357-373 Warringah Rd, Frenchs Forest

Flora and Fauna Assessment

Bunnings Group

12 June 2020

Final





Report No. 16145RP1

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 commendations 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	13/05/2020	HG/VO	Draft	
2	12/06/2020	VO	Final	

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Table of Contents

Glo	ssary	V
Exe	cutive Summary	vi
1.	Introduction	1
	1.1. Purpose	1
	1.2. Background	1
	1.3. Relevant Legislation	2
2.	Methodology	5
	2.1. Database Analysis and Literature Review	5
	2.2. Flora Survey	5
	2.3. Fauna Survey	6
	2.4. Limitations	7
3.	Results	8
	3.1. Vegetation Communities	8
	3.2. Threatened Vegetation Communities	13
	3.3. Flora Species	13
	3.4. Fauna Species	15
4.	Impact Assessment	18
	4.1. Impacts on Vegetation Communities	18
	4.2. Impacts on Flora Species	19
	4.3. Impacts on Fauna Species	20
5.	Mitigation Measures	23
	5.1. Vegetation Protection	23
	5.2. Erosion, Sedimentation and Pollution Control	23
	5.3. Pre-clearing Surveys and Clearing Supervision	23
	5.4. Nest Box Installation	23
	5.5. Weed Control Measures	24
C	5.6. Replanting	24
6.	Conclusion	25
7.	References	27

Table of Tables

Table 1 Priority Weeds occurring within the study area	14
Table 2 Hollow-bearing trees within the study area	15



Table 3. Vegetation Present in the Study Area and Removed from the Subject Site	18
Table 4 Flora Species List	A.2
Table 5 Threatened flora likelihood of occurrence assessment	B.1
Table 6 Threatened fauna likelihood of occurrence assessment	B.10

Table of Photographs

Photograph 1 Duffys Forest within the study area	9
Photograph 2 Duffys Forest within the study area	10
Photograph 3 Duffys Forest within the study area	10
Photograph 4 Planted Urban Native/Exotics within the study area	11
Photograph 5 Lagunaria patersonia (Norfolk Island Hibiscus)	12
Photograph 6 Planted shrubs within the study area	12

Table of Appendices

APPENDIX A : Flora Species List APPENDIX B : Threatened Species Likelihood of Occurrence Assessments APPENDIX C : Tests of Significance

Table of Figures

- Figure 1 Location of the subject site and study area
- Figure 2 Koala Development Application mapping within the study area
- Figure 3 Land zoning of the study area
- Figure 4 Flora survey locations within the study area
- Figure 5 Vegetation communities within the study area
- Figure 6 Habitat features of the study area

Glossary

ABBREVIATION	EXPANSION
BAM	Biodiversity Assessment Method
BC Act	NSW Biodiversity Conservation Act 2016
Biosecurity Act	NSW Biosecurity Act 2015
BOS	Biodiversity Offsets Scheme
DA	Development Application
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DoEE	Commonwealth Department of Environment and Energy
DPIE	NSW Department of Planning, Industry and Environment
Duffys Forest	Duffys Forest Ecological Community in the Sydney Basin Bioregion
EEC	Endangered Ecological Community
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environmental Protection and Biodiversity Conservation Act 1999
FFA	Flora and Fauna Assessment
FM Act	NSW Fisheries Management Act 1994
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectares
LEP	Warringah Local Environment Plan 2011
LGA	Local Government Area
LLSA	NSW Local Land Services Amendment Act 2016
m	metres
MNES	Commonwealth Matters of National Environmental Significance
NSW	New South Wales
OEH	NSW Office of Environment and Heritage (now DPIE)
Project	Construction of the new Bunnings Warehouse and associated infrastructure
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
study area	the area included within this FFA as defined by the boundary of Lot 1 DP 1209581
subject site	the area subject to the Project as shown in Figure 1
TEC	Threatened Ecological Community

Executive Summary

S1 Introduction

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been commissioned by Bunnings Group Limited to conduct a Flora and Fauna Assessment (FFA) to support a Development Application (DA) for the construction of a new Bunnings Warehouse at 357–373 Warringah Road, Frenchs Forest (hereafter referred to as 'the Project'). The purpose of this FFA is to evaluate the ecological impacts of the Project, specifically impacts on threatened flora, fauna or ecological communities listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

S2 Background

The Project is located at 357-373 Warringah Road, Frenchs Forest (Lot 1 DP 1209581), referred to as the 'study area', as shown in **Figure 1**, and lies within the Warringah Local Government Area (LGA). The study area is approximately 2.18 ha in size and is bound by Warringah Road to the north, Rodborough Road to the south, Allambie Road to the west and businesses to the east. The subject site is defined as the direct impact area for the Project as shown in **Figure 1**. Currently two existing businesses are present on the subject site: Infomedia and Australia Post. Vegetation is scattered throughout parts of the study area, with the largest tract of vegetation present along the northern boundary.

Bunnings Group Limited is preparing a DA to be submitted to Warringah Council as Local Development under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The approval will involve the demolition of the current buildings and carpark and the construction of the new Bunnings Warehouse building, a new carpark and associated infrastructure. Given the proposed works will require some minor vegetation removal, this FFA has been prepared as part of the authority to address all the requirements of the BC Act.

S3 Methods

Database analysis, vegetation/flora surveys, fauna habitat surveys and fauna observations were undertaken in July 2016 and April 2020. Flora surveys involved recording the presence of flora species using plot-based surveys following the Biodiversity Assessment Method (BAM), random meander surveys, and targeted threatened flora surveys. All vascular plants were recorded or collected and later identified to species level where possible. Fauna surveys included a habitat assessment and incidental observations of birds and other vertebrates.

S4 Results

The study area contains a mix of exotic and native flora species, with one patch of ~ 0.22 ha (or 2200m²) of native vegetation in the northern portion of the study area that conforms to the listing of *Duffys Forest Ecological Community in the Sydney Basin Bioregion* (Duffys Forest). Duffys Forest is listed as an Endangered Ecological Community (EEC) under the BC Act and is not listed under the EPBC Act. The patch of Duffys Forest comprises remnant canopy trees throughout a modified ground and shrub layer that exists as a managed garden bed. The remainder of the vegetation present throughout the study area comprises Planted Urban



Native/Exotics (~0.30 ha or 3000m²) and Exotic vegetation (~0.06 ha or 600m²). These are not considered to conform to the definition of any native vegetation community.

A total of 137 plant species were recorded during surveys, of which 43 were exotic and 94 were native. Nine of the exotic species are categorised as 'Other Weeds of Regional Concern' and one as a 'Regional Priority Weed – Containment' under the *Biosecurity Act 2015*. Two weed species, *Asparagus aethiopicus* (Ground Asparagus) and *Lantana camara* (Lantana), are listed State Priority Weeds and Weeds of National Significance (WONS).

One threatened flora species, *Eucalyptus nicholii* (Black-leaved Black Peppermint) was recorded within the study area in the Planted Urban Native/Exotic vegetation in the western portion of the subject site. This individual tree is not naturally occurring in the study area as it is outside of the species range and the tree is frequently planted as a roadside and garden bed tree throughout the locality. Several additional threatened flora species were considered as having the potential to occur within the Duffys Forest vegetation in the study area, including *Prostanthera marifolia* (Seaforth Mintbush), *Grevillea caleyi* (Caley's Grevillea) and *Pimelea curviflora var. curviflora*.

No threatened fauna species were recorded during the surveys by Cumberland Ecology, however, six threatened fauna species are considered as having the potential to utilise the habitat within the study area. These are the Powerful Owl (*Ninox strenua*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Little Bentwing-bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*) and the Eastern Coastal Freetail-bat (*Micronomus norfolkensis*).

An additional two migratory species listed under the EPBC Act, the Fork-tailed Swift (*Apus pacificus*) and the White-throated Needletail (*Hirundapus caudacutus*), have the potential to forage aerially above the study area as part of a wider foraging range.

S5 Impact Assessment

The proposed works will involve predominantly utilising previously cleared and developed areas, along with clearing some areas of Planted Urban Native/Exotic and Exotic vegetation. One threatened ecological community, Duffys Forest, has the potential to be indirectly impacted as a result of edge-effects from the proposed development. The Duffys Forest within the study area has a canopy of mature tree species over a cultivated garden bed planted with a mix of non-endemic and native species. Approximately 0.002 ha (or 20m²) of Duffys Forest is located within the subject site and represents canopy overhang, but will not be removed. Therefore, the entire patch of Duffys Forest, totalling 0.22 ha (2200m²) is proposed for retention. Nonetheless, given that the patch already occurs in a highly urbanised environment, and adjoins a carpark, the potential indirect impacts are not likely to be exacerbated by the proposed development, and therefore no significant impact is likely to occur to Duffys Forest.

One threatened flora species, *Eucalyptus nicholii* (Black-leaved Black Peppermint) was recorded within the subject site in the Planted Urban Native/Exotic vegetation and will be retained as within the landscaped area of the Project. This species does not occur naturally in the locality, and the Project will therefore not act to further isolate habitat for the species, or result in a significant impact to the species. The Duffys Forest present in the study area is considered to comprise potential habitat for several additional threatened flora species, however given the modified state of the vegetation any potential indirect impacts as part of the Project, will not result in a significant impact to any of these potentially occurring threatened flora species.



No threatened fauna species have been recorded from the study area. Nevertheless, the ~ 0.11 ha (1100m²) Planted Urban Native/Exotic and ~ 0.02 ha (200m²) Exotic vegetation to be removed from the subject site provide some modified foraging habitat for the six potentially occurring threatened fauna species and for two migratory species. Two microchiropteran bat species also have the potential to roost within the one hollow-bearing tree that will be removed, while four others present within the study area will be retained. None of these threatened fauna species are likely to be dependent on the small area of degraded habitat within the subject site for their survival. These are highly mobile species that access resources from across a vast foraging range. The Project is, therefore, not considered likely to have a significant impact on any threatened or migratory fauna species.

S6 Mitigation Measures

A number of mitigation measures are recommended for the Project. The mitigation measures recommended to be implemented included:

- Vegetation protection;
- Erosion, sedimentation and pollution control;
- Pre-clearing and clearing surveys;
- Nest box installation;
- Weed control measures; and
- Replanting.

S7 Conclusion

The study area has historically been heavily modified and exists in a predominantly degraded urbanised state, however, one patch of moderate condition Duffys Forest occurs within the northern portion of the study area this patch will be retained and protected as part of the Project.

Nevertheless, the proposed demolition and redevelopment will require the removal of a small area of planted native and exotic vegetation that does not conform to any native vegetation community, although may provide potential foraging habitat for threatened and native fauna species.

Based upon the assessments undertaken in this report, no significant impact is expected to occur to threatened species, populations or communities as a result of the proposed redevelopment of the subject site. Therefore, the preparation of a Biodiversity Development Assessment Report (BDAR) is not warranted. A referral to the Commonwealth Department of Agriculture, Water and Environment (DAWE), under the EPBC Act is also not required.



1. Introduction

1.1. Purpose

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been commissioned by Bunnings Group Limited to conduct a Flora and Fauna Assessment (FFA) to support a Development Application (DA) for the proposed construction of a new Bunnings Warehouse (the 'Project') at 357-373 Warringah Road, Frenchs Forest. The Project will involve construction of new buildings, car parks and associated infrastructure in the location of the existing development within the site.

Throughout this FFA, the area delineated by the boundary of Lot 1 DP 1209581 will be referred to as the 'study area' and the development impact area will be referred to as the 'subject site', as shown in **Figure 1**.

The purpose of this report is to describe the current biodiversity values of the study area and to assess the potential impacts of the proposed works on flora and fauna, particularly threatened species, populations and communities that are listed under the New South Wales (NSW) *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The specific objectives of this report are to:

- Describe the vegetation communities of the study area;
- Describe fauna habitats and fauna usage of the study area;
- Identify any threatened species, populations or ecological communities (as listed under the BC Act and/or EPBC Act) existing within the study area;
- Assess the likelihood of occurrence of threatened species, populations or communities (as listed under the BC Act and/or EPBC Act) within the study area;
- Assess the potential impact of the project on threatened species, populations or communities (as listed under the BC Act and/or EPBC Act), including the completion of Tests of Significance under Section 7.3 of the BC Act; and
- Where relevant, recommend mitigation measures to reduce the impacts of the Project on biodiversity values.

1.2. Background

1.2.1. Site Description

The study area is located at 357-373 Warringah Road, Frenchs Forest (Lot 1 DP 1209581) and lies within the Warringah Local Government Area (LGA). The study area is approximately 2.18 ha in size and is bound by Warringah Road to the north, Rodborough Road to the south, Allambie Road to the west and businesses to the east. Currently two existing businesses are present on the subject site: Infomedia and Australia Post. Vegetation is scattered throughout parts of the study area, with the largest tract of vegetation present along the northern boundary.

Previous broad-scale mapping indicates that *Duffys Forest Ecological Community in the Sydney Basin Bioregion* is present along the northern boundary of the study area. This community is listed as an Endangered Ecological Community (EEC) under the BC Act but is not listed under the EPBC Act.

1.2.2. Description of the Project

Bunnings Group Limited is preparing a DA to be submitted to Warringah Council as Local Development under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The approval will involve the demolition of the current buildings and carpark and the construction of the new Bunnings Warehouse building, a new carpark and associated infrastructure. The Project impacts will be predominantly confined to the portion of the subject site that is already developed, however a small portion of native vegetation will be removed under the proposed Project.

1.2.3. Prior Studies

Cumberland Ecology conducted initial flora and fauna surveys of the study area in July 2016 for the purpose of preparing a Due Diligence Report for Bunnings Group Limited to assess the viability of redeveloping the site (our reference – 16245 Let2). The results of this survey and the information provided within the Due Diligence Report have been incorporated into this FFA.

1.3. Relevant Legislation

1.3.1. Environmental Planning and Assessment Act 1979

The EP&A Act is the overarching planning legislation in NSW. This act provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the consideration of the environment and biodiversity values, which is addressed in Section 5A (Significant effect on species, populations or ecological communities or their habitats) should a land use change be proposed. This includes threatened species, communities, habitat and processes as listed under the BC Act and *Fisheries Management Act 1994* (FM Act).

1.3.2. Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's key piece of environmental legislation and is administered by the Commonwealth Department of Agriculture, Water and the Environment (DAWE) (formerly DoEE). It is designed to protect national environmental assets, known as Matters of National Environmental Significance (MNES), which include threatened species of flora and fauna, threatened ecological communities, migratory species as well as other protected matters. Among other things, it defines the categories of threat for threatened flora and fauna, identifies key threatening processes and provides for the preparation of recovery plans for threatened flora, fauna and communities.

Under the EPBC Act, any action (which includes a development, project or activity) that is considered likely to have a significant impact on MNES must be referred to the Commonwealth Minister for the Environment.

1.3.3. Biodiversity Conservation Act 2016

Under the NSW Land Management and Biodiversity Conservation (LMBC) reform, the NSW Parliament passed the following two Acts in November 2016:



- Biodiversity Conservation Act 2016 (BC Act), which replaces the Threatened Species Conservation Act 1995, the Nature Conservation Trust Act 2001 and parts of the National Parks and Wildlife Act 1974; and
- Local Land Services Amendment Act 2016 (LLSA Act), which replaces the Native Vegetation Act 2003 and the Native Vegetation Regulation 2005.

These reforms commenced on 25 August 2017 and are now in force.

A key part of the reforms is the introduction of the Biodiversity Offsets Scheme (BOS). The BOS applies to local development (assessed under Part 4 of the EP&A Act) that is likely to significantly affect threatened species or communities or that triggers threshold levels for when assessment via the BOS is required. The threshold has three elements:

- Whether the amount of native vegetation being cleared exceeds a threshold area;
- Whether the area being cleared is mapped on the Biodiversity Values map published by the Minister for the Environment; and
- Whether the impact on threatened species or ecological communities is deemed significant.

An assessment of whether the project triggers these threshold levels is provided below.

The native vegetation clearing thresholds are defined in Part 7.2 of the *Biodiversity Conservation Regulation* 2017. The minimum lot size for the property is 0.4 ha (4000m²), allowing native vegetation clearance of less than 0.25 ha (2500m²) without triggering the BOS. The native vegetation proposed to be cleared from within the subject site does not exceed 0.25 ha (2500m²) and therefore the BOS will not be triggered by this mechanism.

Under the BC Act the Biodiversity Values Map details sites which are considered to have significant environmental values where the preparation of a Biodiversity Development Assessment Report (BDAR) may be required. In relation to the study area, the property is not mapped under the Biodiversity Values Map.

Based on the results of the Tests of Significance presented within the appendices of this FFA, the BOS threshold is not triggered by this mechanism and a BDAR is not required. Accordingly, this FFA is deemed suitable to accompany the DA for the purpose of assessing the ecological impacts of the Project.

