

# About this document



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#### Statement of Authorship

This study and report were undertaken by Ecological Consultants Australia for the client. The author of the report is Geraldene Dalby-Ball whose qualifications are BSc majoring in Ecology and Botany with over 25 years' experience in this field and specialising in projects within Sydney urban areas and Brooke Thompson whose qualifications are BSc majoring in Conservation Biology.

#### Limitations Statement

Information presented in this report is based on an objective study undertaken in response to the brief provided by the client. Any opinions expressed in this report are the professional, objective opinions of the authors and are not intended to advocate any particular proposal or pre-determined position.

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Distribution:	Eva Wykrota  eva.wykrota@gmail.com  Mick Wykrota  mickwykrota@yahoo.com.au		

Signed: Geraldene Dalby-Ball – Director of Ecological Consultants Australia Pty Ltd Geraldene Dalby-Ball – Director of Ecological Consultants Australia Pty Ltd

# **Executive Summary**

#### Introduction

Ecological Consultants Australia (ECA) trading as Kingfisher Urban Ecology & Wetlands has been contracted by Eva Wykrota to provide a **Flora and Fauna Assessment** for the proposal at 14 Mirrool St, North Narrabeen NSW 2101 within the Northern Beaches Council LGA.

The proposal includes the development of an access driveway and associated engineering and stormwater management. This assessment also takes into account in general terms a possible future development of a dwelling on lot 3.

#### Methods

- On-ground site inspection took place 2021 and September 2022 by Principal Ecologist Geraldene Dalby-Ball.
- Flora and fauna observations were recorded on-site using binoculars and physical examination.
   Notes, photos, and samples of flora species were taken, on-site and neighbouring sites, to assess the ecological health and value of the site.
- BioNet searches were performed for flora, fauna, endangered populations, and communities to identify if there were previous records of threatened species occurring within the local area using a 10 km radius around the site.
- Review of the proposed development was evaluated for potential environmental impacts and to see if entry into the BOS was triggered.

#### Results

- No threatened flora or fauna species were recorded on the site during the survey or previously recorded via BioNet.
- No significant habitat features, values or landscape corridors will be impacted by the proposed development.
- The proposal does not trigger entry into the BOS as per the Area Clearing or Biodiversity Values Map threshold.
- Tree removal includes 12 *Erythrina x sykesii* (Coral Tree) and 2 *Ligustrum lucidum* (Broad-leaved Privet) both exotic and 2 *Eucalyptus botryoides* (Bangalay) permission for removal granted by DA 336/09 currently under construction (not impacted by proposed access driveway).
- Design modification has been recommended to reduce impact on Tree 9 E. botryoides.
- Tree protection will be consistent with the Arboricultural Impact Assessment Report by Hugh the Arborist (1/04/2023).
- The site contains vegetation mapped within PCT 3594 Sydney Coastal Sandstone Foreshores Forest.
  However, the community is not in benchmark condition, replanting and weed removal are expected
  to improve the condition of the vegetation communities on-site. Trees proposed for removal due the
  proposal are all exotic including 12 *Erythrina x sykesii* (Coral Tree) and 2 *Ligustrum lucidum* (Broad-leaved Privet).

- Test of significance (5-part tests) have been conducted for the Little Lorikeet, Powerful Owl, Yellow-bellied Sheathtail-bat, Eastern Coastal Free-tailed Bat, Large-eared Pied Bat, Eastern False Pipistrelle, Southern Myotis, Greater Broad-nosed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Squirrel Glider, and Grey-headed Flying-fox. Appendix V contains 5-Part Test of Significance.
- While the 5-part tests resulted in a 'not significant' impact for the species assessed, recommendations and mitigation measures to assist the long-term survival of these species have been provided. See Section 5.

## **Mitigation Measures**

If the development is approved mitigation works will be required.

#### Before works:

- VMP for site to be written for pre, during, and after works.
- Landscaping to be with locally native plant species.
- Exposed sandstone to be retained in-situ and if engineering stabalisation is needed that it be done
  to have the most aesthetic outcome and least damage to boulders and exposed rock.
- Tree protection as per the Arboricultural Impact Assessment Report by Hugh the Arborist (1/04/2023).
- Removal of weeds to prevent spread of seed.
- Effective site management to minimise sediment runoff.
- Nest box installation in trees to be retained.
- Remove Tree 8 *Ligustrum sinense* (Small-leaved Privet) and all *Erythrina x sykesii* (Coral Tree) and *Ligustrum lucidum* (Broad-leaved Privet)

## **During works:**

- Tree protection as per the Arboricultural Impact Assessment Report by Hugh the Arborist (1/04/2023).
- Effective site management to minimise sediment runoff.
- Bush hygiene protocols are to be followed to prevent the spread of pathogens including Phytophthora.
- Implement VMP.

#### After completion of works:

- Tree and vegetation maintenance and on-going native vegetation and habitat renewal (planting).
- Native species landscaping.
- Exposed sandstone to be retained in-situ and if Engineering stabalisation is needed that it be done
  to have the most aesthetical outcome and least damage to boulders and exposed rock.

Legislation: Various pieces of legislation apply to this location and the proposed works are in keeping with the objective of the Acts. Key acts are listed below.

- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
- Environmental Planning and Assessment Act 1979 (EP&A Act).
- Biodiversity Conservation Act 2016 (BC Act).
- National Parks & Wildlife Act 1974 (NP&W Act).
- Biosecurity Act (superseding the Noxious Weed Act 1993) (NW Act).

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# Flora and Fauna Assessment Preparation

This Flora and Fauna Assessment (FFA) has been prepared in accordance with the Northern Beaches Council's requirements for a Flora and Fauna Assessment, outlined in the guiding document, *Biodiversity Requirements for Development Applications – Guideline 1: Flora and Fauna Assessment*. A compliance table demonstrating how the FFA satisfies the Northern Beaches Council guidelines is presented in the table below.

Compliance of technical requirements of a FFA as per the Northern Beaches Council guiding document Biodiversity Requirements for Development Applications – Guideline 1: Flora and Fauna Assessment.

Chapter	Required Information	Section
Introduction	Identification and description of the site.	Section 1.3
	<ul> <li>Description of the proposed development and references to plans and reports used for the assessment.</li> </ul>	Section 1.4 Section 1.5
	<ul> <li>The regional context and physical description of the study area including hydrology, geology, soils, landforms, climate and types and conditions of the habitat(s) in, and adjacent to, the land affected by the proposal.</li> </ul>	Section 1.3
Legislative and planning requirements	<ul> <li>An outline of legislative requirements relevant to the proposal, addressing local and state environmental planning instruments relevant to biodiversity.</li> </ul>	Section 1.6
	<ul> <li>Consideration of the proposal against the thresholds of the NSW Biodiversity Offsets Scheme (BOS).</li> </ul>	Section 1.7
Survey methodology and results	<ul> <li>The level of survey effort will depend on the size of the development and the level of impact. However, at minimum, all FFAs should include the following information:</li> </ul>	
	<ul> <li>Details of desktop and field survey methods employed;</li> </ul>	Section 2.1 Section 3
	<ul> <li>A map and photos of the study area and subject site;</li> </ul>	Section 1.3 Section 2.2
	<ul> <li>A list of flora and fauna species (native and introduced) identified on site;</li> </ul>	Section 3.4

<ul> <li>A list and map of threatened species and ecological communities known or likely to occur in the study area and locality;</li> </ul>	Section 3.1 Section 3.5 Section 3.6 Section 3.7
<ul> <li>Description, map and photographs of any Plant Community Types (PCTs) identified within the study area;</li> </ul>	Section 2.2 Section 3.1
<ul> <li>List of threatened flora surveyed for, including whether the survey was undertaken within the recommended survey period as outlined in the Threatened Biodiversity Data Collection (TBDC).</li> </ul>	Section 3.5
<ul> <li>Description of fauna habitat available on the site;</li> </ul>	Section 3.3
<ul> <li>Map of all hollow-bearing trees located within the study area, including a description of the size of the hollow (cm);</li> </ul>	Section 3.3
<ul> <li>Map of survey method locations (including any specialist fauna survey methods), including a map of GPS tracks, survey dates, times and weather conditions;</li> </ul>	Section 2.1
<ul> <li>Map of environmental features and habitat types (such as sandstone outcrops, culverts or overhangs);</li> </ul>	Section 1.3
<ul> <li>Discussion of any constraints or limitations of the study.</li> </ul>	Section 1.2

Impact assessment	<ul> <li>The FFA should identify all direct and indirect impacts to biodiversity values associated with the proposal. This includes impacts associated with: demolition and construction; excavation and fill; construction access and staging areas; materials and debris stockpiling; installation of services and stormwater infrastructure; onsite effluent disposal areas, establishment of bush fire APZs; landscaping, and ongoing operation of the development.</li> <li>Direct and indirect impacts may include: clearing and modification of vegetation; removal of habitat features such as hollows, caves and rock outcrops; fragmentation or isolation of habitat; changes to flora and fauna dispersal routes; soil disturbance, run-off and sedimentation; increased noise, vibration, increased lighting and traffic in natural areas, and demolition or modification of human-made structures utilised by wildlife (such as bats).</li> <li>The area (ha) of native vegetation required to be cleared for the development should be clearly stated.</li> <li>Threatened species 'Tests of Significance' for any applicable threatened entities, prepared in accordance with Section 7.3 of the BC Act.</li> </ul>	Section 4  Appendix III
	<ul> <li>Where relevant, an assessmentagainst the Environmental Protection and Biodiversity Conservation Act 1999 (Significant Impact Guidelines 1.1 – Matters of National Environmental Significance) is also required.</li> </ul>	
Avoid and minimise	Discussion of measures undertaken to avoid and minimise impacts of the development.	Section 5
Mitigation measures	Identification of mitigation and/or compensatory measures to reduce impacts following avoidance and minimisation of impacts. Appropriate mitigation measures are outlined further in Guidelines 4.	Section 5
Conclusion	Assessment of the proposal against the biodiversity controls and legislation applicable to the site. A statement summarising the overall direct, indirect, ongoing and cumulative impacts of the proposal on biodiversity values of the subject site and locality, with specific reference to impacts to threatened entities and important wildlife habitat.	

# 1 Introduction

# 1.1 Scope of works

Ecological Consultants Australia (ECA) trading as Kingfisher Urban Ecology & Wetlands has been contracted by Eva Wykrota to provide a **Flora and Fauna Assessment** to assess potential direct and indirect impacts on any threatened species, populations, and communities as per section 5A of the *Environmental Planning & Assessment Act 1979* (EP&A Act 1979).

The 'test of significance' has been undertaken in accordance with the NSW Department of Planning, Industry, and Environment (DPIE) 'threatened species test of significance'. The test of significance is set out in s. 7.3 of the Biodiversity Conservation Act 2016 (BC Act 2016).

# 1.2 Limitations of the study

Limitations of the study may arise where certain cryptic species of plants may occur as soil-stored seed or as subterranean vegetation structures. Some species are identifiable above ground only after environmental circumstances related to factors such as periodic fire frequency, intensity or seasonality, soil moisture regime, biological life-cycle patterns as in the case of small plants such as species of orchids, etc. No specific invertebrate surveys were conducted.

Surveys at one time of the year cannot be expected to detect the presence of all species occurring, or likely to occur, in the study area. This is because some species may (a) occur seasonally, (b) utilise different areas periodically (as a component of a more extensive home range), or (c) become dormant during specific periods of the year. Rather, the survey provides the opportunity to sample the area, search specifically for species likely to be encountered within the available time frame and assess the suitability of habitat for particular species.

