapes have been heavily modified since the first European settlement in NSW. Most of the pre-existing vegetation was historically cleared. Recent clearing events have occurred within the eastern portions of the subject land, and surveys by Cumberland Ecology in 2016 confirmed the extent of understorey and canopy clearing (Cumberland Ecology, 2017) under previous land ownership.

Large areas of regenerating heath and woodland types occur throughout the assessment area, and include a large portion of the subject land.

## 1.4 Information Sources

### 1.4.1 Databases

A number of databases were utilised during the preparation of this BDAR, including:

- Environment, Energy and Science Group (EES) BioNet Atlas (EES 2019a);

- EES BioNet Vegetation Classification database (EES 2019b);
- Commonwealth Department of the Environment and Energy (DoEE) Species Profile and Threat Database (DoEE 2019c);
- DoEE Protected Matters Search Tool (PMST) (DoEE 2019b); and
- DoEE Directory of Important Wetlands in Australia (DoEE 2019a).

### *1.4.2 Literature*

This BDAR has utilised the results and/or spatial data from the following documents:

- 181 Forest Way Belrose: Flora and Fauna Impact Assessment (Cumberland Ecology 2018b);
- 181 Forest Way Belrose: Biodiversity Management Plan (Cumberland Ecology 2019); and
- Native Vegetation of the Sydney Metropolitan Area (OEH 2016a).

### *1.4.3 Aerial Photography*

The aerial imagery utilised in this BDAR is sourced from Nearmap and is dated 23 July 2018.

## 1.5 Authorship and Personnel

This document has been authorised by Vanessa Orsborn (BAM Accredited Assessor No: BAAS18166). This document, and associated filed surveys and Geographic Information Systems (GIS) mapping, was prepared with the assistance of additional personnel as outlined in **Table 1.1**. Notwithstanding the assistance of the additional personnel, the assessment presented within this document is Ms Orsborn's.

**Table 1.1 Personnel**

| Name | Tasks | Relevant Qualifications / Training | BAM Accredited Assessor No. |
|---|---|---|---|
| Vanessa Orsborn | Field surveys, document preparation, credit calculations | Bachelor of Environmental Science. Australian Catholic University, 2005<br>BAM Accredited Assessor Training. Muddy Boots, 2017 | BAAS18166 |
| Tim Playford | Document review | Bachelor of Science (Honours) in Ecology, Adelaide University 2004,<br>Bachelor of Environmental Management, Flinders University of South Australia, 2003 | |

## Table 1.1 Personnel

| Name | Tasks | Relevant Qualifications / Training | BAM Accredited Assessor No. |
|---|---|---|---|
| | | BAM Accredited Assessor Training. Muddy Boots, 2017 | |
| Dr Rohan Mellick | Field surveys | Doctor of Philosophy, Evolutionary Ecology. The University of Adelaide, 2012<br>Bachelor of Applied Science (Honours) in Natural Resource Management, Southern Cross University, 2000.<br>BAM Accredited Assessor Training. Muddy Boots, 2017 | BAAS18075 |
| Cecilia Eriksson-Pinatacan | Field surveys, document preparation, credit calculations | Bachelor of Science (Honour) in Marine Biology University of Technology Sydney 2008<br>Masters of Science (Major in Marine Science and Management) University of Technology Sydney, 2013<br>BAM Accredited Assessor Training. Muddy Boots, 2017 | BAAS19052 |
| Michael Davis | GIS mapping, credit calculations | Bachelor of Biodiversity and Conservation. Macquarie University, 2016<br>BAM Accredited Assessor Training. Muddy Boots, 2017 | - |
| Jesse Luscombe | GIS mapping, credit calculations | Bachelor of Marine Science. Macquarie University, 2013<br>Certificate III in Conservation and Land Management. TAFE NSW, 2016 | - |

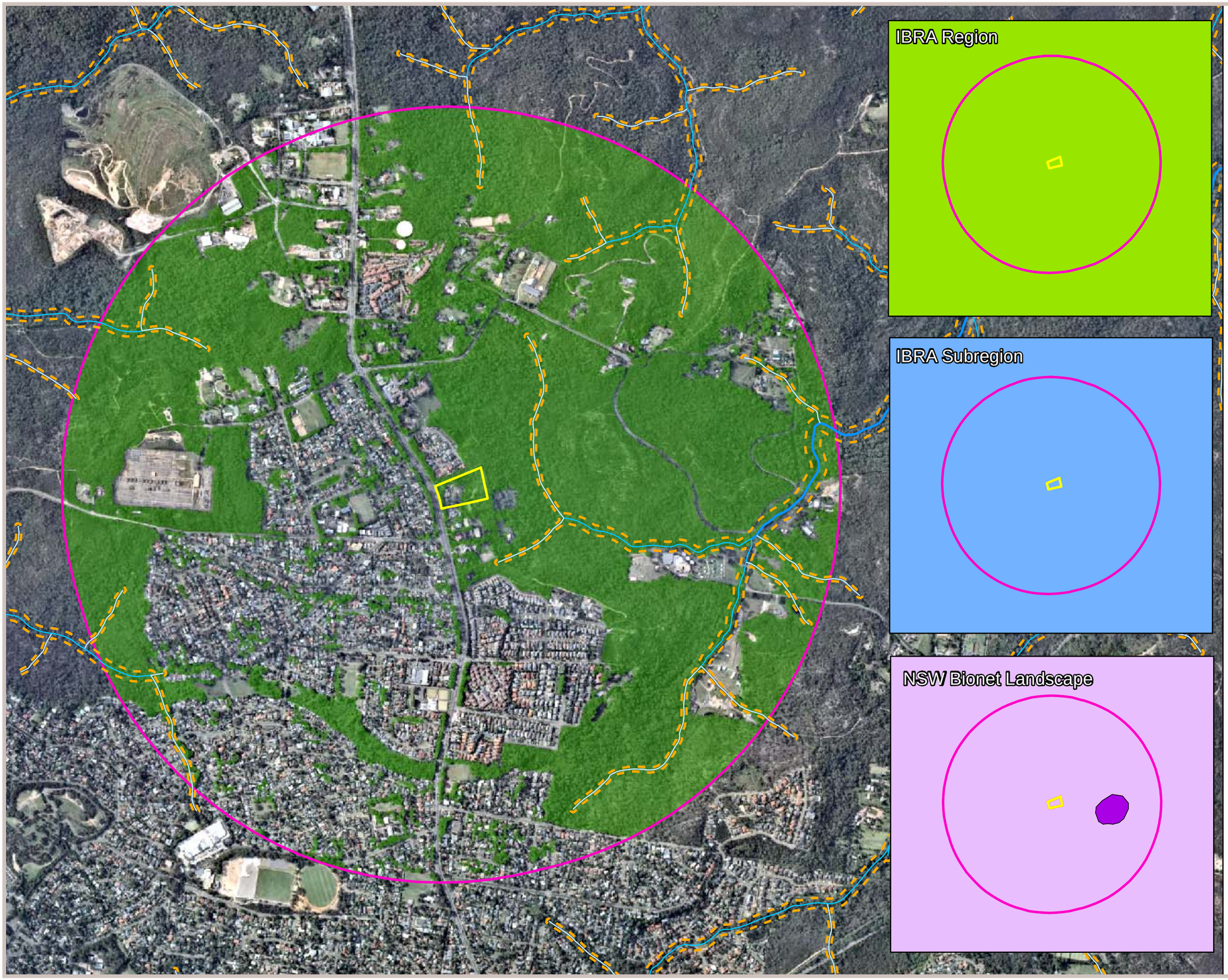



**Figure 1.1. Location Map**


**Legend**

- Development Site
- Subject Land
- Development Footprint
- APZ/Landscaping
- Cadastre

**Rivers and Streams**

- 1st Order Stream
- 2nd Order Stream
- Riparian Buffer
- Native Vegetation Cover

**IBRA Bioregion**

- Sydney Basin

**IBRA Subregion**

- Pittwater

**NSW Bionet Landscape**

- Belrose Coastal Slopes

Image Source:
NearMap
(dated 2019-03-12)

Data Source:
NSW Government Spatial Services
SIX Maps 'Clip and Ship'
Northern Beaches LGA;
DSEWPaC (2012). Interim
Biogeographic Regionalisation for Australia
(IBRA) - Version 7.;
DECCW (2008). Landscapes (Mitchell)
of NSW - Version 3.1

Coordinate System: MGA Zone 56 (GDA 94)

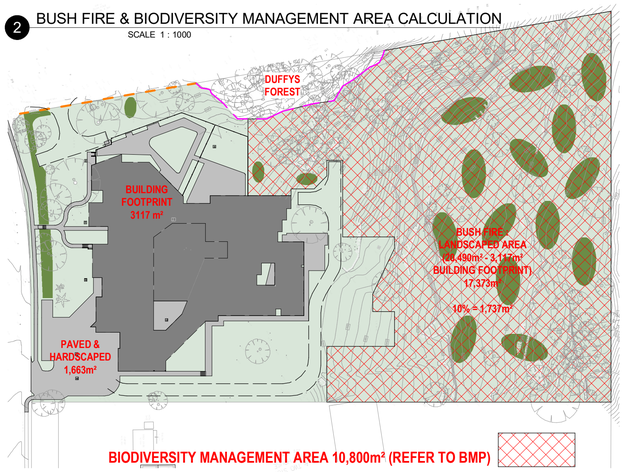
cumberland ecology

0 25 50 75 100 m

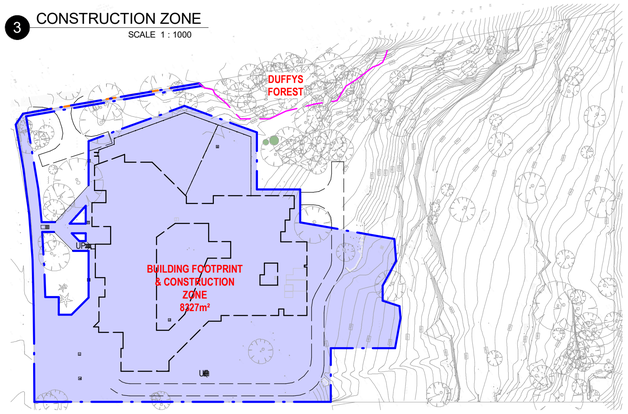
I:\...\16222\Figures\RP4\20191119\Figure 1.2. Site Map

**Figure 1.2. Site Map**

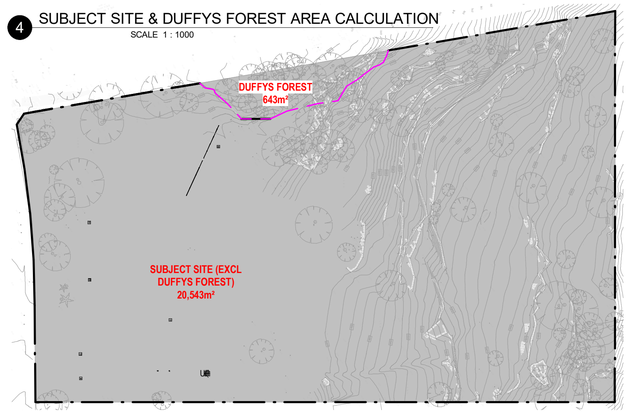
## 2 BUSH FIRE & BIODIVERSITY MANAGEMENT AREA CALCULATION
SCALE 1 : 1000

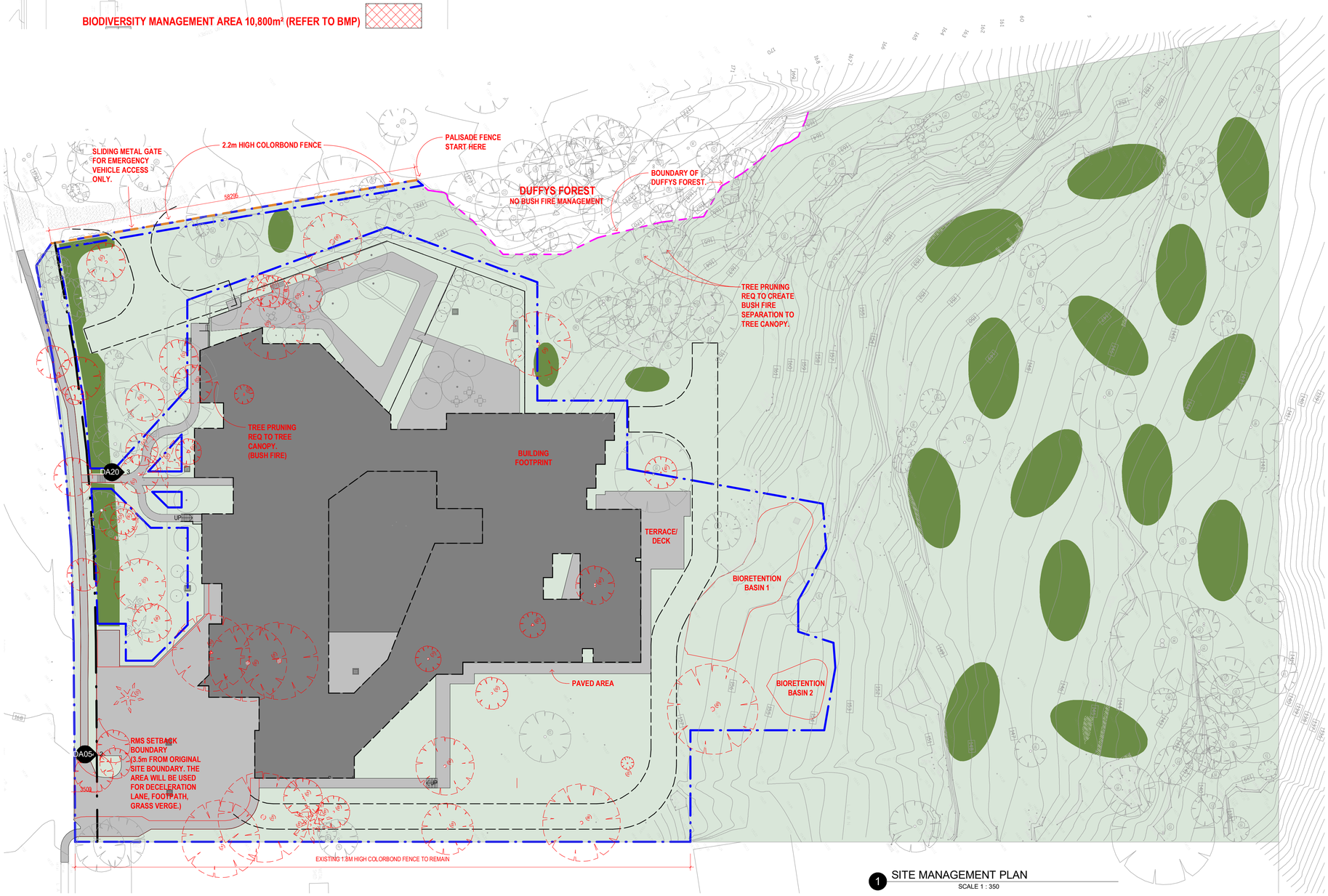



## 3 CONSTRUCTION ZONE
SCALE 1 : 1000




## 4 SUBJECT SITE & DUFFYS FOREST AREA CALCULATION
SCALE 1 : 1000




## 1 SITE MANAGEMENT PLAN
SCALE 1 : 350

| Revision | Date | Details | Initials | Checked |
|---|---|---|---|---|
| A | 20190523 | FOR COORDINATION | VC | |
| B | 20190524 | FOR COORDINATION | VC | |
| C | 20190529 | FOR COORDINATION | VC | |
| D | 20190530 | FOR COORDINATION | VC | |
| E | 20190605 | FOR COORDINATION | VC | |
| F | 20190611 | DA AMENDMENT | VC | |
| G | 20191018 | FOR COORDINATION | VC | |
| H | 20191118 | DA AMENDMENT | VC | |

### SURVEY NOTES
Survey data included in this drawing is based on survey drawing and is provided for preliminary design purposes only.
As this drawing is based on information supplied by others, reference must be made to original survey drawings verified against site conditions.