1.3.4. Biosecurity Act 2015

The *Noxious Weeds Act 1993* no longer applies, and problematic weeds are handled under the NSW *Biosecurity Act 2015* (Biosecurity Act). Under the Biosecurity Act all weeds are required to be controlled by all persons under a "General Biosecurity Duty". The General Biosecurity Duty means that all public and private land owners or managers and all other people who deal with weed species (biosecurity matters) must use the most appropriate approach to prevent, eliminate, or minimise the negative impact (biosecurity risk) of those weeds (DPI 2017).

Under the Biosecurity Act some weed species have been prioritised for management by specific regulations and controls under the act. These are known as State Level Priority Weeds. The state has been divided into 11

regions (each covering a number of LGAs) under the Act. Within each region, additional weed species known as Regional Priority Weeds have been prioritised for management. A further set of weeds are identified within the Regional Strategic Weed Management Plans as being "other weeds of regional concern".

All land within the subject site occurs within the Greater Sydney Local Land Services region, and weed management within the region is to be undertaken under the direction of the South East Regional Strategic Weed Management Plan (2017). Appendix 1 of the Weed Management Plan outlines the State Priority Weeds, Regional Priority Weeds, and other weeds of regional concern.

1.3.5. State Environmental Planning Policy (Koala Habitat Protection) 2019

State Environmental Planning Policy (Koala Habitat Protection) 2019 (Koala Habitat Protection SEPP) applies to Warringah LGA as of 1 March 2020, replacing *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44).

The Koala Habitat Protection SEPP includes a new definition of 'core koala habitat', two maps to help protect koalas across NSW, and includes a Draft Koala Habitat Protection Guideline. The list of tree species used by koalas listed under the SEPP has also been expanded from 10 to 123, across nine distinct regions of NSW.

Under the new process of identifying core koala habitat, a development application must follow the criteria of the Draft Koala Habitat Protection Guideline if it includes land identified as pink on the Koala Development Application Map. If it is determined the development on this land will have an impact on koalas or their habitat, a Koala Assessment Report must be prepared for the project. Areas that are under ongoing site investigations are mapped as blue. The study area is mapped as blue, and therefore does not need to be considered as core koala habitat and does not require a Koala Assessment Report.

Koala Development Application Mapping within the study area is shown in Figure 2.

1.3.6. Warringah Local Environmental Plan 2011

The study area is located within the Warringah LGA and is therefore subject to the *Warringah Local Environment Plan 2011* (LEP).

The study area is currently zoned as B7 Business Park under the LEP (**Figure 3**). The objectives of B7 Zoning are:

- To provide a range of office and light industrial uses;
- To encourage employment opportunities;
- To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area;
- To create business park employment environments of high visual quality that relate favourably in architectural and landscape treatment to neighbouring land uses and to the natural environment; and

• To minimise conflict between land uses in the zone and adjoining zones and ensure the amenity of adjoining or nearby residential land uses.

2. Methodology

2.1. Database Analysis and Literature Review

Database analysis was conducted for the locality using both the NSW Environment, Energy and Science (EES) Threatened Species Data Collection - BioNet (Bionet 2020) and the Commonwealth DAWE Protected Matters Search Tool (DAWE 2020). The locality is defined as the area within a 5 km radius of the study area. The BioNet Database search was used to generate records of threatened flora and fauna species listed under the BC Act within the locality of the study area. The Protected Matters Search Tool generated a list of Matters of National Environmental Significance listed under the EPBC Act potentially occurring within the locality of the study area. For the purpose of this assessment fish, migratory wetland species and marine species were excluded. The lists generated from these databases were reviewed against available knowledge of the study area, in conjunction with the abundance, distribution, and age of records to ascertain the likelihood of occurrence of threatened species within the study area.

2.2. Flora Survey

Flora surveys were undertaken within the study area by Cumberland Ecology on 13 July 2016 and on 28 April 2020. Surveys included vegetation mapping, plot-based vegetation survey, and targeted threatened flora searches. Further details of each of the survey methods are provided below and **Figure 4** shows the survey locations.

All vascular plants recorded or collected were identified using keys and nomenclature provided in Harden (Harden 1990-1993). Where known, taxonomic and nomenclatural changes have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2020).

2.2.1. Vegetation Mapping

Previous broad-scale vegetation mapping conducted for the Sydney Metro v3.1 (OEH 2016) was utilised to determine potential vegetation communities likely to occur within the study area. Cumberland Ecology conducted additional vegetation surveys to revise and update the existing vegetation mapping. The vegetation within the study area was then ground-truthed to examine and verify the mapping of the condition and extent of the different vegetation communities. Where vegetation community boundaries were found to differ from the DPIE mapping, records were made of proposed new boundaries using a hand-held Global Positioning System (GPS) and mark-up of aerial photographs.

The resultant information was synthesised using a Geographic Information System (GIS) to create a spatial database that was used to interpret and interpolate the data to produce a vegetation map of the study area.

2.2.2. Plot-based Floristic Survey

Plot-based floristic surveys were undertaken within the study area. Two plots were surveyed across the study area. Surveys followed the Biodiversity Assessment Method (BAM) and included establishment of 20 m 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 50 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 50m plot;
- Cover of 'High Threat Exotic' weed species;
- 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.

2.2.3. Random Meander Survey

Random meander surveys were undertaken to detect flora species present within the study area. These surveys consisted of traversing all areas of the study area and were undertaken within all vegetation communities present. **Figure 4** shows the area traversed.

2.2.4. Targeted Threatened Flora Surveys

Targeted threatened flora searches via random meanders were undertaken within suitable habitat of threatened flora species known from the locality.

2.3. Fauna Survey

Fauna surveys were undertaken within the study area by Cumberland Ecology on 13 July 2016 and on 28 April 2020. Surveys included a fauna habitat assessment and incidental observations. Further details of each of the survey methods are provided below.

2.3.1. Habitat Assessments

A fauna habitat assessment was undertaken throughout the study area. The assessment included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks and soaks. Structural features considered included the nature and extent of the understorey and ground stratum and extent of canopy. The survey also included an assessment of the presence of habitat features suitable for use by threatened fauna species known from the locality.

2.3.2. Incidental Observations

Any incidental fauna species that were observed, heard calling, or otherwise detected on the basis of tracks or signs, were recorded and listed in the total species list for the study area.

2.4. Limitations

Vertebrate fauna and vascular flora of the locality are well known based upon a sizeable database of past records and various published reports. The surveys by Cumberland Ecology added to the existing database and helped to provide a clear indication of the likelihood that various species occur, or are likely to occur, within the study area. The data obtained from database assessment and surveys of the study area furnished an appropriate level of information to support this assessment.

The weather conditions at the time of the flora surveys were generally favourable for plant growth and production of features required for identification of most species. Shrubs, grasses, herbs and creepers were readily identifiable in most instances. It is expected that not all flora species present would have been recorded during surveys. Despite this, it is considered that sufficient information has been collected to assess issues including conservation significance of the flora, condition and viability of bushland and likely impact on native vegetation. An assessment of the likelihood of occurrence of threatened flora species recorded within the locality of the study area in the database searches was undertaken to supplement the flora survey.

No targeted fauna surveys were undertaken for this assessment, which relied on database analysis, fauna habitat assessment and incidental observations. In general, opportunistic observations of fauna provide a "snapshot" of some of the fauna present on site that was active during time of the surveys. The data produced by the surveys is intended to be indicative of the types of species that could occur and not an absolute census of all vertebrate fauna species occurring within the study area. Therefore, not all fauna utilising the study area are likely to have been recorded during surveys. An assessment of the likelihood of occurrence of threatened and migratory fauna species listed for the locality in the database searches was undertaken to supplement the fauna surveys. The combination of these techniques is considered appropriate for assessing the habitat values of the site for threatened fauna within the study area.

3. Results

3.1. Vegetation Communities

Broad-scale vegetation mapping of the study area by Sydney Metro v3.1 (OEH 2016) identified the presence of *Duffys Forest Ecological Community in the Sydney Basin Bioregion* (Duffys Forest) in the northern portion of the study area. This community is listed as an Endangered Ecological Community (EEC) under the BC Act and is not listed under the EPBC Act. Duffys Forest occurs on shale lenses and lateritic soils in Hawkesbury Sandstone primarily within the Warringah and Ku-ring-gai LGAs.

Cumberland Ecology surveys confirmed that Duffys Forest is present within the northern portion of the study area. For the purpose of comparing the results of the site surveys with species typical of Duffys Forest, the community description from P&J Smith Ecological Consultants *Native Vegetation Communities of Hornsby Shire* (2008) was reviewed. The Final Determination for the community under the BC Act references P&J Smith's studies as containing a diagnostic list of species for the community. The species variation in the occurrence on site was considered to be more accurately represented by the P&J Smith description of the community as it occurs in the Hornsby Shire, than the species listed as characteristic in the Final Determination.

The remainder of the study area comprises a highly modified area that has been cleared of any existing native vegetation community, instead containing a variety of native and exotic species that have been planted and are currently maintained in managed garden beds and lawns. These have been categorised as either Planted Urban Native/Exotic or Exotic vegetation, while the area occupied by infrastructure is categorised as Cleared. This Planted Urban Native/Exotic and Exotic vegetation does not conform to the description of any native vegetation community, including Duffys Forest. The complete list of species recorded in the study area is provided in **Appendix A**. In summary, the vegetation communities within the study area have been categorised into the following:

- Duffys Forest;
- Planted Urban Native/Exotic;
- Exotic; and
- Cleared.

These communities are described below, and **Figure 5** shows the vegetation mapping of the study area.

3.1.1. Duffys Forest Ecological Community

BC Act Status: EEC

EPBC Act Status: Not listed

This community is present throughout an area of ~0.22 ha (or 2200m²) within the northern portion of the study area. It is in moderate condition overall, although it has been modified due to plantings of additional species (including non-endemic natives) and lacks shrub and ground layer diversity as a result of past clearing.

Characteristic canopy species present within the study area are *Angophora costata* (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus piperita* (Sydney Peppermint), *Eucalyptus globoidea* (White

Stringybark), *Eucalyptus sieberi* (Silvertop Ash) and *Eucalyptus resinifera* (Red Mahogany). It is evident that some non-indigenous species have been planted within the canopy and small tree layer including *Eucalyptus elata* (River Peppermint), *Eucalyptus parramattensis* (Parramatta Red Gum) and *Eucalyptus botryoides* (Bangalay). See **Photographs 1** - **3** for examples of the community.

Characteristic shrub species from this community that are present within the study area include *Ceratopetalum gummiferum* (New South Wales Christmas-bush), *Lasiopetalum ferrugineum* and *Persoonia levis* (Broad-leaved Geebung). Some exotic shrubs occur such as *Ligustrum sinense* (Small-leaved Privet) and *Olea europaea* subsp. *cuspidata* (African Olive). Characteristic groundcover species from this community include Austrostipa pubescens, Entolasia stricta (Wiry Panic), *Imperata cylindrica* (Blady Grass), *Micrantheum ericoides*, *Pteridium esculentum* (Common Bracken) and *Themeda triandra* (Kangaroo Grass). The most dominant groundcover occurring is *Lomandra longifolia* (Spiny-headed Mat-rush).

The vegetation within the northern portion of the study area is considered to conform to the Duffys Forest due to a combination of the canopy, understorey and groundcover species, along with the elevation and the soil landscape. The elevation of the study area is 160 m above sea level which is consistent with Duffys Forest (which occurs between 100 - 300 m above sea level). The community within the study area is of an open forest to woodland structure which is typical of Duffys Forest, and the natural soil of the study area contains a sandy influence.

Photograph 1 Duffys Forest within the study area





Photograph 2 Duffys Forest within the study area



Photograph 3 Duffys Forest within the study area



3.1.2. Planted Urban Native/Exotic vegetation

BC Act Status: Not listed

EPBC Act Status: Not listed

Planted Urban Native/Exotic vegetation exists as scattered patches within 0.30 ha (or 3000m²) of the study area. Many of the garden species comprise planted natives, including species typical of Duffys Forest (**Photograph 4**). Canopy species include natives such as *Angophora costata* (Smooth-barked Apple) and *Eucalyptus resinifera* (Red Mahogany) as well as non-endemic planted natives such as *Eucalyptus nicholii* (Narrow-leaved Black Peppermint) and *Lophostemon confertus* (Brush Box). Exotic tree species are also present such as *Lagunaria patersonia* (Norfolk Island Hibiscus) (**Photograph 5**).

Shrubs include a mix of natives such as *Elaeocarpus reticulatus* (Blueberry Ash), *Callistemon salignus* (Willow Bottlebrush), *Pittosporum undulatum* (Native Daphne) and *Banksia integrifolia* (Coast Banksia). Planted nonendemic species include *Chamelaucium uncinatum* (Geraldton Wax) (**Photograph 6**) and *Callistemon viminalis* (Weeping Bottlebrush). Exotic *Cinnamomum camphora* (Camphor Laurel) is present in some areas.

Groundcover includes the natives *Centella asiatica* (Indian Pennywort) and *Dichondra repens* (Kidney Weed), however it is dominated by exotics such as *Sporobolus africanus* (Parramatta Grass), *Pennisetum clandestinum* (Kikuyu Grass), *Taraxacum officinale* (Dandelion) and *Modiola caroliniana* (Red-flowered Mallow).



Photograph 4 Planted Urban Native/Exotics within the study area



Photograph 5 Lagunaria patersonia (Norfolk Island Hibiscus)



Photograph 6 Planted shrubs within the study area



3.1.3. Exotic Vegetation

Exotic vegetation as small scattered patches along the western and southern boundary of the study area, and close to the existing buildings, and occupies approximately 0.06 ha (600m²). Exotic vegetation consists of the same assemblage of exotic species as per the 'Urban Native and Exotic Vegetation', but contains no native species in all stratum. This community does not resemble a native plant community type.

3.1.4. Cleared

Cleared land covers approximately 1.60 ha of the study area and is indicative of areas currently occupied by the existing buildings and the associated infrastructure such as roads, walking paths and car parks.

3.2. Threatened Vegetation Communities

Approximately 0.22 ha (2200m²) of *Duffys Forest Ecological Community within the Sydney Basin Bioregion* (Duffys Forest) occurs within the study area. This vegetation community is listed as an EEC under the BC Act and is not listed under the EPBC Act. The Duffys Forest within the study area comprises a patch of canopy species with a garden bed understorey that includes a mix of native and non-endemic species. Despite the past clearing and management of the understorey resulting in the lack of a complex ground layer and shrub layer, the patch retains characteristics of Duffys Forest. This is particularly evident within the diversity of canopy species and the patch is considered to be a moderate condition example of the vegetation community. Therefore, this patch meets the criteria for conforming to the Threatened Ecological Community (TEC) listing of Duffys Forest under the BC Act.

3.3. Flora Species

3.3.1. General Species

A total of 137 plant species were recorded within the study area, comprising 43 exotic species and 94 native species (**Appendix A**).

3.3.2. Threatened Species

One threatened flora species, *Eucalyptus nicholii* (Narrow-leaved Black Peppermint) is present as a single tree near the western boundary of the subject site. This species is listed as Vulnerable under both the BC Act and EPBC Act. This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. This species is not considered to be locally indigenous to the study area and therefore its conservation significance is reduced. This species has been observed to be planted in gardens and roadside verges within the locality (DPIE 2019b).

A total of 36 threatened flora species listed under the BC Act and/or the EPBC Act have been recorded for the locality or identified as having the potential to occur in the locality. An assessment of the likelihood of occurrence of these species in the study area has been conducted and is presented in **Appendix B**. This assessment indicates that three species have the potential to occur within the study area, all of which would be associated with the patch of Duffys Forest vegetation in the northern portion of the study area. These are:

• Prostanthera marifolia (Seaforth Mintbush);

- Grevillea caleyi (Caley's Grevillea); and
- Pimelea curviflora var. curviflora.

3.3.2.1. Prostanthera marifolia

Prostanthera marifolia is listed as Endangered under the BC Act and Critically Endangered under the EPBC Act. This species is known only from three sites within the Manly and Warringah LGAs. It occurs on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses associated with the TEC Duffy's Forest. This habitat occurs on ridgetops within Hawkesbury Sandstone (DPIE 2020h).

3.3.2.2. Grevillea caleyi

Grevillea caleyi is listed as Critically Endangered under the BC Act and EPBC Act. This species occurs in three major areas in the suburbs of Belrose, Ingleside, and Terrey Hills. All sites it occurs at are on ridgetops, and the species is associated with lateritic soils and the TEC Duffys Forest (DPIE 2020a).

3.3.2.3. Pimelea curviflora var. curviflora

Pimelea curviflora var. curviflora is listed as Vulnerable under the BC Act and EPBC Act. This species occurs on ridge tops and upper slopes in open forest and woodland on sandy soils derived from sandstone, on shale/lateritic soils, and on shale/sandstone transition soils, where it is confined to the coastal areas of the Sydney and Illawarra regions (DPIE 2020f).