Considering the site and habitat availability Kingfisher are confident that this survey is representative of the likely species and vegetation community and that future studies at other times would not change the conclusions in this report.

# 1.3 Identification and description of the site

The Subject Site (the "Site") is the area of direct and likely indirect impacts and is defined as the whole of the property. The study area includes the site, as well as any additional surrounding land traversed during the site survey.

The site is identified as 14 Mirrool St, North Narrabeen NSW 2101. The site is approximately 3553 m² in size and zoned C4 Environmental Living. The site is within the local government area of Northern Beaches Council. The site is bounded by residential housing and patches of bushland. The site currently contains a garage/gymnasium structure.

Table 1.1. Site administrative information.

Category	Details
Title Reference (Lot/DP)	9/DP18515
Area	3553 m <sup>2</sup>
Street Address	14 Mirrool St, North Narrabeen NSW 2101
LGA	Northern Beaches Council
Land Zoning	C4 Environmental Living



Figure 1.1. Site map. Source: Nearmap. Date accessed: 11/04/2023.

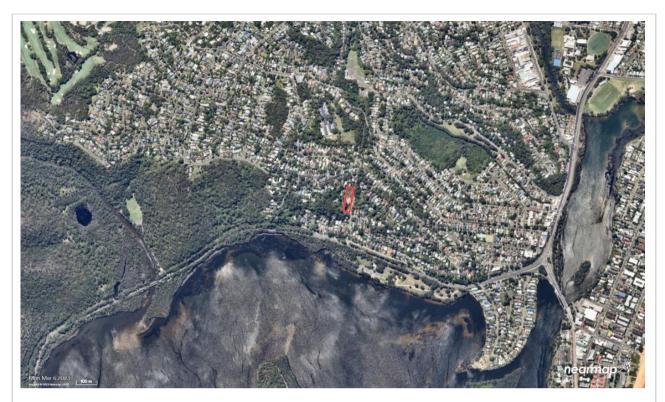


Figure 1.2. Location map. Source: Nearmap. Date accessed: 11/04/2023.

#### 1.3.1 Catchment context

No rivers, streams or estuaries occur on site. Narrabeen Lagoon occurs approximately 250 m south of the site. See Figure 1.3.



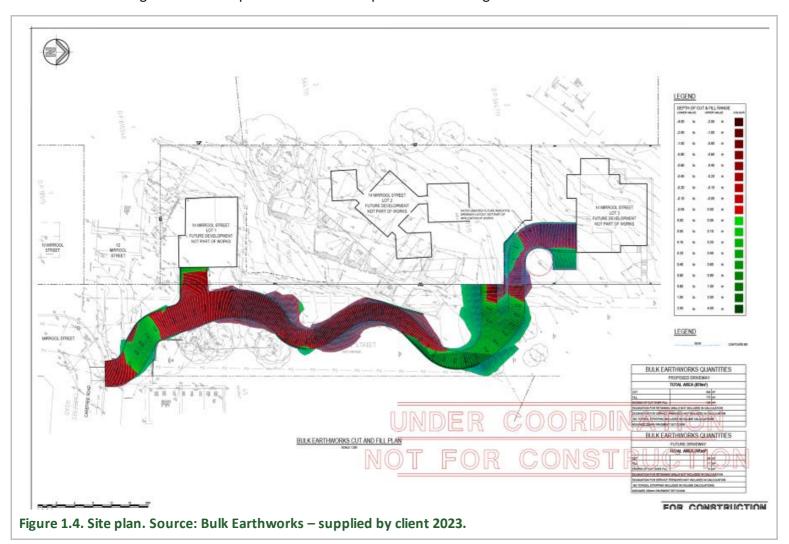
Figure 1.3. Watercourses. Source: SEED NSW Hydrography. Date accessed: 11/04/2023.

### 1.3.2 Geology and soil landscapes

The property is situated upon the 'Watagan' soil landscape, made up of a Narrabeen Group of sediments consisting of mostly interbedded laminate and shale with quartz to lithic quartz sandstone. The 'Watagan' soil landscape is characterised by rolling to very steep low hills. Local relief 60–120 m. Slope gradients are steeper than 25%. Crests and ridges are convex and narrow. Hillslopes are steep with talus slopes containing sandstone boulders. Occasional sandstone benches and colluvial benches are present. Slopes with gradients >70% often have cliffs and scarps >10 m high.

# 1.4 Proposed development

The proposal includes the development of an access driveway and associated engineering and stormwater management (see Figure 1.4). This assessment also takes into account in general terms a possible future development of a dwelling on lot 3.



### 1.5 Source of information used in the assessment

The following sources of information were used for the assessment.

BioNet, previous studies and the author's knowledge of the locality, were used to determine the likelihood of occurrence of threatened species or ecological communities, or their habitats onsite. BioNet records with a 10 km radius of the subject site were accessed and include records from 1993 to the present day.

Records from the following databases were collated and reviewed:

- Atlas of NSW Wildlife (BioNet). New South Wales, Office of Environment and Heritage (OEH).
- Biodiversity Values Map and Threshold Tool. New South Wales, Office of Environment and Heritage (OEH).
- Nearmap.
- NSW Threatened Species Information (DPIE).
- PlantNET (The Royal Botanic Gardens and Domain Trust, 2014).
- Protected Matters Search Tool of the Australian Government Department of the Environment (DoE) for matters protected by the Cwlth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
- The Native Vegetation of the Sydney Metropolitan Area Version 3.1 (OEH, 2016) VIS ID 4489.
- Water Management (General) Regulation 2018 hydro line spatial data (DPIE).

Plans and drawings specific to this development:

- Arboricultural Impact Assessment Report Hugh the Arborist 1/04/2023.
- Bulk Earthworks Plan 2023 supplied by client.

## 1.6 Legislative context and statutory requirements

The implications for the project were assessed in relation to key biodiversity legislation, policy and guidelines including:

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is applicable if it was considered that an impact on a 'Matters of National Environmental Significance (NES)' were likely, thus providing a trigger for referral of the proposal to the Department of Environment and Heritage.

Matters of national environmental significance identified in the Act are:

- world heritage properties;
- national heritage places;
- Ramsar wetlands;
- nationally threatened species and communities;
- migratory species protected under international agreements;
- the Commonwealth marine environment; and

nuclear actions.

The Commonwealth Government has published Significant Impact Guidelines (DE 2013) to assist in the determination of whether an action is likely to have a significant impact on a matter of NES. The proposal does not impact on a 'Matter of National Environmental Significance' and therefore is compliant with the EPBC Act.

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

The EP&A Act requires that the assessing body, in this case local government, consider the impact of the development on the surroundings – with respect to this ecology report the impacts on the environment are assessed. The proposal indicates no significant impact on threatened species, populations, or communities.

Biodiversity Conservation Act 2016 (BC Act);

The BC Act replaces the Threatened Species Conservation Act and includes the test of significance for impacts on threatened species or ecological communities, or their habitats. The test of significance has been conducted and the proposal was found to not have a significant impact on the currently ecology of the site. The proposed development is compliant with the BC Act.

Biosecurity Act 2015;

The Biosecurity Act replaced the Noxious Weeds Act, and the objectives of this Act are to manage, and eradicate and Weeds that cause a high level of environmental, economic, or social harm. With the removal of and management of weeds the sites work with be compliant with the objectives of this Act.

Pittwater Local Environment Plan (LEP) 2014;

The Pittwater Local Environmental Plan 2014 applies to 14 Mirrool St, North Narrabeen NSW 2101. The proposal satisfies the provisions under section 7.6 (Biodiversity protection) of the Pittwater Local Environmental Plan 2014.

• Pittwater 21 Development Control Plan (DCP)

The proposal satisfies the controls under the Pittwater 21 Development Control Plan.

# 1.7 Biodiversity Offsets Scheme threshold

The Biodiversity Offsets Scheme (BOS) is a test used to determine when it is necessary to engage an accredited assessor to apply the Biodiversity Assessment Method (the BAM) and thus evaluate the impacts of a proposal.

The Biodiversity Offsets Scheme applies to local development (assessed under Part 4 of the Environmental Planning and Assessment Act 1979) that triggers the Biodiversity Offsets Scheme threshold (see section 1.6) or is likely to significantly affect threatened species based on the test of significance in section 7.3 of the Biodiversity Conservation Act 2016.

The Biodiversity Conservation Regulation 2017 sets out the threshold level for when the BOS will be trigger. The threshold has two elements:

- whether the amount of native vegetation being cleared exceeds an area threshold
- whether the impacts occur on an area mapped on the Biodiversity Values Map published by the Environment Agency Head

### **Area Clearing Threshold**

The area clearing threshold is based on the minimum or actual lot size associated with the property (Less than 1 ha) and the thresholds for clearing, above which the BAM and offsets scheme apply (0.25 ha or more).

The proposal does not trigger the area clearing threshold as per the BOS entry requirements. The impact area does not exceed the threshold for clearing (0.25 ha or more) (see Table 1.2).

Table 1.2. Minimum lot size and threshold trigger.

Impact area	<0.25 ha
Threshold for clearing, above which the BAM and offsets scheme apply	0.25 ha
Minimum lot size	550 m <sup>2</sup>

# Area clearing threshold

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

Minimum lot size associated with the property	Threshold for clearing, above which the BAM and offsets scheme apply
Less than 1 ha	0.25 ha or more
1 ha to less than 40 ha	0.5 ha or more
40 ha to less than 1000 ha	1 ha or more
1000 ha or more	2 ha or more

Figure 1.4. Area clearing threshold as per the BOS entry requirements. Source:

https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity-offsets-scheme/about-the-biodiversity-offsets-scheme/when-does-bos-apply

#### **Biodiversity Values Map threshold**

The Biodiversity Values (BV) Map identifies the land of high biodiversity value, as defined by clause 7.3(3) of the Biodiversity Conservation Regulation 2017. The Biodiversity Offsets Scheme applies to the clearing of native vegetation and other biodiversity impacts prescribed by clause 6.1 of the Biodiversity Regulation 2017 on land identified on the map.

### The proposal does not trigger the Biodiversity Values Map threshold as per the BOS entry requirements.

The proposal does not require the clearing of native vegetation on land identified on the Biodiversity Values Map as published by the Chief Executive of the NSW Office of Environment and Heritage (see Figure 1.6.)

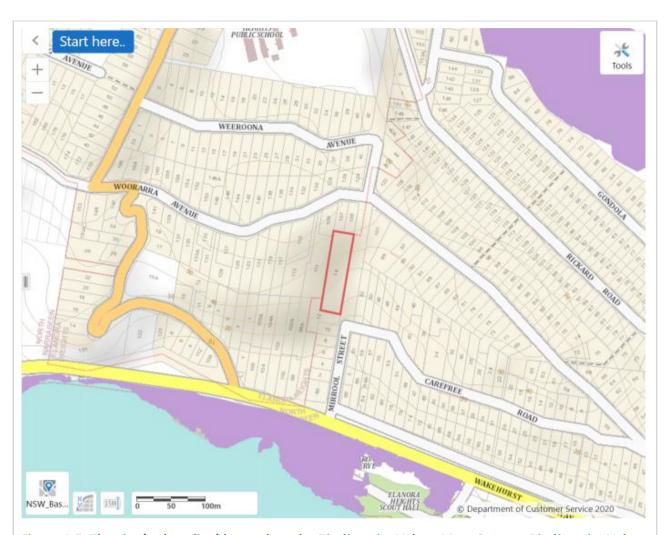


Figure 1.5. The site (red outline) located on the Biodiversity Values Map. Source: Biodiversity Values Map and Threshold Tool 2022.