### GENERAL NOTES
**Morrison Design Partnership Pty. Limited** accept no responsibility for the usability, completeness or accuracy of data transferred electronically.
Recipients should when necessary request a hard copy version for verification.
This drawing shall be read in conjunction with all architectural and other Consultants drawings and specifications and with such other written instructions as may be issued during the course of the contract.
Figured dimensions shall be taken in preference to scaling.
All level, datum points and dimensions on this drawing shall be verified by the builder on site.
All discrepancies shall be referred to the architect for direction before proceeding with any works. **DO NOT SCALE THIS DRAWING.**

- CONSTRUCTION ZONE
- RMS REQUIRED SETBACK FOR ADDITIONAL DECELERATION LANE (325.5m²)
- BUILDING FOOTPRINT (EXCL. BASEMENT)
- PAVED / HARDSCAPED AREAS
- BUSH FIRE MANAGEMENT AREA
- BIODIVERSITY MANAGEMENT AREA (REFER TO BMP)
- TEMPORARY CONSTRUCTION FENCE/ BOUNDARY
- DUFFYS FOREST BOUNDARY (REFER TO ECOLOGIST REPORT FOR DETAILS)
- BUSH FIRE FENCE (REFER TO BUSH FIRE REPORT FOR DETAILS)
- NATIVE SHRUBS (100m²)
- NATIVE SHRUBS (22m²)
- NATIVE SHRUBS (195m²) STREET FRONTAGE

## DEVELOPMENT APPLICATION

APPLICANT:
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St Leonards NSW 2065

ARCHITECT:
**Morrison Design Partnership Pty Ltd**
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architecture
interior design
project management

NSW ARB REG ARCHITECT: G. OLLERTON #7421
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PROJECT:
# BELROSE MANOR
**RESIDENTIAL AGED CARE FACILITY**
181 FOREST WAY
BELROSE NSW 2085

DRAWING:
*SITE & BUSH FIRE MANAGEMENT PLAN*

PROJECT NO. **2951**
REVISION NO. ***H***
DRAWING NO. DA052
SCALE: **As indicated @ A1**
ARCHITECT: VEE CHIN
DATE: **APRIL 2017**
PROJECT DIRECTOR: **MARKAM RALPH**

Morrison Design Partnership ARCHITECTS Since 1969

Chapter 2

# Landscape Features

## 2.1 Site Context

### *2.1.1 Assessment Area*

As the Project is being assessed as a non-linear project, the assessment area comprises the area of land within a 1500 m buffer around the outer boundary of the subject land. The location of the assessment area is shown in **Figure 1.1**.

### *2.1.2 Native Vegetation Cover*

The native vegetation cover present in the assessment area was determined through the use of GIS. To map native vegetation cover within the subject land and assessment area, this assessment utilised detailed vegetation mapping of the subject land prepared by Cumberland Ecology in conjunction with broad scale mapping of the Sydney Metropolitan area (OEH 2016a). The assessment area is approximately 767 ha in size, of which approximately 445 ha comprises native vegetation cover, which represents 58% of the assessment area. Therefore, the native vegetation cover value is assigned to the cover class of >30-70%.

## 2.2 Landscape Features

Landscape features identified within the subject land and assessment area are outlined below. The extent of these features within the subject land is shown in **Figure 1.1** and their extent within the assessment area is shown in **Figure 1.2**.

### *2.2.1 IBRA Bioregions and IBRA Subregions*

The subject land and assessment area are located within the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion and within the Pittwater IBRA Subregion.

### *2.2.2 Rivers, Streams and Estuaries*

The subject land and assessment area are located within the Hawkesbury-Nepean catchment. Notable surface drainage systems are not present on the subject land, but offsite watercourses include a first order (main) watercourse; Deep Creek, second order

streams; Snake Creek, Frenchs Creek, and Five Mile Creek, and third order streams; Oxford Creek to the east and Fireclay Creek within the assessment area.

A buffer of 10m, 20m and 30m either side of the waterways applies to first, second and third order streams, respectively, in accordance with Appendix 3 of the BAM.

### *2.2.3 Important and Local Wetlands*

No important wetlands listed in the Directory of Important Wetlands in Australia are present in the subject land or assessment area.

The closest important wetland based on the Directory of Important Wetlands in Australia is at Centennial Parklands, located approximately 18 km to the south west of the assessment area.

No local wetlands are present in the assessment area.

### *2.2.4 Habitat Connectivity*

The subject land is located at the eastern edge of a large patch of native vegetation that extends to the east within the retained bushland that extends to Oxford Falls to the east. The native vegetation present on the subject land is partially fragmented, with small discontinuous patches in the western extent of the site, and sparse regrowth in the east that has been largely cleared. The subject land joins onto a large tract of vegetation which eventually connects to Garigal National Park to the north east, and Ku-ring-gai Chase National Park further to the north and north east, although these blocks of habitat are fragmented by existing dual lane roads; Forest Way and Mona Vale Road. As the proposed development will occur at the western extent of this larger patch, it will not act to fragment it, further than current conditions.

### *2.2.5 Karsts, Caves, Crevices, Cliffs and Areas of Geological Significance*

Areas of geological significance, in the form of rock outcrops, are present on the subject land and in the assessment area. .

### *2.2.6 Areas of Outstanding Biodiversity Value*

No Areas of Outstanding Biodiversity Value (AOBV) have been mapped within the assessment area.

### *2.2.7 Mitchell Landscapes*

The Mitchell Landscape that occurs in the subject land and surrounds is Belrose Coastal Slopes. The assessment area also includes an area of Sydney Basin Diatremes. This is characterised by shallow sandstone derived soils and steep slopes.

### *2.2.8 Soil Hazard Features*

Soil hazard features are not required to be identified or mapped for Part 4 projects.

Chapter 3

# Methodology

## 3.1 Review of Existing Data

Existing information on biodiversity values within the assessment area were reviewed, including the following:

- Survey data held in the Flora Survey (BioNet) including:
  - EES Threatened Biodiversity Data Collection (EES, 2019).
- Existing vegetation mapping, being:
  - Vegetation of the Sydney Metropolitan Area (OEH, 2016); and
  - Vegetation mapping by Cumberland Ecology (2017, 2018b)

This existing information was considered and included, where appropriate, into survey design, vegetation mapping and reporting.

Previous reports were utilised in the preparation of this BDAR, including the Flora and Fauna Impact Assessment (Cumberland Ecology, 2017, 2018b) for the previous and current DA.

## 3.2 Flora Survey

### *3.2.1 Vegetation Mapping*

Vegetation mapping of the subject land was undertaken by random meander searches throughout each patch of vegetation, noting key characteristics of areas in similar broad condition states such as similar tree cover, shrub cover, ground cover, weediness or combinations of these.

### *3.2.2 Vegetation Integrity Assessment*

Vegetation integrity assessments were conducted in accordance with the BAM. Surveys included establishment of 20 x 50 m plots within which the following data was collected:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within a 20 m x 20 m plot;

- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within a 20 m x 20m plot;
- Cover of 'High Threat Exotic' weed species within a 20 m x 20m plot;
- Assessment of function attributes within a 20 m x 50 m plot, including:
  - Count of number of large trees;
  - Tree stem size classes, measured as 'diameter at breast height over bark' (DBH);
  - Regeneration based on the presence of living trees with stems <5 cm DBH;
  - The total length in metres of fallen logs over 10 cm in diameter;
- Assessment of litter cover within five 1 m x 1 m plots evenly spread within the 20 m x 50 m plot; and
- Number of trees with hollows that are visible from the ground within the 20 m x 50 m plot.

A total of five (5) plots were undertaken within the subject land, and their location is shown in **Figure 3.1**. Of these five plots, a total of 4 were undertaken within native vegetation and were utilised further within this assessment. The fifth plot was undertaken in Duffys Forest, which has been excluded from the development site, and therefore the results from this plot were not used in calculations according to the BAM. **Table 3.1** summarises the plot requirements based on vegetation zones. The minimum number of plots has been completed for both vegetation zones.

**Table 3.1 Plot survey requirements**

| Vegetation Zone | PCT | Condition* | Area (ha) | Minimum Number of Plots Required | Number of Plots Completed |
|---|---|---|---|---|---|
| 1 | 882 | Moderate | 0.75 | 1 | 2 |
| 2 | 1250 | Low | 0.11 | 1 | 1 |
| 3 | 1783 | Low | 0.16 | 1 | 1 |

### *3.2.3 Threatened Flora Species Survey*

Targeted threatened flora surveys were undertaken for species credit species that have the potential to occur within the subject land as determined by the BAM Calculator.

A number of candidate species were removed from consideration and the requirement for survey, based on a lack of suitable habitat features for these species in the subject land, or

because the subject land is located outside of the known distribution of the species. These species are listed in **Table 5.2**.

All targeted surveys were conducted using random meanders in accordance with the NSW Guide to Surveying Threatened Plants (OEH 2016b). Targeted threatened flora surveys were undertaken over several survey seasons by botanists Bryan Furchert and Rohan Mellick, on the dates shown in **Table 3.2** for the candidate species listed in Table 5.2.

### *3.2.4 Flora Survey Effort*

**Table 3.2** below provided as summary of the flora survey effort undertaken in the subject land, including dates, staff members and weather conditions.

**Table 3.2 Flora survey dates and conditions**

| Date | Staff | Temp. (°C) | Rainfall |
|---|---|---|---|
| 22-Nov-16 | Bryan Furchert | 26 | 0 |
| 5-Oct-17 | Bryan Furchert | 19.6 | 0 |
| 21-Mar-19 | Rohan Mellick | 22.5 | 0 |

The dates for survey coincideded with the appropriate survey times for candidate flora species, as identified in **Table 5.2**.

## 3.3 Fauna Survey

### *3.3.1 Threatened Fauna Species Survey*

Targeted threatened fauna surveys were not completed, beyond detailed habitat assessments, conducted during multiple surveys in spring, autumn and summer seasons, by Cumberland Ecology, concurrently with flora surveys, as summarised in **Table 3.2**.

Under Section 6.4.1.13 of the BAM, species credit species can be excluded from further assessment, and thereby targeted surveys, if it is determined that no species-specific habitat constraints are present within the subject land (see ***Section 5.3***).

Of the Candidate Species predicted in the BAM Calculator, the Powerful Owl, Barking Owl, Masked Owl, Regent Honeyeater, Swift Parrot, Southern Myotis, Gang-gang Cockatoo, Glossy Black-Cockatoo, Square-tailed Kite, Little Eagle, Eastern Osprey, White-bellied Sea-Eagle, Squirrel Glider, Koala, Long-nosed Bandicoot (North Head population), Broad-headed Snake (breeding habitat), Giant Burrowing Frog and Green and Golden Bell Frog were excluded from requiring further assessment based on either the lack of/degradation of habitat constraints within the subject land, a lack of suitable breeding habitat, or because the subject land does not occur within the mapped area for the species as advised by EES.

The results of the habitat assessment were also used to determine the potential presence of breeding habitat for cave roosting bats. The Large-eared pied bat, Eastern Bentwing-bat and Little Bentwing-bat were excluded from further consideration due to the lack of evidence of a large breeding colony of each of these species (as defined by EES).

A detailed assessment of the removal for consideration of Candidate Species is provided in **Section 5.3.2.**

Habitat assessments were carried out throughout the entirety of the subject land on 5 October 2017. This survey identified any potential habitat features such as significant rocky outcrops, bush rock, fallen logs, culverts, water bodies, decorticating bark, nests and hollow-bearing trees.

### *3.3.2 Fauna Survey Effort*

No targeted threatened fauna surveys were conducted, although detailed habitat assessments were undertaken concurrently with flora surveys as shown in **Table 3.2**. A total of approximately 16 person hours were spent on the subject land during the survey period.


**Legend**

Subject Land

**Survey Locations**

Midline

BAM Plot (20 x 20m)

**PCT**

PCT 882: Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion

PCT 1250: Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion

PCT 1783: Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast

PCT 1786: Red Bloodwood - Silvertop Ash - Stringybark open forest on ironstone in the Sydney region

Image Source:
NearMap
(dated 2018-12-28)

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 10 20 m

I:\...\16222\Figures\RP4\20190602\Figure 3.1. Flora Survey Locations

**Figure 3.1. Flora survey locations**


**Legend**

Subject Land

**Survey Locations**

**CE, 2019**

Midline

BAM Plot (20 x 20m)

Random Meander

**CE, 2017**

Random Meander

Image Source:
NearMap
(dated 2018-12-28)

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 10 20 30 m

I:\...\16222\Figures\RP4\20190602\Figure 3.2. Targeted Floar and Fauna Survey Locations

**Figure 3.2. Targeted flora and fauna survey locations**

Chapter 4

# Native Vegetation

## 4.1 Native Vegetation Extent

The subject land has been subject to detailed surveys by Cumberland Ecology for the purpose of previous flora and fauna impact assessments and the preparation of this BDAR. The native vegetation extent within the subject land was determined through aerial photograph interpretation and field surveys and is shown in **Figure 4.1**.

The remainder of the subject land consists of garden beds, cleared areas and exotic dominated grassland. In accordance with Section 5.1.1.5 of the BAM, the areas of cleared land, garden beds and exotic grassland do not require further assessment, unless they provide habitat for species credit species.

## 4.2 Plant Community Types

### *4.2.1 Introduction*

Identification of the PCTs occurring within the subject land was guided by the results of the Cumberland Ecology surveys. The data collected during surveys of the subject land was analysed in conjunction with a review of the PCTs held within the BioNet Vegetation Classification Database. Consideration was given to the following:

- Occurrence within the Pittwater IBRA subregion;
- Vegetation formation;
- Alignment with TECs;
- Landscape position; and
- Upper, mid and ground strata species.

The analysis determined that the native vegetation within the subject land aligned with the following PCTs listed below. The distribution of these PCTs within the subject land is shown in **Figure 4.2**. Detailed descriptions of this PCT and the justification for PCT selection is provided in the sections below.

- PCT 1786: Red Bloodwood - Silvertop Ash - Stringybark open forest on ironstone in the Sydney region (this PCT has been excluded from the development site, but occurs on the subject land);
- PCT 882: Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion;
- PCT 1250: Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion; and
- PCT 1783: Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast (planted)

### *4.2.2 Red Bloodwood - Silvertop Ash - Stringybark open forest on ironstone in the Sydney region*

Vegetation Formation: Dry Sclerophyll Forests (Shrubby sub-formation)

Vegetation Class: Sydney Coastal Dry Sclerophyll Forests

Area: ~0.08 ha within subject land (located outside of the development site)

Percent Cleared Value: 70%

TEC Status: Endangered Ecological Community (EEC)

*i. General Description*

Red Bloodwood – Silvertop Ash – Stringybark open forest on Ironstone in the Sydney Basin, which corresponds to Duffys Forest Endangered Ecological Community as listed under the BC Act, covers 0.08 ha in the north of the subject land. It occurs as an open forest with some scattered shrubs (**Photograph 3.1**), though much of the shrub layer and ground layer are in a state of regrowth following former clearing. The community is situated on a ridgetop, at the highest point within the subject land.

The characteristic canopy species is *Eucalyptus sieberi* (Silvertop Ash), with other native trees being *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus globoidea* (White Stringybark). Characteristic shrubs for DFEC present within the subject land are *Phyllota phylicoides* (Heath Phyllota), *Acacia ulicifolia* (Prickly Moses), *Leptospermum trinervium* (Flaky-barked Tea-tree), *Persoonia levis* (Broad-leaved Geebung) and *Lambertia formosa* (Mountain Devil). Many of the shrub species within the community are juveniles in the early stages of regrowth or as coppiced regrowth from cut stumps.

The ground layer includes indigenous species such as *Pteridium esculentum* (Common Bracken), *Entolasia stricta* (Wiry Panic), *Lepidosperma laterale*, *Cyathochaeta diandra*, *Patersonia sericea* (Silky Purple-flag), *Lomandra glauca* (Pale Mat-rush), *Xanthorrhoea media* and *Lomandra obliqua*. Some exotic species are present including *Cirsium vulgare* (Spear Thistle), *Plantago lanceolata* (Lamb's Tongues), *Ehrharta erecta* (Panic Veldtgrass) and *Paspalum dilatatum* (Paspalum).

A full flora species list is provided in **Appendix B**.

The vegetation within the north of the subject land is considered to conform to DFEC due to a combination of the canopy, understorey and groundcover species, elevation and soil type. The elevation of the subject land where DFEC occurs is 175 m above sea level (asl) which is consistent with the Duffys Forest community (which occurs between 100 – 300m asl). The community on the subject land is also of an open forest to woodland structure, typical of Duffys Forest and the natural soil of the subject land contains a sandstone influence with some ironstone nodules present.