3.3.3. Priority Weeds

Two weed species recorded within the study area are listed as State Priority Weeds – Asset Protection and as Weeds on National Significance (WONS), these were; *Asparagus aethiopicus* (Ground Asparagus) and *Lantana camara* (Lantana). State Priority weeds are widely distributed in some areas of the State and are those that are also listed as WONS. The spread of WONS must be minimised to protect priority assets and the sale or distribution of these species is prohibited. One weed species, *Olea europaea subsp. cuspidata* (African Olive), is listed as a Regional Priority Weed – Containment. Regional Priority Weeds are those that are widely distributed in the region. While broadscale elimination is not practicable, minimisation of the biosecurity risk posed by these weeds is reasonably practicable (LLS: Greater Sydney 2019).

A number of other weeds occurring within the study area are listed as Other Weeds of Regional Concern in the Greater Sydney Regional Weed Management Plan 2017 – 2022 (LLS: Greater Sydney 2019). These are weeds that may be useful or widely spread as crops or garden plants, but that can become invasive in certain circumstances. These are shown below in **Table 1**, along with the State / Regional Priority Weeds and the WONS.

Species Name	Common Name	State/Regional Listing	WONS
Asparagus aethiopicus	Ground Asparagus	State Priority Weed - Asset Protection	Yes
Cinnamomum camphora	Camphor Laurel	Other Weed of Regional Concern	
Cotoneaster pannosus		Other Weed of Regional Concern	

Table 1 Priority Weeds occurring within the study area

Species Name	Common Name	State/Regional Listing	WONS
Lantana camara	Lantana	State Priority Weed - Asset Protection	Yes
Ligustrum lucidum	Large-leaved Privet	Other Weed of Regional Concern	
Ligustrum sinense	Small-leaved Privet	Other Weed of Regional Concern	
Ochna serrulata	rrulata Mickey Mouse Plant Other Weed of Regional Concern		
Olea europaea subsp. cuspidata	iropaea subsp. cuspidata African Olive Regional Priority Weed - Containment		
Pennisetum clandestinum	etum clandestinum Kikuyu Grass Other Weed of Regional Concern		
Senna pendula		Other Weed of Regional Concern	
Zantedeschia aethiopica	Arum Lily	Other Weed of Regional Concern	

3.4. Fauna Species

3.4.1. Fauna Habitat

The vegetation within the study area has limited habitat potential for fauna due to its disturbed condition and relative lack of microhabitats such as fallen logs, hollow-bearing trees and bush rock. Of the one native vegetation community remaining within the study area, the vegetation is degraded through past clearing activities and current management as a garden such that it would likely only provide occasional forging habitat and marginal roosting habitat for urban-adapted fauna. Potential foraging resources for nectivorous mammals and birds are primarily present within the varied eucalypt species throughout the study area, and the patch of Duffys Forest would provide the most optimal fauna habitat of the available vegetation.

Five hollow-bearing trees were recorded within the study area. The locations of these trees are provided in **Figure 6** and details of these trees are provided below in **Table 2**.

Table 2 Hollow-bearing trees within the study area			
Habitat ID	Species Name	Notes	
H1	Stag	Hollow throughout top half of trunk - 2 medium sized entrances	
H2	Eucalyptus globoidea	1 medium hollow	
H3	Eucalyptus piperita	1 medium hollow	
H4	Eucalyptus piperita	1 medium hollow	
H5	Angophora costata	2 medium hollows	

Table 2 Hollow-bearing tre	es within the study area
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3.4.2. General Species

Several common bird species were seen and/or heard during the site surveys: Noisy Miner (*Manorina melanocephala*), Australian Raven (*Corvus coronoides*), Galah (*Eolophus roseicapilla*) and Rainbow Lorikeets

(*Trichoglossus haematodus*). A Rabbit (*Oryctolagus cuniculus*) was also sighted along with a few small burrows within the vegetation in the northern portion of the study area.

3.4.3. Threatened Species

No previous records of threatened fauna or migratory species are present within the study area (DPIE, 2020).

A total of 69 threatened native fauna species listed under the BC Act and/or EPBC Act, as well as 12 migratory bird species listed under the EPBC Act, have been recorded in the locality or identified as having the potential to occur. The likelihood of these species occurring within the study area has been assessed and the results presented in **Appendix B**.

Based on the results of the site survey and the habitat requirements of each threatened fauna species, six threatened fauna species are considered as having the potential to utilise the study area. These species would likely pass through the site on occasion as part of a much larger foraging range. The hollow-bearing trees may provide potential roost habitat for two of the microchiropteran bat species. The threatened fauna species considered as having the potential to occur include:

- Powerful Owl (Ninox strenua);
- Grey-headed Flying-fox (Pteropus poliocephalus);

Four microchiropteran bat species:

- Yellow-bellied Sheathtail-bat (Saccolaimus flaviventris);
- Little Bentwing-bat (Miniopterus australis);
- Large Bent-winged Bat (Miniopterus orianae oceanensis); and
- Eastern Coastal Freetail-bat (Micronomus norfolkensis).

3.4.3.1. Powerful Owl

The Powerful Owl is listed as Vulnerable under the BC Act and is not listed under the EPBC Act. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. It breeds and hunts in open or closed sclerophyll forests or woodlands and occasionally hunts in open habitats. Roosting during the day time occurs in dense vegetation of eucalypts and species such as *Syncarpia glomulifera* (Turpentine) and *Angophora floribunda* (Rough-barked Apple). Prey species are medium-sized arboreal mammals such as the Greater Glider, Common Ringtail Possum, and Sugar Glider. As most prey species require hollows and a shrub layer these are important habitat components of the Powerful Owl. Nests are in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old (DPIE 2020g).

Given the lack of large suitable hollows and dense shrub layer, this species would only likely use the study area as occasional foraging habitat in search of arboreal prey species that would primarily occur within the Duffys Forest vegetation.

3.4.3.2. Grey-headed Flying-fox

The Grey-headed Flying-fox is listed as Vulnerable under the BC Act and EPBC Act.

The species occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. They are commonly found in gullies, close to water, and in vegetation with a dense canopy. Individuals will travel up to 20km a night from communal roosts to forage (DPIE 2020c).

There are no Grey-headed Flying-fox roosts within the study area, however they have the potential to forage within the vegetation available as part of a much broader foraging range.

3.4.3.3. Microchiropteran bats

The Yellow-bellied Sheathtail-bat is listed as Vulnerable under the BC Act and is not listed under the EPBC Act. They roost singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, it flies high and fast over the forest canopy, but lower in more open country. The species forages in most habitats across its very wide range, in areas with or without trees, and appears to defend an aerial territory (DPIE 2019c).

The Little Bentwing-bat is listed as Vulnerable under the BC Act and is not listed under the EPBC Act. The species inhabits moist eucalypt forest, rainforest, wet and dry sclerophyll forest, melaleuca swamps, dense coastal forests and banksia scrub, preferring well-timbered areas. They roost predominantly in caves, tunnels, stormwater drains, culverts, bridges and sometimes in buildings (DPIE 2020e).

The Large Bent-winged Bat is listed as Vulnerable under the BC Act and is not listed under the EPBC Act. The species roosts mainly in caves but also in tunnels, mines or buildings. Non-breeding populations disperse within a 300 km range of maternity caves. Hunting for moths and other insects takes place in forested areas above the canopy (DPIE 2020d).

The Eastern Coastal Freetail-bat is listed as Vulnerable under the BC Act and is not listed under the EPBC Act. The species occur in dry sclerophyll forest and woodlands east of the Great Dividing Range, roosting occasionally in tree hollows but they will also roost under bark or in man-made structures (DPIE 2019a).

The habitat within the study area has the potential to provide foraging habitat for all of these microchiropteran bat species who would likely use it only as part of a larger foraging range. There is also potential roosting habitat for the Yellow-bellied Sheathtail-bat and Eastern Coastal Freetail-bat in the form of the five hollowbearing trees and mature trees with decorticating bark present within the study area.

3.4.3.4. Migratory Species

The two migratory species considered as having the potential to utilise the study area include:

- Fork-tailed Swift (Apus pacificus); and
- White-throated Needletail (Hirundapus caudacutus).

These species have the potential to forage aerially above the study area, however, would not use it for roosting purposes.



4. Impact Assessment

4.1. Impacts on Vegetation Communities

4.1.1. Vegetation Removal

The primary direct impact resulting from the Project is the removal of native and exotic vegetation within the subject site, which represents marginal habitat for threatened fauna. Past and current use of the subject site has entailed clearing and modification of the remaining vegetation, which is now dominated by planted native and exotic tree species that lack a significant understorey or midstorey due to their occurrence in isolated mulched garden beds and lawns. This vegetation does not conform to the description of any native vegetation community. A total of 0.11 ha (1100m²) of Planted Urban Native/Exotic vegetation and 0.02 ha (200m²) of Exotic vegetation will be removed under the proposed Project. Given these are species that have been planted and exist in a highly urbanised setting, the removal of these areas of vegetation is unlikely to have any significant impacts on the flora and fauna values of the locality. Nevertheless, planted native and exotic vegetation will be planted as part of landscaping. **Table 4** shows the total areas of each vegetation community within the study area and the total area to be removed by the proposed development.

Vegetation Community	Present in the Study Area (ha)	Removed from the Subject Site (ha)
Duffys Forest Ecological Community	0.22	0.00
Planted Native Vegetation	0.30	0.11
Exotic Vegetation	0.06	0.02
Total	0.58	0.13

Table 3. Vegetation Present in the Study Area and Removed from the Subject Site

Additionally, approximately 0.002 ha (20m²) of Duffys Forest TEC is located within the subject site and represents canopy overhang, but will not be removed (See **Figure 5**). Therefore, the entire patch of Duffys Forest, totalling 0.22 ha (2200m²) is proposed for retention. The Duffys Forest within the study area has a canopy of mature tree species over a cultivated garden bed planted with a mix of non-endemic and native species. The small portion of Duffys Forest canopy overhanging the development footprint is on the far north western corner of the study area, and is proposed for retention.

There is potential for some indirect impacts to occur to Duffys Forest as a result of edge-effects on the retained patch from adjoining development, as discussed further in **Section 4.1.3**). However, given that the patch already occurs in a highly urbanised environment, and adjoins a carpark, the such indirect impacts are not likely to be significantly exacerbated. It is proposed that the patch of Duffys Forest is fenced and managed under a Vegetation Management Plan (VMP), as discussed in **Section 5.5**.

A Test of Significance for Duffys Forest is provided in **Appendix C**. The assessment concluded that the potential indirect impacts to Duffys Forest are considered unlikely to result in a significant impact to the continued viability of the vegetation community. The patch of Duffys Forest has persisted despite its urban setting, prior history of clearing, and current management as a garden bed that has resulted in the lack of a complex ground or shrub layer.

Avoidance, minimisation and mitigation measures will be addressed in Chapter 5.

4.1.2. Loss of Specific Habitat Features

In addition to the clearance of broad habitats within the subject site, one hollow-bearing tree will be removed under the proposed Project, while the remaining four will be retained. The loss of these habitat features is unlikely to significantly impact on the flora and fauna of the study area as they represent only a small number of such features that occur within in a modified and degraded habitat. The preservation of the Duffys Forest and the remaining habitat features, along with the mitigation measures outlined in **Chapter 5**, is deemed appropriate to offset the minor losses that will occur as a result of the Project.

4.1.3. Impacts on Remaining Vegetation and Habitats

The Project has the potential to indirectly impact remaining vegetation and habitats within the study area. These impacts include:

- Habitat fragmentation affects biodiversity by reducing the amount of available habitat for some species to occupy due to the increased distances between habitat patches;
- Edge effects affects biodiversity through microclimatic changes in light, temperature, humidity and wind, which can favour a suite of different species and therefore cause significant changes to the ecology of the patch (Lindenmayer and Fischer 2006); and
- Increased sedimentation and erosion affects biodiversity through the smothering of vegetation, increasing turbidity of waterways and transportation of weed matter and nutrients.

4.2. Impacts on Flora Species

The Project has the potential to result in a number of direct and indirect impacts to flora species within the study area. In addition to the direct removal and modification of vegetation within the subject site, potential indirect impacts to flora species include:

- Weed invasion;
- Run-off, erosion and sedimentation; and
- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

A number of mitigation measures are proposed to minimise these impacts. These are discussed further in **Chapter 5**.

4.2.1. Threatened Flora Species

A single planted threatened flora species (*Eucalyptus nicholii*) is present within the Planted Urban Native/Exotic vegetation in the western portion of the study area, however this species does not naturally occur within the study area as it is outside of the species' range. *Eucalyptus nicholii* is frequently planted as a roadside tree and numerous other individuals have been observed planted throughout the locality. This individual is proposed



for retention, and will be incorporated into the landscaped zone as part of the Project. Therefore, the Project is not considered to have a significant impact on the threatened species *Eucalyptus nicholii* due it not being a naturally occurring example of the species and because it is located outside of the species range.

No other threatened flora species listed under the BC Act or EPBC Act were located within the study area.

Several additional threatened flora species are considered as having the potential to occur within the study area, including *Prostanthera marifolia*, *Grevillea caleyi* and *Pimelea curviflora var. curviflora*. Tests of Significance for all of these threatened flora species are provided in **Appendix C**. While suitable habitat for these species exists within the study area, two separate flora surveys have not recorded these species and it is unlikely that they would persist in an area that is managed predominantly as garden beds. Furthermore, the species are associated with the Duffys Forest TEC, which is to be retained under the Project.

4.3. Impacts on Fauna Species

The Project has the potential to result in a number of direct and indirect impacts to fauna species within the study area. In addition to the direct removal and modification of vegetation within the subject site, potential indirect impacts to fauna species include:

- Habitat disturbance during the construction phase of the project (e.g. changes in noise);
- Runoff, erosion and sedimentation;
- Increased pollution; and
- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

4.3.1. Threatened and Migratory Species

No threatened or migratory species were recorded within the study area. Six threatened species are considered to have the potential to occur within the study area. Tests of significance for the six threatened species are provided in **Appendix C**. These assessments concluded the project is not considered likely to have a significant impact upon any of these species.

The potential impacts of the Project on each threatened species is discussed in sub-sections below. Microchiropteran bat species have been addressed together in this section and in the Tests of Significance.

4.3.1.1. Powerful Owl

The Powerful Owl has not been recorded from the study area in previous surveys by Cumberland Ecology, however some potential foraging habitat is present, particularly within the Duffys Forest vegetation. This predatory species has a large foraging range and the study area is not considered to represent a core foraging habitat due to its degraded condition and relatively small size. The study area does not constitute roosting or breeding habitat for the Powerful Owl as the species requires large tree hollows in dense vegetation for roosting and breeding which have not been recorded within the subject site or study area.

The Project will result in the removal of ~0.13 ha (1300m²) of potential foraging habitat for this raptor species within the subject site. However, all of the Duffys Forest, totalling approximately 0.22 ha of Duffys Forest and additional native and exotic vegetation will be planted as part of landscaping surrounding the proposed development, which will provide similar habitat for this species. The retained vegetation will be managed to enhance the value as foraging grounds for this threatened species.

The vegetation to be cleared within the subject site will likely only represent a loss of sub-optimal foraging habitat for the Powerful Owl and it is considered that this species is likely to only utilise the subject site occasionally as part of a much broader foraging range. Therefore, the Project is considered unlikely to result in a significant impact to the Powerful Owl.

4.3.1.2. Grey-headed Flying-fox

The Grey-headed Flying-fox is a nectivorous species and may forage periodically on trees present in the subject site and study area occasionally as part of a wider foraging range. The extent of foraging resources in the study area is low due to the predominantly cleared state of the site and the relatively small size.

The Grey-headed Flying-fox is a social animal that roost and breeds in camps with hundreds of other individuals. The study area does not constitute a roosting camp for the species, and it is considered that the species is only likely to forage in the study area as part of a larger foraging range. Accordingly, the removal of ~ 0.13 ha of predominantly planted and exotic vegetation for the Project is not considered likely to result in a significant impact to this species.

4.3.1.3. Microchiropteran Bats

The Yellow-bellied Sheathtail-bat roosts in tree hollows and buildings and forages flying high and fast over the forest canopy, but lower in more open country. This species has the potential to roost in the five hollow-bearing trees within the study area and to forage throughout the site. Of the available roosting hollows, four of the five will be retained under the Project and the most optimal foraging habitat for this species is the Duffys Forest vegetation of which will be retained.

The Little Bentwing-bat roosts predominantly in caves, which are not present within the subject site or study area. Accordingly, it is considered this species would only visit the site for foraging purposes as part of a much larger foraging area. The Duffys Forest (totalling 0.22 ha) will be retained, and additional areas of native and exotic vegetation will be planted as part of landscaping surrounding the proposed development, which will provide similar habitat for this species.

The Large Bent-winged Bat roosts mainly in caves, which are not present within the subject site or study area. This species is considered as having the potential to forage occasionally within the study area, however the small size of the site and degraded vegetation state is unlikely to provide optimal foraging habitats for this species. The species hunts for moths and other insects in forested areas above the canopy, and ~ 0.22 ha of Duffy Forest will be retained, which represents the area of vegetation within the study area that has an established canopy.