# 2 Methods

# 2.1 Site inspection

On-ground site inspection took place in July 2021 and September 2022 by Principal Ecologist Geraldene Dalby-Ball. Geraldene is very familiar (over 30 years' experience) with the flora and fauna of the locality.

The survey flora and fauna surveys were opportunistic in nature and were conducted as a random meander across the site and surrounding areas. During the surveys, notes and photos were taken of the vegetation types, flora and fauna present.

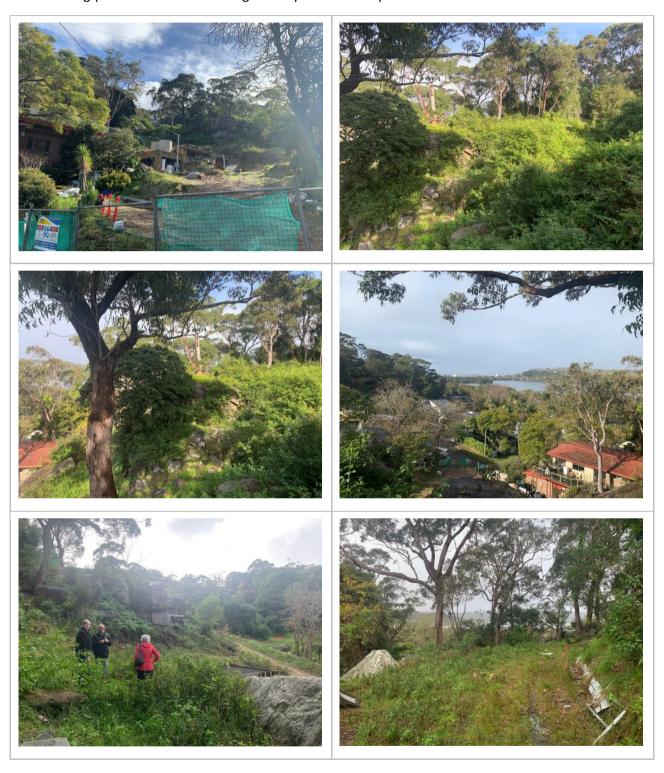
Flora surveys included identification of native and exotic species and observation of vegetation in surrounding areas. Fauna surveys included diurnal bird and fauna observations and assessment of suitable habitat resources including the following:

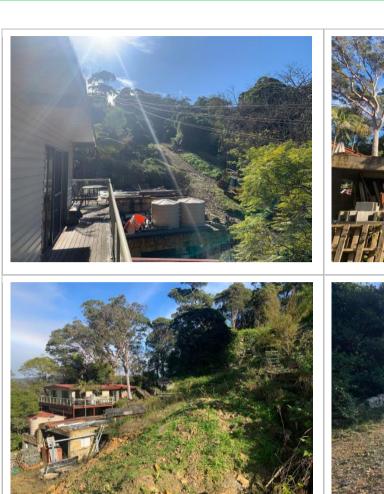
- Hollow bearing trees;
- Roosting and/or foraging trees;
- Fruiting and flowering plants;
- Rocks;
- Burrows;
- Scats;
- Tree scratchings;
- Loose bark;
- Scrapes or diggings;
- Dead trees and logs;
- Long grass and leaf litter; and
- Waterbodies.

No targeted surveys for threatened species were undertaken due to the likelihood of the species occurring within or adjacent to the proposed development. See Appendix III for Likelihood of Occurrence for threatened species recorded within a 10 km radius of the site.

# 2.2 Site photos

The following photos were taken during the July 2021 site inspection.

















# 3 Site Assessment

# 3.1 Desktop results – Plant Community Types (PCTs)

A review of the most complete and consistent representation of the distribution of Plant Community Types (PCTs) across NSW, NSW State Vegetation Type Map Edition C1.1.M1.1, identified one (1) PCT within the site. The PCT is listed in Table 3.1 below.

Table 3.1. PCT synonyms as per NSW and Commonwealth legislation.

PCT Code	PCT Name	BC Act 2016	EPBC Act 1999	Estimated Percentage Cleared
3594	Sydney Coastal Sandstone Foreshores Forest	No associated TEC	No associated TEC	96.01%

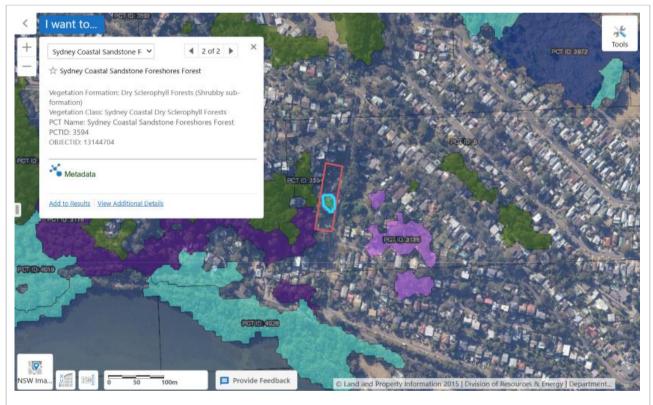


Figure 3.1. Current PCTs mapped on site. Source: SEED NSW State Vegetation Type Map. Date accessed: 11/04/2023.

### 3.2 Weeds

The following weeds of significant importance were identified within the site during the site inspection. Weeds must be controlled as required under the *Biosecurity Act 2015*. See Table 3.2

Table 3.2. Weeds present on or within close proximity to the site with the potential to spread.

Scientific Name	Common Name	
Asparagus aethiopicus	Asparagus fern	
Asparagus asparagoides	Bridal Creeper	
Erythrina x sykesii	Coral Tree	
Lantana camara	Lantana	
Ligustrum lucidum	Broad-leaved Privet	
Ligustrum sinense	Small-leaved Privet	

# 3.3 Fauna sightings and habitat

### Fauna sightings

A number of faunae were identified during the site assessment including:

- Noisy Minor (Manorina melanocephala)
- Australian Magpie (Gymnorhina tibicen)
- Rainbow lorikeet (Trichoglossus moluccanus)
- Laughing kookaburra (Dacelo novaeguineae)
- Brush-tailed possum (Trichosurus vulpecula)
- Sulphur-crested cockatoo (Cacatua galerita)

No reptiles or mammals were identified during the site assessment. No threatened fauna listed under the BC Act 2016 or EPBC Act 1999 were identified during the site assessment.

#### Fauna habitat

Potential habitat features were identified during the site assessment including:

Hollow-bearing trees are within 200 m of the site.

# 3.4 Threatened flora - Desktop

BioNet records within a 10 km radius of the subject site were used to create a list of threatened species known or likely to occur in the locality. BioNet records indicate that 20 flora species currently listed as vulnerable, endangered, or critically endangered under state and/or Commonwealth legislation, out of a total of 1,848 species occur in the locality. The vulnerable, endangered and critically endangered flora species can be seen in Table 3.2 below. This is based on likelihood of occurrence.

Table 3.2. Threatened flora recorded within a 10 km radius of the subject site since 1993. Source: NSW BioNet 2023.

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Records
Elaeocarpaceae	Tetratheca glandulosa		V		156
Ericaceae	Epacris purpurascens var. purpurascens		>		3
Euphorbiaceae	Chamaesyce psammogeton	Sand Spurge	E1		13
Fabaceae (Mimosoideae)	Acacia terminalis subsp. Eastern Sydney	Sunshine wattle	E1	E	2
Grammitidaceae	Grammitis stenophylla	Narrow-leaf Finger Fern	E1,3		1
Lamiaceae	Prostanthera densa	Villous Mint-bush	٧	\ \	1
Lamiaceae	Prostanthera marifolia	Seaforth Mintbush	E4A,3	CE	1
Malvaceae	Lasiopetalum joyceae		V	V	1
Myrtaceae	Callistemon linearifolius	Netted Bottle Brush	V,3		7
Myrtaceae	Eucalyptus camfieldii	Camfield's Stringybark	V	V	55
Myrtaceae	Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	4
Myrtaceae	Kunzea rupestris		V	V	1
Myrtaceae	Melaleuca deanei	Deane's Paperbark	V	V	1
Myrtaceae	Rhodamnia rubescens	Scrub Turpentine	E4A	CE	21
Myrtaceae	Syzygium paniculatum	Magenta Lilly Pilly	E1	V	16
Orchidaceae	Genoplesium baueri	Bauer's Midge Orchid	E1,P,2	E	3
Orchidaceae	Microtis angusii	Angus's Onion Orchid	E1,P,2	E	164
Proteaceae	Grevillea caleyi	Caley's Grevillea	E4A,3	CE	1564

Proteaceae	Persoonia hirsuta	Hairy Geebung	E1,P,3	E	23
Thymelaeaceae	Pimelea curviflora var. curviflora		V	V	28

Note: CE = Critically Endangered, E = Endangered, V = Vulnerable, P = Protected.

# 3.1 Threatened fauna – Desktop

BioNet records within a 10 km radius of the subject site were used to create a list of threatened species known or likely to occur in the locality. BioNet records indicate that 57 fauna species currently listed as vulnerable, endangered, or critically endangered under state and/or Commonwealth legislation, out of a total of 541 species occur in the locality. The vulnerable, endangered and critically endangered fauna species can be seen in Table 3.3 below. This is based on likelihood of occurrence.

**Note**: Marine species including Turtles (*Cheloniidae*, *Dermochelyidae*), Dugongs (*Dugongidae*), Marine Birds (*Diomedeidae*, *Procellariidae*), Penguins (*Spheniscidae*), Seals (*Otariidae*) and Whales (*Balaenidae*, *Balaenopteridae*, *Physeteridae*) have been omitted from this list.

Table 3.3. Threatened fauna recorded within a 10 km radius of the subject site since 1993. Source: NSW BioNet 2023.