**Photograph 4.1 Red Bloodwood – Silvertop Ash – Stringybark open forest present on the subject land, outside of the development site**

*ii. Justification of PCT Selection*

PCTs were initially filtered using BioNet Vegetation Classification System for IBRA Region and for the key canopy species *Eucalyptus sieberi* and *Eucalyptus globoidea*. The community names mapped within and adjoining the subject land (OEH, 2016) were also utilised as a guide for the selection of PCTs. The resulting list was narrowed down based on

landform and geology. PCT 1786 was determined to be the best fit based on the PCT Classification Confidence Level and the number of key indicator species present based on the BAM plot surveys undertaken.

### *4.2.3 Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion*

Vegetation Formation: Dry Sclerophyll Forests (Shrubby sub-formation)

Vegetation Class: Heathlands

Area: ~0.75 ha

Percent Cleared Value: 10%

TEC Status: Not listed

*i. General Description*

Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion with a regrowing understorey occupies an area of 0.75 ha in the subject land and occurs below the ridgeline on south facing slopes and in the east of the subject land on the flat and the gradual gradient toward the east. Generally this area is quite open with scattered canopy trees and a sparse shrub layer (**Photograph 3.2**). Canopy species include *Corymbia gummifera* (Red Bloodwood), *Eucalyptus globoidea* (White Stringybark), *Allocasuarina distyla* (Scrub She-oak), *Allocasuarina littoralis* (Black She-oak) and *Eucalyptus haemastoma* (Scribbly Gum). The canopy species are stunted due to shallow soils.

A diversity of native shrub species in the early stages of regrowth are present. Native shrubs include *Platysace linearifolia*, *Woollsia pungens, Epacris crassifolia*, *Pultenaea stipularis* (Handsome Bush-pea) and *Acacia longifolia* subsp. *longifolia* (Sydney Golden Wattle). Exotic shrubs present include *Senna pendula* and *Solanum mauritianum* (Wild Tobacco Bush).

The ground layer of this community in the study area is comprised predominately of native species including *Gleichenia dicarpa* (Pouched Coral Fern), *Xanthosia pilosa* (Woolly Xanthosia), *Actinotus minor* (Lesser Flannel Flower), *Actinotus helianthi* (Flannel Flower), *Pteridium esculentum* (Common Bracken), *Caustis pentandra* (Thick Twist Rush) and *Lomandra glauca* (Pale Mat-rush). Exotic species present include *Bidens pilosa* (Cobblers Pegs), *Cirsium vulgare* (Spear Thistle), *Trachelospermum jasminoides* (Star Jasmine) and *Paspalum dilatatum* (Paspalum).

This is a regenerating community, with a lack of floristic diversity, and the condition is considered to be moderate.

**Photograph 4.2 Hairpin Banksia - Slender Tea-tree heath present on the development site**

*ii. Justification of PCT Selection*

PCTs were initially filtered using BioNet Vegetation Classification System for IBRA Region and for the key canopy species *Corymbia gummifera* and *Eucalyptus globoidea*, and the heath formation. The community names mapped within and adjoining the subject land (OEH, 2016) were also utilised as a guide for the selection of PCTs. The resulting list was narrowed down based on landform and geology. PCT 882 was determined to be the best fit based on the PCT Classification Confidence Level and the number of key indicator species present based on the BAM plot surveys undertaken.

### *4.2.4 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion*

Vegetation Formation: Dry Sclerophyll Forests (Shrubby sub-formation)

Vegetation Class: Sydney Coastal Dry Sclerophyll Forests

Area: ~0.11 ha

Percent Cleared Value: 30%

TEC Status: Not listed

*i. General Description*

This community occurs in the south-east corner of the subject land (0.11 ha) in the lowest elevation. It consists of a canopy of one large *Eucalyptus piperita* (Sydney Peppermint), and several smaller, younger trees of *Eucalyptus piperita*, *Eucalyptus sieberi*, *Angophora costata*, and *Glochidion ferdinandi* (Cheese Tree). The shrub and ground layer have been cleared as with elsewhere on the subject land, and regrowing species of shrubs include *Leptospermum polygalifolium* (Tantoon), *Hakea propinqua*, *Persoonia pinifolia* (Pine-leaved Geebung), and *Bauera rubioides* (Dog Rose) (**Photograph 3.7**).

The ground layer ranges from native regrowth to dominated by exotic weed species. Native species present include *Xanthosia tridentata*, *Dampiera stricta, Lepidosperma laterale*, *Gleichenia dicarpa* (Pouched Coral Fern), and the grasses *Lachnagrostis filiformis* (Blown Grass), and *Imperata cylindrica* (Blady Grass).

Exotic species in the ground layer include *Ageratina adenophora, Cenchrus clandestinus* (Kikuyu), *Paspalum dilatatum*, *Cyperus eragrostis*, and *Bidens pilosa*. The condition is considered to be low.

**Photograph 4.3 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies**

*ii. Justification of PCT Selection*

PCTs were initially filtered using BioNet Vegetation Classification System for IBRA Region and for the key canopy species *Eucalyptus piperita* and *Eucalyptus sieberi*. The community

names mapped within and adjoining the subject land (OEH, 2016) were also utilised as a guide for the selection of PCTs. The resulting list was narrowed down based on landform and geology. PCT 1783 was determined to be the best fit based on the PCT Classification Confidence Level and the number of key indicator species present based on the BAM plot surveys undertaken.

### *4.2.5 Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast (Planted)*

Vegetation Formation: Dry Sclerophyll Forests (Shrubby sub-formation)

Vegetation Class: Sydney Coastal Dry Sclerophyll Forests

Area: ~0.16 ha

Percent Cleared Value: 30%

TEC Status: Not listed

Planted Urban Native and Exotic Vegetation is present throughout the west of the subject land near the residential dwelling (**Photograph 4.4**). Canopy trees present include planted non-indigenous natives such as *Casuarina glauca* (Swamp Oak), *Eucalyptus globulus* subsp. *globulus*, *Eucalyptus cladocalyx* (Sugar Gum), *Lophostemon confertus* (Brush Box) and *Syzygium paniculatum* (Magenta Lilly Pilly). Some remnant native trees are present which include *Syncarpia glomulifera* (Turpentine), *Acacia decurrens* (Black Wattle), *Pittosporum undulatum* (Native Daphne) and *Eucalyptus haemastoma* (Scribbly Gum). Many exotic trees have been planted throughout the west of the subject land such as *Liquidambar styraciflua*, *Syagrus romanzoffiana* (Cocos Palm), *Pinus radiata* (Radiata Pine), *Schinus areira* (Pepper Tree) and *Jacaranda mimosifolia* (Jacaranda).

Shrubs include exotic species *Harpephyllum caffrum* (Kaffir Plum), *Erythrina crista-galli* (Cockspur Coral Tree), *Senna pendula*, *Cotoneaster glaucophyllus* and *Ochna serrulata* (Mickey Mouse Plant). Remnant indigenous *Angophora costata* (Sydney Red Gum) and planted non-indigenous natives also occur: *Syzygium australe* (Brush Cherry) and *Tristaniopsis laurina* (Water Gum). Groundcover is predominantly exotic grasses such as *Cynodon dactylon* (Couch), *Ehrharta erecta* (Panic Veldtgrass) and *Cenchrus clandestinus* (Kikuyu Grass) maintained by mowing as a lawn. The condition is low_planted.

Due to the planted nature of the vegetation within the subject land, including non-endemic native species, the vegetation is not considered to comprise a naturally occurring PCT. The Department of Planning, Industry and Environment published a revised version of the BAM that was on public exhibition until 16 October 2019, which included a module to assess planted native vegetation. Application of this module to the planted vegetation within the subject land would result in the vegetation not being assisted to a PCT. As the revised version of the BAM is not finalised, this BDAR has been based on the current advice for planted vegetation, which is to assign to a best-fit PCT.

**Photograph 4.4 4.2.5 Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast (Planted)**

*i. Justification of PCT Selection*

As the majority of the 'urban native and exotic vegetation' present on the subject land has been planted, the few remnant trees present; *Syncarpia glomulifera*, *Acacia decurrens*, *Pittosporum undulatum* and *Eucalyptus haemastoma*, and the landscape position (on a ridge-top) were used as a guide for assigning the best-fit PCT. The plant communities mapped within and adjoining the subject land (OEH, 2016) were also utilised as a guide for the selection of PCTs. PCT 1783 was determined to be the best fit based on the PCT Classification Confidence Level.

## 4.3 Threatened Ecological Communities

One TEC is present on the subject land; Duffys Forest Ecological Community. Duffys Forest Ecological Community (DFEC) is listed as an EEC under the BC Act but is not listed under the EPBC Act. In order to avoid impacts to this TEC, which is listed as a candidate entity for 'Serious and Irreversible Impacts' (SAII), as defined by the BAM, the entire patch of this TEC was excluded from the development site.

No TEC vegetation will be cleared or modified as a result of the proposed development.

## 4.4 Vegetation Integrity Assessment

The native vegetation identified within the subject land was assigned to a vegetation zone based on PCTs and broad condition state. Patch sizes were subsequently assigned for each vegetation zone. The extent of vegetation zones and patch size classes within the development site are shown in **Figure 4.4**.

Each vegetation zone was assessed using survey plots/transects (see ***Section 3.2***) to determine the vegetation integrity score. Plot/transects utilised within the BAM Calculator to determine the vegetation integrity score are provided in **Appendix A**. A flora species list for the subject land is provided in **Appendix B**. Field data sheets and electronic copies of raw data are provided separately to this document.

Vegetation zones, patch sizes and vegetation integrity scores for the subject land are summarised in **Table 4.1**.

**Table 4.1 Vegetation Zones**

| Zone | PCT No. | PCT Name | Condition | Vegetation Community (CE 2019) | TEC Name | Patch Size Class (ha) | Vegetation Integrity Score |
|---|---|---|---|---|---|---|---|
| 1 | 882 | Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion | Moderate | Coastal Sandstone Heath-Mallee (regenerating) | NA | 101 | 39 |
| 2 | 1250 | Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion | Low | Coastal Sandstone Gully Forest (exotic dominated ground layer) | NA | 101 | 52.3 |
| 3 | 1783 | Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast | Low (planted) | Urban Native and Exotic | NA | 101 | 27.9 |

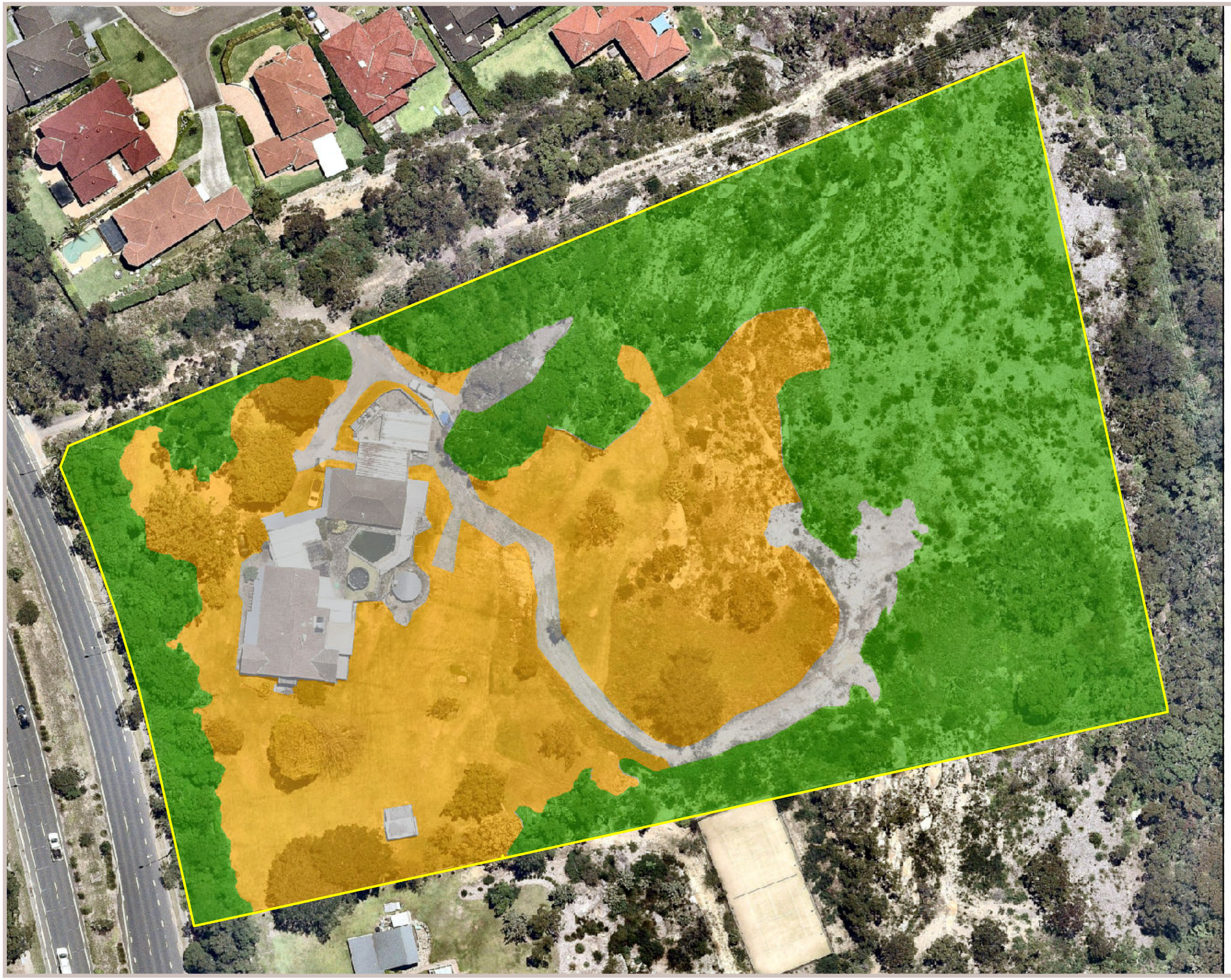


**Figure 4.1. Native vegetation extent**

**Legend**

Subject Land

**PCT**

PCT 882: Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion

PCT 1250: Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion

PCT 1783: Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast

PCT 1786: Red Bloodwood - Silvertop Ash - Stringybark open forest on ironstone in the Sydney region

Image Source:
NearMap
(dated 2018-12-28)

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 10 20 m

I:\...\16222\Figures\RP4\20190602\Figure 4.2. Plant Community Types

**Figure 4.2. Plant community types**

**Legend**

Subject Land

**TEC**

Duffys Forest Ecological Community in the Sydney Basin

Image Source:
NearMap
(dated 2018-12-28)

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 10 20 m

I:\...\16222\Figures\RP4\20190602\Figure 4.3. TECs

**Figure 4.3. Threatened ecological communities**


**Figure 4.4. Vegetation zones**

Chapter 5

# Threatened Species

## 5.1 Threatened Species for Assessment

The BAM Calculator generates a list of threatened species requiring assessment utilising a number of variables. The following criteria have been utilised to predict the threatened species requiring further assessment in the subject land:

- IBRA subregion: Pittwater;
- Percent native vegetation cover in the assessment area: 58.09%;
- Patch size:>101ha ; and
- Credit type: Ecosystem and/or species.

Based on the above variables, the BAM Calculator generated a list of 35 ecosystem credit species, 78 species credit species and seven joint ecosystem/species credit species.

## 5.2 Ecosystem Credit Species

**Table 5.1** lists the ecosystem credit species that are predicted to occur in each of the vegetation zones within the subject land. A number of these species have been removed from consideration due to a lack of habitat present on the subject land, as described in **Table 5.1**.