The Eastern Coastal Freetail-bat roosts occasionally in tree hollows but will also roost under bark, and it is considered the species has the potential to roost and forage within the study area. The species would likely

only utilise the hollows and eucalypts with decorticating bark present within the Duffys Forest vegetation of the study area, of which the majority will be retained. Additionally, only one of the five hollow-bearing trees will be removed under the Project, leaving the other four available for roosting purposes.

The vegetation to be cleared as part of the Project is not considered to be core habitat for these microbats and large areas of similar and more optimal vegetation will remain in the locality, particularly around Allambie and Allenby Park. Four of the five hollow-bearing trees will be retained, and the entire patch of Duffys Forest (0.22 ha) available will be retained, which represents the highest quality foraging habitat for these species within the study area. Therefore, the proposed vegetation clearing is not considered likely to have a significant effect on these four microchiropteran bat species.

4.3.1.4. Migratory Species

Two migratory species (Fork-tailed Swift and White-throated Needletail) may forage over the study area as part of their foraging range; however, these highly aerial and wide-ranging species are unlikely to be reliant on the small patch of modified habitat available within the subject site. Large areas of similar habitat will remain in the locality and they are unlikely to be dependent on habitats to be removed as part of the Project.

For the reasons presented above, the proposed works are not considered likely to have a significant impact on any threatened or migratory fauna species. Nonetheless, as a precautionary measure, Tests of Significance for all six threatened fauna species with the potential to occur in the study area have been conducted and are provided in **Appendix C**. These assessments concluded that the Project is unlikely to have a significant impact on any of these threatened fauna species and the preparation of a BDAR or a Referral to the Commonwealth DAWE is not required.



5. Mitigation Measures

Although only a very small area of vegetation will be removed, comprising planted and exotic vegetation, a number of mitigation measures are recommended. These measures should be implemented to minimise biodiversity impacts to the subject site and adjoining habitats of the study area, in particular the retained patch of Duffys Forest.

5.1. Vegetation Protection

To avoid unnecessary removal or damage to the nearby vegetation, the clearing area should be clearly demarcated and signed, where appropriate, to ensure no vegetation beyond these boundaries is removed. Clearing works and equipment should be excluded from areas outside the clearing area. Site inductions are to be given by the civil contractor to ensure all site workers and visitors are aware of any no-access areas.

5.2. Erosion, Sedimentation and Pollution Control

Potential impacts to flora and fauna occurring in the construction phase that can be managed include: run-off, sedimentation, erosion and pollution. To reduce sedimentation on the construction site, erosion control measures should be implemented in accordance with the erosion and sediment control plan submitted as part of the development application. This includes minimising the amount of exposed soils on the site at any given time. All soil stockpiles should be adequately covered when not in use to prevent erosion from heavy rainfall. Sediment fences should be established around the perimeter of the development area to prevent the impacts of sedimentation on the adjoining vegetation. During development, precautions should be taken to ensure that no pollution, such as petrochemical substances or water containing suspended solids, escapes the construction site. Pollution traps and efficient removal of pollution to an off-site location would help to minimise pollution impacts.

5.3. Pre-clearing Surveys and Clearing Supervision

5.3.1. Pre-clearing Surveys

An ecologist should conduct a pre-clearing survey of all buildings and vegetation within one week of commencing demolition works in order to identify the occurrence of fauna and/or fauna habitat present. Any fauna species recorded during the pre-clearance survey will be captured (where possible) and relocated to adjacent habitat to be retained.

5.3.2. Clearing Supervision

Any habitat features identified during the pre-clearing surveys should be removed under the supervision of an ecologist or qualified animal carer. Details regarding the appropriate methodology to be implemented during habitat removal should be provided following the results of the pre-clearing survey. Any fauna captured during clearing supervision works should be relocated into adjacent areas of habitat to be retained, taken to a veterinarian or wildlife carer, or humanely euthanised at the discretion of the attending ecologist.

5.4. Nest Box Installation

It is recommended nest boxes be installed in the retained trees at a ratio of two nest boxes for each hollowbearing tree removed. This would equate to two nest boxes being installed to replace the one hollowbearing tree proposed to be removed. The size of the nest boxes will need to reflect the size of the hollow removed. Multiple nest boxes can be installed in a single tree if required. Supervision of nest box installation must be carried out by a person experienced in nest box installation, and the nest boxes must be installed at a height of at least 4 m from the ground.

5.5. Weed Control Measures

Priority weed species occurring within the subject site should be managed in order to prevent further spread. Prior to any vegetation clearance, noxious weeds in the canopy and shrub layers should be demarcated in order for these to be disposed of separately from native material. All groundcover should be disposed of as exotic as these cover a large portion of the subject site.

It is recommended that a Vegetation Management Plan is prepared for the appropriate management of the retained patch of Duffys Forest. Duffys Forest has been excluded from the landscaped zone for the Project, and will be fenced to retain its ecological values. However, the condition of the community should be improved through active management to avoid indirect impacts such as weed invasion. The VMP can commence after construction of the Project.

5.6. Replanting

Replanting of native species representative of the vegetation community Duffys Forest has been incorporated into the landscape plan for the Project (John Lock & Associates 2020).



6. Conclusion

Past and current use of the study area has entailed clearing and modification of most of the pre-existing native vegetation, however, a patch of the TEC Duffys Forest occurs within the northern portion of the study area, and scattered patches of native and exotic vegetation occur at the periphery of the study area. Direct impacts to vegetation will result in the removal of ~0.11 ha (1100m²) of Planted Urban Native/Exotic vegetation and ~0.02 ha (200m²) of Exotic vegetation will be removed as part of the Project. These areas are not considered to conform to the definition of any native vegetation communities.

The Duffys Forest within the study area comprises canopy species over a predominantly cultivated garden bed that contains a mix of native and non-endemic species. Nevertheless, the vegetation is considered to meet the listing of Duffys Forest under the BC Act. Approximately 0.002 ha (or 20m²) of Duffys Forest TEC is located within the subject site and represents canopy overhang, but will not be removed (See **Figure 5**). Therefore, the entire patch of Duffys Forest, totalling 0.22 ha (2200m²) is proposed for retention.

There is potential for some indirect impacts to occur to Duffys Forest as a result of edge-effects on the retained patch from adjoining development. However, given that the patch already occurs in a highly urbanised environment, and adjoins a carpark, the such indirect impacts are not likely to be exacerbated, and no significant impact is predicted as identified by the Test of Significance.

One threatened flora species, *Eucalyptus nicholii* was recorded in the western portion of the Planted Urban Native/Exotic vegetation within the subject site. This individual tree has been planted as part of the garden bed and does not occur naturally in the region. The species is commonly planted as a roadside tree throughout the locality, and removal of this individual is not considered to significantly impact upon this threatened flora species. Several other threatened flora species are considered as having the potential to occur in the study area, including *Prostanthera marifolia*, *Grevillea caleyi* and *Pimelea curviflora var. curviflora*. However, these species are all associated with Duffys Forest and this patch will be retained. Accordingly, the Project is not likely to have a significant impact upon any of these potentially occurring threatened flora species.

No fauna species listed under the BC Act or EPBC Act were recorded within the study area. Six threatened fauna species are considered as having the potential to occur within the study area from time to time. This includes the Powerful Owl, Grey-headed Flying-fox, Yellow-bellied Sheathtail-bat, Little Bentwing-bat, Large Bentwinged Bat and the Eastern Coastal Freetail-bat. These species are expected to only utilise the modified habitat within the study area as part of a much broader foraging range, with marginal roosting habitat for the Yellow-bellied Sheathtail-bat and Eastern Coastal Freetail-bat occurring as one hollow-bearing tree that will be removed. The remaining four hollow-bearing trees will be retained, and the tract patch of Duffys Forest that represents the highest quality foraging habitat for these species will also be retained. Accordingly, the Project is not considered likely to result in a significant impact to any of these potentially occurring threatened species.

A range of mitigation measures are proposed to prevent degradation of the ecological values in the vegetation of surrounding areas, including vegetation protection measures, pre-clearing surveys and erosion and sedimentation controls. Furthermore, if additional plantings of local native trees and shrubs are made, and weed species are removed within the study area, there is potential to improve the habitat available for native flora and fauna species.



No significant impact is predicted to occur to any threatened species or endangered ecological communities as a result of the proposed works, and the preparation of a BDAR is not warranted. A referral to the Commonwealth DAWE, under the EPBC Act is also not required.

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APPENDIX A : Flora Species List
Table 4 Flora Species List

Family	Exotic/ Planted	Species Name	Common Name
Fabaceae (Mimosoideae)	P	Acacia elata	Mountain Cedar Wattle
Fabaceae (Mimosoideae)		Acacia fimbriata	Fringed Wattle
Fabaceae (Mimosoideae)		Acacia floribunda	White Sally Wattle
Fabaceae (Mimosoideae)		Acacia longifolia subsp. longifolia	Sydney Golden Wattle
Myrtaceae		Acmena smithii	Lilly Pilly
Amaryllidaceae	*	Agapanthus praecox subsp. orientalis	African Lily
Myrtaceae	*	Agonis flexuosa	
Casuarinaceae		Allocasuarina littoralis	Black She-oak
Myrtaceae		Angophora costata	Smooth-barked Apple
Poaceae		Aristida vagans	Threeawn Speargrass
Asparagaceae	*	Asparagus aethiopicus	Ground Asparagus
Poaceae		Austrostipa pubescens	
Poaceae	*	Axonopus fissifolius	Narrow-leafed Carpet Grass
Proteaceae		Banksia integrifolia	Coast Banksia
Pittosporaceae		Billardiera scandens	Hairy Apple Berry
Acanthaceae		Brunoniella australis	Blue Trumpet
Acanthaceae		Brunoniella pumilio	Dwarf Blue Trumpet
Cunoniaceae		Callicoma serratifolia	Black Wattle
Myrtaceae	Р	Callistemon citrinus	Crimson Bottlebrush
Myrtaceae		Callistemon rigidus	Stiff Bottlebrush
Myrtaceae		Callistemon salignus	Willow Bottlebrush
Myrtaceae	Р	Callistemon viminalis	Weeping Bottlebrush
Brassicaceae	*	Cardamine hirsuta	Common Bittercress
Aizoaceae		Carpobrotus glaucescens	Pigface
Casuarinaceae		Casuarina glauca	Swamp Oak
Apiaceae		Centella asiatica	Indian Pennywort
Caryophyllaceae	*	Cerastium glomeratum	Mouse-ear Chickweed
Cunoniaceae		Ceratopetalum gummiferum	New South Wales Christmas- bush
Myrtaceae	Р	Chamaelaucium uncinatum	Geraldton Wax
Lauraceae	*	Cinnamomum camphora	Camphor Laurel
Asteraceae	*	Cirsium vulgare	Spear Thistle
Ranunculaceae		Clematis glycinoides	Headache Vine

Family	Exotic/ Planted	Species Name	Common Name	
Asteraceae	*	Conyza sumatrensis	Tall Fleabane	
Asteliaceae	*	Cordyline australis	Cabbage Tree	
Myrtaceae		Corymbia gummifera	Red Bloodwood	
Malaceae	*	Cotoneaster pannosus		
Cupressaceae	*	Cupressus sp.		
Poaceae	*	Cynodon dactylon	Couch	
Phormiaceae		Dianella caerulea var. producta		
Convolvulaceae		Dichondra repens	Kidney Weed	
Sapindaceae		Dodonaea triquetra	Large-leaf Hop-bush	
Doryanthaceae		Doryanthes excelsa	Giant Lily	
Poaceae	*	Ehrharta erecta	Panic Veldtgrass	
Elaeocarpaceae		Elaeocarpus reticulatus	Blueberry Ash	
Poaceae		Entolasia marginata	Bordered Panic	
Poaceae		Entolasia stricta	Wiry Panic	
Myrtaceae		Eucalyptus amplifolia	Cabbage Gum	
Myrtaceae	Р	Eucalyptus botryoides	Bangalay	
Myrtaceae	Р	Eucalyptus elata	River Peppermint	
Myrtaceae		Eucalyptus globoidea	White Stringybark	
Myrtaceae	Р	Eucalyptus grandis	Flooded Gum	
Myrtaceae	Р	Eucalyptus nicholii	Narrow-leaved Peppermint	Black
Myrtaceae		Eucalyptus parramattensis	Parramatta Red Gum	
Myrtaceae		Eucalyptus piperita	Sydney Peppermint	
Myrtaceae		Eucalyptus resinifera	Red Mahogany	
Myrtaceae		Eucalyptus saligna	Sydney Blue Gum	
Myrtaceae	Р	Eucalyptus saligna x botryoides		
Myrtaceae		Eucalyptus sieberi	Silvertop Ash	
Myrtaceae		Eucalyptus tereticornis	Forest Red Gum	
Myrtaceae		Eucalyptus umbra	Broad-leaved Mahogany	White
Asteraceae	*	Facelis retusa	Annual Trampweed	
Moraceae		Ficus rubiginosa	Port Jackson Fig	
Moraceae		Ficus sp.		
Cyperaceae		Gahnia radula		
Cyperaceae		Gahnia sieberiana	Red-fruit Saw-sedge	

Family	Exotic/ Planted	Species Name	Common Name
Asteraceae	*	Gamochaeta americana	Cudweed
Phyllanthaceae		Glochidion ferdinandi	Cheese Tree
Fabaceae (Faboideae)		Glycine microphylla	Small-leaf Glycine
Fabaceae (Faboideae)		Glycine tabacina	Variable Glycine
Goodeniaceae		Goodenia hederacea	lvy Goodenia
Proteaceae	Р	Grevillea lanigera	Woolly Grevillea
Proteaceae		Grevillea linearifolia	Linear-leaf Grevillea
Proteaceae	Р	Grevillea 'Robyn Gordon'	
Proteaceae		Hakea salicifolia	Willow-leaved Hakea
Euphorbiaceae		Homalanthus populifolius	Bleeding Heart
Fabaceae (Faboideae)		Hovea acutifolia	
Apiaceae		Hydrocotyle laxiflora	Stinking Pennywort
Asteraceae	*	Hypochaeris radicata	Catsear
Poaceae		Imperata cylindrica	Blady Grass
Malvaceae	*	Lagunaria patersonia	Norfolk Island Hibiscus
Verbenaceae	*	Lantana camara	Lantana
Malvaceae		Lasiopetalum ferrugineum	
Cyperaceae		Lepidosperma laterale	Variable Sword-sedge
Myrtaceae	Р	Leptospermum petersonii	Lemon-scented Teatree
Oleaceae	*	Ligustrum lucidum	Large-leaved Privet
Oleaceae	*	Ligustrum sinense	Small-leaved Privet
Campanulaceae		Lobelia purpurascens	Whiteroot
Lomandraceae		Lomandra filiformis	Wattle Mat-rush
Lomandraceae		Lomandra gracilis	
Lomandraceae		Lomandra longifolia	Spiny-headed Mat-rush
Lomandraceae		Lomandra multiflora	Many-flowered Mat-rush
Lomandraceae		Lomandra obliqua	
Lomandraceae	Р	Lomandra longifolia 'Tanika'	
Myrtaceae	Р	Lophostemon confertus	Brush Box
Proteaceae	Р	Macadamia integrifolia	Macadamia Nut
Fabaceae (Faboideae)	*	Medicago minima	Woolly Burr Medic
Myrtaceae		Melaleuca quinquenervia	Broad-leaved Paperbark
Myrtaceae	Р	Melaleuca sieberi	
Myrtaceae		Melaleuca styphelioides	Prickly-leaved Tea Tree

Family	Exotic/ Planted	Species Name	Common Name
Picrodendraceae		Micrantheum ericoides	
Poaceae		Microlaena stipoides	Weeping Grass
Malvaceae	*	Modiola caroliniana	Red-flowered Mallow
Rutaceae	Р	Murraya paniculata	Mock Orange
Davalliaceae		Nephrolepis cordifolia	Fishbone Fern
Alliaceae	*	Nothoscordum gracile	Onion Weed
Ochnaceae	*	Ochna serrulata	Mickey Mouse Plant
Oleaceae	*	Olea europaea subsp. cuspidata	African Olive
Poaceae		Oplismenus aemulus	
Oxalidaceae	*	Oxalis corniculata	Creeping Oxalis
Oxalidaceae	*	Oxalis latifolia	
Asteraceae		Ozothamnus diosmifolius	Rice Flower
Poaceae		Paspalidium distans	
Poaceae	*	Paspalum dilatatum	Paspalum
Passifloraceae	*	Passiflora edulis	Common Passionfruit
Iridaceae		Patersonia sericea	Silky Purple-flag
Poaceae	*	Pennisetum clandestinum	Kikuyu Grass
Proteaceae		Persoonia levis	Broad-leaved Geebung
Pittosporaceae		Pittosporum undulatum	Native Daphne
Plantaginaceae	*	Plantago lanceolata	Lamb's Tongues
Dennstaedtiaceae		Pteridium esculentum	Common Bracken
Rubiaceae	*	Richardia brasiliensis	Mexican Clover
Poaceae		Rytidosperma sp.	
Fabaceae (Caesalpinioideae)	*	Senna pendula	
Smilacaceae		Smilax glyciphylla	Sweet Sarsaparilla
Asteraceae	*	Soliva sessilis	Bindyi
Asteraceae	*	Sonchus oleraceus	Common Sowthistle
Poaceae	*	Sporobolus africanus	Parramatta Grass
Poaceae	*	Stenotaphrum secundatum	Buffalo Grass
Strelitziaceae	*	Strelitzia nicolai	
Asteraceae	*	Taraxacum officinale	Dandelion
Poaceae		Themeda triandra	Kangaroo Grass
Apocynaceae	*	Trachelospermum jasminoides	Star Jasmine
Fabaceae (Faboideae)	*	Trifolium repens	White Clover