Class	Scientific Name	Common Name	NSW Status	Comm. Status	Records
Amphibia	Pseudophryne australis	Red-crowned Toadlet	V,P		120
Amphibia	Heleioporus australiacus	Giant Burrowing Frog	V,P	V	48
Amphibia	Litoria aurea	Green and Golden Bell Frog	E1,P	V	5
Reptilia	Varanus rosenbergi	Rosenberg's Goanna	V,P		109
Aves	Stictonetta naevosa	Freckled Duck	V,P		1
Aves	Ptilinopus magnificus	Wompoo Fruit-Dove	V,P		2
Aves	Ptilinopus regina	Rose-crowned Fruit- Dove	V,P		1
Aves	Ptilinopus superbus	Superb Fruit-Dove	V,P		3
Aves	Botaurus poiciloptilus	Australasian Bittern	E1,P	E	3
Aves	Ixobrychus flavicollis	Black Bittern	V,P		25
Aves	Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P		34
Aves	Hieraaetus morphnoides	Little Eagle	V,P		7
Aves	Lophoictinia isura	Square-tailed Kite	V,P,3		6

Aves	Pandion cristatus	Eastern Osprey	V,P,3		31
Aves	Burhinus grallarius	Bush Stone-curlew	E1,P		9
Aves	Esacus magnirostris	Beach Stone-curlew	E4A,P		1
Aves	Haematopus fuliginosus	Sooty Oystercatcher	V,P		23
Aves	Haematopus longirostris	Pied Oystercatcher	E1,P		7
Aves	Charadrius leschenaultii	Greater Sand-plover	V,P	V,C,J,K	3
Aves	Charadrius mongolus	Lesser Sand-plover	V,P	E,C,J,K	2
Aves	Rostratula australis	Australian Painted Snipe	E1,P	E	3
Aves	Calidris alba	Sanderling	V,P	C,J,K	8
Aves	Calidris ferruginea	Curlew Sandpiper	E1,P	CE,C,J,K	3
Aves	Calidris tenuirostris	Great Knot	V,P	CE,C,J,K	4
Aves	Xenus cinereus	Terek Sandpiper	V,P	C,J,K	2
Aves	Gygis alba	White Tern	V,P		1
Aves	Onychoprion fuscata	Sooty Tern	V,P		3
Aves	Sternula albifrons	Little Tern	E1,P	C,J,K	2
Aves	Callocephalon fimbriatum	Gang-gang Cockatoo	V,P,3	E	3
Aves	Calyptorhynchus lathami	Glossy Black-Cockatoo	V,P,2	V	103
Aves	Glossopsitta pusilla	Little Lorikeet	V,P		13
Aves	Lathamus discolor	Swift Parrot	E1,P	CE	31
Aves	Neophema pulchella	Turquoise Parrot	V,P,3		1
Aves	Ninox connivens	Barking Owl	V,P,3		21
Aves	Ninox strenua	Powerful Owl	V,P,3		463
Aves	Tyto novaehollandiae	Masked Owl	V,P,3		7
Aves	Tyto tenebricosa	Sooty Owl	V,P,3		2
Aves	Anthochaera phrygia	Regent Honeyeater	E4A,P	CE	37

Aves	Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V,P		1
Aves	Daphoenositta chrysoptera	Varied Sittella	V,P		5
Aves	Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		7
Aves	Petroica boodang	Scarlet Robin	V,P		2
Mammalia	Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	19
Mammalia	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	E1,P	E	26
Mammalia	Phascolarctos cinereus	Koala	E1,P	E	19
Mammalia	Cercartetus nanus	Eastern Pygmy-possum	V,P		502
Mammalia	Petaurus norfolcensis	Squirrel Glider	V,P		5
Mammalia	Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	182
Mammalia	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		3
Mammalia	Micronomus norfolkensis	Eastern Coastal Free- tailed Bat	V,P		23
Mammalia	Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	18
Mammalia	Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		3
Mammalia	Myotis macropus	Southern Myotis	V,P		54
Mammalia	Scoteanax rueppellii	Greater Broad-nosed Bat	V,P		7
Mammalia	Vespadelus troughtoni	Eastern Cave Bat	V,P		1
Mammalia	Miniopterus australis	Little Bent-winged Bat	V,P		58
Mammalia	Miniopterus orianae oceanensis	Large Bent-winged Bat	V,P		167

**Note**: CE = Critically Endangered, E = Endangered, V = Vulnerable, P = Protected.

No threatened species have been previously recorded on site (see Figure 3.2).



Figure 3.2. BioNet Species Sightings. Source: SEED NSW BioNet Species Sightings. Date accessed: 11/04/2023.

# 4 Impact Assessment

# 4.1 Direct impacts

### 4.1.1 Clearing and modification of vegetation

**25** trees were considered in the Arboricultural Impact Assessment Report by Hugh the Arborist (1/04/2023) of which:

- 9 trees are proposed to be retained and protected:
  - T1 Angophora costata (Sydney Red Gum)
  - T2, T6, T9 Eucalyptus botryoides (Bangalay)
  - T5 Allocasuarina torulosa (Forest Oak)
  - T7 Pittosporum undulatum (Sweet Pittosporum)
  - T8 Ligustrum sinense (Small-leaved Privet) Weed MUST be removed to avoid spread DO
     NOT retain and protect
  - T12 Ficus rubiginosa (Port Jackson Fig)
  - T13 Livistona australis (Cabbage Tree Palm)
- 16 trees are proposed to be removed:
  - T3, T4 Eucalyptus botryoides (Bangalay) (2) permission for removal granted by DA 336/09 currently under construction
  - T10, T11 Ligustrum lucidum (Broad-leaved Privet) (2) Weed
  - T14 T25 Erythrina x sykesii (Coral Tree) (12) Weed

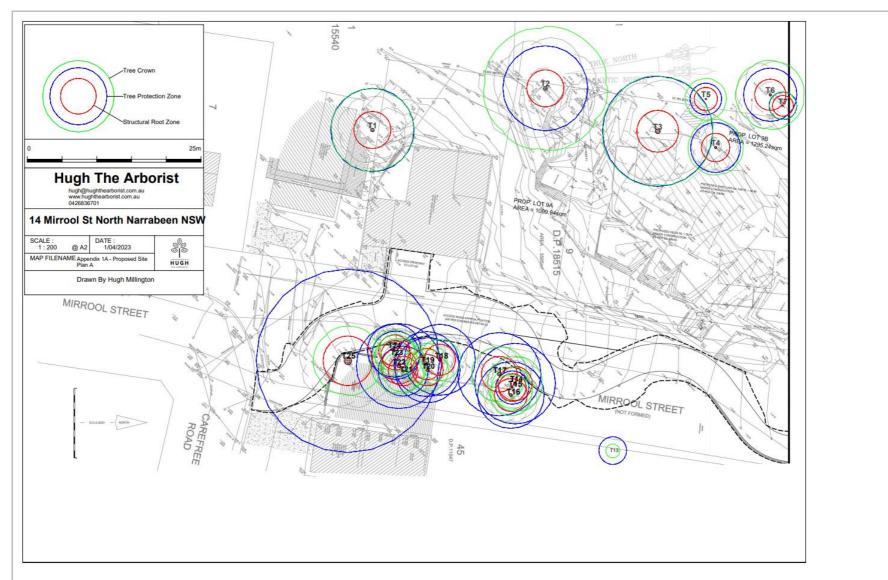


Figure 4.1. Extract – Appendix 1A – Proposed Site Plan A. Source: Arboricultural Impact Assessment Report. Hugh the Arborist. 1/04/2023.

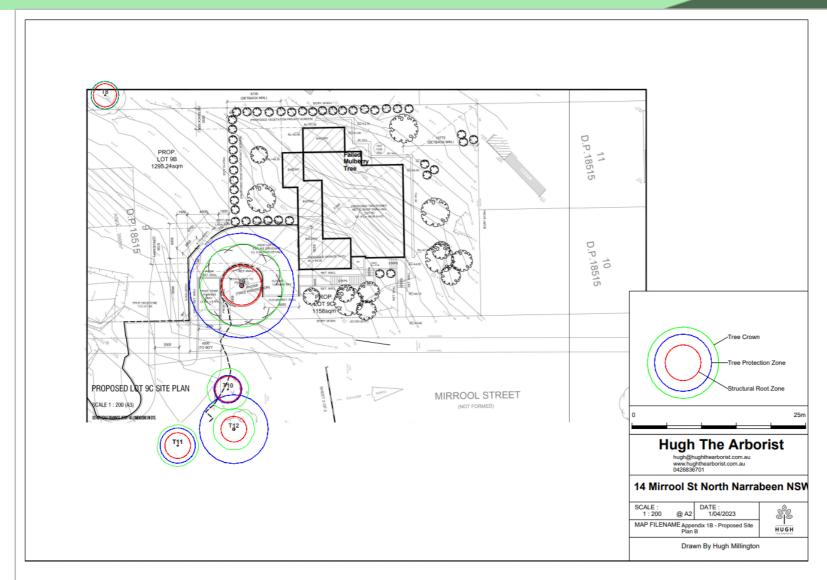


Figure 4.2. Extract – Appendix 1B – Proposed Site Plan B. Source: Arboricultural Impact Assessment Report. Hugh the Arborist. 1/04/2023.

### Appendix 2 - Tree Inspection Schedule

Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1 (mm)	Stem 2 (mm)	Stem 3	Stem 4	Stem 5	Stem 6	DBH (mm)	DAB (mm)	Health	Structure	Landscape Value	SULE	Trees AZ Value	TPZ Radius (m)	SRZ Radius (m)	Notes
1	Smooth Barked Apple	Angophora costata	Semi-mature	13	6	500						500	600			High	1. Long	A1	6.0		On rock shelf existing building works below. Isolated
2	Bangalay	Eucalyptus botryoides	Semi-mature		9	510						510	600	Good		High	1. Long	A1	6.1	2.7	On rock prov no rocks are removed stability or assess by geotechnical
3	Bangalay	Eucalyptus botryoides	Semi-mature	_	8	580	320					662	800			Medium	3. Short	Z10	7.9	3.0	Existing approval and major roots severed within 1m of trunk. Old wounds
4	Bangalay	Eucalyptus botryoides	Semi-mature	9	4	300						300	320	Good	Fair	Medium	3.Short	Z10	3.6	2.1	Existing approval and major roots severed within 1m of trunk. Old wounds
5	Forest Oak	Allocasuarina torulosa	Semi-mature	6	3	190						190	200	Good	Good	Medium	1. Long	A1	2.3	1.7	Neighbors tree
6	Bangalay	Eucalyptus botryoides	Semi-mature	10	5	320						320	400	Good	Good	Medium	1. Long	A1	3.8	2.3	Neighbors tree
7	Sweet Pittosporum	Pittosporum undulatum	Semi-mature	5	2	110						110	120	Good		Low	1. Long	Z3	2.0	1.5	Neighbors tree
8	Small Leaved Privet	Ligustrum sinense	Mature	5	2	100	50	50	50	50		141	200	Good		Very Low	1. Long	Z3	2.0	1.7	Neighbors tree
9	Bangalay	Eucalyptus botryoides	Semi-mature	13	6	630						630	700	Good	Good	Medium	1. Long	A1	7.6	2.8	
10	Broad Leaved Privet	Ligustrum lucidum	Semi-mature	9	3	150						150	250	Good	Good	Very Low	1. Long	Z3	2.0	1.8	Isolated on rock shelf
11	Broad Leaved Privet	Ligustrum lucidum	Semi-mature	9	3	150	150					212	250	Good	Good	Very Low	1. Long	Z3	2.5	1.8	
12	Port Jackson Fig	Ficus rubiginosa	Semi-mature	9	3	350	220					413	250	Good	Good	Very Low	1. Long	A1	5.0	1.8	Isolated on rock shelf
13	Cabbage Palm	Livistona australis	Semi-mature	7	1	200						200	NA	Good	Good	High	1. Long	A1	2.0	NA	
14	Indian Coral	Erythrina x sykesii	Semi-mature	9	4	380	300					484	500	Good	Good	Very Low	1. Long	Z3	5.8	2.5	On adjoining site
15	Indian Coral	Erythrina x sykesii	Young	5	3	200						200	300	Fair	Poor	Very Low	1. Long	Z3	2.4	2.0	
16	Indian Coral	Erythrina x sykesii	Semi-mature	9	3	400						400	450	Good	Good	Very Low	1. Long	Z3	4.8	2.4	
17	Indian Coral	Erythrina x sykesii	Semi-mature	12	4	500						500	550	Good	Good	Very Low	1. Long	Z3	6.0	2.6	Site highly disturbed Road over existing fill
18	Indian Coral	Erythrina x sykesii	Semi-mature	9	3	360	180	80	80	80		426	400	Good	Good	Very Low	1. Long	Z3	5.1	2.3	On council land?
19	Indian Coral	Erythrina x sykesii	Semi-mature	10	3	390						390	400	Good	Good	Very Low	1. Long	Z3	4.7	2.3	
20	Indian Coral	Erythrina x sykesii	Semi-mature	10	3	390						390	400	Good	Good	Very Low	1. Long	Z3	4.7	2.3	
21	Indian Coral	Erythrina x sykesii	Semi-mature	10	3	300						300	350	Good	Good	Very Low	1. Long	Z3	3.6	2.1	
22	Indian Coral	Erythrina x sykesii	Semi-mature	11	4	510						510	550	Good	Good	Very Low	1. Long	Z3	6.1	2.6	
23	Indian Coral	Erythrina x sykesii	Semi-mature	10	3	200	210					290	350			Very Low	1. Long	Z3	3.5	2.1	
24	Indian Coral	Erythrina x sykesii	Semi-mature	10	3	320						320	400	Good	Good	Very Low	1. Long	Z3	3.8	2.3	
25	Indian Coral	Erythrina x sykesii	Mature	13	5	1100						1100	1200	Good	Fair	Very Low	2. Medium	Z3	13.2	3.6	In recent retaining wall.