## Table 5.1 Predicted ecosystem credit species

| Scientific Name | Common Name | PCT #882 | PCT #1250 | PCT #1783 | Habitat Constraints and Limitations | Considered Further in Assessment | Reason for Removal |
|---|---|---|---|---|---|---|---|
| *Anthochaera phrygia* | Regent Honeyeater | x | x | x | | Yes | |
| *Artamus cyanopterus cyanopterus* | Dusky Woodswallow | x | x | x | | Yes | |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | | x | x | | Yes | |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo | x | x | x | | Yes | |
| *Daphoenositta chrysoptera* | Varied Sittella | x | x | x | | Yes | |
| *Dasyurus maculatus* | Spotted-tailed Quoll | x | x | x | | Yes | |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | | x | | | Yes | |
| *Glossopsitta pusilla* | Little Lorikeet | x | x | x | | Yes | |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle | x | x | x | | Yes | |
| *Hieraaetus morphnoides* | Little Eagle | x | x | x | | Yes | |
| *Hoplocephalus bungaroides* | Broad-headed Snake | | | | Northern extent of the IBRA Sub-region | No | Subject Land not located within northern extent of sub-region |
| *Ixobrychus flavicollis* | Black Bittern | | x | | Waterbodies. Land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense | No | No large waterbodies present on the subject land, or within 40m of the subject land |

## Table 5.1 Predicted ecosystem credit species

| Scientific Name | Common Name | PCT #882 | PCT #1250 | PCT #1783 | Habitat Constraints and Limitations | Considered Further in Assessment | Reason for Removal |
|---|---|---|---|---|---|---|---|
| | | | | | vegetation<br>-- | | |
| *Lathamus discolor* | Swift Parrot | | x | x | | Yes | |
| *Lophoictinia isura* | Square-tailed Kite | x | x | x | | Yes | |
| *Melithreptus gularis gularis* | Black-chinned Honeyeater (eastern subspecies) | | | x | | Yes | Habitat is too degraded for this species, being a small area of planted vegetation |
| *Miniopterus australis* | Little Bentwing-bat | x | x | x | | Yes | |
| *Miniopterus schreibersii oceanensis* | Eastern Bentwing-bat | x | x | x | | Yes | |
| *Micronomus norfolkensis* | Eastern Freetail-bat | x | x | x | | Yes | |
| *Neophema pulchella* | Turquoise Parrot | | x | x | | Yes | |
| *Ninox connivens* | Barking Owl | | x | x | | Yes | |
| *Ninox strenua* | Powerful Owl | | x | x | | Yes | |
| *Pandion cristatus* | Eastern Osprey | x | x | | | Yes | |
| *Petaurus australis* | Yellow-bellied Glider | | x | | | Yes | |
| *Petroica boodang* | Scarlet Robin | | x | x | | Yes | |
| *Petroica phoenicea* | Flame Robin | | x | | | Yes | |

## Table 5.1 Predicted ecosystem credit species

| Scientific Name | Common Name | PCT #882 | PCT #1250 | PCT #1783 | Habitat Constraints and Limitations | Considered Further in Assessment | Reason for Removal |
|---|---|---|---|---|---|---|---|
| *Phascolarctos cinereus* | Koala | x | x | x | | Yes | |
| *Phoniscus papuensis* | Golden-tipped Bat | | x | | | Yes | |
| *Potorous tridactylus* | Long-nosed Potoroo | x | x | | Dense shrub layer or alternatively high canopy cover exceeding 70% (i.e. to capture populations inhabiting wet sclerophyll and rainforest) | No | Dense shrub layer is not present and canopy cover does not exceed 70% |
| *Pseudomys gracilicaudatus* | Eastern Chestnut Mouse | x | | | | Yes | |
| *Pteropus poliocephalus* | Grey-headed Flying-fox | x | x | x | | Yes | |
| *Saccolaimus flaviventris* | Yellow-bellied Sheathtail-bat | x | x | | | Yes | |
| *Scoteanax rueppellii* | Greater Broad-nosed Bat | x | x | | | Yes | |
| *Tyto longimembris* | Eastern Grass Owl | x | | | | Yes | |
| *Tyto novaehollandiae* | Masked Owl | | x | x | | Yes | |
| *Varanus rosenbergi* | Rosenberg's Goanna | x | x | x | | Yes | |

## 5.3 Species Credit Species

### *5.3.1 Assessment of Habitat Constraints and Microhabitats*

**Table 5.2** lists the species credit species predicted to occur in the subject land by the BAM Calculator and details whether the species have been further assessed based on the presence or absence of habitat constraints within the subject land. Under Section 6.4.1.13 of the BAM, further species credit species can be excluded from further assessment if an assessment of habitat constraints and microhabitats determines that the habitat within the subject land is substantially degraded such that the species credit species is unlikely to occur.

Detailed habitat assessments of the subject land were undertaken as described in ***Section 3.3.3***. The habitat assessments focussed on habitat features relevant to species credit species predicted to occur. This included determining the presence/absence of the habitat constraints identified for the predicted threatened species and the condition of these habitat constraints and other microhabitats.

The initial habitat assessment survey completed in October 2017 focussed on determining if habitat for any potential species credit species (or relevant breeding component for dual credit species) was substantially degraded such that the species is unlikely to utilise the subject land or specific vegetation zone in accordance with the requirements of Step 3 (a) of Section 6.4 of the BAM. Based on the results of the survey and with consideration of the species records from the EES BioNet Atlas within 10km of the subject land, habitat requirements listed in the BioNet Atlas, and the habitat constraints present in the BAM, a number of candidate species were excluded from further assessment, as outlined in **Table 5.2**.

Two potential candidate species credit species that were recorded previously on the subject land have been excluded from consideration; *Syzygium paniculatum* and *Eucalyptus scoparia*, as they are planted species in landscaped areas.

One individual of Syzygium *paniculatum* (Magenta Lily Pilly) was recorded in the north west of the subject land (Cumberland Ecology, 2017). This species is listed as Endangered under the BC Act and Vulnerable under the EPBC Act. It occurs in subtropical and littoral rainforest within a narrow coastal strip between Upper Lansdowne and Conjola State Forest. This species is not considered to be locally indigenous to the subject land and therefore its conservation significance is reduced. This species has been observed to be planted in gardens and roadside verges within the locality.

Two individuals of *Eucalyptus scoparia* was recorded in the north west of the subject land (Cumberland Ecology, 2017). This species is listed as Endangered under the BC Act and Vulnerable under the EPBC Act. In NSW *Eucalyptus scoparia* (Wallangarra White Gum) occurs naturally in only three locations near Tenterfield. This species is not considered to be locally indigenous to the locality and therefore its conservation significance is reduced. It is commonly planted in landscaped areas in the Sydney region.

All other candidate flora species credit species have been removed from further consideration due to the degraded habitat present, lack of known local records, and through survey of the subject land.

Some candidate fauna species credit species have been removed as mapped habitat or the known distribution of the population does not occur on the subject land in the case of Regent Honeyeater, the Pittwater Koala Population, Broad-headed Snake, the population of Southern Brown Bandicoot of North Head, the Barrenjoey Peninsula population of Squirrel Glider.

Candidate fauna species credit species with breeding habitat that is lacking from the subject land have been excluded from further consideration, including for cave-dependant species; Large-eared Pied bat, Little Bentwing-bat and Large Bentwing-bat, which require that a breeding population is identified, for habitat to represent a species credit. Breeding habitat for large owls is lacking, due to an absence of large hollows, and therefore Powerful Owl and Barking Owl are excluded.

The vegetation present on the subject land is degraded due to past clearing, and has a simplified floristic composition, sparse regenerating understorey, and only scattered canopy cover throughout much of the subject land. Due to the degraded and open vegetation, the majority of candidate fauna species credit species are considered unlikely to occur, and have been removed from further consideration, including; Southern brown Bandicoot (which requires dense understorey cover), Squirrel Glider, Eastern Osprey and the other large forest birds.

For candidate species that rely of waterbodies, the subject land lacks this habitat feature, although a minor watercourse is present 200m to the east (Snake Creek). The watercourse is located outside of the development site, but is not considered to provide habitat for Green and Golden Bell Frog or Southern Myotis, which require open water habitats.

Giant Burrowing Frog has been recorded in the locality, but the species requires dense vegetation cover of 30-70%, and is dependent on hanging swamps and deeply incised drainag lines (EES, 2019), which are not present on the subject land. For these reasons, this species has been excluded as a candidate species credit species.

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| **FLORA** | | | | | | | |
| *Acacia bynoeana* | Bynoe's Wattle | | Yes | Site surveyed twice within survey time period and was not found. No records within the locality | x | | x |
| *Acacia prominens* - endangered population | Gosford Wattle, Hurstville and Kogarah Local Government Areas | Occurs in Hurstville and Kogarah Local Government Areas | No – not within geographic limitation | - | | | |
| *Acacia terminalis subsp. terminalis* | Sunshine Wattle | | Yes | Site surveyed and was not found. No records within the locality | x | | |
| *Allocasuarina portuensis* | Nielsen Park She-oak | | Yes | Site surveyed and was not found. No records within the locality | | | |
| *Asterolasia elegans* | Asterolasia elegans | | Yes | Site surveyed twice within survey time period and was not found | x | | x |
| *Astrotricha crassifolia* | Thick-leaf Star-hair | | Yes | Site surveyed twice within survey time period and was not found. No records in the | x | | x |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | | | locality | | | |
| *Caladenia tessellata* | Thick Lip Spider Orchid | | No - No records within the locality. Habitat is degraded for this species | | | | |
| *Callistemon linearifolius* | Netted Bottle Brush | | Yes | Site surveyed twice within survey time period and was not found | x | | x |
| *Camarophyllopsis kearneyi* | Camarophyllopsis kearneyi | | No - Subject land outside of geographic area of lane Cove Bushland Park | | | | |
| *Cryptostylis hunteriana* | Leafless Tongue Orchid | | Yes | Site surveyed within survey time period and was not found. No records in the locality | x | | |
| *Darwinia biflora* | Darwinia biflora | | Yes | Site surveyed within survey time period and was not found. No records in the | x | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | | | locality | | | |
| *Darwinia glaucophylla* | Darwinia glaucophylla | | Yes | Site surveyed twice within survey time period and was not found. No records in the locality | x | | x |
| *Darwinia peduncularis* | Darwinia peduncularis | | Yes | Site surveyed twice within survey time period and was not found. No records in the locality | x | | x |
| *Diuris bracteata* | Diuris bracteata | | Yes | | | | |
| *Eucalyptus camfieldii* | Camfields Stringybark | | Yes | Site surveyed twice within survey time period and was not found | x | | x |
| *Genoplesium baueri* | Bauer's Midge Orchid | | Yes | Site surveyed within survey time period and was not found | | | x |
| *Genoplesium plumosum* | Tallong Midge Orchid | | No – Subject land located outside of geographic distribution of Kurnell | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| *Grammitis stenophylla* | Narrow-leaf Finger Fern | | Yes | Site surveyed twice within survey time period and was not found. No records in the locality | x | | x |
| *Grevillea caleyi* | Caley's Grevillea | | Yes | Species recorded adjoining the subject land. Not recorded on development site during targeted surveys on 2 occasions. | x | x | |
| *Grevillea parviflora subsp. parviflora* | Small-flower Grevillea | | Yes | Site surveyed twice within survey time period and was not found. No records in the locality | x | | x |
| *Grevillea parviflora subsp. supplicans* | Grevillea parviflora subsp. supplicans | | Yes | Site surveyed twice within survey time period and was not found. No records in the locality | x | | x |
| *Grevillea shiressii* | Grevillea shiressii | | No – Subject land located outside of geographic distribution of | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | | Brisbane Waters National Park | | | | |
| *Haloragodendron lucasii* | Haloragodendron lucasii | | Yes | Site surveyed twice within survey time period and was not found | x | | x |
| *Hibbertia procumbens* | Spreading Guinea Flower | | No – Subject land located outside of geographic distribution of north of Hawesbury River | | | | |
| *Hibbertia puberula* | *Hibbertia puberula* | | Yes | Site surveyed within survey time period and was not found. No records in the locality | x | | |
| *Hibbertia spanantha* | Julian's Hibbertia | | No – habitat is degraded for this species. No records in the locality | | | | |
| *Hibbertia superans* | *Hibbertia superans* | | Yes | Site surveyed within survey | x | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | | | time period and was not found. No records in the locality | | | |
| *Hygrocybe anomala var. ianthinomarginata* | *Hygrocybe anomala var. ianthinomarginata* | | No - Subject land not located within geographic distribution in Lane Cove National Park | | | | |
| *Hygrocybe aurantipes* | *Hygrocybe aurantipes* | | No - Subject land not located within geographic distribution in Lane Cove National Park | | | | |
| *Hygrocybe austropratensis* | *Hygrocybe austropratensis* | | No - Subject land not located within geographic distribution in Lane Cove National Park | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| *Hygrocybe collucera* | *Hygrocybe collucera* | | No - Subject land not located within geographic distribution in Lane Cove National Park | | | | |
| *Hygrocybe griseoramosa* | *Hygrocybe griseoramosa* | | No - Subject land not located within geographic distribution in Lane Cove National Park | | | | |
| *Hygrocybe lanecovensis* | *Hygrocybe lanecovensis* | | No - Subject land not located within geographic distribution in Lane Cove National Park | | | | |
| *Hygrocybe reesiae* | *Hygrocybe reesiae* | | No - Subject land not located within geographic | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | | distribution in Lane Cove National Park | | | | |
| *Hygrocybe rubronivea* | *Hygrocybe rubronivea* | | No - Subject land not located within geographic distribution in Lane Cove National Park | | | | |
| *Kunzea rupestris* | *Kunzea rupestris* | | Yes | Site surveyed twice within survey time period and was not found. No records in the locality | x | | x |
| *Lasiopetalum joyceae* | *Lasiopetalum joyceae* | | Yes | Site surveyed twice within survey time period and was not found | x | | x |
| *Leptospermum deanei* | Leptospermum deanei | | Yes | Site surveyed twice within survey time period and was not found. No records in the locality | x | | x |
| *Melaleuca deanei* | Deane's Paperbark | | Yes | The site surveyed and was not | x | x | x |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | | | found | | | |
| *Melaleuca groveana* | Grove's Paperbark | | Yes | Site surveyed twice within survey time period and was not found. No records in the locality | x | | x |
| *Micromyrtus blakelyi* | *Micromyrtus blakelyi* | | Yes | No records in the locality | | | |
| *Microtis angusii* | Angus's Onion Orchid | | Yes | Not recorded during survey | | x | |
| *Persoonia hirsuta* | Hairy Geebung | | No – Habitat is degraded for this species. No records in the locality | | | | |
| *Persoonia mollis subsp. maxima* | *Persoonia mollis subsp. maxima* | | No – Habitat is degraded for this species. No records in the locality | | | | |
| Prostanthera junonis | Somersby Mintbush | | No – Habitat is degraded for this species. No records in the | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | | locality | | | | |
| *Pterostylis sp. Botany Bay* | Botany Bay Bearded Orchid | | No – Habitat is degraded for this species. Located outside of the known distribution of this species, in Botany Bay National Park | | | | |
| *Senecio spathulatus* | Coast Groundsel | | No – habitat is degraded for this species | | | | |
| *Tetratheca glandulosa* | *Tetratheca glandulosa* | | Yes | Site surveyed three times within survey time period and was not found | x | x | |
| *Wahlenbergia multicaulis* - endangered population | Tadgells Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and | | No – The subject land is located outside of the known distribution of this species | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | Strathfield | | | | | | |
| **FAUNA** | | | | | | | |
| *Anthochaera phrygia* | Regent Honeyeater | Mapped area of habitat | No - No breeding habitat is present for this species, as mapped by EES | | | | |
| *Callocephalon fimbriatum* - endangered population | Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas | Eucalypt tree species with hollows greater than 9 cm diameter | No – hollows greater than 9cm not present | | | | |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | Eucalypt tree species with hollows greater than 9 cm diameter | No - hollows greater than 9cm not present | | | | |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo | Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground. | No - hollows greater than 15cm not present | | | | |
| *Cercartetus nanus* | Eastern Pygmy-possum | | Yes | No survey conducted due to seasonal constraints. Presence assumed | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| *Chalinolobus dwyeri* | Large-eared Pied Bat | Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels. | No – Cave habitat not identified with evidence of a breeding population | | | | |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle | Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines | No – Subject land lacks mature trees | | | | |
| *Heleioporus australiacus* | Giant Burrowing Frog | Species is dependent on hanging swamps on the top of sandstone plateaus and deeply dissected gullies that occur as erosion features in the Sydney Basin | Yes | No hanging swamps or deeply disected gullys are present on the subject land | | | |
| *Hieraaetus morphnoides* | Little Eagle | Nest trees - live | No – No large old | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | (occassionally dead) large old trees within vegetation. | trees present on the subject land | | | | |
| *Hoplocephalus bungaroides* | Broad-headed Snake | Northern extent of the Sydney basin - Pittwater sub-region | No - Subject land does not occur in the northern extent of the sub-region, within the area of breeding habitat for the species (as defined by EES) | | | | |
| *Isoodon obesulus obesulus* | Southern Brown Bandicoot (eastern) | Requires dense ground cover in a variety of habitats. | No – The subject land lacks dense ground cover | | | | |
| *Lathamus discolor* | Swift Parrot | As per mapped areas | No – Subject land not within mapped area | | | | |
| *Litoria aurea* | Green and Golden Bell Frog | Semi-permanent/ephemeral wet areas | No – habitat degraded for this species | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | Within 1km of wet areas\|Swamps<br>Within 1km of swamp\|Waterbodies<br>Within 1km of waterbody | | | | | |
| *Lophoictinia isura* | Square-tailed Kite | Nest trees | No – No nesting trees present | | | | |
| *Miniopterus australis* | Little Bentwing-bat | Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature. | No – BioNet records with codes depicting habitat not present on the subject land | | | | |
| *Miniopterus schreibersii oceanensis* | Eastern Bentwing-bat | Cave, tunnel, mine, culvert or other structure | No - BioNet records with codes | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | known or suspected to be used for breeding including species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;" with numbers of individuals >500 | depicting habitat not present on the subject land | | | | |
| Myotis macropus | Southern Myotis | Dependent on waterways with pools of 3m wide or greater for foraging. Within 200 m of riparian zone. Bridges, caves or artificial structures within 200 m of riparian zone. Waterbodies, including rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site | No – No open waterbodies within 200m of the subject land | | | | |
| *Ninox connivens* | Barking Owl | Requires dense vegetation | No - | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| *Ninox strenua* | Powerful Owl | Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground. | No – Hollows greater than 20cm in diameter are absent from the subject land | | | | |
| *Pandion cristatus* | Eastern Osprey | Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting | No – stick nests are absent from the subject land | | | | |
| *Perameles nasuta - endangered population* | Long-nosed Bandicoot, North Head | South of Addison Rd Manly Headland, including Sydney Harbour NP (north)) | No – Subject land outside of geographical distribution | | | | |
| *Petaurus norfolcensis - endangered population* | Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill | Barrenjoey Peninsula | No – Subject land located outside of the geographical distribution of the population | | | | |
| *Petaurus norfolcensis* | Squirrel Glider | Relies on large old trees with hollows for breeding | No – Subject land lacks large old | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | and nesting. These trees are also critical for movement and typically need to be closely-connected (i.e. no more than 50 m apart). | trees with hollows, and mature trees that are connected | | | | |
| *Phascolarctos cinereus - endangered population* | Koala in the Pittwater Local Government Area | | No – habitat is degraded for this species | | | | |
| *Phascolarctos cinereus* | Koala | Areas identified via survey as important habitat | No - habitat is degraded for this species and not determined important habitat | | | | |
| *Pommerhelix duralensis* | Dural Woodland Snail | Leaf litter and shed bark or within 50m of litter or bark. Rocky areas<br>Rocks or within 50m of rocks. Fallen/standing dead timber including logs<br>Including logs and bark or | No – Habitat considered to be degraded for this species, due to a lack of dead timber | | | | |