Family	Exotic/ Planted	Species Name	Common Name
Violaceae		Viola banksii	
Lamiaceae		Westringia fruticosa	Coastal Rosemary
Xanthorrhoeaceae		Xanthorrhoea sp.	
Araceae	*	Zantedeschia aethiopica	Arum Lily

P denotes Planted, * denotes Exotics



APPENDIX B : Threatened Species Likelihood of Occurrence Assessments

Table 5	Threatened	flora	likelihood	of	occurrence assessment
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Family	Species Name	Common Name	BC Act Status	Comm Status	No. of Records (BioNet)	Habitat Requirements	Likelihood of occurrence
Apocynaceae	Cynanchum elegans	White- flowered Wax Plant	E	E	-	Usually associated with dry rainforest vegetation and in coastal communities. Can occur in clay influenced woodland associated with <i>Eucalyptus tereticornis</i> and <i>Corymbia maculata</i> .	Unlikely to occur. No suitable habitat present within the subject land.
Casuarinaceae	Allocasuarina glareicola		E	Ε	-	Grows in Castlereagh woodland on lateritic soil with <i>Eucalyptus parramattensis, Eucalyptus</i> <i>fibrosa, Angophora bakeri, Eucalyptus</i> <i>sclerophylla</i> and <i>Melaleuca decora</i> . Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool.	Unlikely to occur. No suitable habitat present within the subject land.
Dilleniaceae	Hibbertia superans		E	-	1	Found in open woodland and heathland often near disturbed areas.	Unlikely to occur. No suitable habitat present within the subject land.
Elaeocarpaceae	Tetratheca glandulosa		V	-	107	Restricted to the Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong Local Government Areas. It is associated with shale- sandstone transitional areas, where shale overlays sandstone, generally in ridgetop and upper slope areas. It occurs in a variety of vegetation types including heath and scrub, and open forests and woodlands.	Unlikely to occur. No suitable habitat present within the subject land.



Family	Species Name	Common Name	BC Act Status	Comm Status	No. of Records (BioNet)	Habitat Requirements	Likelihood of occurrence
Ericaceae	Epacris purpurascens var. purpurascens		V	-	2	<i>Epacris purpurascens var. purpurascens</i> occurs in sclerophyll forest, scrubs and swamps, from Gosford and Sydney districts in the Central Coast botanical subdivision. It is found in a large array of habitat types, though mostly in areas with a strong shale influence.	Unlikely to occur. No suitable habitat present within the subject land.
Fabaceae (Mimosoideae)	Acacia bynoeana	Bynoe's Wattle	E	V	-	Found in heath and woodland on sandy soils. Prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches.	Unlikely to occur. No suitable habitat present within the subject land.
Fabaceae (Mimosoideae)	Acacia pubescens	Downy Wattle	V	V	-	Occurs on alluviums, shales and at the intergrade between shales and sandstones. Occur in open woodland and forest, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.	Unlikely to occur. No suitable habitat present within the subject land.
Fabaceae (Mimosoideae)	Acacia terminalis subsp. terminalis	Sunshine Wattle (Sydney region)	E	Ε	12	Confined to the eastern suburbs of Sydney between Botany Bay and the northern foreshore of Port Jackson. Found in open coastal eucalypt woodland or forest, usually in sandy soil on creek banks, hill-slopes, or in shallow soil in rock crevices and sandstone platforms on cliffs.	Unlikely to occur. No suitable habitat present within the subject land.
Geraniaceae	Pelargonium sp. Striatellum	Omeo Stork's-bill	-	E	-	The species occurs in habitat located just above the high water level of irregularly inundated or ephemeral lakes. The habitat is the transitional zone between grasslands and the wetland or aquatic vegetation. During dry periods the species spreads to colonise exposed lake beds. It is only currently known from 4 locations, three of which are on lake-beds within the	Unlikely to occur. No suitable habitat present within the subject land.



Family	Species Name	Common Name	BC Act Status	Comm Status	No. of Records (BioNet)	Habitat Requirements	Likelihood of occurrence
						basalt plains of the Monaro, and the fourth at Lake Basalt.	
Lamiaceae	Prostanthera junonis	Somersby Mintbush	E	E	2	The species is restricted to the Somersby Plateau. It occurs on both the Somersby and Sydney Town soil landscapes on gently undulating country over weathered Hawkesbury sandstone within open forest/low woodland/open scrub. It occurs in both disturbed and undisturbed sites.	Unlikely to occur. No suitable habitat present within the subject land.
Lamiaceae	Prostanthera marifolia	Seaforth Mintbush	E	CE	168	Known only from three sites within the Manly and Warringah LGAs. Occurs on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses and associated with the Threatened Ecological Community Duffy's Forest. This habitat occurs on ridgetops within Hawkesbury Sandstone.	Potential to occur within the Duffys Forest vegetation of the study area.
Malvaceae	Lasiopetalum joyceae		V	V	-	Occurs on the Hornsby Plateau south of the Hawkesbury River. Grows in heath on sandstone on lateritic and shale soils on ridgetops. Associated with Shale/Sandstone Transition Forest and Turpentine-Ironbark Forest.	Unlikely to occur. No suitable habitat present within the subject land.
Myrtaceae	Callistemon linearifolius	Netted Bottle Brush	V	-	3	In the Sydney area it has been recorded from Georges River to the Hawkesbury River, and occurs northwards to Nelson Bay. It grows in	Unlikely to occur. No suitable habitat



Family	Species Name	Common Name	BC Act Status	Comm Status	No. of Records (BioNet)	Habitat Requirements	Likelihood of occurrence
						dry sclerophyll forest close to the coast and in adjacent ranges.	present within the subject land.
Myrtaceae	Darwinia biflora		V	V	-	Occurs within an area comprising Maroota to the north, North Ryde to the south, Cowan to the east, and Kellyville to the west. Prefers the edges of weathered shale-capped ridges where shale intergrades with Hawkesbury Sandstone.	Unlikely to occur. No suitable habitat present within the subject land.
Myrtaceae	Eucalyptus camfieldii	Camfield's Stringybark	V	V	15	The species has been recorded as occurring in coastal areas from Raymond Terrace in the north to Waterfall in the south. It occurs mostly in small, scattered stands in exposed situations on sandstone plateaus, ridges and slopes near the coast, often on the edges of tall heath and low open woodland. It grows in shallow sandy soils overlying Hawkesbury Sandstone.	Unlikely to occur. No suitable habitat present within the subject land.
Myrtaceae	Eucalyptus nicholii	Narrow- leaved Black Peppermint	V	V	3	Has a natural range from east of Tamworth to north of Glen Innes. It occurs in grassy or sclerophyll woodland. The species has been cultivated since 1975 and is a popular street planting species throughout the east coast of Australia.	Present as a planted species only. Unlikely to occur naturally within the study area.



Family	Species Name	Common Name	BC Act Status	Comm Status	No. of Records (BioNet)	Habitat Requirements	Likelihood of occurrence
Myrtaceae	Eucalyptus scoparia	Wallangarra White Gum	Ε	V	-	Species has a restricted distribution in the east of the Wallangarra district, on the Queensland- NSW border. The majority of populations occur at altitudes to 1300m in clefts of large granite outcrops, growing in skeletal soils. It occurs at lower altitudes in damp situations. In NSW there are only three known occurrences, all near Tenterfield. The species is widely planted as an ornamental tree throughout south- eastern Australia, including in the Sydney Region.	Unlikely to occur. No suitable habitat present within the subject land.
Myrtaceae	Leptospermum deanei		V	V	-	Occurs in riparian vegetation, or in woodland adjacent to creeks, between Port Jackson and Botany Bay. Requires sandy alluvial soil, or sand over sandstone.	Unlikely to occur. No suitable habitat present within the subject land.
Myrtaceae	Melaleuca deanei	Deane's Paperbark	V	V	-	Grows in wet heath on sandstone, sandy soils and woodlands. The majority of populations occur in clefts within granite outcrops on skeletal soils, though also occurs at lower altitudes in damp situation.	Unlikely to occur. No suitable habitat present within the subject land.
Myrtaceae	Syzygium paniculatum	Magenta Lilly Pilly	E	V	12	Species occurs naturally from Forster in the north to Jervis Bay in the south. It is found in rainforest on sandy soils or on sand dunes at low altitude in coastal areas. It is most commonly associated with littoral and gallery rainforest types. The species is extensively cultivated as an ornamental plant.	Unlikely to occur. No suitable habitat present within the subject land.



Family	Species Name	Common Name	BC Act Status	Comm Status	No. of Records (BioNet)	Habitat Requirements	Likelihood of occurrence
Myrtaceae	Kunzea rupestris		V	V	-	a clonal shrub to approximately 1.5m in height. This species has a restricted distribution with most locations in the Maroota - Sackville - Glenorie area and one outlier in Ku-ring-gai Chase NP, all within the Central Coast botanical subdivision of NSW. This species grows in shallow depressions on large flat sandstone outcrops and is found in short-tall shrubland or heathland.	Unlikely to occur. No suitable habitat present within the subject land.
Myrtaceae	Melaleuca biconvexa	Biconvex Paperbark	V	V	-	Occurs in damp areas, often near watercourses, on alluvium soils over shale. Vegetation communities associated with the species include 'Eucalypt open-forest' with Sydney Blue Gum (Eucalyptus saligna), Swamp Mahogany (Eucalyptus robusta) and Mountain Cedar Wattle (Acacia elata) and in 'Paperbark scrub' with Prickly-leaved Paperbark (Melaleuca styphelioides), Snow-in-summer (Melaleuca linariifolia), White Feather Honeymyrtle (Melaleuca decora), Sieber's Paperbark (Melaleuca sieberi) and Melaleuca nodosa.	Unlikely to occur. No suitable habitat present within the subject land.
Myrtaceae	Triplarina imbricata	Creek Triplarina	E	E	-	Occurs in a few areas in northern New South Wales, and was historically collected from Parramatta. The last collection in Parramatta was in the 1850s and the species is now thought to be extinct in the locality. It occurs along rocky riverbanks in low open forest on sandy alluvial soils derived from sandstone.	Unlikely to occur. No suitable habitat present within the subject land.
Orchidaceae	Genoplesium baueri	Bauer's Midge Orchid	E	E	-	Grows in dry sclerophyll forest and in moss gardens over sandstone and flowers February to March.	Unlikely to occur. No suitable habitat



Family	Species Name	Common Name	BC Act Status	Comm Status	No. of Records (BioNet)	Habitat Requirements	Likelihood of occurrence
							present within the subject land.
Orchidaceae	Microtis angusii	Angus's Onion Orchid	E	E	9	This species is only known from a single population in the Warringah and Pittwater LGAs. Soils are ridgetop lateritic soils which once contained Duffys Forest, however locations where the species has been recorded are degraded and dominated by weeds.	Flowers May to October when it is easily recognisable. Surveys in July did not detect species, therefore considered unlikely to occur.
Orchidaceae	Caladenia tessellata	Thick-lipped Spider- orchid	E	V	-	Distributed along the eastern coast of Australia from the Central Coast to the Westernport region in Victoria. It favours low, dry sclerophyll vegetation with a heathy, or occasionally grassy understorey, or sedgy open forest. Soils it prefers are drained sand and clay loams.	Unlikely to occur. No suitable habitat present within the subject land.
Orchidaceae	Cryptostylis hunteriana	Leafless Tongue- orchid	V	V	-	Occur in a wide variety of habitats including heathlands, heathy woodlands, sedgelands, Xanthorrhoea spp. plains, dry sclerophyll forests (shrub/grass sub-formation and shrubby sub-formation), forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests and wet sclerophyll forests. Soils are generally considered to be moist and sandy, however, this species is also known to grow in dry or peaty soils. Is associated with the community Bloodwood / Scribbly Gum / Silver-top Ash Forest on the South Coast. Species is known to have occurrence associated with other Cryptostylis species. Flowering occurs generally from November to February.	Unlikely to occur. No suitable habitat present within the subject land.



Family	Species Name	Common Name	BC Act Status	Comm Status	No. of Records (BioNet)	Habitat Requirements	Likelihood of occurrence
Poaceae	Deyeuxia appressa		E	E	-	Species has only been collected twice, with both records prior to 1942. Locations were at Killara, near Hornsby, and the Georges River area, south of Bankstown. Little is known about the species habitat or ecology and it is likely to be extinct.	Unlikely to occur. No suitable habitat present within the subject land.
Proteaceae	Grevillea caleyi	Caley's Grevillea	CE	CE	180	Occurs in three major areas in the suburbs of Belrose, Ingleside, and Terrey Hills. All sites it occurs at are on ridgetops, and the species is associated with lateritic soils and the Threatened Ecological Community Duffys Forest.	Potential to occur within the Duffys Forest vegetation of the study area.
Proteaceae	Persoonia hirsuta	Hairy Geebung	E	E	23	Has a scattered distribution along the east coast from Singleton in the north to Bargo in the south, and the Blue Mountains to the west. It is found in mostly small populations on sandy soils in dry sclerophyll forest, woodland, and heath.	Unlikely to occur. No suitable habitat present within the subject land.
Proteaceae	Grevillea shiressii		V	V	-	Known from two populations near Gosford on Mooney Creek and Mullet Creek (tributaries of the Hawkesbury River). It grows along creek banks on alluvial sandy or loamy soils within wet sclerophyll forest.	Unlikely to occur. No suitable habitat present within the subject land.
Proteaceae	Persoonia mollis subsp. maxima		E	E	-	Occurs in three populations all from the Hornsby Heights to Mount Colah area. Found in sheltered aspects of deep gullies on sandstone, or on the steep upper slopes of narrow sandstone gullies. It is associated with moist, tall forest.	Unlikely to occur. No suitable habitat present within the subject land.



Family	Species Name	Common Name	BC Act Status	Comm Status	No. of Records (BioNet)	Habitat Requirements	Likelihood of occurrence
Rutaceae	Asterolasia elegans		E	E	-	Occurs on Hawkesbury sandstone growing between sandstone boulders and rocky outcrops found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. It is currently only known from 7 populations occurring in the hills north of Maroota within a 22 km ² extent of occurrence.	Unlikely to occur. No suitable habitat present within the subject land.
Santalaceae	Thesium australe	Austral Toadflax	V	V	-	Found in very small populations scattered across eastern NSW. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (<i>Themeda</i> <i>triandra</i>).	Unlikely to occur. No suitable habitat present within the subject land.
Thymelaeaceae	Pimelea curviflora var. curviflora		V	V	27	Occurs on ridge tops and upper slopes in open forest and woodland on sandy soils derived from sandstone, on shale/lateritic soils, and on shale/sandstone transition soils.	Potential to occur within the Duffys Forest vegetation of the study area.
Thymelaeaceae	Pimelea spicata	Spiked Rice- flower	E	E	-	Found on well-structured clay soils in Cumberland Plain and Illawarra environments. In the inland Cumberland Plain sites it is associated with Grey Box and Ironbark. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a better developed shrub and grass understorey.	Unlikely to occur. No suitable habitat present within the subject land.