Figure 4.3. Extract – Appendix 2 – Proposed Site Plan B. Source: Arboricultural Impact Assessment Report. Hugh the Arborist. 1/04/2023.

# 4.2 Indirect impacts

The proposed actions may result in a range of minor indirect impacts affecting species and communities.

### 4.2.1 Loss of breeding opportunities

Works on-site may result in temporary reduced breeding opportunities for locally occurring native species including amphibians, reptiles, birds, mammals, and invertebrate through the production of construction noise.

### 4.2.2 Soil disturbance and compaction

The removal of vegetation may result in soil disturbance and compaction through machinery and trampling during works.

#### 4.2.3 Weed growth and invasion

Weed species may arise within the direct works zone and surrounding landscaped areas through soil disturbance or by being brought in as seed on work machinery, tools, equipment, and worker clothes (e.g., boots). Excessive or biosecurity weeds must be managed to stop the spread into other areas and maximise the opportunities for soil re-use in other areas.

### 4.2.4 Introduction of pathogens

The introduction of pathogens may occur in the site via machinery, tools, equipment, and worker clothing (e.g., boots). Diseases to watch out for include Phytophthora (also known as Root Rot – type of water mold) and Myrtle Rust (*Puccinia psidii* – type of fungus). See Appendix II for methods to control selected pathogens.

#### 4.2.5 Noise

The proposed actions may result in noise which may cause minor disturbance to sensitive fauna in the local canopy. Construction noise may also result in fewer aerial fauna species frequenting the site for the duration of works.

#### 4.2.6 Runoff

The proposed actions may result in the transport of sediment from the work zones off-site.

## 5 Recommendations

## 5.1 Mitigation measures

The following mitigation measures have been suggested if the proposed development is approved.

#### 5.1.1 Delineation of work areas

During the development, impacts to the site and the vegetation to be retained should be reduced by the delineation of work areas. The access to the site would be best restricted to the development footprint only. An exclusive zone will be established for the vegetation outside the work areas.

#### 5.1.2 Vegetation clearing control measures

Prior to the removal of vegetation or other habitat that has been approved for removal, the applicant must engage a qualified and experienced Ecologist to:

- Undertake a pre-clearing survey to delineate, map and mark habitat-bearing trees and shrubs to be
  retained/removed and other fauna habitat features, and determine the presence of any resident
  native fauna using hollow-bearing trees, roosting and foraging trees, fruiting and flowering plants,
  rocks, burrows, scats, tree scratchings, loose bark, scrapes or diggings, dead trees and logs, long
  grass and leaf litter, and waterbodies.
- Supervise the clearance of trees and shrubs (both native and exotic) and other habitat to capture, treat and/or relocate any displaced native fauna to an appropriate nearby location.
- Remove sections of a tree containing a hollow or habitat prior to clearing and felling the tree, for reuse on-site as habitat refuge.

#### 5.1.3 Fencing and tree protection

See Arboricultural Impact Assessment Report by Hugh the Arborist (1/04/2023). Tree protection must be consistent with the Arboricultural Impact Assessment.

#### 5.1.4 Replanting

Planting is one of several best practice measures to retain and support the long-term survival of the vegetation community on-site. Plantings of tube stock across the site should be selected from locally native ground and shrub species and this is to be in accordance with Asset Protection Zone (APZ) requirements. See Appendix IV for species consistent with PCT 3594.

#### 5.1.5 Habitat salvage

It is recommended that significant habitat features including rocks, logs, tree stumps and leaf litter be maintained and preserved where possible. The retention of these significant habitat features will maintain refuge habitat values. Larger logs, 10 cm in diameter and above and no longer than 1 m, should be left on the ground in the Fauna Refuge Zone as refuge habitat. This will encourage native fauna to use the area including amphibians and reptiles.

#### 5.1.6 Erosion and sedimentation controls

Where required, sediment controls will be put in place. These will include, but not limited to sediment fencing, jute mating, crushed sandstone, and coir logs. Sediment controls will be revised during site inspection and/or after significant rainfall (more than 10 mm in 24 hours resulting in site runoff). Sediment and erosion control measures must ensure that no settlement of sediment or silt is to occur within areas of vegetation to be retained. All sediment fences should be retained for as long as practical. If removed, then monitoring is required to ensure flows do not concentrate and cause further erosion. If concentrated flows do occur and/or erosion gullies develop then coir logs baffles are required.

#### 5.1.7 Weed removal

Weeds are present on the site and must be appropriately managed to ensure they do not spread. There must be continuous maintenance of the vegetation on-site otherwise increased weed growth may result, exacerbated by the high abundance of weeds present pre-works. Weeds will colonize and pioneer on any cleared grounds, therefore must be managed during works as well as ongoing post-works. See Table 4.1 for Weed Removal Methods.

All bush regeneration activities requiring the use of chemicals must be performed in accordance with the *NSW Pesticides Act 1999*. Herbicides must not be applied whilst exotic plants are setting seed. The weed removal program aims to be broad in approach and sustained in application to provide the best possible conditions for natural regeneration and to control weeds within the site.

Performance targets for weed species include:

- A reduction in noxious weed density to 5% or less in the management zone; and
- A reduction in all other weed density to 10% or less in the management zone.

Although soil borne pathogens have not been identified as a Key Threatening Process, accidental spread of pathogens can occur at any time. To prevent the introduction of pathogens, Bushland Hygiene Protocols outlined in Appendix II must be followed. Hydrological conditions may promote the spread of Phytophthora (a group of fungus-like diseases affecting plants) due to moist soil and proximity to water. It is recommended that Bushland Hygiene Protocols be followed closely.

Table 5.1. Weed removal methods.

Weed type	Primary control treatment	Follow up control	Maintenance weeding post- planting (revegetation)	Disposal
Woody weeds (e.g., shrubs and trees)	Cut/scrape and paint with herbicide for small shrubs <sup>1</sup> . Large trees greater than four metres high and diameter > 10 cm drill and inject with registered herbicide <sup>2</sup> .	Retain dead trunks in or on ground has habitat. Continue to Cut/scrape and paint remaining weeds. Monitored monthly and controlled as required (and within a minimum of three months) and up until the date of final plantings.	Cut/scrape and paint germinating weeds. Monitored and carried out regularly for a period of five years from the date of final planting.	Raft and pile non-reproductive parts on site (for later pile burns or left as habitat) and bag flower heads, berries, and seeds.
Climbing weeds (e.g., vines and scramblers)	Hand pull/ Dig juvenile growths and bag. Bag seeds, pods and flowers then skirt vines out of the canopy and Scrape and paint for established growths. Scrape from the base up the stem covering 1 m length. Large infestations foliar spray using registered herbicides.	Scrape and paint and bag reproductive parts. Monitored monthly and controlled as required (and within a minimum of three months) and up until the date of final plantings.	Scrape and paint and bag reproductive parts. Monitored and carried out regularly for a period of five years from the date of final planting.	Bag and remove from site.
Herbaceous weeds	Spraying using a combination of non-selective and selective	Spray or hand pull seedlings. Monitored monthly and	Spray or hand pull seedlings. Monitored and carried out	Bag and remove from site.

	herbicides where damage to adjoining native vegetation can be avoided. Spray herbicide close to and before flowering.	controlled as required (and within a minimum of three months) and up until the date of final plantings.	regularly for a period of five years from the date of final planting.	
Exotic grasses and broadleaf annuals around native grasses	Spray prep around natives. Low volume spot spraying of broadleaf selective and nonselective herbicides. Flame (thermal) weed in areas of large infestation of grasses and annuals.	Continue spray prep and spot spraying for reestablished growths. Hand pull and bag weeds in amongst natives.  Monitored monthly and controlled as required (and within a minimum of three months) and up until the date of final plantings.	Hand weed isolated patches. Monitored and carried out regularly for a period of five years from the date of final planting.	Bag and remove from site.
Weeds and seedlings in close proximity to protected native vegetation	Spray prep around natives and Spot spray. Hand weeding.	Spray prep around natives and Spot spray. Where possible hand weed. Monitored monthly and controlled as required (and within a minimum of three months) and up until the date of final plantings.	Monitored and carried out regularly for a period of five years from the date of final planting.	Bag and remove from site.
Bulbous and succulent weeds	Hand pull/dig, bagging all plant parts and	Foliar spray and/or Cut and Paint.	Monitored and carried out regularly for a	Bag and remove from site.

removing from	period of five	
site <sup>3</sup> .	years from the	
	date of final	
	planting.	

**Note:** <sup>1</sup> Some weeds will have different treatment requirements i.e., *Ochna serrulata* requires scrape and paint on one side with stem width less than 2 cm thick, scrape and paint both sides from root to 2/3 up the stem >2 cm thick. *Ligustrum spp.* and Lantana are treated with cut and paint.

<sup>2</sup> After drill and inject treatment, the plant usually will drop its leaves within six weeks and dies within a few months. Monitor the plant and if it re-sprouts, the process will need to be repeated. Drill around the base of the tree and on exposed lignotubers less than 20mm apart and as deep as possible.

<sup>3</sup> If hand pulling/dig, ensure all reproductive parts of the plant e.g., corms, tubers and rhizomes are removed. See to Appendix I for Bush Regeneration Techniques.

#### 5.1.8 Installing a nest box

The installation of a single nest box designed for microbats should be added to the management zone to replace the potential loss of roosting habitat. This will encourage threatened microbats to utilise the area. Attachments all weather and looped over not nailed into the tree. Loop to have spacer to enable tree growth.



#### 5.1.9 Pathogen prevention

To prevent the introduction of pathogens, Bushland Hygiene Protocols outlined in Appendix II should be followed. The site is considered to be an area which may promote the spread of Phytophthora (a group of fungus-like diseases affecting plants) due to its moist soil and proximity to water. It is recommended that Bushland Hygiene Protocols be followed closely.



Phytophthora infected vegetation. (Image by Rasbak, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported, 2.5 Generic, 2.0 Generic and 1.0 Generic license.)



Myrtle Rust generally infects new leaf growth. (Image by John Tann, licensed under the Creative Commons Attribution 2.0 Generic license.)