## Table 5.2 Candidate Species Credit Species

| Species Credit Species | Common Name | Habitat Constraint | Confirmed Candidate Species | Result of Targeted Survey | Survey Nov 2016 | Survey Oct 2017 | Survey Mar 2019 |
|---|---|---|---|---|---|---|---|
| | | within 50m of logs or bark | | | | | |
| *Pseudophryne australis* | Red-crowned Toadlet | | Yes | No survey was undertaken due to seasonal constraints. Assumed presence | | | |
| *Pteropus poliocephalus* | Grey-headed Flying-fox | Breeding camps | No – Breeding camps not present on the subject land | | | | |
| *Tyto novaehollandiae* | Masked Owl | Living or dead trees with hollows greater than 20cm diameter. | No – Subject land lacks hollows greater than 20cm in diameter | | | | |

### 5.3.2 Candidate Species for Further Assessment

The following species were identified as candidate species credit species for further assessment;

- Flora:
  - *Grevillea caleyi*
- Fauna:
  - Eastern Pygmy-possum (*Cercartetus nanus*);

  and
  - Red-crowned Toadlet (*Pseudophryne australis*).

### 5.3.3 Presence of Candidate Species

Previous surveys by Cumberland Ecology recorded four adult, one juvenile (> 50cm tall) and seven young *Grevillea caleyi* in the road reserve along the frontage to Forest Way, located outside of the development site. Some of these had previously been recorded by Northern Beaches Council (Cumberland Ecology, 2018). This species was considered further as a candidate species credit species, although detailed surveys of the development site have failed to record any individuals on the development site.

Targeted surveys for the candidate fauna species credit species (Eastern Pygmy-possum and the Red-crowned Toadlet) were not undertaken due to the timing constraints of this assessment which meant that targeted surveys could not be undertaken during the appropriate survey period. It has therefore been assumed that these candidate species are present on the development site for the purposes of the BAM.

## 5.4 Prescribed Impacts

Prescribed impacts are outlined within the NSW *Biodiversity Conservation Regulation 2017*. The project is considered to result in a number of prescribed impacts which are outlined in **Table 5.4**.

## Table 5.3 Identification of Prescribed Impacts on the Development Site

| Feature | Present (Yes/No) | Description of feature characteristics and location | Potential Impact | Threatened species or community using or dependent on feature | Section of BDAR where impact is addressed |
|---|---|---|---|---|---|
| Karst, caves, crevices, cliffs or other geologically significant feature | No | N/A | Feature not present within site | N/A | N/A |
| Rocks | Yes | Sandstone outcrops are present on the development site, predominantly in the APZ. | Removal of some rocky habitat suitable for sheltering of fauna species | Red-crowned Toadlet andRosenberg's Goanna | Section 6.1.2 Chapter 6 |
| Human-made structure | No | N/A | Feature not present within site | N/A | N/A |
| Non-native vegetation | Yes | Exotic vegetation is present in the form of planted garden-beds at the western edge of the development site. | Reduce extent of potential foraging habitat for species | Grey-headed Flying Fox | Section 6.1.2 Chapter 6 |
| Connectivity of different areas of habitat that facilitates movement across a species' range | Yes | The subject land is located at the western extent of a vegetated corridor that includes the subject land, and extends to the north east and south east, into conservation areas. | Reduce connectivity between habitats and accessibility to habitat for species | All fauna species | Section 6.1.2 Chapter 6 |

## Table 5.3 Identification of Prescribed Impacts on the Development Site

| Feature | Present (Yes/No) | Description of feature characteristics and location | Potential Impact | Threatened species or community using or dependent on feature | Section of BDAR where impact is addressed |
|---|---|---|---|---|---|
| Movement of threatened species that maintains their lifecycle | No | NA | NA | NA | NA |
| Water quality, water bodies and hydrological processes | No | NA | NA | NA | NA |
| Wind turbine strikes | No | N/A | NA | N/A | N/A |
| Vehicle strikes | Yes | Increased truck movements during construction phase. Increase localised traffic during operation phase. | Vehicle strikes possible during construction. Additional localised traffic during operational phase unlikely to be a risk to threatened species. | All fauna species | N/A |
| Other | No | N/A | No additional prescribed impacts identified | N/A | N/A |


**Figure 5.1. Species credit species polygons**

Chapter 6

# Avoid and Minimise Impacts

## 6.1 Avoid and Minimise Impacts

This section includes demonstration of efforts to avoid and minimise impact on biodiversity values identified within the subject land.

### *6.1.1 Avoid and Minimise Direct Impacts*

*i. Project Location*

The primary measure taken to avoid impacts to biodiversity is the siting of the development site in a predominantly cleared area, which contains existing buildings, lawns and landscaped gardens. Native vegetation is very limited within the development footprint, and consists mainly of exotic species, with some species native to NSW present. Remnant trees have been avoided to the greatest extent possible. Naturally occurring plant communities will be managed to the specifications of an APZ, with careful design of the landscaped areas to retain large clumps of heath vegetation with fully structured ground and shrub layers retained. The existing scattered trees present within the APZ, are predominantly proposed for retention. Duffys Forest TEC, which occurs as a small patch in the northern portion of the subject land has been completed excluded from the development site. The patch of Duffys Forest will be fenced from the construction site to limit impacts, and will be managed under the BMP as a fully structured community, rather than being included in the APZ, in the long-term.

*ii. Consideration of Alternative Locations*

Alternative development layouts were considered throughout the planning stage and were amended as outlined below:

- Driveway realignment from the north west to the south west of the development site, to respond to Council concerns with access and threatened species impacts;
- Reduced footprint and 'built-form' as indicated by Council; and
- Avoidance of significant trees.

*iii. Consideration of Project Design*

As discussed above, the amended project design has condensed the footprint, with a compact, multi-level building sited within an existing cleared area. All ancillary works are also situated in existing disturbed areas, and will be close to the building footprint, to limit the disturbance of native vegetation. Remnant trees will be retained, wherever possible, and incorporated into landscaping. The APZ has been carefully designed with consideration of the high biodiversity values of the subject land, including the patch of Duffys Forest TEC, and *Grevillea caleyi* present in the road reserve adjoining the subject land. The fencing proposed to protect these entities will ensure that neither the Duffys Forest nor *Grevillea caleyi* will be impacted during the construction or operational phases of the Project.

### *6.1.2 Avoid and Minimise Prescribed Impacts*

Measures to avoid and minimise prescribed impacts identified in ***Section 5.4*** are outlined below.

*i. Non-native Vegetation*

The development design has focused on avoiding areas of native vegetation, and locating the development site predominantly within areas of cleared land and exotic grassland. As a result, the majority of areas to be cleared are non-native vegetation including the exotic dominated pasture and garden beds **(Photograph 6.2**).

However, the removal of this non-native vegetation has the potential to reduce the foraging habitat for the Grey-headed Flying-fox as it is known to forage in garden plantings. That notwithstanding, the exotic vegetation proposed to be removed is considered highly marginal foraging habitat for this species and is unlikely to be relied upon as a substantial foraging area. Nevertheless, approximately half of the non-native vegetation will be retained and additional landscaping will occur around the new development which will minimise the impact (if any) of the potential loss of foraging habitat for the Grey-headed Flying-fox.

*ii. Connectivity*

The development has been designed to avoid impacts to native vegetation and the development will only remove a relatively small area of native vegetation/habitat within the subject land. The vegetation to be completely removed consists of low condition fragments surrounded by exotic dominated grassland. The proposed removal of these small areas of vegetation and marginal habitat would very minimally add to fragmentation further than current conditions, as planted garden-beds will replace those removed from the western portion of the subject land. Threatened woodland birds may occasionally utilise this area for movement throughout the landscape and between areas of habitat, however none are likely to rely on the small areas of non-native vegetation that represents habitat available within the subject land.

*iii. Movement of Threatened Species*

Small areas of native vegetation and three small hollow-bearing trees will be removed that may act as part of threatened woodland bird movements; however it is considered unlikely that any birds would be solely reliant or regularly utilising the degraded and open/exposed habitat within the subject land.

*iv. Vehicle Strikes*

The construction of the slip-lane from Forest Way, to service the additional trucks and vehicles that will be accessing the site will increase the risk of fauna vehicle strike. This risk will be minimised by restricting the additional vehicles and construction to an area primarily devoid of native vegetation that could act as habitat for threatened species. Accordingly, the chance of vehicle strike to species, particularly threatened woodland bird species, is substantially reduced by avoidance of areas most likely to facilitate the movements and foraging of these species.

Chapter 7

# Impact Assessment

## 7.1 Assessment of Impacts to Native Vegetation and Habitat

### *7.1.1 Direct Impacts*

The primary and direct impact resulting from the proposed development is the loss of vegetation and associated habitat within the subject land.

*i. Impacts on Vegetation Communities*

The proposed development footprint will require the complete removal of 0.03 ha of PCT 882 and 0.08 ha of PCT 1783. Additionally vegetation will be modified in the APZ, including a total of 0.72 ha of PCT 882, 0.11 ha of PCT 1250 and 0.09 ha of PCT 1783 (see **Table 7.1**). The modification of vegetation in the APZ will result in the retention of approximately 10% of cover in each stratum over the entire APZ, as reflected by the delineation of management zones.

A total of 0.08 ha of DFEC is present in the north of the subject land that will be completely avoided, and excluded from APZ management. During construction, temporary fencing will be installed around the patch of Duffys Forest to reduce impacts from the construction of the proposed development.

The APZ will be maintained to provide adequate canopy separation in the IPA, with the retention of the existing sparse trees, and retention and planting of clumps of shrubs, as shown in **Figure 1.3**. The IPA will be managed to avoid the regrowth of canopy trees in the future, in order to comply with the Bushfire Impact Assessment (Travers Bushfire and Ecology, 2019). The OPA allows for greater retention of canopy trees, and larger clumps of shrubs (see **Figure 1.3**), in order to comply with Schedule 1, Bushfire Protection Measures, in Attachment S1 of the Bushfire Impact Assessment (Travers Bushfire and Ecology, 2019)), and this zone will be managed as a reduced fuel zone, according to the specifications of the Biodiversity Management Plan that has been prepared for the subject land (Cumberland Ecology, 2019).

**Table 7.1** identifies the areas of vegetation to be removed and retained within the subject land.

**Table 7.1 Vegetation Retained and Removed on the Development Site**

| PCT | Vegetation Community | Removed on the development site (ha) | Modified on the development site (ha) |
|---|---|---|---|
| PCT 882: Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion | Coastal Sandstone Heath-Mallee (regenerating) | 0.03 | 0.72 |
| PCT 1250: Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion | Coastal Sandstone Gully Forest (Exotic Dominated Ground Layer) | | 0.11 |
| PCT 1783: Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast | Urban Native and Exotic (planted) | 0.08 | |
| PCT 1783: Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast | Urban Native and Exotic | | 0.09 |
| Total | | 0.11 | 0.92 |

*ii. Loss of Specific Habitat Features*

The majority of the habitat, albeit degraded and young regrowth habitat, for native fauna in the subject land is in the areas of native vegetation. Overall, between 10-20% of the native vegetation on site and the majority of the habitat features will be retained under the proposed development.

Nevertheless, the proposed development will result in the loss of some existing habitat in the form of three small hollow-bearing trees and other regrowth/immature native trees that provide marginal roosting and foraging habitat for a variety of predominantly avian species.

Rock outcrops are a significant habitat feature present on the subject land. The majority of rock outcrops occur at the edge of the Duffys Forest patch and will be retained, and in the mid and eastern portions of the subject land, located outside of the development footprint, and will be retained. Landscaping has aimed to include these rock features, and retention of shrubs and trees will be located between them to allow for stepping-stone habitat for small fauna, including reptiles and amphibians.

Overall, the removal of these habitat features are considered to have only minor implications for fauna species due to the highly modified and degraded ecological context they are within and the high mobility of the species likely to utilise these habitats.

Furthermore, the bioretention basins have also been designed to include fauna habitat features, such as shallow banks, logs and rocks placed at the edges, and aquatic reeds and sedges planted in clumps. This will increase the available wetland habitat for native and threatened fauna on the subject land, once established.

### *7.1.2 Change in Vegetation Integrity Score*

To reflect the intended management of the development site, and careful retention of clumps of native vegetation within the APZ, management zones have been delineated to reflect the complete removal (development footprint) and partial clearing (APZ) of the development site. As identified in the BAM Operations Manual Stage 2 (DPIE 2019), the future structure of the vegetation in management zones applicable to the APZ, has been adjusted represent a future slight decrease of cover and species abundance, removal of structural features such as logs and litter, but slight increase in species composition. The future management zones will contain a similar density of large trees, as very few will be removed on the development site, although canopy regeneration will be inhibited.

The management zones delineated for each vegetation zone are shown in **Figure 7.1** and are listed in **Table 7.2** below.

**Table 7.2 Management Zones**

| Mngt Zone No. | Management Zone Name |
|---|---|
| 1 | Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion – Footprint |
| 2 | Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion – APZ |
| 3 | Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion - APZ |
| 4 | Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast (Landscaped/planted vegetation) - Footprint |
| 5 | Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast (Landscaped/planted vegetation) - APZ |

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Based on the management zones above, and adjustment for retention of approximately 10% of the patches of heath vegetation, and the majority of existing canopy trees within the APZ, the changes in vegetation integrity score in the development site have been calculated, as shown in **Table 7.3**.