*CE = Critically Endangered, E = Endangered, V = Vulnerable



Table 6 Threatened fauna likelihood of occurrence assessment

Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Amphibia							
Hylidae	Litoria aurea	Green and Golden Bell Frog	E	V	-	Marshes, dams, stream sides, particularly those containing bulrushes or spikerushes; unshaded water bodies free of Gambusia form optimum habitat; vegetation and/or rocks are needed for sheltering.	Unlikely to occur. No suitable habitat present within the study area.
Myobatrachidae	Heleioporus australiacus	Giant Burrowing Frog	V	V	10	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Breeding habitat is generally soaks or pools within first or second order streams and are commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water. Largely confined to sandstone in the Sydney Basin.	Unlikely to occur. No suitable habitat present within the study area.
Myobatrachidae	Pseudophryne australis	Red-crowned Toadlet	V	-	114	Has a distribution restricted to the Sydney Basin, from Pokolbin in the north, Nowra to the south, and Mt Victoria in the Blue Mountains to the west. It inhabits ephemeral drainage lines below sandstone ridges that often have shale caps, in open forests on Hawkesbury and Narrabeen Sandstones. The species utilises dense vegetation and debris besides water in the breeding season. Outside of breeding season the species is found under rocks, logs, and leaf litter nearby to breeding areas.	Unlikely to occur. No suitable habitat present within the study area.
Myobatrachidae	Mixophyes balbus	Stuttering Frog	E	V	-	Found in rainforest and wet, open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Occurs in deep leaf litter and thick understorey vegetation, and breeds in streams after heavy rain.	Unlikely to occur. No suitable habitat present within the study area.
Aves							



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Accipitridae	Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	35	Found in coastal habitats and around terrestrial wetlands, including rivers, swamps, lakes and the sea.	Unlikely to occur. No suitable habitat present within the study area.
Accipitridae	Hieraaetus morphnoides	Little Eagle	V	-	1	Occupies open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	Unlikely to occur. No suitable habitat present within the study area.
Accipitridae	Lophoictinia isura	Square-tailed Kite	V	-	5	Found in a variety of timbered habitats including dry woodlands and open forests. It is a specialist hunter preying on passerine birds, especially honeyeaters and targets predominately nestlings and insects occurring in the tree canopy. It nests in tree forks or on large horizontal tree limbs located mostly along or near watercourses.	Unlikely to occur. No suitable habitat present within the study area.
Accipitridae	Pandion cristatus	Eastern Osprey	V	-	13	Found in littoral and coastal habitats and terrestrial wetlands. They generally are found in coastal areas though will travel inland along major water courses. They visit a wide range of wetland habitats including inshore waters, reefs, bays, coastal cliffs, estuaries, mangrove swamps, broad rivers, reservoirs, large lakes, and water holes. They feed on fish over clear, open water, and nest in trees or dead trees, generally within one kilometre of the ocean.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Apodidae	Apus pacificus	Fork-tailed Swift	-	Mig	1	Species has been recorded throughout NSW, but mostly east of the Great Divide. The species is almost exclusively aerial in Australia and breeds overseas. It forages from a metre above the ground, up to hundreds of metres in altitude, and mostly occur over inland plains, though sometimes over foothills, and coastal areas.	Low potential to occur. May forage aerially over study area occasionally.
Apodidae	Hirundapus caudacutus	White-throated Needletail	-	Mig	11	Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Occur over most types of habitat, particularly above wooded areas including open forest and rainforest, between trees or in clearings and below the canopy.	Low potential to occur. May forage aerially over study area occasionally.
Ardeidae	Botaurus poiciloptilus	Australasian Bittern	E	E	-	Occurs in freshwater wetlands, and more rarely, estuarine wetlands. It favours wetlands with tall, dense vegetation, and forages in shallow water up to a depth of 0.3m. It nests in deep vegetative cover over shallow pools.	Unlikely to occur. No suitable habitat present within the study area.
Ardeidae	Ixobrychus flavicollis	Black Bittern	V	-	16	Inhabits terrestrial and estuarine wetlands, generally in areas containing permanent water and dense vegetation. The species can occur in flooded grassland, woodland, rainforest, and mangroves. It feeds on frogs, reptiles, fish, and invertebrates such as snails, dragonflies, shrimp and crayfish. It roosts during the day on the ground amongst dense reeds or within trees. It nests in branches overhanging water.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Artamidae	Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	5	Occurs from Atherton Tableland in Queensland, down to Tasmania and west to the Eyre Peninsula in South Australia. In NSW it occurs from the coast to the western slopes of the Great Dividing Range and farther west. It breeds primarily on the western slopes of the Great Dividing Range in woodland and open dry forest. The species often occurs in eucalypt woodland and forest, though is also found in shrubland and heathland. It forages both above and below the canopy primarily for invertebrates, though will occasionally consume nectar, fruit and seed.	Unlikely to occur. No suitable habitat present within the study area.
Burhinidae	Burhinus grallarius	Bush-stone Curlew	E	-	7	Lives in open forest and woodlands with a sparse, grassy ground layer, and fallen timber. It feeds on insects and small insects and vertebrates including frogs, lizards, and snakes. Nesting is undertaken in a scrape or small bare patch.	Unlikely to occur. No suitable habitat present within the study area.
Burhinidae	Esacus magnirostris	Beach Stone- curlew	CE	-	1	Beach Stone-curlews are found exclusively along the coast, on a wide range of beaches, islands, reefs and in estuaries, and may be seen at the edges of or near mangroves. They forage in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves. Beach Stone-curlews breed above the littoral zone, at the backs of beaches, or on sandbanks and islands, among low vegetation of grass, scattered shrubs or low trees; also among open mangroves. In Australia, the Beach Stone-curlew is found along coastlines from Point Cloates in Western Australia, across northern and north-eastern Australia and south to north-eastern NSW, with occasional vagrants to south-eastern NSW and Victoria. In NSW, the species occurs regularly to about the Manning River.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Cacatuidae	Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	1	Occurs within a variety of forest and woodland types. Usually frequents forested areas with old growth attributes required for nesting and roosting purposes. Also utilises less heavily timbered woodlands and urban fringe areas to forage, but appears to favour well-timbered country through which it habitually flies as it moves about.	Unlikely to occur. No suitable habitat present within the study area.
Cacatuidae	Calyptorhynch us lathami	Glossy Black- Cockatoo	V	-	61	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m ASL in which stands of She-Oak species, particularly Black She-oak (<i>Allocasuarina littoralis</i>), Forest She-oak (<i>A. torulosa</i>) or Drooping She-oak (<i>A. verticillata</i>) occur.	Unlikely to occur. No Allocasuarina spp. present within the study area.
Charadriidae	Pluvialis squatarola	Grey Plover	-	Mig	3	Found in coastal areas where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons.	Unlikely to occur. No suitable habitat present within the study area.
Charadriidae	Thinornis rubricollis	Hooded Plover	CE	V	-	The species inhabits coastal areas, on or near high energy sandy beaches. They are generally found close to the shore but may visit coastal lakes.	Unlikely to occur. No suitable habitat present within the study area.
Columbidae	Ptilinopus magnificus	Wompoo Fruit- Dove	V	-	1	Occurs in or near rainforest, low elevation moist eucalypt forest and brush box forests. Nesting often occurs in palms over water.	Unlikely to occur. No suitable habitat present within the study area.
Columbidae	Ptilinopus regina	Rose-crowned Fruit-Dove	V	-	3	Occurs primarily in sub-tropical and dry rainforest, and occasionally in moist eucalypt forest and swamp forest.	Unlikely to occur. No suitable habitat present



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
							within the study area.
Columbidae	Ptilinopus superbus	Superb Fruit- Dove	V	-	3	Inhabits rainforest and closed forests where it forages high in the canopy, preferring figs and palms. Occasionally occurs in eucalypt or acacia woodland where fruit-bearing trees are present.	Unlikely to occur. No suitable habitat present within the study area.
Dasyornithidae	Dasyornis brachypterus	Eastern Bristlebird	E	E	-	Inhabits low dense vegetation in: sedgeland, heathland, swampland, shrubland, sclerophyll forest and woodland, and rainforest. Found near the coast, on tablelands and in ranges.	Unlikely to occur. No suitable habitat present within the study area.
Diomedeidae	Diomedea exulans antipodensis	Antipodean Albatross	V	V, Mig	-	Marine and pelagic species. Nests in open patchy vegetation on ridges, slopes and plateaus.	Unlikely to occur. No suitable habitat present within the study area.
Diomedeidae	Diomedea antipodensis gibsoni	Gibson's Albatross	V	V, Mig	-	Marine and pelagic species that nests on islands near coastal or inland ridges, slopes, plateaux and plains, often on marshy ground.	Unlikely to occur. No suitable habitat present within the study area.
Diomedeidae	Diomedea epomophora	Southern Royal Albatross	-	V, Mig	_	Marine and pelagic species. Nests on large islands and islets.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Diomedeidae	Diomedea exulans	Wandering Albatross	E	V, Mig	-	Marine and pelagic species that nests on islands near coastal or inland ridges, slopes, plateaux and plains, often on marshy ground.	Unlikely to occur. No suitable habitat present within the study area.
Diomedeidae	Diomedea sanfordi	Northern Royal Albatross	-	E, Mig	-	Marine and pelagic species. Nests on large islands and islets.	Unlikely to occur. No suitable habitat present within the study area.
Diomedeidae	Thalassarche bulleri	Buller's Albatross	E	V	-	In Australia, Buller's Albatross are seen over inshore, offshore and pelagic waters. Breeds and nests in the New Zealand region.	Unlikely to occur. No suitable habitat present within the study area.
Diomedeidae	Thalassarche bulleri platei	Northern Buller's Albatross	-	V, Mig	-	The Pacific Albatross is a marine, pelagic species. It occurs in subtropical and subantarctic waters of the South Pacific Ocean. The species occurs over inshore, offshore and pelagic waters and forages off the surface waters of the ocean.	Unlikely to occur. No suitable habitat present within the study area.
Diomedeidae	Thalassarche cauta cauta	Shy Albatross	V	V	1	Marine species that nests on level or gently sloping ledges, summits, slopes and caves of rocky islets and stacks, usually in broken terrain with little soil and vegetation.	Unlikely to occur. No suitable habitat present within the study area.
Diomedeidae	Thalassarche cauta steadi	White-capped Albatross	-	V	-	Marine species that nests on slopes vegetated with tussock and succulents on Auckland Island.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Diomedeidae	Thalassarche eremita	Chatham Albatross	-	E	-	Marine species that nests on level or gently sloping ledges, summits, slopes and caves of rocky islets and stacks, usually in broken terrain with little soil and vegetation.	Unlikely to occur. No suitable habitat present within the study area.
Diomedeidae	Thalassarche impavida	Campbell Albatross	-	V	-	Marine species, in winter, they are commonly found in the coastal waters of continents, over up-wellings or boundaries of currents.	Unlikely to occur. No suitable habitat present within the study area.
Diomedeidae	Thalassarche melanophris	Black-browed Albatross	V	V	-	Marine species that breeds on subantarctic and peri- Antarctic islands. Species is rarely sighted over land away from its breeding islands.	Unlikely to occur. No suitable habitat present within the study area.
Diomedeidae	Thalassarche salvini	Salvin's Albatross	-	V	-	Marine species that nests on level or gently sloping ledges, summits, slopes and caves of rocky islets and stacks, usually in broken terrain with little soil and vegetation. It occurs both inshore and offshore, entering harbours and bays.	Unlikely to occur. No suitable habitat present within the study area.
Haematopodidae	Haematopus fuliginosus	Sooty Oystercatcher	V	-	2	Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Laridae	Anous stolidus	Common Noddy	-	Mig	1	In Australia, the Common Noddy occurs mainly in ocean off the Queensland coast, but the species also occurs off the north-west and central Western Australia coast. The species is also rarely encountered off the coast of the Northern Territory, where only one breeding location with about 100-130 birds is known. The species also occurs on Norfolk, Lord Howe, Christmas and Cocos-Keeling Islands.	Unlikely to occur. No suitable habitat present within the study area.
Laridae	Hydroprogne caspia	Caspian Tern	-	Mig	7	Prefers sheltered coastal embayment's but is known to occur in near-coastal or inland terrestrial wetlands. Builds nests in open areas or areas with low vegetation.	Unlikely to occur. No suitable habitat present within the study area.
Laridae	Sternula nereis nereis	Australian Fairy Tern	-	V	-	Species nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. It has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline. It roosts on beaches at night.	Unlikely to occur. No suitable habitat present within the study area.
Meliphagidae	Anthochaera phrygia	Regent Honeyeater	CE	CE	-	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes.	Unlikely to occur. No suitable habitat present within the study area.
Meliphagidae	Grantiella picta	Painted Honeyeater	V	V	-	Occurs in Boree, Brigalow and Box-Gum Woodlands and Box-Ironbarks. Feeds primarily on mistletoe fruit and insects.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Neosittidae	Daphoenositta chrysoptera	Varied Sittella	V	-	2	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Unlikely to occur. No suitable habitat present within the study area.
Petroicidae	Petroica boodang	Scarlet Robin	V	-	2	Occurs in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Habitat usually contains abundant logs and fallen timber: these are important components of its habitat. Nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	Unlikely to occur. No suitable habitat present within the study area.
Procellariidae	Ardenna pacificus	Wedge-tailed Shearwater	-	Mig	1	Species is pelagic with only one breeding area on the mainland.	Unlikely to occur. No suitable habitat present within the study area.
Procellariidae	Ardenna tenuirostris	Short-tailed Shearwater	-	Mig	8	A marine species that breeds on numerous small islands in the southern areas of the Australian coastline, particularly in the Bass Straight.	Unlikely to occur. No suitable habitat present within the study area.
Procellariidae	Macronectes giganteus	Southern Giant- Petrel	E	E	-	Pelagic species with a circumpolar range from Antarctica to approximately 20° S and is a common visitor off the coast of NSW.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Procellariidae	Macronectes halli	Northern Giant Petrel	V	V	-	Pelagic species with a circumpolar pelagic distribution, usually between 40-64°S in open oceans. Their range extends into subtropical waters (to 28°S) in winter and early spring, and they are a common visitor in NSW waters, predominantly along the south-east coast during winter and autumn.	Unlikely to occur. No suitable habitat present within the study area.
Psittacidae	Glossopsitta pusilla	Little Lorikeet	V	-	4	Forages mostly in the canopy of open Eucalyptus forest and woodland, on Eucalypt species, and species of Angophora, Melaleuca, and other trees. Riparian habitats are ideal for the species due to higher productivity of flowering feed species. Isolated trees in paddocks and roadside remnants, along with urban trees can help sustain populations of the species. The species roosts in tree tops, often some distance from food trees, though prefers to nest in close proximity to feed areas. The species nests in hollows with a small entrance (3 cm) and at a height of between two and fifteen metres. Often nest trees are in riparian areas, and include trees of species like Allocasuarina spp.	Unlikely to occur. No suitable habitat present within the study area.
Psittacidae	Lathamus discolor	Swift Parrot	E	CE	17	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Psittacidae	Neophema pulchella	Turquoise Parrot	V	-	1	The species range extents from southern Queensland to northern Victoria, from coastal plains to the western slopes of the Great Dividing Range. The species is found inhabiting the edges of eucalypt woodlands, timbered ridges and creeks in farmland. Prefers to feed in the shade of trees and spends most of the day foraging in the ground for seeds and grasses. The Turquoise Parrot nests in hollows, logs or pots August to December.	Unlikely to occur. No suitable habitat present within the study area.
Rostratulidae	Rostratula australis	Australian Painted Snipe	E	E	-	Inhabits fringes of shallow inland wetlands, swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Unlikely to occur. No suitable habitat present within the study area.
Scolopacidae	Calidris acuminata	Sharp-tailed Sandpiper	-	Mig	2	Species prefers muddy edges of shallow fresh or brackish wetlands with inundated or low vegetation. Known to occur lagoons, swamps, lakes, dams, and other waterbodies. Roosts at the edges of wetlands.	Unlikely to occur. No suitable habitat present within the study area.
Scolopacidae	Calidris canutus	Red Knot	-	E, Mig	-	Summer migrant from the Northern Hemisphere where it breeds. In NSW it mainly occurs on intertidal mudflats, estuaries, bays, inlets, lagoons, harbours, sandflats, and sandy beaches, of sheltered coasts. It is occasionally found closer to the open ocean, and rarely in terrestrial saline and freshwater swamps. It forages near the water's edge on worms, bivalves, gastropods, crustaceans, and echinoderms. It roosts on sandy beaches, spits, islets, and mudflats close to feeding grounds in open areas.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Scolopacidae	Calidris ferruginea	Curlew Sandpiper	E	CE, Mig	1	Occurs around coastal areas and is widespread inland. The species occupies mainly intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and around non-tidal swamps. They forage for invertebrates at the edges of shallow waters. The species generally roosts in dunes and sandy areas.	Unlikely to occur. No suitable habitat present within the study area.
Scolopacidae	Gallinago hardwickii	Latham's Snipe	-	Mig	1	Seen in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration. They also use crops and pasture.	Unlikely to occur. No suitable habitat present within the study area.
Scolopacidae	Limosa lapponica baueri	Bar-tailed Godwit	-	Mig	4	A migratory, long-necked wader with a migratory route of approximately 11,000km. The species is most commonly recorded along major coastal river estuaries and sheltered embayments, particularly in the Tweed, Richmond, Clarence, Macleay, Hastings, Hunter and Shoalhaven river estuaries. Found in coastal habitats (sandflats, banks, mudflats, inlets, bays). Occurs around seagrass beds and occasionally in salt marshes or outer mangrove margins. Forages in low to mid tide on worms, molluscs, insects and plant material.	Unlikely to occur. No suitable habitat present within the study area.
Scolopacidae	Limosa lapponica menzbieri	Northern Siberian Bar- tailed Godwit	-	CE	-	Breeds in north Siberia east to the Kolyma Delta and winters in South-east Asia and Northern Australia. Occupies marshy areas in lowland tundra, and migrates to muddy coastlines, inlets, mangrove lagoons and sheltered bays to forage on bivalves, annelids and crustaceans.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Scolopacidae	Numenius madagascarien sis	Eastern Curlew	-	CE, Mig	-	Breeds in the Northern Hemisphere and spends the non-breeding season in all states of Australia in coastal areas and rarely inland. In NSW it is distributed along all coastal areas, but it mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River and Richmond River. It occupies lakes, inlets, bays and estuarine habitat. It is mainly found in intertidal mudflats and sometimes saltmarsh. It forages at the edge of shallow water and roosts on sandy spits and islets especially on dry beach sand.	Unlikely to occur. No suitable habitat present within the study area.
Scolopacidae	Tringa nebularia	Common Greenshank	-	Mig	1	Occurs in a wide variety of inland wetlands and sheltered coastal areas. Species does not breed in Australia.	Unlikely to occur. No suitable habitat present within the study area.
Strigidae	Ninox connivens	Barking Owl	V	-	9	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. Nests in hollows of large, old eucalypts. Hunts small arboreal mammals such as Squirrel Gliders and Ringtail Possums, but when loss of tree hollows decreases these prey populations it becomes more reliant on birds, invertebrates and terrestrial mammals. Requires very large permanent territories in most habitats due to sparse prey densities.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Strigidae	Ninox strenua	Powerful Owl	V	-	261	The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. It breeds and hunts in open or closed sclerophyll forests or woodlands and occasionally hunts in open habitats. Roosting during the day time occurs in dense vegetation of Eucalypts and species such as <i>Syncarpia glomulifera</i> (Turpentine), <i>Angophora floribunda</i> (Rough-barked Apple), and other species. Prey species are medium-sized arboreal mammals such as the Greater Glider, Common Ringtail Possum, and Sugar Glider. As most prey species require hollows and a shrub layer these are important habitat components also of the Powerful Owl. Nests are in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	Potential to occur for foraging purposes only
Threskiornithidae	Plegadis falcinellus	Glossy Ibis	-	Mig	1	Preferred foraging and breeding habitat are fresh water marshes at the edges of waterbodies. This species has low breeding site fidelity and nests in primarily in swamps.	Unlikely to occur. No suitable habitat present within the study area.
Tytonidae	Tyto tenebricosa	Sooty Owl	V	-	2	Occurs in coastal rainforest, including dry, subtropical, and temperate rainforests, and moist eucalypt forests. Utilises tall trees in heavily vegetated areas for day time resting. It hunts during the night for small ground or tree dwelling mammals such as the Common Ringtail Possum or Sugar Glider. The species requires very large tree hollows for nesting.	Unlikely to occur. No suitable habitat present within the study area.