## 6 Appendices

## 6.1 Appendix I – Key Weed Removal Methods

Technique	Method	Equipment
Hand Removal	Seedlings and smaller weed species where appropriate will be pulled out by hand, without risk of injury to workers. The size that this can occur varies throughout the treatment area. Generally, it ranges from post seed to approximately 300mm in height.  Rolling and raking is suitable for larger infestations of Wandering Jew. The weed can be raked, and stems and plant parts rolled. The clump of weed material can then be bagged and removed from site.	Tools: gloves, rakes, knife, and weed bags
Crowning  State & Stat	Plants that possess rhizomes or bulbs might not respond to various removal techniques and may need to be treated with crowning.  A knife, mattock, or trowel is to be driven into the soil surrounding the bulb or rhizome at an angle of approximately 45 degrees, to cut any roots that may be running off. This is to occur in 360 degrees around the bulb/rhizome. The rhizome or bulb is to be bagged and removed from the site and disposed of at an appropriate waste recycling facility.  Soil disturbance is to be kept to a minimum when using this technique.	Tools: knife, mattock, trowel, impervious gloves, and all other required PPE
Cut and Paint Stems	Weed species deemed unsuitable for hand removal shall but cut. Those that have persistent vigorous growth will be cut and painted with Roundup® Biactive Herbicide or equivalent.  Juvenile and smaller weed species will be cut with secateurs at base of plant, and herbicide applied via applicator bottle. Stem to be cut horizontally as close to the ground as possible, using secateurs, loppers, or a pruning saw. Horizontal cuts to be made on top of stem to prevent the herbicide running off the stump.  Apply herbicide to the cut stem immediately, within 10-20 seconds, before the plant cells close and the translocation of herbicide is limited. Herbicide is not to reach sediment or surrounding non-target plants.	Tools: loppers, secateurs, pruning saw, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide and all other required PPE

Technique	Method	Equipment
Scrape and Painting	More resilient weed species, where other techniques are less reliable are to be scraped with a knife or chisel and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current herbicide license.  Weed species will be scrapped with a knife or chisel up the length of the trunk, and herbicide applied via applicator bottle. Scrape the trunk from as close to the ground as possible to approximately ¾ of the plants height. Where trunk diameters exceed approximately 5cm a second scrape shall be made on the other side of the trunk.  Apple undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of herbicide is limited. Herbicide is not to reach sediment or surrounding non-target plants.  Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.	Tools: knife, chisel, protective clothing, safety glass, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required PPE
Cut with a Chainsaw and Paint	Larger size weed species, too large for cutting with hand tools, shall be cut with a chainsaw, and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current chainsaw and herbicide license.  Larger weed species will be cut with a chainsaw at base of plant, and herbicide applied via applicator bottle. Cut the stem horizontally as close to the ground as possible, using the chainsaw. Remove upper branches to reduce bulk of plant.  If cutting at the base is impractical, cut higher to get rid of the bulk of the weed, then cut again at the base and apply herbicide. Make cuts horizontal to prevent the herbicide running off the stump. Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of herbicide is limited. Herbicide is not to reach sediment or surrounding non-target plants.  Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.	Tools: chainsaw, earmuffs, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required PPE

Technique	Method	Equipment
Spot Spraying	Spot spraying involves spraying non-seeding annuals and grasses, and for regrowth of weeds once an area has been cleared or brush cut. Works to be carried out by a contractor with a current herbicide license.  Herbicide will be mixed up according to the manufacturer's directions for the weed species being targeted.  Mixed herbicide shall be applied to the targeted weed species with a backpack sprayer. All care must be taken by the contractor not to spill herbicide onto sediment or surrounding non-targeting plants.	Tools: protective clothing, safety glasses, herbicide sprayer, impervious gloves, Herbicide, and all other required PPE

#### Flame Weeding

Thermal (flame) weeding is a method where high temperatures are applied to weeds, causing the plant to die. Thermal weeding is particularly useful in situations where conservation or health considerations are high and weed density is low such as waterways where herbicide use is not permitted.

For native vegetation areas, thermal weeding, with a flame weeder, has been shown to stimulate germination of native plants while killing the seeds of annual weeds such as Devils Pitchfork, *Bidens pilosa*. Flame weeding is also effective in killing persistent weeds like Mother of Millions.

Best results are obtained when follow up weed control is undertaken 4-6 weeks after treatment. In addition, weed control should be conducted periodically after that for example to control weeds over a period of a year it is likely that between 3-5 applications will be necessary, depending on rainfall and the extent of the weed seed bank. This method is most effective on young annual weeds and least effective on older perennial weeds. In some cases, control of perennial weeds will be ineffective however this depends on the species present and its age.





Case Study: Weed Mgt and Eco-burn Glenorie in the Hills Shire Council





Flame weeding should be undertaken outside of the fire seasons. Flame weeding allows for the mimicking of a burn in areas where a control burn could not be undertaken. Find native plants regenerating after flame weeding.

Images provided by Dragonfly Environmental



## 6.2 Appendix II – Bushland Hygiene Protocols for Phytophthora

- Always assume that the area you are about to work in is free of disease and therefore needs to be protected against infection.
- And always assume that the activity you are about to undertake has the potential to introduce the disease.
- Before you move onto the site spray the bottom of your shoes / plant with 70% methylated spirit. Bleach solution (1% strength) or household/commercial disinfectant (as per label) are also suitable.
- Check all tools and equipment that come in contact with soil are cleaned before entering the area (they should have been cleaned on-site at the end of the previous work session). If there is any dirt on them, spray them with 70% methylated spirit.

**Kit contents:** 1 bucket, 1 scrubbing brush, 1 spray bottle (methylated spirit 70% solution), 1 bottle of tap water, and 1 bottle of methylated spirits.

### **Facts about Phytophthora**

Phytophthora cinnamomi (Phytophthora) is a microscopic, soil-borne, water-mould that has been implicated in the death of remnant trees and other plants in Australian bushland. Phytophthora is not native to Australia. It is believed to have been introduced sometime after European settlement. Phytophthora is a national problem and is listed as a key threatening process under the Commonwealth's Environmental Protection and Biodiversity Conservation Act 1999.

#### Symptoms including Dieback

Initial symptoms of Phytophthora include wilting, yellowing and retention of dried foliage, loss of canopy and dieback. Infected roots blacken and rot and are therefore unable to take-up water and nutrients. Severely infected plants will eventually die. Symptoms can be more obvious in summer when plants may be stressed by drought. If you suspect that Phytophthora is on your site, please contact the Bushcare team to collect a soil sample to be lab tested. This is usually done in the warmer months where conditions are optimum for the disease.

#### Infection

There is no way of visually telling if Phytophthora is present in the soil as its structures and spores are microscopic (invisible to the naked eye). Phytophthora requires moist soil conditions and warm temperatures for infection, growth, and reproduction. Spores travel through moist soil and attach to plant roots. Once Phytophthora has infected a host plant it can grow inside plant root tissue independent of external soil moisture conditions. After infection, Phytophthora grows through the root destroying the tissue which is then unable to absorb water and nutrients.

## 6.3 Appendix III – Threatened species likelihood of occurrence

Appendix III is based on BioNet records within a 10 km radius of the subject site. The following flora and fauna species are currently listed as vulnerable or endangered under state and/or Commonwealth legislation. The likelihood of occurrence for the flora and fauna species is listed below.

Table 6.1. Threatened flora species likelihood of occurrence.

Scientific name	Common name	Habitat associations	Site suitability
Tetratheca glandulosa		Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops.	No flora bearing the key identifying features of this species was identified during surveys. No potential habitat within the site boundaries.  No further assessment required.
Tetratheca juncea	Black-eyed Susan	It is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest. It generally prefers well-drained sites below 200m elevation and annual rainfall between 1000 - 1200mm. The preferred substrates are sandy skeletal soil on sandstone, sandy-loam soils, low nutrients; and clayey soil from conglomerates, pH neutral.	No flora bearing the key identifying features of this species was identified during surveys. No potential habitat within the site boundaries.  No further assessment required.

Scientific name	Common name	Habitat associations	Site suitability
Callistemon linearifolius	Netted Bottle Brush	Grows in dry sclerophyll forest on the coast and adjacent ranges.	No flora bearing the key identifying features of this species was identified during surveys. No potential habitat within the site boundaries.  No further assessment required.
Rhodamnia rubescens	Scrub Turpentine	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	No flora bearing the key identifying features of this species was identified during surveys. No potential habitat within the site boundaries.  No further assessment required.
Rhodomyrtus psidioides	Native Guava	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.	No flora bearing the key identifying features of this species was identified during surveys. No potential habitat within the site boundaries.  No further assessment required.
Syzygium paniculatum	Magenta Lilly Pilly	Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	No flora bearing the key identifying features of this species was identified during surveys. No potential habitat within the site boundaries.  No further assessment required.

Table 6.2. Threatened fauna species likelihood of occurrence.

**Note**: Marine species including Turtles (*Cheloniidae*, *Dermochelyidae*), Dugongs (*Dugongidae*), Marine Birds (*Diomedeidae*, *Procellariidae*), Penguins (*Spheniscidae*), Seals (*Otariidae*) and Whales (*Balaenidae*, *Balaenopteridae*, *Physeteridae*) have been omitted from this list.

Scientific name	Common name	Habitat associations	Site suitability
Ptilinopus magnificus	Wompoo Fruit-Dove	Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Feeds on a diverse range of tree and vine fruits and is locally nomadic - following ripening fruit. Thought to be an effective medium to long-distance vector for seed dispersal. Feeds alone, or in loose flocks at any height in the canopy. The nest is a typical pigeon nest - a flimsy platform of sticks on a thin branch or a palm frond, often over water, usually 3 - 10 m above the ground. Breeds in spring and early summer; a single white egg is laid. Most often seen in mature forests, but also found in remnant and regenerating rainforest.	Unlikely.  Associated habitat and resources not present on or adjacent to the proposed development or possible impact area.  No further assessment required.
Ptilinopus regina	Rose-crowned Fruit- Dove	Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful.	Unlikely.  Associated habitat and resources not present on or adjacent to the proposed development or possible impact area.  No further assessment required.
Ptilinopus superbus	Superb Fruit-Dove	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic. There are records of single birds flying into lighted windows and lighthouses, indicating that birds travel at night. At least some of the population, particularly young birds,	Unlikely.  Associated habitat and resources not present on or adjacent to the

Scientific name	Common name	Habitat associations	Site suitability
		moves south through Sydney, especially in autumn. Breeding takes place from September to January. The nest is a structure of fine interlocked forked twigs, giving a stronger structure than its flimsy appearance would suggest, and is usually 5-30 metres up in rainforest and rainforest edge tree and shrub species.	proposed development or possible impact area.  No further assessment required.
Haliaeetus leucogaster	White-bellied Sea- Eagle	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea.	Unlikely.  Associated habitat and resources not present on or adjacent to the proposed development or possible impact area.  No further assessment required.
Hieraaetus morphnoides	Little Eagle	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	Unlikely.  Associated habitat and resources not present on or adjacent to the proposed development or possible impact area.  No further assessment required.
Lophoictinia isura	Square-tailed Kite	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Unlikely.  Associated habitat and resources not present on or adjacent to the

Scientific name	Common name	Habitat associations	Site suitability
			proposed development or possible impact area.  No further assessment required.
Calyptorhynchus Iathami	Glossy Black- Cockatoo	Lives in coastal woodlands and drier forest areas, open inland woodlands or timbered watercourses where casuarinas (or sheoaks), its main food trees, are common. Glossy black cockatoos occasionally eat seeds from eucalypts, angophoras, acacias and hakeas, as well as eating insect larvae. Prefers to nest in the hollows of large, old eucalypt trees, alive or dead. The typical nest site will be around 3 to 30 metres above the ground.	Unlikely.  Associated habitat and resources not present on or adjacent to the proposed development or possible impact area.  No further assessment required.
Glossopsitta pusilla	Little Lorikeet	Prefers open Eucalypt Forest and woodlands. Primarily feeds within the canopy of Eucalyptus, Angophora and Melaleuca trees. Prefers riparian areas but may visit isolated trees in open or cleared land.	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.  5-part test conducted.
Lathamus discolor	Swift Parrot	On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Forest Red Gum E. tereticornis, Mugga Ironbark E. sideroxylon, and White Box E. albens. Commonly used lerp	Unlikely.  Associated habitat and resources not present on or adjacent to the

Scientific name	Common name	Habitat associations	Site suitability
		infested trees include Inland Grey Box E. microcarpa, Grey Box E. moluccana, Blackbutt E. pilularis, and Yellow Box E. melliodora. Return to some foraging sites on a cyclic basis depending on food availability.	proposed development or possible impact area.  No further assessment required.
Ninox connivens	Barking Owl	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats. Two or three eggs are laid in hollows of large, old trees. Living eucalypts are preferred though dead trees are also used. Nest sites are used repeatedly over years by a pair, but they may switch sites if disturbed by predators (e.g. goannas).	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.  5-part test conducted.
Ninox strenua	Powerful Owl	The species requires large tracts of forest or woodland, however fragmented landscapes can contribute to their range. Breeds in forests and woodlands but may forage in open areas. Mainly preys upon medium sized arboreal mammals. Requires tree hollows for breeding.	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.  5-part test conducted.