**Table 7.3 Changes in Vegetation Integrity Score**

| Vegetation Zone | PCT code | Condition class | Management zone | Area (ha) | Vegetation integrity (VI) score | Change in VI score | Total Change in VI score |
|---|---|---|---|---|---|---|---|
| 1 | 882 | Moderate | Zone 1 | 0.03 | 0 | -39 | -39 |
| | | | Zone 2 | 0.72 | 4.1 | -34.9 | |
| 2 | 1250 | Low | Zone 3 | 0.11 | 4.6 | -47.8 | -47.8 |
| 3 | 1783 | Low_planted | Zone 4 | 0.07 | 0 | -35.4 | -35.4 |
| | | | Zone 5 | 0.09 | 4.7 | -30.7 | |

### *7.1.3 Indirect Impacts*

The following indirect impacts to native vegetation and habitat may occur as a result of the Project:

- Inadvertent impacts on adjacent habitat or vegetation;
- Reduced viability of adjacent habitat due to noise, dust or light spill; and
- Alternations to drainage and hydrology.

These are considered below in subsequent subsections.

*i. Inadvertent Impacts on Adjacent Habitat or Vegetation*

a. Nature and Extent

The vegetation within the development site that will be removed occurs predominantly within an existing disturbed area, and vegetation present is located at the western extent of a larger patch that extends to the north east and south east. Removal of the edge areas of native vegetation and construction activities associated with the new development are unlikely to inadvertently impact on the adjacent habitat beyond potential minor loss of connectivity by reducing the total width of the large corridor that extends to the east. The small patches of planted vegetation that will be removed from the western edge of the development site, may act as stepping-stone habitat patches for highly mobile species, but these patches are discontinuous with the intact corridor to the east.

b. Duration

Any impact on adjacent habitat or vegetation is likely to be long term.

c. Likely Affected Threatened Entities

There is a potential for the following threatened entities to be affected:

- Eastern Pygmy-possum; and
- Threatened woodland birds (ecosystem credit species).

d. Consequences

The construction of the Project will result in the removal of approximately 0.11 ha of native vegetation and modification of a further 0.92 ha that provides connectivity to adjacent vegetation and habitats that could be used by threatened species as they traverse throughout the landscape. However, the majority of the vegetation proposed to be removed is in low condition. The areas of modified native vegetation in the APZ will be retained as a fuel reduced area, with further separation between canopy species, but it will contain a similar diversity of species as it does currently. Due to its poor condition and sparse structure, all vegetation to be removed or modified is currently unlikely to be solely relied upon by any threatened species, or contribute substantially to genetic flow between adjacent areas of native vegetation. Therefore, the consequences of the Project on adjacent habitat or vegetation is expected to be nil or minimal.

*ii. Reduced Viability of Adjacent Habitat Due to Noise, Dust or Light Spill*

a. Nature and Extent

The Project will involve construction of the aged care facility and will therefore increase the noise, dust and light due above current levels due to the additional traffic, infrastructure and construction hours. However, the development occurs in an area adjoining Forest Way, which is a dual-carriageway main road, and already creates significant noise, dust and light spill into adjoining vegetation in the western portions of the subject land.

The retained vegetation and proximate conservation area to the east, south east and north east are located at a lower elevation than the location of the development footprint, and therefore light spill from the Project is unlikely to increase in the bushland areas.

Construction will be conducted to conform to the relevant Council and State Government requirements in relation to dust and noise generation, and there it is not considered that noise, dust, or light levels are likely to significantly increase in this area. Furthermore, construction hours will be restricted to daylight hours, and will therefore avoid disturbance of nocturnal species, which represent the majority of species groups present in the locality.

The operation of the aged care facility may result in some long term increases in light and noise relative to current levels; however, they are expected to be minor.

b. Duration

Increases in noise, dust and light are expected to last for the duration of the construction activities of the Project. The operation of the aged care facility may result in some minor long term increases in light and noise relative to current levels.

c. Likely Affected Threatened Entities

Threatened fauna.

d. Consequences

The potential increase in noise, dust and light from the proposed development is unlikely to significantly impact the adjacent habitats, particularly to the east. The area of vegetation is already subject to the significant levels of noise, dust and light from the traffic of Forest Way, and the surrounding urban and light industrial land uses. The minor increase in light, noise and dust from the Project during construction is unlikely to be such that it would reduce the viability of the adjacent habitats surrounding the subject land. The long term use of the development site may increase noise and light levels in the long term, however considering the already degraded nature of the development site and the proximity of Forest Way, this is not likely to be significant.

*iii. Inadvertent impacts to hydrological processes*

a. Nature and Extent

The subject land occurs on a steep slope, and drainage is directed both to a small drainage line in the east of the site, and overland flow and seepage occurs over the bush-rock located in the lower/eastern portions of the subject land. Natural hydrological processes on the subject land have been altered in the past from the construction of Forest Way on the ridge-line, and drainage entering the site from adjoining properties.

The location and design of the proposed development has incorporated bioretention basins to be constructed on the eastern edge of the development footprint. The primary purpose of the bioretention basins are to trap pollutants and sediment, and filter the receiving run-off from the development, before releasing the water in a way that reflects the natural hydrology of the subject land. However, it is expected that a slight increase in the volume of water received downstream will occur, and the overland flow will be restricted to some extent. Nonetheless, the alterations to natural hydrological processes are not expected to alter the habitats present such that flora or fauna would be impacted.

Sediment control and reduction measures in accordance with Managing Storm Water: Soils and Construction – Volume 1, 4$^{th}$ Edition “The Blue Book” (2004) will also be employed to minimise impacts on water quality in the downstream environment. No mapped watercourses have been mapped on the subject land, although the proposed development is located outside of the riparian corridor to the first order stream located in Oxford Falls Reserve to the east and will thereby avoid impacts to the most ecologically significant watercourse in the vicinity of the subject land.

b. Duration

Impacts to hydrological processes are expected to last in the long-term for the overland flow on the subject land, although no mapped watercourses will be impacted on or adjoining the subject land.

c. Likely Affected Threatened Entities

There is a potential for the Red-crowned Toadlet to be affected.

d. Consequences

The alteration of overland flow on the subject land has the potential to reduce habitat suitability for the Red-crowned Toadlet. This species utilises semi-aquatic habitats, such as minor watercourses, and seepage zones in rock outcrops, such as are present on the subject land. However, the alterations to hydrological processes proposed by the development are not likely to reduce the water available in the eastern portion of the subject land, and therefore the potential habitat for these species is considered largely unaffected.

## 7.2 Assessment of Prescribed Impacts

The following prescribed impacts are potentially relevant to the proposal:

- Impacts of development on the threatened species that utilise the non-native vegetation within the subject land;
- Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range; and
- Impacts on movement of species to maintain their life-cycle; and
- Impacts of development on threatened species that may occur as a result of vehicle strike.

These are discussed in detail in subsequent sections.

### *7.2.1 Impacts on Species Utilising Non-native Vegetation*

The development design has been focused on avoiding areas of native vegetation, and locating the development site predominantly within areas of cleared and exotic dominated vegetation. As a result, the majority of areas to be completely cleared contain non-native vegetation including the exotic dominated grassland and gardens, which has the potential to reduce the foraging habitat for the Grey-headed Flying-fox.

However, this non-native vegetation is considered highly marginal foraging habitat for this species and is unlikely to be relied upon as a substantial foraging area. Nevertheless, approximately half of the non-native vegetation will be retained and additional landscaping will occur around the new development which will minimise the impact (if any) of the potential loss of foraging habitat for the Grey-headed Flying-fox.

### 7.2.2 *Connectivity of Different Areas of Habitat that Facilitates Movement Across a Species Range*

The development has been designed to avoid impacts to native vegetation; hence the development will only remove a relatively small area of native vegetation/habitat within the subject land. The vegetation to be completely removed consists of low condition fragments surrounded by exotic dominated grassland. The proposed removal of these small areas of vegetation and marginal habitat would very minimally add to fragmentation further than current conditions, as planted garden-beds will replace those removed from the western portion of the subject land. Threatened woodland birds may occasionally utilise this area for movement throughout the landscape and between areas of habitat, however none are likely to rely on the small areas of non-native vegetation that represents habitat available within the subject land.

### 7.2.3 *Movement of Threatened Species that Maintains their Lifecycle*

The project design has aimed to reduce the development footprint where feasible and the current layout will allow for the retention of over half the area of both native and non-native vegetation within the subject land that may be utilised by threatened woodland birds. These retained areas will provide for any movement of threatened species required to maintain their lifecycle, however it is considered unlikely that any species would be regularly utilising the exposed and degraded habitats within the subject land as part of their lifecycle movements.

### 7.2.4 *Vehicle Strike*

The proposed development will increase the number of trucks and vehicles that will access the site during construction, and to a lesser extent during operation, and will increase the risk of fauna vehicle strike. However, the development footprint occurs in an area primarily devoid of native vegetation that could act as habitat for threatened species. Accordingly, the chance of vehicle strike to species, particularly threatened woodland bird species, is substantially reduced by avoidance of areas most likely to facilitate the movements and foraging of these species.

## 7.3 Mitigation Measures for Impacts to Native Vegetation and Habitat

A range of mitigation measures have been developed for this project to mitigate the impacts that are unable to be avoided using the measures outlined previously. These include a range of measures to be undertaken before and during construction to limit the impact of construction, enhance the retained vegetation and measures to manage weed control.

These measures are discussed in more detail below.

### *7.3.1 Construction Mitigation Measures*

*i. Timing of Construction Works*

In order to minimise impacts to nocturnal fauna, bulk earthworks within the vicinity of the retained bushland areas will be conducted during day-light hours.

In order to minimise impacts to threatened fauna species that may utilise the hollow-bearing trees within the subject land, removal of these will either be:

- Undertaken after a pre-clearance inspection by a qualified ecologist determines no hollow-dwelling species breeding presence at that time; or
- If breeding hollow-dwelling species are located, removal will be once the ecologist determines the breeding period for that species has ended and all juveniles have moved on.

*ii. Delineation of Clearing Areas*

Areas that require clearance will be flagged and clearly delineated by temporary fencing (as shown in **Figure 1.3**) to ensure that no areas intended for conservation will be inadvertently cleared during the construction process. No machinery will be parked on areas beyond the temporary fencing and no access will be allowed during construction. Ancillary facilities such as stockpile sites, site compounds and construction zones will not be located beyond the limits of clearing.

*iii. Pre-clearance Surveys*

In order to avoid impacts to fauna species during construction, pre-clearance surveys will be conducted in all areas that are required to be cleared. Pre-clearing surveys will be undertaken ahead of clearing, to limit fauna injury and mortality and to identify habitat features to be relocated. Pre-clearance surveys will be conducted by suitably qualified ecologists and all fauna found during these surveys will be encouraged to move on or relocated by the ecologists in areas of similar habitat nearby that will not be impacted.

Pre-clearing protocols will include:

- Preparation of an inventory of trees and hollows to be removed and relocated, prior to clearing;
- Checking trees for the presence of bird nests and arboreal mammals, such as possums, gliders and bats, prior to felling;
- Animals found to be occupying trees and habitat will be safely removed before the clearing of trees and relocated into nearby woodlands; and
- Boulders and large logs will be placed in nearby areas of retained vegetation to allow their continued use as fauna habitat.

*iv. Sedimentation Control Measures*

One of the potential impacts of the project is increased sedimentation of waterways downstream as a result of soil disturbance during construction. In order to prevent this impact, the construction management plan for the Project includes details of erosion, sediment and stormwater control during construction. These measures will be undertaken in accordance with "The Blue Book" (Landcom 2004).

*v. Weed Management*

The subject land lies within the Greater Sydney Local Land Services Area and is subject to the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 and management of Weeds of National Significance (WoNS).

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds and high risk activities, as provided in the Appendices of the Greater Sydney Regional Strategic Weed Management Plan.

Priority weed species occurring within the subject land will be managed in order to prevent further spread downslope to intact native vegetation. Prior to any vegetation clearance, Priority weeds in the canopy and shrub layers should be demarcated in order for these to be disposed of separately from native material. Priority weed species present within the subject land are listed in **Section 3.2.3***.* Further specifications of weed control measures that will be implemented throughout the subject land are provided in the Biodiversity Management Plan (BMP) that has been prepared for the site.

## 7.4 Mitigation Measures for Prescribed Impacts

### *7.4.1 Impacts on Species Utilising Non-native Vegetation*

Although non-native vegetation that may occasionally be utilised by the Grey-headed Flying-fox for foraging will be removed from the development site, the majority of native trees will be retained on the subject land. Additionally, clumps of native vegetation will be retained and additional areas that comprise a mix of native and non-native species will be planted in accordance with the landscaping plan. The plantings provided under the landscape plan are likely to result in maintenance or improvement of the biodiversity values of the non-native vegetation currently occupying the subject land.

### *7.4.2 Connectivity of Different Areas of Habitat that Facilitates Movement Across a Species' Range*

As previously stated in ***Section 7.2.3***, the vegetation to be removed is located within an existing disturbed area, at the western extent of a corridor of habitat that extends to the east, south east and north east. The proposed removal of this small area of vegetation and marginal habitat would very minimally add to fragmentation further than current conditions, as there is currently very limited connectivity due to numerous existing hostile gaps to the west, due to the presence of Forest Way.

The design of the Project provides for landscaped vegetation throughout the subject land, which can be used as "stepping stones" for fauna species to move through the landscape. The "stepping stone" habitat will provide maintain fauna habitat and movement corridors for the species that may utilise the subject land and will contribute to the broader corridor that extends to the east and adjacent habitats, including threatened woodland birds.

### *7.4.3 Movement of Threatened Species that Maintains their Lifecycle*

As previously mentioned in ***Section 7.3.1***, a number of construction measures are proposed to mitigate any potential impacts to threatened species that may occasionally utilise the subject land for foraging. These measures are focused around the timing of the construction works and pre-clearance surveys.

As detailed previously, landscaped vegetation will be created throughout the subject land, which can be used as "stepping stones" for fauna species to move through the landscape. The "stepping stone" habitat will enable the continued movement of threatened species that may utilise the subject land.

To minimise the impacts upon native threatened woodland birds utilising hollows for breeding or tree limbs for nesting, vegetation pre-clearance surveys are required for all vegetation to be removed and clearing should not occur during the breeding period for any species found to be utilising the habitats within the subject land.

### *7.4.4 Vehicle Strike*

As discussed in ***Section 7.2.5***, the limiting of the construction timing to daylight hours, will avoid the most active times for nocturnal species. Low speed limits will be enforced, both during construction and operation, to limit the risk to fauna susceptible to vehicle strike. The construction zone will be fenced to exclude access to retained vegetation, including the APZ areas in the eastern portion of the site. Nonetheless, as the development footprint is located within a predominantly cleared area, and close to Forest Way, it is unlikely that fauna will be utilising the habitats closest to the construction site, and therefore the risk of vehicle interactions is relatively low.

Accordingly, the chance of vehicle strike to species, particularly threatened woodland bird species, is substantially reduced by avoidance of areas most likely to facilitate the movements and foraging of these species.

## 7.5 Adaptive Management of Uncertain Impacts

Vehicle strike is the only uncertain impact likely to be relevant to the Project. Management of vehicle strike will be through implementation of:

- Signage: appropriate signage notifying vehicles of potential fauna presence should be installed along the access road;
- Fencing of the construction site;

- Speed limits: Speed limits will be introduced to restrict the speed of vehicles travelling along the access road; and

- Lighting: Low wattage lighting, and minimal / well-spaced street lights should be considered. The use of lights with flat glass aeroscreen rather than reflector glass covers may be an option to reduce glare, thus reducing impact on nocturnal fauna. The location of street lights is subject to the final road design plans.

## 7.6 Assessment Thresholds

Unavoidable impacts of the project have been considered and a determination made of the assessment thresholds. The following sections outline the assessment thresholds and their relevance to the project.

### *7.6.1 Impacts that Require an Offset*

*i. Native Vegetation*

In accordance with the BAM, an offset is required for all impacts of development on PCTs that are associated with:

- A vegetation zone that has a vegetation integrity score ≥15 where the PCT is representative of an EEC or CEEC, or;

- A vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community; or

- A vegetation zone that has vegetation integrity score of ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The PCTs and vegetation zones requiring offsets, and the number of ecosystem credits required, are documented in **Table 7.4**, whilst these areas are mapped in **Figure 7.2**.

It is noted that the Department of Planning, Industry and Environment published a revised version of the BAM that was on public exhibition until 16 October 2019, which included a module to assess planted native vegetation. Application of this module to the planted vegetation within the subject land would result in the vegetation being assessed for species credits only (i.e. no calculation of ecosystem credits). As the revised version of the BAM is not finalised, this BDAR has been based on the current advice for planted vegetation, which is to assign to a best-fit PCT. Due to the presence of several large trees in this planted area of vegetation, the vegetation integrity score is relatively high, and has resulted in high credit liability for PCT 1783. This is despite the fact that the majority of large trees are being retained.