Mammalia



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Burramyidae	Cercartetus nanus	Eastern Pygmy- possum	V	-	106	Species is found in a broad range of habitats from rainforest to wet and dry sclerophyll forests through to woodland and heath. Woodland and heath habitats are preferred. The species feeds on pollen and nectar from banksias, eucalypts, and bottlebrushes, though will eat soft fruits when flowers are unavailable, and will also eat insects throughout the year. They shelter in tree hollows, rotten stumps, holes in the ground, abandoned bird nests and Ringtail Possum dreys, and thickets of vegetation. Tree hollows are preferred for nesting, but the species will also nest under tree bark and shredded bark in tree forks.	Unlikely to occur. The study area has poor connectivity to other tracts of suitable vegetation due to major roads and surrounding development.
Dasyuridae	Dasyurus maculatus	Spotted-tailed Quoll	V	E	14	Occurs in wide variety of habitats; rainforest, open forest, woodland, coastal heath and riparian forest. Uses hollows in trees, logs and rock crevasses as den sites.	Unlikely to occur. No suitable habitat present within the study area.
Emballonuridae	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	1	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Low potential to occur. Marginal suitable habitat present in the subject site.
Macropodidae	Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	-	Occupies rock outcrops, escarpments and cliffs with features such as caves, fissures and ledges. Browses on adjacent vegetation. Has a home range of about 15 ha and shelters in caves.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Miniopteridae	Miniopterus australis	Little Bentwing- bat	V	-	31	Inhabits moist eucalypt forest, rainforest, wet and dry sclerophyll forest, melaleuca swamps, dense coastal forests and banksia scrub, preferring well-timbered areas. Species roosts in caves, tunnels, stormwater drains, culverts, bridges and sometimes in buildings.	Low potential to occur. Marginal suitable habitat present in the subject site.
Miniopteridae	Miniopterus orianae oceanensis	Large Bent- winged Bat	V	-	145	Roosts mainly in caves but also in tunnels, mines or buildings. Non-breeding populations disperse within a 300 km range of maternity caves. Hunting for moths and other insects takes place in forested areas above the canopy.	Low potential to occur. Marginal suitable habitat present in the study area.
Molossidae	Micronomus norfolkensis	Eastern Coastal Freetail-bat	V	-	3	Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts in tree hollows but will also roost under bark or in man-made structures.	Low potential to occur. Marginal suitable habitat present in the subject site.
Muridae	Pseudomys novaehollandia e	New Holland Mouse	-	V	2	Occurs in open habitats (heathland, woodland and forest) with a heath understorey and vegetated sand dunes. The species prefers deep soft top soils in order to burrow.	Unlikely to occur. No suitable habitat present within the study area.
Peramelidae	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	E	E	6	Within NSW, the species is rare and almost exclusively restricted to the coastal fringe of the state, from the southern side of the Hawkesbury River in the north to the Victorian border in the south. More specifically, the subspecies is considered to occur primarily in two areas: (i) Ku-ring-gai Chase and Garigal National Parks; and (ii) in the far south-east corner of the state. Occurs within their distribution in a variety of habitats including heathland, shrubland, sedgeland, heathy open forest and woodland.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Phascolarctidae	Phascolarctos cinereus	Koala	V	V	2	Inhabits eucalypt woodlands and forests, feeding on the leaves of Eucalyptus species. They feed on the foliage of more than 70 Eucalypt species and 30 non- eucalypt species.	Unlikely to occur. Very few records from the area and the study area has poor connectivity to other tracts of suitable vegetation due to major roads and surrounding development.
Pseudocheiridae	Petauroides volans	Greater Glider	-	V	_	Restricted to eastern Australia and occurring from the Windsor Tableland in Queensland south to Wombat State Forest in central Victoria. Largely restricted to eucalypt forests and woodlands. The diet is predominately comprised of eucalypt leaves, and more rarely flowers. Highest abundances occur in tall montane forests with old trees and abundant hollows.	Unlikely to occur. No suitable habitat present within the study area.
Pteropodidae	Pteropus poliocephalus	Grey-headed Flying-fox	V	V	290	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Commonly found in gullies, close to water, in vegetation with a dense canopy.	Potential to occur for foraging purposes only
Vespertilionidae	Chalinolobus dwyeri	Large-eared Pied Bat	V	V	4	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin. Found in well-timbered areas containing gullies.	Unlikely to occur. No suitable habitat present within the study area.



Family	Scientific Name	Common Name	BC Act	EPBC Act	No.	Habitat Requirements	Likelihood of occurrence
Vespertilionidae	Myotis macropus	Southern Myotis	V	-	39	Roosts close to water in caves, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish. Known from a range of habitats close to water from lakes, small creeks to large lakes and mangrove lined estuaries	Unlikely to occur. No suitable habitat present within the study area.
Vespertilionidae	Scoteanax rueppellii	Greater Broad- nosed Bat	V	-	2	Found mainly in the gullies and river systems that drain the Great Dividing Range. Usually roosts in tree hollows and buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects. Species is not known to occur in areas of high urban density.	Unlikely to occur. No suitable habitat present within the study area.
Reptilia							
Elapidae	Hoplocephalus bungaroides	Broad-headed Snake	E	V	-	Found in rocky outcrops and adjacent sclerophyll forest and woodland. The most suitable sites occur on sandstone ridgetops. During autumn, winter, and spring the species shelters in rock crevices and under flat exposed sandstone rocks on cliff edges. In Summer it shelters in the hollows of large trees, within 200 m of escarpments.	Unlikely to occur. No suitable habitat present within the study area.
Varanidae	Varanus rosenbergi	Rosenberg's Goanna	V	-	83	Inhabits heath, open forest and woodland containing termite mounds. Shelters in hollow logs, rock crevices and in burrows.	Unlikely to occur. No suitable habitat present within the study area.

*CE = Critically Endangered, E = Endangered, V = Vulnerable, Mig = Migratory



APPENDIX C: Tests of Significance

357-373 Warringah Rd, Frenchs Forest Cumberland Ecology © Final | Bunnings Group Page C.1



C.1. Duffys Forest Ecological Community in the Sydney Basin Bioregion

C.1.1. Background

Duffys Forest is listed as an Endangered Ecological Community (EEC) under the BC Act and is not listed under the EPBC Act. This vegetation community is characterised by an open-forest or woodland that is dominated by Red Bloodwood (*Corymbia gummifera*), Black Ash (*Eucalyptus sieberi*) and Smooth-barked Apple (*Angophora costata*). Shrub layer species commonly include Myrtle Wattle (*Acacia myrtifolia*), Hairpin Banksia (*Banksia spinulosa*), Rusty Velet-bush (*Lasiopetalum ferrugineum*), Crinkle Bush (*Lomatia silaifolia*) and Broad-leaf Geebung (*Persoonia levis*). Duffys Forest is primarily located within the Warringah and Ku-ring-gai LGAs, where it occurs in association with shale lenses and lateritic soils in Hawkesbury Sandstone. It is generally situated on ridgetops, plateaus and upper slopes, but may also occur on mid-slopes or benches downslope of Sydney Sandstone Ridgetop Woodland (DPIE, 2020b).

Duffys Forest occupies approximately 0.22 ha (2200m²) of the study area and the proposed Project will retain the entire patch of this vegetation community. One tree overhangs the subject site, and has a total area of 0.002 ha (20m²), however, the tree is proposed for retention and will be fenced and protected, as shown on the Landscape Plan (John Lock & Associates 2020).

There is potential for some indirect impacts to occur to Duffys Forest as a result of edge-effects on the retained patch from adjoining development. However, given that the patch already occurs in a highly urbanised environment, and adjoins a carpark, the such indirect impacts are not likely to be exacerbated.

C.1.2. Test of Significance

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

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

Not applicable.

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

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

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

No area of Duffys Forest will be removed for the proposed Project within the study area. There is potential for indirect impacts to result from edge-effects in association with the adjoining development. However, as the Duffys Forest remnant already occurs within a highly urban landscape, and adjoins a carpark, such impacts are unlikely to be exacerbated beyond current levels. The patch of vegetation within the study area has some


connectivity to a much larger tract occurring in the Allambie area and the Duffys Forest within the study area has persisted despite previous clearing, modification of the shrub and ground layers, and the establishment of many surrounding developments. Therefore, as the entire patch will be retained, the Project is not likely to have an adverse impact on the ecological community such that its local occurrence will be placed at risk of extinction nor will the composition of the Duffys Forest be modified such that the local occurrence of the community will be placed at risk of extinction.

(c) in relation to the habitat of a threatened species or ecological community:

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

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

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

No area of Duffys Forest will be removed for the proposed Project within the study area. There is potential for indirect impacts to result from edge-effects in association with the adjoining development.

The existing patch is already fragmented from other contiguous native vegetation, and the Project will not act to further fragment this patch.

The potential modification is not considered significant to the long-term survival of the ecological community in the locality. The habitat has already been modified and exists in an urbanised setting and is not considered important habitat for the community.

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

No areas of outstanding biodiversity value (AOBV) are within the subject site or immediate surrounds and therefore no AOBVs will be directly or indirectly impacted by the proposed development.

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

The key threatening process of 'Loss and fragmentation of habitat through clearing and development' applies to the proposed Project, as there is a potential for indirect impacts to occur to Duffys Forest that will adjoin the proposed development. No area of Duffys Forest will be removed, and the Project provides for the retention and improvement of the entire ~0.22 ha ($2200m^2$) patch of Duffys Forest within the study area. This is considered to negate the minor potential indirect impacts from edge-effects caused by the development of the subject site.



C.1.3. Conclusion

No area of Duffys Forest will be removed for the proposed Project within the study area. There is potential for indirect impacts to result from edge-effects in association with the adjoining development. The vegetation exists as a diverse canopy layer with a modified shrub and ground layer that is managed as garden beds. Despite the surrounding developments and history of clearing and modification, the Duffys Forest in the study area has persisted and has some connectivity to much larger tracts of vegetation located in Allambie to the south. The potential for minor modification to the community from edge-effects resulting from the proposed adjoining development is not considered likely to have an adverse effect of the longevity of the community in the locality. Therefore, no significant impact upon Duffys Forest is likely to result from the proposed Project and subsequently no BDAR or Referral to the Commonwealth is required.

C.2. Eucalyptus nicholii

C.2.1. Background

Eucalyptus nicholii (Narrow-leaved Black Peppermint) occurs on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range, where it is found on private property and roadsides, and occasionally in conservation reserves. This species grows in dry grassy woodland, on shallow soils of slopes and ridges on infertile soils derived from granite or metasedimentary rock. It is commonly planted as urban trees and for windbreaks and corridors (DPIE 2019b).

Eucalyptus nicholii is listed as Vulnerable under the BC Act and the EPBC Act.

C.2.2. Test of Significance

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

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

One individual *Eucalyptus nicholii* occurs as a planted urban tree in the gardens surrounding the existing development within the subject site. This species does not naturally occur in the locality, although it is frequently planted as a roadside and garden tree throughout the surrounding suburb of Frenchs Forest. The individual tree is proposed for retention, and will be incorporated into the landscaping of the subject site. The Project is not likely to have an adverse effect of the life cycle of the species such that a viable local population is placed at risk of extinction as there is no viable local population due to this being a planted species outside of the species range with poor connectivity to any other planted individuals.

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

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



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

Not applicable.

(c) in relation to the habitat of a threatened species or ecological community:

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

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

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

The sole *Eucalyptus nicholii* within the subject site will be retained as part of the proposed Project. Due to this occurring as a planted garden species, the species is already fragmented from naturally occurring habitat, and the Project will not act to further fragment or isolate the habitat for the species. The individual will be retained, although its occurrence would impact on the long-term survival of the species in the locality because this species would not occur in the locality expect where it has been cultivated. The species has no natural habitat in the study area or surrounding suburbs, and would not be expected to survive in the region except as a planted species.

Accordingly, the proposed development will not remove, modify, fragment or isolate important habitat.

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

No areas of outstanding biodiversity value (AOBV) are within the study area or immediate surrounds and therefore no AOBVs will be directly or indirectly impacted by the proposed development.

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

No key threatening processes for the species are applicable to the proposed Project.

C.2.3. Conclusion

One *Eucalyptus nicholii* occurs as a planted garden bed species within the study area and will be retained as part of the proposed Project. The study area is outside of the species range and it only occurs as a planted species in the surrounding suburbs. This species would not naturally occur within the habitats of the study area, nor would it persist in the long-term except as a planted species. Therefore, the Project is not likely to have a significant detrimental impact upon *Eucalyptus nicholii* and subsequently no BDAR or Referral to the Commonwealth is required.



C.3. Duffys Forest Associated Threatened Flora Species

C.3.1. Background

The following threatened flora species have not been recorded within the study area, however, are considered to have the potential to occur within the Duffys Forest vegetation on site. Due to their similarities in habitat requirements, they have been addressed together.

Prostanthera marifolia (Seaforth Mintbush) is only known from Seaforth, where the single population is fragmented by urbanisation into three small sites in the local government area of Northern Beaches Council. This species occurs in, or in close proximity to, the Duffys Forest ecological community (DPIE 2020b). *Prostanthera marifolia* is listed as Critically Endangered under the BC Act and EPBC Act.

Grevillea caleyi (Caley's Grevillea) occurs in three major areas of suitable habitat around Belrose, Ingleside and Terrey Hills/Duffys Forest within the Ku-ring-gai, Pittwater and Warringah Local Government Areas. This species is commonly found in the Duffys Forest ecological community in areas of open forest dominated by *Eucalyptus sieberi* and *E. gummifera* (DPIE 2020b). *Grevillea caleyi* is listed as Critically Endangered under the BC Act and EPBC Act (*DPIE 2020a*).

Pimelea curviflora var. curviflora is to the coastal area of the Sydney and Illawarra regions between northern Sydney and Maroota in the north-west. The species was formerly recorded around the Parramatta River and Port Jackson region. It Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands (DPIE 2020f). *Pimelea curviflora var. curviflora* is listed as Vulnerable under the BC Act and EPBC Act.

C.3.2. Test of Significance

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

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

These threatened flora species have not been recorded within the study area, however potential habitat for these species occurs within the Duffys Forest vegetation in the northern portion of the site. The proposed Project will retain the entire 0.22 ha (2200m²) patch of Duffys Forest within the study area, which comprises a modified and managed ground and shrub layer that would generally reduce the likelihood of these species occurring. Given the retention of the patch of Duffys Forest within the study area and none of the species have been recorded within the study area previously, it is not considered likely that the proposed Project would have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

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



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

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

Not applicable.