Scientific name	Common name	Habitat associations	Site suitability
Anthochaera phrygia	Regent Honeyeater	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She oak. Regent Honeyeaters inhabit woodlands that support significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast. In the last 10 years Regent Honeyeaters have been recorded in urban areas around Albury where woodlands tree species such as Mugga Ironbark and Yellow Box were planted 20 years ago. The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. There are three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks. Also nest in mistletoe haustoria.	Unlikely.  Associated habitat and resources not present on or adjacent to the proposed development or possible impact area.  No further assessment required.
Petroica boodang	Scarlet Robin	The Scarlet Robin lives 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. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. The Scarlet Robin is primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding.	Unlikely.  Associated habitat and resources not present on or adjacent to the proposed development or possible impact area.

Scientific name	Common name	Habitat associations	Site suitability
			No further assessment required.
Phascolarctos cinereus	Koala	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Unlikely.  Associated habitat and resources not present on or adjacent to the proposed development or possible impact area.  No further assessment required.
Cercartetus nanus	Eastern Pygmy- possum	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. They may occupy small patches of vegetation in fragmented landscapes and although the species prefers habitat with a rich shrub understory, they are known to occur in grassy woodlands and the presence of Eucalypts alone is sufficient to support populations in low densities.	Unlikely.  Associated habitat and resources not present on or adjacent to the proposed development or possible impact area.  No further assessment required.
Petaurus norfolcensis	Squirrel Glider	Inhabits mature or old growth Blackbutt-Bloodwood forests with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia mid-storey. Requires abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.

Scientific name	Common name	Habitat associations	Site suitability
			5-part test conducted.
Pteropus poliocephalus	Grey-headed Flying- fox	Occurs within tall sclerophyll forests and woodlands, heath, swamp subtropical and temperate rainforests, and urban areas. Occurs within 20km of a significant food source. May be found close to gullies and water within vegetation with a dense canopy.	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.  5-part test conducted.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	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. Breeding has been recorded from December to mid-March, when single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.  5-part test conducted.
Micronomus norfolkensis	Eastern Coastal Freetailed Bat	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.  5-part test conducted.

Scientific name	Common name	Habitat associations	Site suitability
Chalinolobus dwyeri	Large-eared Pied Bat	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies.	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.  5-part test conducted.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer.	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.  5-part test conducted.
Myotis macropus	Southern Myotis	Generally, roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.  5-part test conducted.
Scoteanax rueppellii	Greater Broad-nosed Bat	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been	Possible. Associated foraging resources present on or

Scientific name	Common name	Habitat associations	Site suitability
		found in 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; this species has been known to eat other bat species.	adjacent to the proposed development or possible impact area.  5-part test conducted.
Miniopterus australis	Little Bent-winged Bat	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters.	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.  5-part test conducted.
Miniopterus orianae oceanensis	Large Bent-winged Bat	Caves are the primary roosting habitat, but also use derelict mines, stormwater tunnels, buildings and other man-made structures. Form discrete populations centered on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops.	Possible.  Associated foraging resources present on or adjacent to the proposed development or possible impact area.  5-part test conducted.

## 6.4 Appendix IV – Suitable Plants for landscaping

PCT 3594			
Scientific name	Common name		
Upper stratum			
Banksia integrifolia	Coast Banksia		
Eucalyptus botryoides	Bangalay		
Glochidion ferdinandi	Cheese Tree		
Pittosporum undulatum	Sweet Pittosporum		
Allocasuarina littoralis	Black She-Oak		
Middle stratum			
Breynia oblongifolia	Coffee Bush		
Notelaea longifolia	Large Mock-olive		
Dodonaea triquetra	Large-leaf Hop-bush		
Elaeocarpus reticulatus	Blueberry Ash		
Polyscias sambucifolia	Elderberry Panax		
Acacia longifolia			
Myrsine variabilis			
Ground stratum			
Dianella caerulea	Blue Flax-lily		
Pteridium esculentum	Bracken		
Lomandra longifolia	Spiny-headed Mat-rush		
Entolasia stricta	Wiry Panic		
Imperata cylindrica var. major	Blady Grass		
Microlaena stipoides	Weeping Grass		

PCT 3594		
Scientific name	Common name	
Poa affinis		
Themeda australis		
Xanthorrhoea arborea		
Lepidosperma laterale	Variable Sword-sedge	
Pratia purpurascens	Whiteroot	

## 6.5 Appendix V – Threatened species test of significance

#### 7.3 Test for determining whether proposed development or activity likely to significantly affect threatened species or ecological communities, or their habitats

- (1) 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,
  - (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,
  - (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,
  - (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),
  - (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.

Figure 6.1 Source: Biodiversity Conservation Act 2016 s 7.3

## Little Lorikeet (Glossopsitta pusilla) 5-part test



While no Little Lorikeet were recorded in the study area during the field survey, this species is considered moderately likely to occur based on the presence of suitable foraging habitat and nearby records. The Little Lorikeet is likely to opportunistically forage in trees within the study area.

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 the risk of extinction,

The Little Lorikeet (Glossopsitta pusilla) occurs in open eucalyptus forest and woodland, as well as isolated flowering trees in open country including, paddocks, roadside remnants and urban trees. Breeding sites are generally located in hollows of large old eucalypts, often smooth barked species and are commonly found in riparian habitats. No known Little Lorikeet breeding site are known in close proximity to the study area and the proposal would not impact on likely breeding habitat as no hollows were observed in the trees to be removed. As such, the impacts of the proposal to the Little Lorikeet would be limited to the loss of foraging habitat caused by direct clearing or damage to street and garden trees during the construction phase. Flowering tree resources would be impacted. Foraging habitat mainly comprises of nectar resources from planted native trees and shrubs. The affected area of foraging habitat would represent a small percentage of the total extent of foraging habitat present in the locality. The proposed development is not expected to significantly affect the life cycle of the species.

- (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 potential habitat of the Little Lorikeet within the study area is limited to foraging habitat and includes all native flowering trees and shrubs.

The extent of habitat for the Little Lorikeet would be reduced is exotic Coral Trees and not key habitat.

The proposal would not result in fragmentation of habitat for the Little Lorikeet. The species is highly mobile and would freely fly long distances over open areas including urbanised city centres to move between foraging sites. The proposal would not affect the movement of the Little Lorikeet between habitat patches.

The proposal would not impact on the most important habitats for the Little Lorikeet in the locality. The most important habitats for the local Little Lorikeet populations are the remnant areas of native vegetation in larger reserves. The vegetation to be affected would only form a small proportion of available habitat for this species. The foraging habitat within the study area is unlikely to be of critical importance for the survival of the Little Lorikeet in the locality.

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

There will be no impact on any declared area of outstanding biodiversity value.

(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 proposal involves clearing of native vegetation which is listed as a Key Threatening Process under the BC Act.

#### Conclusion

The Little Lorikeet would suffer a small reduction in extent of suitable foraging habitat from the proposal. No likely breeding sites or other important habitat would be impacted. The proposal is unlikely to reduce the population size of the Little Lorikeet or decrease the reproductive success of this species. The proposal would not interfere with the recovery of the Little Lorikeet and would not contribute to the key threats to this species. The proposed development is unlikely to result in a significant impact to the Little Lorikeet.

## **Threatened Owls 5-part test**

While no threatened owls were recorded in the study area during the field survey, the following three species are considered moderately likely to occur based on the presence of suitable foraging habitat and nearby records.

- Barking Owl (Ninox connivens)
- Powerful Owl (Ninox strenua)
- Masked Owl (Tyto novaehollandiae)
- Sooty Owl (Tyto tenebricosa)

These threatened owls are likely to opportunistically forage in trees within the study area.

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 the risk of extinction,

No known threatened owl breeding sites are known to occur within close proximity to the study area and the proposal is not expected to impact on critical breeding habitat of any species. As such, the impacts of the proposal to threatened owls would be limited to the loss of potential foraging habitat by direct clearing or damage to trees during the construction phase.

The proposal is expected to remove marginal foraging habitat. The proposal alone is not expected to cause significant impacts to biodiversity, as large areas of dense woodland and forest are available and deemed more suitable for threatened species within surrounding lands. The proposal would add to the loss of habitat in the locality. Foraging habitat mainly comprises of tree canopies where species hunt small arboreal mammals, birds, invertebrates and terrestrial mammals. The affected area of foraging habitat represents a small percentage of the total extent of foraging habitat in the locality. The study area is not considered critical habitat. Given the widespread nature of similar vegetation in the locality and abundance of high quality foraging habitat within surrounding area, the proposal is not expected to significantly affect the life cycle of these species such that a viable population is likely to be placed at the 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,

The potential habitat of the threatened owls within the study area is limited to foraging habitat. The extent of habitat for the threatened owls would be reduced by loss of trees. This amount of habitat removal is small when the amount of available foraging habitat in the locality is considered.

Importantly, the proposal would not result in fragmentation of habitat for the threatened owls. These species are highly mobile and would freely fly long distances over open areas including urbanised city centres to move between foraging sites and roost sites. The proposal would not affect the movement of the threatened owls between habitat patches.

Importantly, the proposal would not impact on the most important habitats for threatened owls in the locality. The vegetation to be affected would only form a small proportion of available habitat for these species. The foraging habitat within the study area is unlikely to be of critical importance for the survival of the threatened owls in the locality.

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

There will be no impact on any declared area of outstanding biodiversity value.

(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 proposal involves clearing of native vegetation which is listed as a Key Threatening Process under the BC Act.

#### Conclusion

The threatened owls would suffer a small reduction in extent of suitable foraging habitat from the proposal. No likely breeding sites or other important habitat would be impacted. The proposal is unlikely to reduce the population size of the threatened owls or decrease the reproductive success of these species. The proposal would not interfere with the recovery of the threatened owls and would not contribute to the key threats to these species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant effect on the threatened owls.

#### **Threatened Microbats 5-part test**

While no threatened microbats were recorded in the study area during the field survey, the following eight species are considered moderately likely to occur based on the presence of suitable foraging habitat and nearby records.

- Yellow-bellied Sheathtail-bat (Saccolaimus flaviventris)
- Eastern Coastal Free-tailed Bat (Micronomus norfolkensis)
- Large-eared Pied Bat (Chalinolobus dwyeri)
- Eastern False Pipistrelle (Falsistrellus tasmaniensis)
- Southern Myotis (Myotis macropus)
- Greater Broad-nosed Bat (Scoteanax rueppellii)
- Little Bent-winged Bat (Miniopterus australis)
- Large Bent-winged Bat (Miniopterus orianae oceanensis)

These threatened microbats are likely to forage opportunistically in trees within the study area.