**Table 7.4 Credit requirements for the Project - Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat**

| PCT | Vegetation zone name | Vegetation integrity loss / gain | Area (ha) | Constant | Species sensitivity to gain class (for BRW) | Biodiversity risk weighting | Ecosystem credits |
|---|---|---|---|---|---|---|---|
| Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion | | | | | | | |
| Zone 1 | 882_Moderate | 39 | 0.8 | 0.25 | High Sensitivity to Potential Gain | 1.5 | 11 |
| | | | | | | | 11 |
| Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast | | | | | | | |
| Zone 3 | 1783_Low_planted | 35.4 | 0.2 | 0.25 | High Sensitivity to Potential Gain | 1.5 | 2 |
| | | | | | | | 2 |
| Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion | | | | | | | |
| Zone 2 | 1250_Low | -47.8 | 0.1 | 0.25 | High Sensitivity to Potential Gain | 1.5 | 2 |
| | | | | | | | 2 |
| Total Ecosystem Credits | | | | | | | 15 |

*ii. Threatened Species*

Species credit species have been assessed as impacted within the subject land, based on assumed presence of Eastern Pygmy-possum. These species require an offset, as shown in **Table 7.5** and mapped in **Figure 7.2**.

**Table 7.5 Species Credit Requirements for the Project**

| Vegetation zone name | Habitat condition (HC) | Area (ha) / individual (HL) | Constant | Biodiversity risk weighting | Potential SAII | Species credits |
|---|---|---|---|---|---|---|
| Cercartetus nanus / Eastern Pygmy-possum ( Fauna ) | | | | | | |
| 882_Moderate | 39 | 0.75 | 0.25 | 2 | False | 15 |
| 1250_Low | 47.8 | 0.11 | 0.25 | 2 | False | 3 |
| | | | | | Subtotal | 18 |
| Pseudophryne australis / Red-crowned Toadlet ( Fauna ) | | | | | | |
| 882_Moderate | 39 | 0.75 | 0.25 | 1.5 | False | 11 |
| 1250_Low | 47.8 | 0.11 | 0.25 | 1.5 | False | 2 |
| | | | | | Subtotal | 13 |
| Total Species Credits | | | | | | 31 |

### *7.6.2 Impacts that do not Require an Offset*

All areas identified in **Figure 7.2** as 'Cleared' or 'Exotic dominated grassland' occur within the subject land however do not require an offset. Areas within the subject land that do not require assessment are shown in **Figure 7.3**.

## 7.7 Summary of Offset Credits Required

The credit requirement for the project is summarised in **Table 7.4**. A credit report from the BAM calculator has been included in **Appendix C**.

## Legend

Development Site

**Management Zone**

Zone 1: Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion - Footprint

Zone 2: Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion - APZ/landscaping

Zone 3: Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion - APZ/landscaping

Zone 4: Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast (Landscaped/planted vegetation) - Footprint

Zone 5: Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast (Landscaped/planted vegetation) - APZ/landscaping

Image Source:
NearMap
(dated 2018-12-28)

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 10 20 m

I:\...\16222\Figures\RP4\20191108\Figure 7.1. Management Zones

**Figure 7.1. Management zones**


**Figure 7.2. Location of impacts that require an offset**


**Figure 7.3. Location of impacts that do not require an offset**

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Chapter 8

# Conclusion

The Project involves the construction and operation of an aged care facility within the subject land. An assessment was undertaken to examine the impacts of the Project on the biodiversity values of the subject land. This BDAR has been prepared to document the findings of an ecological investigation undertaken within the subject land in accordance with the BAM.

Past and current use of the subject land has entailed clearing and modification of the majority of pre-existing native vegetation. Despite the impacts of previous disturbance and location within a fragmented landscape, the proposed development will require the clearing of native vegetation that forms marginal suitable habitat for some threatened fauna species.

The development layout has been modified to ensure that direct and indirect impacts on the TEC Duffys Forest present on the subject land, and the nearby population of *Grevillea caleyi* located in the unformed road easement to the north, are completely avoided. These entities are located entirely outside of the development site (and footprint) and will be fenced to protect the full occurrence of Duffys Forest and *Grevillea caleyi* from construction impacts.

The proposed development footprint will require the complete removal of 0.03 ha of PCT 882 and 0.08 ha of PCT 1783 (planted vegetation). Additionally, vegetation will be modified in the APZ, including a total of 0.72 ha of PCT 882, 0.11 ha of PCT 1250 and 0.07 ha of PCT 1783. The modification of vegetation in the APZ will result in the retention of approximately 10% of cover over the entire area, as reflected by the delineation of management zones.

Vegetation retained on the subject land will be modified as part of an APZ, and will retain large clumps of native heath vegetation, managed with groundcover and shrubs. Additionally, the scattered trees present on the subject land will be predominantly retained. All retained vegetation will be managed under a BMP, which will improve the function of the ecological communities present through weed control and active management.

The mitigation measures recommended to be implemented include:

- Vegetation protection;
- Erosion, sedimentation and pollution control;
- Pre-clearing and clearing surveys;
- Weed control measures; and

- Re-vegetation.

In order to address the residual impacts, ecosystem and species credits are required.

A total of 15 ecosystem credits are required for PCT 882, PCT 1250 and PCT 1783.

Species credit species have been assessed as impacted within the subject land, based on assumed presence of the Eastern Pygmy Possum and Red-crowned Toadlet and these species require an offset. A total of 31 species credits are required.

A suite of mitigation measures have been proposed to minimise the direct, indirect and prescribed impacts of the Project, such as construction mitigation measures, weed management and pre-clearance surveys. With the implementation of the proposed mitigation measures and the offsetting described previously, it is considered that the impacts of this project on biodiversity will be minimal and can be appropriately managed.

# References


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*Appendix A*

# BAM Plot Data

**Table A.1 BAM Plot Data**

| Zone / Plot No. | PCT | Area | Patch Size | Condition class | Zone | Easting | Northing | Bearing | Tree | Shrub | Grass | Forb | Fern | Other | Tree | Shrub | Grass | Forb | Fern | Other | Large Trees | Hollows | Litter | Fallen logs | Stems 5-10cm | Stems 10-20cm | Stems 20-30cm | Stem 30-50cm | Stems 50-80cm | Regeneration present | High Threat exotics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zone 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Plot | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 882 | 0.75 | 101 | Moderate | 56 | 335239 | 6266779 | 45 | 2 | 25 | 13 | 14 | 4 | 5 | 15.2 | 9.9 | 10.1 | 3.1 | 5.3 | 0.5 | 1 | 0 | 16.0 | 2.5 | 1 | 1 | 1 | 1 | 0 | 1 | 2.2 |
| 2 | 882 | 0.75 | 101 | Moderate | 56 | 335290 | 6266782 | 180 | 2 | 19 | 10 | 9 | 0 | 0 | 5.1 | 9.5 | 12.9 | 1.6 | 0.0 | 0.0 | 0 | 0 | 53.0 | 0.0 | 1 | 0 | 1 | 0 | 0 | 1 | 1.3 |
| Zone 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Plot | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 1250 | 0.11 | 101 | Low | 56 | 335324 | 6266712 | 320 | 7 | 20 | 12 | 10 | 3 | 4 | 28.8 | 10.0 | 4.2 | 2.5 | 3.6 | 1.6 | 1 | 1 | 50.0 | 3.5 | 0 | 1 | 1 | 1 | 1 | 1 | 5.2 |
| Zone 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Plot | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 1783 | 0.16 | | Low_planted | 56 | 335146 | 6266730 | 60 | 4 | 14 | 6 | 5 | 1 | 2 | 41.1 | 3.3 | 1.6 | 1.0 | 0.2 | 0.6 | 1 | 0 | 69.0 | 1.1 | 1 | 1 | 1 | 1 | 1 | 1 | 3.6 |

*Appendix B*

# Flora species list

## Table B.1 Flora species list

| Family | Exotic | Scientific Name | Common Name | NSW Status | Comm. Status | Native | Exotic | High Threat Weed | BAM Growth Form Group |
|---|---|---|---|---|---|---|---|---|---|
| Caprifoliaceae | * | Abelia chinensis | | | | | YES | #N/A | #N/A |
| Fabaceae (Mimosoideae) | | Acacia linifolia | White Wattle | | | YES | | #N/A | Shrub (SG) |
| Fabaceae (Mimosoideae) | | Acacia longifolia subsp. longifolia | Sydney Golden Wattle | | | YES | | #N/A | Shrub (SG) |
| Fabaceae (Mimosoideae) | | Acacia myrtifolia | Red-stemmed Wattle | | | YES | | #N/A | Shrub (SG) |
| Fabaceae (Mimosoideae) | | Acacia podalyriifolia | Queensland Silver Wattle | | | YES | | #N/A | Shrub (SG) |
| Fabaceae (Mimosoideae) | | Acacia suaveolens | Sweet Wattle | | | YES | | #N/A | Shrub (SG) |
| Fabaceae (Mimosoideae) | | Acacia terminalis | Sunshine Wattle | | | YES | | #N/A | Shrub (SG) |
| Fabaceae (Mimosoideae) | | Acacia ulicifolia | Prickly Moses | | | YES | | #N/A | Shrub (SG) |
| Apiaceae | | Actinotus helianthi | Flannel Flower | P | | YES | | #N/A | Forb (FG) |
| Apiaceae | | Actinotus minor | Lesser Flannel Flower | | | YES | | #N/A | Forb (FG) |
| Bromeliaceae | * | Aechmea cylindrata | | | | | YES | #N/A | #N/A |
| Alliaceae | * | Agapanthus africanus | Lily of the Nile | | | | YES | #N/A | #N/A |
| Asteraceae | * | Ageratina adenophora | Crofton Weed | | | | YES | YES | #N/A |
| Casuarinaceae | | Allocasuarina distyla | | | | YES | | #N/A | Shrub (SG) |
| Casuarinaceae | | Allocasuarina torulosa | Forest Oak | | | YES | | #N/A | Tree (TG) |
| Poaceae | * | Andropogon virginicus | Whisky Grass | | | | YES | YES | #N/A |
| Myrtaceae | | Angophora costata | Sydney Red Gum | | | YES | | #N/A | Tree (TG) |
| Myrtaceae | | Angophora hispida | Dwarf Apple | | | YES | | #N/A | Tree (TG) |

## Table B.1 Flora species list

| Family | Exotic | Scientific Name | Common Name | NSW Status | Comm. Status | Native | Exotic | High Threat Weed | BAM Growth Form Group |
|---|---|---|---|---|---|---|---|---|---|
| Poaceae | | Anisopogon avenaceus | Oat Speargrass | | | YES | | #N/A | Grass & grasslike (GG) |
| Poaceae | * | Arundo donax | Giant Reed | | | | YES | YES | #N/A |
| Asparagaceae | * | Asparagus aethiopicus | Asparagus Fern | | | | YES | YES | #N/A |
| Poaceae | | Austrostipa puberula | | | | YES | | #N/A | Grass & grasslike (GG) |
| Poaceae | * | Axonopus fissifolius | Narrow-leafed Carpet Grass | | | | YES | YES | #N/A |
| Myrtaceae | | Baeckea imbricata | | | | YES | | #N/A | Shrub (SG) |
| Proteaceae | | Banksia ericifolia | Heath-leaved Banksia | | | YES | | #N/A | Shrub (SG) |
| Proteaceae | | Banksia integrifolia | Coast Banksia | | | YES | | #N/A | Tree (TG) |
| Proteaceae | | Banksia serrata | Old-man Banksia | | | YES | | #N/A | Tree (TG) |
| Cunoniaceae | | Bauera microphylla | | | | YES | | #N/A | Shrub (SG) |
| Cunoniaceae | | Bauera rubioides | River Rose | | | YES | | #N/A | Shrub (SG) |
| Asteraceae | * | Bidens pilosa | Cobbler's Pegs | | | | YES | YES | #N/A |
| Pittosporaceae | | Billardiera scandens | Hairy Apple Berry | | | YES | | #N/A | Other (OG) |
| Rutaceae | | Boronia ledifolia | Sydney Boronia | P | | YES | | #N/A | Shrub (SG) |
| Fabaceae (Faboideae) | | Bossiaea heterophylla | Variable Bossiaea | | | YES | | #N/A | Shrub (SG) |
| Fabaceae (Faboideae) | | Bossiaea scolopendria | | | | YES | | #N/A | Shrub (SG) |
| Acanthaceae | | Brunoniella pumilio | Dwarf Blue Trumpet | | | YES | | #N/A | Forb (FG) |
| Cunoniaceae | | Callicoma serratifolia | Black Wattle | | | YES | | #N/A | Shrub (SG) |

## Table B.1 Flora species list

| Family | Exotic | Scientific Name | Common Name | NSW Status | Comm. Status | Native | Exotic | High Threat Weed | BAM Growth Form Group |
|---|---|---|---|---|---|---|---|---|---|
| Theaceae | * | Camellia japonica | Camellia | | | | YES | #N/A | #N/A |
| Lauraceae | | Cassytha glabella | | | | YES | | #N/A | Other (OG) |
| Cyperaceae | | Caustis flexuosa | Curly Wig | P | | YES | | #N/A | Grass & grasslike (GG) |
| Cyperaceae | | Caustis pentandra | Thick Twist Rush | P | | YES | | #N/A | Grass & grasslike (GG) |
| Apiaceae | | Centella asiatica | Indian Pennywort | | | YES | | #N/A | Forb (FG) |
| Cunoniaceae | | Ceratopetalum gummiferum | Christmas Bush | P | | YES | | #N/A | Tree (TG) |
| Poaceae | * | Chloris gayana | Rhodes Grass | | | | YES | YES | #N/A |
| Asteraceae | * | Cirsium vulgare | Spear Thistle | | | | YES | #N/A | #N/A |
| Amaryllidaceae | * | Clivia miniata | | | | | YES | #N/A | #N/A |
| Commelinaceae | | Commelina cyanea | Native Wandering Jew | | | YES | | #N/A | Forb (FG) |
| Asteraceae | * | Conyza bonariensis | Flaxleaf Fleabane | | | | YES | #N/A | #N/A |
| Asteraceae | * | Conyza sumatrensis | Tall fleabane | | | | YES | #N/A | #N/A |
| Myrtaceae | | Corymbia gummifera | Red Bloodwood | | | YES | | #N/A | Tree (TG) |
| Rutaceae | | Crowea saligna | | P | | YES | | #N/A | Shrub (SG) |
| Orchidaceae | | Cryptostylis subulata | Large Tongue Orchid | P | | YES | | #N/A | Forb (FG) |
| Cupressaceae | * | Cupressus spp. | | | | | YES | #N/A | #N/A |
| Cyatheaceae | | Cyathea cooperi | Straw Treefern | P | | YES | | #N/A | Other (OG) |
| Cyperaceae | | Cyathochaeta diandra | | | | YES | | #N/A | Grass & grasslike (GG) |

## Table B.1 Flora species list

| Family | Exotic | Scientific Name | Common Name | NSW Status | Comm. Status | Native | Exotic | High Threat Weed | BAM Growth Form Group |
|---|---|---|---|---|---|---|---|---|---|
| Poaceae | | Cynodon dactylon | Common Couch | | | YES | | #N/A | Grass & grasslike (GG) |
| Cyperaceae | * | Cyperus brevifolius | | | | | YES | #N/A | #N/A |
| Cyperaceae | * | Cyperus eragrostis | Umbrella Sedge | | | | YES | YES | #N/A |
| Cyperaceae | | Cyperus gracilis | Slender Flat-sedge | | | YES | | #N/A | Grass & grasslike (GG) |
| Cyperaceae | | Cyperus polystachyos | | | | YES | | #N/A | Grass & grasslike (GG) |
| Goodeniaceae | | Dampiera stricta | | | | YES | | #N/A | Forb (FG) |
| Phormiaceae | | Dianella caerulea | Blue Flax-lily | | | YES | | #N/A | Forb (FG) |
| Phormiaceae | | Dianella caerulea var. producta | | | | YES | | #N/A | Forb (FG) |
| Phormiaceae | | Dianella prunina | | | | YES | | #N/A | Forb (FG) |
| Convolvulaceae | | Dichondra repens | Kidney Weed | | | YES | | #N/A | Forb (FG) |
| Orchidaceae | | Dipodium variegatum | | P | | YES | | #N/A | Forb (FG) |
| Poaceae | * | Ehrharta erecta | Panic Veldtgrass | | | | YES | YES | #N/A |
| Elaeocarpaceae | | Elaeocarpus reticulatus | Blueberry Ash | | | YES | | #N/A | Shrub (SG) |
| Poaceae | | Entolasia marginata | Bordered Panic | | | YES | | #N/A | Grass & grasslike (GG) |
| Poaceae | | Entolasia stricta | Wiry Panic | | | YES | | #N/A | Grass & grasslike (GG) |
| Ericaceae | | Epacris crassifolia | | | | YES | | #N/A | Shrub (SG) |
| Ericaceae | | Epacris longiflora | Fuchsia Heath | | | YES | | #N/A | Shrub (SG) |
| Ericaceae | | Epacris microphylla | Coral Heath | | | YES | | #N/A | Shrub (SG) |