(c) in relation to the habitat of a threatened species or ecological community:

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

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

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

No area of habitat for Duffys Forest will be removed, which could provide marginal and degraded potential habitat for these species will be removed as part of the proposed Project. There is potential for indirect impacts to occur to the Duffys Forest as a result of edge-effects from the adjoining development, however, edge-effects are already in operation in the study area, and these are unlikely to be greatly exacerbated.

The habitat occurs in a highly urban environment that has connectivity to areas of similar isolated patches of degraded remnant vegetation and urban vegetation; while a much larger intact patch of vegetation and potential habitat occurs nearby in Allambie. As such, while the development has the potential to indirectly impact the area of existing habitat, it will not isolate it and will only very marginally fragment it further. The potential habitat in the study area represents only a very small area available to the species is considered sub-optimal due the management of the ground layer as a garden bed. As the species were not recorded within the study area, the removal of this small portion of habitat available for the species is not considered likely to have an adverse impact to the long-term survival of any of the threatened flora species. Accordingly, the proposed development will not remove, modify, fragment or isolate important habitat.

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

No areas of outstanding biodiversity value (AOBV) are within the subject site or immediate surrounds and therefore no AOBVs will be directly or indirectly impacted by the proposed development.

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

The key threatening process of 'Habitat loss due to clearing for urban development' could potentially impact habitat for these species further than current conditions. However, the vegetation on the subject site is not considered to constitute significant habitat for these threatened flora species due historical clearing activities and ongoing management as an urban garden bed. As potential habitat will remain in the vicinity of the study



area, the potential modification of a small area of degraded habitat is not likely to significantly impact habitat for the potentially occurring threatened species.

C.3.3. Conclusion

The patch of Duffys Forest present within the study area will be retained as part of the proposed Project which has the potential to be marginal, degraded habitat for the threatened flora species *Prostanthera marifolia*, *Grevillea caleyi* and *Pimelea curviflora var. curviflora*. None of these species have been recorded within the study area, and it is considered the potential modification of the available habitat for these species is unlikely to have an adverse effect on their long-term survival. The Duffys Forest within the study area has historically been cleared and is currently managed as a garden bed that has resulted in the lack of a complex ground and shrub layer, indicating this modified vegetation would be sub-optimal habitat for the three threatened flora species. More optimum habitat exists in the wider locality including within Allambie, around the Manly dam, and in Garigal National Park. Any local population of the species is unlikely to depend on the limited habitat of subject site. Nevertheless, the majority of the suitable habitat within the study area will be retained and improved as part of the proposed Project.

Accordingly, the Project is not likely to have a significant detrimental impact upon *Prostanthera marifolia*, *Grevillea caleyi* and *Pimelea curviflora var. curviflora* and subsequently no BDAR or Referral to the Commonwealth is required.

C.4. Powerful Owl

C.4.1. Background

The Powerful Owl (*Ninox strenua*) is listed as Vulnerable under the BC Act and is not listed under the EPBC Act. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. It breeds and hunts in open or closed sclerophyll forests or woodlands and occasionally hunts in open habitats. Roosting during the day time occurs in dense vegetation of Eucalypts and species such as *Syncarpia glomulifera* (Turpentine) and *Angophora floribunda* (Rough-barked Apple). Prey species are medium-sized arboreal mammals such as the Greater Glider, Common Ringtail Possum, and Sugar Glider. As most prey species require hollows and a shrub layer these are important habitat components of the Powerful Owl. Nests are in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old (DPIE 2020g).

C.4.2. Test of Significance

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

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

The Powerful Owl is a highly mobile species that has vast foraging ranges and the species is unlikely to rely on the small area of potential foraging habitat to be removed as a result of the proposed Project. No breeding



hollows suitable for the Powerful Owl are present within the subject site or study area, and it is expected the species would only utilise the habitat within the subject site for occasional foraging purposes. Any individual of the species that may access the vegetation of the subject site would also have access to the much larger, higher quality foraging habitats available within the nearby Allambie parks, Manly dam area, and Garigal National Park. The habitat to be removed as part of the proposal represents a very small portion of potential foraging habitat available in the locality. As such, the proposal is not considered likely to affect the life cycle of the Powerful Owl such that a viable local population is placed at risk of extinction.

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

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

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

Not applicable.

(c) in relation to the habitat of a threatened species or ecological community:

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

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

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

Only ~0.13 ha (1300m²) of Planted Urban Native/Exotic vegetation will be removed as part of the proposed Project that has the potential to harbor urban-adapted prey species that the Powerful Owl would hunt.

The habitat occurs in a highly urban environment that has connectivity to areas of similar isolated patches of degraded remnant vegetation and urban vegetation, however much larger tracts of foraging habitat is available within the locality, including in Allambie and around the Manly dam. As such, while the development will encroach slightly into the area of existing foraging habitat, it will not isolate it and will only marginally fragment it further. The potential habitat on the subject site represents only a very small area available to the species in the locality and as the species is highly mobile and accesses resources from across a vast foraging range, the proposal is not likely to decrease the movement of individuals and gene flow between areas of potential habitat throughout the locality or within or between local populations. Accordingly, the proposed development will not remove, modify, fragment or isolate important habitat for the Powerful Owl.

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



No areas of outstanding biodiversity value (AOBV) are within the subject site or immediate surrounds and therefore no AOBVs will be directly or indirectly impacted by the proposed development.

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

No key threatening processes for the Powerful Owl apply to the proposed Project.

C.4.3. Conclusion

Very marginal foraging habitat will be removed within the subject site; however more optimum habitat exists in the wider locality including within Allambie, the Manly dam area and in Garigal National Park. Any local population of this species is unlikely to depend on the limited resources contained on the subject site for its survival and large areas of suitable habitat remain in the locality with much of that being in conservation areas.

No breeding habitat exists on the subject site and the proposal is not likely to place a viable local population of this species at risk of extinction. The Powerful Owl is highly mobile and is expected to move between areas of remaining habitat within the immediate vicinity of the subject site and wider area. Nevertheless, ~0.22 ha (2200m²) of Duffys Forest vegetation will be retained within the study area, along with four of the five hollow-bearing trees, which have the potential to be inhabited by arboreal mammals that he Powerful Owl preys upon.

The small area of highly urban and degraded foraging habitat for the Powerful Owl to be removed as part of the proposed Project is not likely to have a significant detrimental impact upon the species and subsequently no BDAR or Referral to the Commonwealth is required.

C.5. Grey-headed Flying-fox

C.5.1. Background

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is distributed along the east coast of NSW from Bundaberg in Queensland to Melbourne, Victoria. It occurs as far west as the western slopes of the Great Dividing Range in northern NSW. It occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Grey-headed Flying-foxes migrate according to the availability of native fruits, nectar and pollen. They roost in large "camps" which are generally within 20 km of a food source (NSW Scientific Committee 2004). The Grey-headed Flying-fox is listed as Vulnerable under the BC Act and the EPBC Act.

C.5.2. Test of Significance

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

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

The Grey-headed Flying-fox is a highly mobile species that has vast foraging ranges and the species is unlikely to rely on the small area of potential foraging habitat to be removed as a result of the proposed Project. No



breeding camps are present within the subject site or will be affected (DoEE 2019). Any local population of the species that may access the vegetation of the subject site would also have access to the much larger, higher quality foraging areas available within the nearby Allambie area, Manly dam, and Garigal National Park. The habitat to be removed as part of the proposal represents a very small portion of potential foraging habitat available in the locality. As such, the proposal is not considered to affect the life cycle of the Grey-headed Flying-fox such that a viable local population is placed at risk of extinction.

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

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

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

Not applicable.

(c) in relation to the habitat of a threatened species or ecological community:

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

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

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

Only a small number of trees which could provide very marginal, degraded potential foraging habitat for this species will be removed as part of the proposed development.

The habitat occurs in a highly urban environment that has connectivity to areas of similar isolated patches of degraded remnant vegetation and urban vegetation. As such, while the development will encroach slightly into the area of existing foraging habitat, it will not isolate it and will only marginally fragment it further. The potential habitat on the subject site represents only a very small area available to the species in the locality and as the species is highly mobile and accesses resources from across a vast foraging range, the proposal is not likely to decrease the movement of individuals and gene flow between areas of potential habitat throughout the locality or within or between local populations. Accordingly, the proposed development will not remove, modify, fragment or isolate important habitat.

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

No areas of outstanding biodiversity value (AOBV) are within the subject site or immediate surrounds and therefore no AOBVs will be directly or indirectly impacted by the proposed development.



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

The key threatening process of 'loss of roosting and foraging sites' could potentially impact habitat for this species further than current conditions. However, the vegetation on the subject site is not considered to constitute significant habitat for the Grey-headed Flying-fox. As potential habitat will remain in the vicinity of the subject site, including within the study area, the loss of a small area of degraded foraging habitat is not likely to significantly impact habitat for potentially occurring threatened species.

C.5.3. Conclusion

Very marginal foraging habitat will be removed within the subject site; however more optimum habitat exists in the wider locality including within the Allambie area, around Manly dam and in Garigal National Park. Any local population of this species is unlikely to depend on the limited resources contained in the subject site for its survival and large areas of suitable habitat remain in the locality with much of that being in conservation areas.

No breeding habitat exists on the subject site and the proposal is not likely to place a viable local population of this species at risk of extinction. The Grey-headed Flying-fox is highly mobile and is expected to move between areas of remaining habitat within the immediate vicinity of the study area and wider area.

The project is not likely to have a significant detrimental impact upon the Grey-headed Flying-fox and subsequently no BDAR or Referral to the Commonwealth is required.

C.6. Microchiropteran Bats

C.6.1. Background

The Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) is listed as Vulnerable under the BC Act and is not listed under the EPBC Act. They roost singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, it flies high and fast over the forest canopy, but lower in more open country. The species forages in most habitats across its very wide range in areas with or without trees and appears to defend an aerial territory (DPIE 2019c).

The Little Bent-winged bat (*Miniopterus australis*) is listed as Vulnerable under the BC Act and is not listed under the EPBC Act. The species inhabits moist eucalypt forest, rainforest, wet and dry sclerophyll forest, melaleuca swamps, dense coastal forests and banksia scrub, preferring well-timbered areas. They roost predominantly in caves, tunnels, stormwater drains, culverts, bridges and sometimes in buildings (DPIE 2020e).

The Large Bent-winged Bat (*Miniopterus orianae oceanensis*) is listed as Vulnerable under the BC Act and is not listed under the EPBC Act. The species roosts mainly in caves but also in tunnels, mines or buildings. Non-breeding populations disperse within a 300 km range of maternity caves. Hunting for moths and other insects takes place in forested areas above the canopy (DPIE 2020d).

The Eastern Coastal Freetail-bat (*Micronomus norfolkensis*) is listed as Vulnerable under the BC Act and is not listed under the EPBC Act. The species occur in dry sclerophyll forest and woodland east of the Great Dividing



Range, roosting occasionally in tree hollows but will also roost under bark or in man-made structures (DPIE 2019a).

C.6.2. Test of Significance

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

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

The habitat within the study area has the potential to provide foraging habitat for all of these microchiropteran bat species, who would likely only use the small area within the subject site as part of a larger foraging area. There is also potential roosting habitat for the Yellow-bellied Sheathtail-bat and Eastern Coastal Freetail-bat in the form. The study area exists in a highly modified and urban environment and these highly mobile species have vast foraging ranges are unlikely to rely on the small area of potential foraging habitat to be removed as a result of the proposed Project. Only one of the five hollow-bearing trees will be removed that has the potential to be utilised as roosting habitat for the Yellow-bellied Sheathtail-bat and the Eastern Coastal Freetail-bat. Large tracts of more optimal habitat will remain in the nearby Allambie area, around Manly dam and in Garigal National Park. The removal of this small, modified area of potential foraging and roosting (for two species) habitat is not considered likely to have an adverse effect on the life cycle of these microchiropteran bat species such that a viable local population is placed at risk of extinction.

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

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

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

Not applicable.

(c) in relation to the habitat of a threatened species or ecological community:

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

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

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



Only a small area of previously developed and modified planted vegetation which could provide very marginal, potential foraging habitat for this species will be removed as part of the proposed development. One hollow-bearing tree that could provide potential roosting habitat for the Yellow-bellied Sheathtail-bat and the Eastern Coastal Freetail-bat will be removed, while the additional four hollow-bearing trees in the study area will be retained along the patch of Duffys Forest native vegetation.

The habitat occurs in a highly urban environment that has connectivity to areas of similar isolated patches of degraded remnant vegetation and urban vegetation. As such, while the development will encroach slightly into the area of existing foraging habitat, it will not isolate it and will only marginally fragment it further. The potential habitat on the subject site represents only a very small area available to the species in the locality and as these species are highly mobile and access resources from across a vast foraging range, the proposal is not likely to decrease the movement of individuals and gene flow between areas of potential habitat throughout the locality or within or between local populations. Accordingly, the proposed development will not remove, modify, fragment or isolate important habitat for these microchiropteran bat species.

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

No areas of outstanding biodiversity value (AOBV) are within the subject site or immediate surrounds and therefore no AOBVs will be directly or indirectly impacted by the proposed development.

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

The key threatening process of 'Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat' could potentially impact habitat for this species further than current conditions. However, the vegetation on the subject site is not considered to constitute significant habitat for these microchiropteran bat species. As potential habitat will remain in the vicinity of the subject site, and within the study area, the loss of a small area of degraded foraging habitat is not likely to significantly impact habitat for potentially occurring threatened species.

C.6.3. Conclusion

Very marginal foraging habitat will be removed within the subject site, which exists in a highly urban and already developed environment. More optimum habitat exists in the wider locality including within Allambie, around Manly dam and in Garigal National Park. The most optimal vegetation in the study area includes the Duffys Forest in the northern portion of the study area and 0.22 ha (2200m²) will be retained, along with four of the five hollow-bearing trees. Any local population of these species are unlikely to depend on the limited resources contained on the subject site for their survival and large areas of suitable habitat remain in the locality with much of that being in conservation areas.

These microchiropteran bat species are highly mobile and are expected to move between areas of remaining habitat within the immediate vicinity of the study area and wider area.

The project is not considered likely to have a significant detrimental impact upon any of these threatened microchiropteran bat species and subsequently no BDAR or Referral to the Commonwealth is required.



FIGURES



Figure 1. Location of the subject site and study area



Subject Site



Image Source: Image © Nearmap (2020) Date: 28/02/2020

Data Source: Spatial Services (2020) NSW Department of Finance and Services



100 m

Coordinate System: MGA Zone 56 (GDA 94)



75

50



Figure 2. Koala Development Application mapping within the study area

Subject Site

Study Area

Koala Habitat Protection SEPP (2019)



Koala Development Application Map

Site Investigation Area for Koala Plans of Management Map

Image Source: Image © Nearmap (2020) Date: 28/02/2020

Data Source: Spatial Services (2020) NSW Department of Finance and Services

Koala Habitat Protection SEPP (2020) NSW Departmentment of Planning, Industry and Environent



100 m

Coordinate System: MGA Zone 56 (GDA 94)



75

50

25

I:\...\16145\Figures\RP1\20200611\Figure 2. Koala SEPP



Figure 3. Land zoning of the study area

Subject Site

Study Area

Land Use Zone

B1 Neighbourhood Centre

B7 Business Park

E2 Environmental Conservation

- R2 Low Density Residential
- **RE1** Public Recreation
- SP1 Special Activities
- SP2 Infrastructure

Image Source: Image © Nearmap (2020) Date: 28/02/2020

Data Source: Spatial Services (2020) NSW Department of Finance and Services

NSW Department of Finance -NSW Department of Planning & Environment (2017). Standard Instrument Local Environmental Plan (LEP) - Land Use Zoning (LZN).





75 100 m

50



Figure 4. Flora survey locations within the study area



Subject Site

Study Area

BAM Plot Locations

Random Meander Searches

Image Source: Image © Nearmap (2020) Date: 28/02/2020

Data Source: Spatial Services (2020) NSW Department of Finance and Services



40 m

Coordinate System: MGA Zone 56 (GDA 94)





Figure 5. Vegetation communities within the study area



Subject Site

Study Area

Vegetation Community

Duffys Forest Ecological Community

Planted Native Vegetation

Exotic Vegetation

Image Source: Image © Nearmap (2020) Date: 28/02/2020

Data Source: Spatial Services (2020) NSW Department of Finance and Services



40 m

Coordinate System: MGA Zone 56 (GDA 94)



20



Figure 6. Habitat features of the subject site



Subject Site

Study Area



Habitat Feature

Image Source: Image © Nearmap (2020) Date: 28/02/2020

Data Source: Spatial Services (2020) NSW Department of Finance and Services



Coordinate System: MGA Zone 56 (GDA 94)



10

40 m