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 the risk of extinction,

No known threatened microbat breeding sites are known to occur within close proximity to the study area and the proposal is not expected to impact on likely breeding habitat of the species. As such, the impacts of the proposal to threatened microbats would be limited to the loss of foraging habitat caused by direct clearing or damage to trees during the construction phase.

The proposal would remove potential foraging but not roosting habitat. The proposal alone would not cause significant impacts to biodiversity, as large areas of dense woodlands and forest are available and deemed more suitable for threatened species in the locality. The proposal would add to the loss of trees in the locality. Foraging habitat mainly comprises of insects amongst the canopy of planted native trees and shrubs. The affected area of foraging habitat would represent a small percentage of the total extent of foraging habitat in the locality. The study area is not considered critical habitat for these species. The proposal is not expected to significantly affect the life cycle of these species such that a viable population is likely to be placed at the 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,

The potential habitat of the threatened microbats within the study area is limited to foraging habitat and includes all trees and shrubs and associated air spaces. The extent of habitat for the threatened microbats would be reduced by loss of trees. This amount of habitat removal is small when the amount of available foraging habitat in the locality is considered.

Importantly, the proposal would not result in fragmentation of habitat for the threatened microbats. These species are highly mobile and would freely fly long distances over open areas including urbanised city centres to move between foraging sites and roost sites. The proposal would not affect the movement of the threatened microbats between habitat patches.

Importantly, the proposal would not impact on the most important habitats for threatened microbats in the locality. The most important habitats for the local threatened microbat sub-populations are the remnant areas of native vegetation in larger reserves. The vegetation to be affected would only form a small proportion of available habitat for these species. The foraging habitat within the study area is unlikely to be of critical importance for the survival of the threatened microbats in the locality.

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

There will be no impact on any declared area of outstanding biodiversity value.

(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 proposal involves clearing of native vegetation which is listed as a Key Threatening Process under the BC Act.

#### Conclusion

The threatened microbats would suffer a small reduction in extent of suitable foraging habitat from the proposal. No likely breeding sites or other important habitat would be impacted. The proposal is unlikely to reduce the population size of the threatened microbats or decrease the reproductive success of these species. The proposal would not interfere with the recovery of the threatened microbats and would not contribute to the key threats to these species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant effect on the threatened microbats.

## Grey-headed Flying Fox (Pteropus poliocephalus) 5-part test



While no Grey-headed Flying Fox were recorded in the study area during the field survey, this species is considered highly likely to occur based on the presence of suitable foraging habitat and nearby records. The Grey-headed Flying Fox is likely to forage in trees within the study area.

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 the risk of extinction,

The Grey-headed Flying Fox (Pteropus poliocephalus) occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps, and urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 kilometres of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Annual mating commences in January and conception occurs in April or May with single young born in October or November. No Grey-headed Flying Fox camps occur in close proximity to the study area and the proposed development would not impact on any camp. As such, the impacts of the proposal to the Grey-headed Flying Fox would be limited to the loss of foraging habitat caused by direct clearing or damage to trees during the construction phase. Flowering tree resources would be impacted. The proposal would remove potential foraging habitat. The proposal alone would not cause significant impacts to biodiversity, as large areas of dense woodlands and forest are available and deemed more suitable for threatened species in the locality. The proposal would add to the loss of trees in the locality. Foraging habitat mainly comprises nectar resources from planted native trees and shrubs as well as fruit resources from some exotic trees. The affected area of foraging habitat would represent a small percentage of the total extent of foraging habitat present within the locality. Given the relatively widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of the camps located near the study area, the proposal is not expected to significantly affect the lifecycle of the species.

(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 potential habitat of the Grey-headed Flying Fox within the study area is limited to foraging habitat and includes all native flowering trees and shrubs. The extent of habitat for the Grey-headed Flying Fox would be reduced by loss of trees. This amount of habitat is considered small when the amount of available foraging habitat in the locality is considered. The proposed development would not result in fragmentation of habitat for the Grey-headed Flying Fox. This species is highly mobile and would freely fly long distances (up to 50 kilometres) over open areas including urbanised city centres to move between roost camps and foraging sites. The proposal would not affect the movement of the Grey-headed Flying Fox between habitat patches. The proposed development would not impact on the most important habitats for Grey-headed Flying Fox within the locality. The most important habitats for the local Grey-headed Flying Fox sub-populations are remnant areas of native vegetation in larger reserves. The vegetation to be affected would only form a small proportion of available habitat for this species. The foraging habitat within the study area is unlikely to be of critical important for the survival of the Grey-headed Flying Fox.

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

There will be no impact on any declared area of outstanding biodiversity value.

(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 proposal involves clearing of native vegetation which is listed as a Key Threatening Process under the BC Act.

#### Conclusion

The Grey-headed Flying Fox would suffer a small reduction in extent of suitable foraging habitat from the proposal. No camps or other important habitat would be impacted. The proposal is unlikely to reduce the population size of the Grey-headed Flying Fox or decrease the reproductive success of the species. The proposal would not interfere with the recovery of Grey-headed Flying Fox and would not contribute to the key threats to this species. The proposal is unlikely to result in a significant impact to the Grey-headed Flying Fox.

## Squirrel Glider (Petaurus norfolcensis) 5-part test



While no Squirrel Glider were recorded in the study area during the field survey, this species is considered highly likely to occur based on the presence of suitable foraging habitat and nearby records. The Squirrel Glider is likely to forage in trees within the study area.

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—

(f) 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 the risk of extinction,

The Squirrel Glider inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum Forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. No Squirrel Glider camps occur in close proximity to the study area and the proposed development would not impact on any camp. As such, the impacts of the proposal to the Squirrel Glider would be limited to the loss of foraging habitat caused by direct clearing or damage to trees during the construction phase. Flowering tree resources would be impacted. The proposal would remove potential foraging habitat. The proposal alone would not cause significant impacts to biodiversity, as large areas of dense woodlands and forest are available and deemed more suitable for threatened species in the locality. The proposal would add to the loss of trees in the locality. Foraging habitat mainly comprises nectar resources from planted native trees and shrubs as well as fruit resources from some exotic trees. The affected area of foraging habitat would represent a small percentage of the total extent of foraging habitat present within the locality. Given the relatively widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of the camps located near the study area, the proposal is not expected to significantly affect the lifecycle of the species.

- (g) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity—
  - (iii) 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
  - (iv) 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.

- (h) in relation to the habitat of a threatened species or ecological community—
  - (iv) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
  - (v) 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
  - (vi) 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 potential habitat of the Squirrel Glider within the study area is limited to foraging habitat and includes all native flowering trees and shrubs. The extent of habitat for the Squirrel Glider would be reduced by loss of trees. This amount of habitat is considered small when the amount of available foraging habitat in the locality is considered. The proposed development would not result in fragmentation of habitat for the Squirrel Glider. The proposal would not affect the movement of the Squirrel Glider between habitat patches. The proposed development would not impact on the most important habitats for Squirrel Glider within the locality. The vegetation to be affected would only form a small proportion of available habitat for this species. The foraging habitat within the study area is unlikely to be of critical important for the survival of the Squirrel Glider.

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

There will be no impact on any declared area of outstanding biodiversity value.

(j) 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 proposal involves clearing of native vegetation which is listed as a Key Threatening Process under the BC Act.

#### Conclusion

The Squirrel Glider would suffer a small reduction in extent of suitable foraging habitat from the proposal. No camps or other important habitat would be impacted. The proposal is unlikely to reduce the population size of the Squirrel Glider or decrease the reproductive success of the species. The proposal would not interfere with the recovery of Squirrel Glider and would not contribute to the key threats to this species. The proposal is unlikely to result in a significant impact to the Squirrel Glider.

## 7 Expertise of Authors

With over 25 years wetland and urban ecology experience, a great passion for what she does, and extensive technical and on-ground knowledge make Mia a valuable contribution to any project.

Geraldene has over 8 years local government experience as manager of environment and education for Pittwater Council. Geraldene presented papers on the topic at the NSW Coastal Conference, Sydney CMA and Hawkesbury Nepean forums. Geraldene is a Technical Advisor Sydney Olympic Park Wetland Education and Training (WET) panel.

Geraldene has up to date knowledge of environmental policies and frequently provides input to such works. Mia was a key contributor to the recent set of Guidelines commissioned by Southeast Queensland Healthy Waterways Water Sensitive Urban Design Guidelines. Geraldene's role included significant contributions and review of the Guideline for Maintaining WSUD Assets and the Guideline for Rectifying WSUD Assets.

Geraldene is a frequent contributor to many community and professional workshops on ecological matters particularly relating to environmental management. She is an excellent Project Manager.

Geraldene is a joint author on the popular book Burnum Burnum's Wildthings published by Sainty and Associates. Author of the Saltmarsh Restoration Chapter Estuary Plants of East Coast Australia published by Sainty and Associates (2013). Geraldene's early work included 5 years with Wetland Expert Geoff Sainty of Sainty and Associates. Geraldene is an expert in creating and enhancing urban biodiversity habitat and linking People with Place.

# Geraldene Dalby-Ball DIRECTOR SPECIALISATIONS



- Urban Ecology and habitat rehabilitation and re-creation.
- Urban waterway management assessing, designing, and supervising rehabilitation works
- Saltmarsh and Wetland re-creation and restoration – assessment, design, and monitoring
- Engaging others in the area of environmental care and connection
- Technical Advisor environmental design, guidelines, and policies
- Sound knowledge and practical application of experimental design and statistics
- Project management and supervision
- Grant writing and grant assessment
- Budget estimates and tender selection
- Expert witness in the Land and Environment Court

#### CAREER SUMMARY

- Director and Ecologist, Ecological Consultants Australia. 2014-present
- Director and Ecologist, Dragonfly Environmental. 1998-present
- Manager Natural Resources and Education, Pittwater Council 2002-2010
- Wetland Ecologist Sainty and Associates 1995-2002

#### **OUALIFICATIONS AND MEMBERSHIPS**

- Bachelor of Science with 1st Class Honors, Sydney University.
- WorkCover WHS General Induction of Construction Industry NSW White Card.
- Senior First Aid Certificate.

Practicing member and vice president Ecological Consultants Association of NSW

Brooke is an ecologist with valuable on-ground experience working on bush regeneration projects throughout the Sydney region, including revegetation and weed management projects.

Brooke is passionate about conserving and restoring natural areas for native species to thrive.

Brooke completed her undergraduate Bachelor of Science degree majoring in Conservation Biology. Brooke has knowledge of experimental design and analysis, research and reports, geographic information systems (GIS), environmental legislation, and flora identification.

Brooke has experience working with conservation organisations, including Sea Shepherd Australia, helping to raise awareness around the destruction of habitats in the world's oceans. She has participated in the organisation and delivery of fundraising events around Sydney.

Brooke has exceptional communication and customer service skills and an extended client relations history.

## Brooke Thompson ECOLOGIST



#### **SPECIALISATIONS**

- Urban and Landscape Ecology
- Fauna and Flora Assessments
- Vegetation Management
- Habitat Tree Assessment, Marking and Mapping

#### CAREER SUMMARY

- **Ecologist**, Ecological Consultants Australia. 2022-present
- Natural Area Specialist, Dragonfly Environmental. 2022

#### **OUALIFICATIONS AND MEMBERSHIPS**

 BSc Conservation Biology, University of Wollongong.

WorkCover WHS General Induction of Construction Industry NSW White Card.