## Table B.1 Flora species list

| Family | Exotic | Scientific Name | Common Name | NSW Status | Comm. Status | Native | Exotic | High Threat Weed | BAM Growth Form Group |
|---|---|---|---|---|---|---|---|---|---|
| Ericaceae | | Epacris pulchella | Wallum Heath | | | YES | | #N/A | Shrub (SG) |
| Myrtaceae | | Eucalyptus globoidea | White Stringybark | | | YES | | #N/A | Tree (TG) |
| Myrtaceae | | Eucalyptus haemastoma | Broad-leaved Scribbly Gum | | | YES | | #N/A | Tree (TG) |
| Myrtaceae | | Eucalyptus piperita | Sydney Peppermint | | | YES | | #N/A | Tree (TG) |
| Myrtaceae | | Eucalyptus sieberi | Silvertop Ash | | | YES | | #N/A | Tree (TG) |
| Moraceae | * | Ficus spp. | | | | | YES | #N/A | #N/A |
| Cyperaceae | | Gahnia clarkei | Tall Saw-sedge | | | YES | | #N/A | Grass & grasslike (GG) |
| Cyperaceae | | Gahnia sieberiana | Red-fruit Saw-sedge | P | | YES | | #N/A | Grass & grasslike (GG) |
| Geraniaceae | | Geranium homeanum | | | | YES | | #N/A | Forb (FG) |
| Gleicheniaceae | | Gleichenia dicarpa | Pouched Coral Fern | | | YES | | #N/A | Fern (EG) |
| Phyllanthaceae | | Glochidion ferdinandi | Cheese Tree | | | YES | | #N/A | Tree (TG) |
| Fabaceae (Faboideae) | | Glycine tabacina | Variable Glycine | | | YES | | #N/A | Other (OG) |
| Haloragaceae | | Gonocarpus teucrioides | Germander Raspwort | | | YES | | #N/A | Forb (FG) |
| Goodeniaceae | | Goodenia paniculata | | | | YES | | #N/A | Forb (FG) |
| Proteaceae | | Grevillea sericea | Pink Spider Flower | | | YES | | #N/A | Shrub (SG) |
| Proteaceae | | Hakea dactyloides | Finger Hakea | | | YES | | #N/A | Shrub (SG) |
| Proteaceae | | Hakea propinqua | | | | YES | | #N/A | Shrub (SG) |
| Proteaceae | | Hakea sericea | Needlebush | | | YES | | #N/A | Shrub (SG) |

## Table B.1 Flora species list

| Family | Exotic | Scientific Name | Common Name | NSW Status | Comm. Status | Native | Exotic | High Threat Weed | BAM Growth Form Group |
|---|---|---|---|---|---|---|---|---|---|
| Fabaceae (Faboideae) | | Hardenbergia violacea | False Sarsaparilla | | | YES | | #N/A | Other (OG) |
| Dilleniaceae | | Hibbertia scandens | Climbing Guinea Flower | | | YES | | #N/A | Other (OG) |
| Dennstaedtiaceae | | Histiopteris incisa | Bat's Wing Fern | | | YES | | #N/A | Fern (EG) |
| Asteraceae | * | Hypochaeris radicata | Catsear | | | | YES | #N/A | #N/A |
| Juncaceae | | Juncus usitatus | | | | YES | | #N/A | Grass & grasslike (GG) |
| Fabaceae (Faboideae) | | Kennedia rubicunda | Dusky Coral Pea | | | YES | | #N/A | Other (OG) |
| Myrtaceae | | Kunzea ambigua | Tick Bush | P | | YES | | #N/A | Shrub (SG) |
| Proteaceae | | Lambertia formosa | Mountain Devil | | | YES | | #N/A | Shrub (SG) |
| Verbenaceae | * | Lantana camara | Lantana | | | | YES | YES | #N/A |
| Cyperaceae | | Lepidosperma laterale | Variable Sword-sedge | | #N/A | YES | | #N/A | #N/A |
| Asteraceae | | Leptorhynchos squamatus | Scaly Buttons | | | YES | | #N/A | Forb (FG) |
| Myrtaceae | | Leptospermum polyanthum | | | | YES | | #N/A | Shrub (SG) |
| Myrtaceae | | Leptospermum squarrosum | | | #N/A | YES | | #N/A | #N/A |
| Myrtaceae | | Leptospermum trinervium | Slender Tea-tree | | | YES | | #N/A | Shrub (SG) |
| Restionaceae | | Lepyrodia scariosa | | | | YES | | #N/A | Grass & grasslike (GG) |
| Ericaceae | | Leucopogon microphyllus | | | | YES | | #N/A | Shrub (SG) |
| Liliaceae | * | Lilium formosanum | Formosan Lily | | | | YES | #N/A | #N/A |
| Lindsaeaceae | | Lindsaea linearis | Screw Fern | | | YES | | #N/A | Fern (EG) |

## Table B.1 Flora species list

| Family | Exotic | Scientific Name | Common Name | NSW Status | Comm. Status | Native | Exotic | High Threat Weed | BAM Growth Form Group |
|---|---|---|---|---|---|---|---|---|---|
| Lomandraceae | | Lomandra filiformis subsp. filiformis | | | | YES | | #N/A | Grass & grasslike (GG) |
| Lomandraceae | | Lomandra glauca | Pale Mat-rush | | | YES | | #N/A | Grass & grasslike (GG) |
| Lomandraceae | | Lomandra longifolia | Spiny-headed Mat-rush | | | YES | | #N/A | Grass & grasslike (GG) |
| Lomandraceae | | Lomandra multiflora | Many-flowered Mat-rush | | | YES | | #N/A | Grass & grasslike (GG) |
| Lomandraceae | | Lomandra obliqua | | | | YES | | #N/A | Grass & grasslike (GG) |
| Proteaceae | | Lomatia silaifolia | Crinkle Bush | P | | YES | | #N/A | Shrub (SG) |
| Caprifoliaceae | * | Lonicera japonica | Japanese Honeysuckle | | | | YES | YES | #N/A |
| Fabaceae (Faboideae) | | Mirbelia rubiifolia | Heathy Mirbelia | | | YES | | #N/A | Shrub (SG) |
| Loganiaceae | | Mitrasacme paludosa | | | | YES | | #N/A | Forb (FG) |
| Malvaceae | * | Modiola caroliniana | Red-flowered Mallow | | | | YES | #N/A | #N/A |
| Davalliaceae | | Nephrolepis cordifolia | Fishbone Fern | | | YES | | #N/A | Fern (EG) |
| Ochnaceae | * | Ochna serrulata | Mickey Mouse Plant | | | | YES | YES | #N/A |
| Poaceae | | Oplismenus aemulus | | | | YES | | #N/A | Grass & grasslike (GG) |
| Oxalidaceae | * | Oxalis corniculata | Creeping Oxalis | | | | YES | #N/A | #N/A |
| Oxalidaceae | * | Oxalis latifolia | | | | | YES | #N/A | #N/A |
| Poaceae | * | Paspalum dilatatum | Paspalum | | | | YES | YES | #N/A |
| Iridaceae | | Patersonia sericea | Silky Purple-Flag | | | YES | | #N/A | Forb (FG) |
| Proteaceae | | Persoonia levis | Broad-leaved Geebung | P | | YES | | #N/A | Shrub (SG) |

## Table B.1 Flora species list

| Family | Exotic | Scientific Name | Common Name | NSW Status | Comm. Status | Native | Exotic | High Threat Weed | BAM Growth Form Group |
|---|---|---|---|---|---|---|---|---|---|
| Proteaceae | | Persoonia pinifolia | Pine-leaved Geebung | P | | YES | | #N/A | Shrub (SG) |
| Fabaceae (Faboideae) | | Phyllota phylicoides | Heath Phyllota | | | YES | | #N/A | Shrub (SG) |
| Phytolaccaceae | * | Phytolacca octandra | Inkweed | | | | YES | #N/A | #N/A |
| Thymelaeaceae | | Pimelea linifolia | Slender Rice Flower | | | YES | | #N/A | Shrub (SG) |
| Pinaceae | * | Pinus radiata | Radiata Pine | | | | YES | #N/A | #N/A |
| Pittosporaceae | | Pittosporum undulatum | Sweet Pittosporum | | | YES | | #N/A | Shrub (SG) |
| Plantaginaceae | * | Plantago lanceolata | Lamb's Tongues | | | | YES | #N/A | #N/A |
| Platanaceae | * | Platanus x acerifolia | Hybrid Plane | | | | YES | #N/A | #N/A |
| Apiaceae | | Platysace linearifolia | | | | YES | | #N/A | Shrub (SG) |
| Lobeliaceae | | Pratia purpurascens | Whiteroot | | | YES | | #N/A | Forb (FG) |
| Dennstaedtiaceae | | Pteridium esculentum | Bracken | | | YES | | #N/A | Fern (EG) |
| Cyperaceae | | Ptilothrix deusta | | | | YES | | #N/A | Grass & grasslike (GG) |
| Fabaceae (Faboideae) | | Pultenaea stipularis | | | | YES | | #N/A | Shrub (SG) |
| Goodeniaceae | | Scaevola ramosissima | Purple Fan-flower | | | YES | | #N/A | Forb (FG) |
| Schizaeaceae | | Schizaea bifida | Forked Comb Fern | | | YES | | #N/A | Fern (EG) |
| Cyperaceae | | Schoenus apogon | Fluke Bogrush | | | YES | | #N/A | Grass & grasslike (GG) |
| Cyperaceae | | Schoenus melanostachys | | | | YES | | #N/A | Grass & grasslike (GG) |
| Fabaceae (Caesalpinioideae) | * | Senna pendula var. glabrata | | | | | YES | #N/A | #N/A |

## Table B.1 Flora species list

| Family | Exotic | Scientific Name | Common Name | NSW Status | Comm. Status | Native | Exotic | High Threat Weed | BAM Growth Form Group |
|---|---|---|---|---|---|---|---|---|---|
| Poaceae | * | Setaria parviflora | | | | | YES | #N/A | #N/A |
| Malvaceae | * | Sida rhombifolia | Paddy's Lucerne | | | | YES | #N/A | #N/A |
| Smilacaceae | | Smilax glyciphylla | Sweet Sarsparilla | | | YES | | #N/A | Other (OG) |
| Solanaceae | * | Solanum mauritianum | Wild Tobacco Bush | | | | YES | #N/A | #N/A |
| Poaceae | * | Sporobolus africanus | Parramatta Grass | | | | YES | #N/A | #N/A |
| Poaceae | * | Stenotaphrum secundatum | Buffalo Grass | | | | YES | YES | #N/A |
| Arecaceae | * | Syagrus romanzoffiana | Cocos Palm | | | | YES | #N/A | #N/A |
| Myrtaceae | | Syncarpia glomulifera | Turpentine | | | YES | | #N/A | Tree (TG) |
| Asteraceae | * | Taraxacum officinale | Dandelion | | | | YES | #N/A | #N/A |
| Elaeocarpaceae | | Tetratheca thymifolia | Black-eyed Susan | | | YES | | #N/A | Shrub (SG) |
| Verbenaceae | * | Verbena officinalis | Common Verbena | | | | YES | #N/A | #N/A |
| Ericaceae | | Woollsia pungens | | | | YES | | #N/A | Shrub (SG) |
| Xanthorrhoeaceae | | Xanthorrhoea arborea | | P | | YES | | #N/A | Other (OG) |
| Xanthorrhoeaceae | | Xanthorrhoea media | | P | | YES | | #N/A | Other (OG) |
| Apiaceae | | Xanthosia pilosa | Woolly Xanthosia | | | YES | | #N/A | Forb (FG) |
| Apiaceae | | Xanthosia tridentata | Rock Xanthosia | | | YES | | #N/A | Forb (FG) |
| Rutaceae | | Zieria pilosa | Pilose-leafed Zieria | | | YES | | #N/A | Shrub (SG) |

*Appendix C*

# Credit Report

# BAM Biodiversity Credit Report (Like for like)

## Proposal Details

| | | |
|---|---|---|
| Assessment Id | Proposal Name | BAM data last updated * |
| 00015032/BAAS18166/19/00015033 | Belrose Manor | 30/10/2019 |
| Assessor Name | Assessor Number | BAM Data version * |
| David Robertson | BAAS17027 | 16 |
| Proponent Names | Report Created | BAM Case Status |
| Chriroseph Pty Ltd | 19/11/2019 | Finalised |
| Assessment Revision | Assessment Type | Date Finalised |
| 0 | Part 4 Developments (General) | 19/11/2019 |

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

## Potential Serious and Irreversible Impacts

Nil

Nil

## Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

# BAM Biodiversity Credit Report (Like for like)

Predicted Threatened Species Not On Site

| Name |
|---|
| **Ixobrychus flavicollis /** Black Bittern |
| **Hoplocephalus bungaroides /** Broad-headed Snake |
| **Potorous tridactylus /** Long-nosed Potoroo |

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

| Name of Plant Community Type/ID | Name of threatened ecological community | Area of impact | Number of credits to be retired |
|---|---|---|---|
| 882-Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion | Not a TEC | 0.8 | 11.00 |
| 1250-Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion | Not a TEC | 0.1 | 2.00 |
| 1783-Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast | Not a TEC | 0.2 | 2.00 |

| **882-Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion** | **Like-for-like credit retirement options** | | | |
|---|---|---|---|---|
| | Class | Trading group | HBT | IBRA region |

| | | | | |
|---|---|---|---|---|
| | Sydney Coastal Heaths<br>This includes PCT's:<br>772, 881, 882, 1134, 1143, 1641, 1822, 1823, 1824, 1826 | Sydney Coastal Heaths - < 50% cleared group (including Tier 7 or higher). | Yes | Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| | | | | |
| **1250-Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion** | **Like-for-like credit retirement options** | | | |
| | Class | Trading group | HBT | IBRA region |
| | Sydney Coastal Dry Sclerophyll Forests<br>This includes PCT's:<br>1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787 | Sydney Coastal Dry Sclerophyll Forests - < 50% cleared group (including Tier 7 or higher). | Yes | Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |
| | | | | |

# BAM Biodiversity Credit Report (Like for like)

| 1783-Red Bloodwood - Scribbly Gum / Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast | **Like-for-like credit retirement options** | | | |
|---|---|---|---|---|
| | Class | Trading group | HBT | IBRA region |
| | Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787 | Sydney Coastal Dry Sclerophyll Forests - < 50% cleared group (including Tier 7 or higher). | Yes | Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

## Species Credit Summary

| Species | Area | Credits |
|---|---|---|
| **Cercartetus nanus** / Eastern Pygmy-possum | 0.9 | 18.00 |
| **Pseudophryne australis** / Red-crowned Toadlet | 0.9 | 13.00 |

| **Cercartetus nanus**/ Eastern Pygmy-possum | 1250_Low | **Like-for-like credit retirement options** | |
|---|---|---|---|
| | | Spp | IBRA region |
| | | **Cercartetus nanus**/Eastern Pygmy-possum | Any in NSW |

| | | |
|---|---|---|
| **Cercartetus nanus**/ Eastern Pygmy-possum | 1250_Low | |
| | 882_Good | **Like-for-like credit retirement options** |
| | | Spp / IBRA region |
| | | **Cercartetus nanus**/Eastern Pygmy-possum / Any in NSW |
| **Pseudophryne australis**/ Red-crowned Toadlet | 1250_Low | **Like-for-like credit retirement options** |
| | | Spp / IBRA region |
| | | **Pseudophryne australis**/Red-crowned Toadlet / Any in NSW |
| | 882_Good | **Like-for-like credit retirement options** |
| | | Spp / IBRA region |
| | | **Pseudophryne australis**/Red-crowned Toadlet / Any in NSW |