

# Flora and Fauna Report

110 Wallumatta Rd, Newport NSW 2106

*By Ecological Consultants Australia Pty Ltd TA*

*Kingfisher Urban Ecology and Wetlands*

**March 2022**





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### Statement of Authorship

*This study and report was undertaken by Ecological Consultants Australia at Studio 1/33 Avalon Parade, Avalon. The author of the report is Geraldene Dalby-Ball with qualifications BSc. majoring in Ecology and Botany with over 20 years' experience in this field, Luke Johnson with qualifications BSc. Majoring in Ecology.*

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



## Summary

### Introduction

- This Flora and Fauna was prepared for Terry-Lyn Stevens c/o BAJA Projects for the proposed development at 110 Wallumatta Rd, Newport NSW 2106 (Lot 17 in DP 26254), in the Northern Beaches Council LGA.
- The proposed development involves construction of second dwelling and garage.
- Recommendations have been provided to reduce the likelihood of impact and mitigate impacts if the proposal is approved.

### Methods

- On-ground survey took place in 8<sup>th</sup> March 2022 by Senior Ecologist Geraldene Dalby-Ball.
- Flora and fauna observations were recorded on-site using binoculars. Notes, photos and samples of flora species were taken to assess ecological health and value of the site.
- Bionet searches were performed for flora, fauna and endangered populations to identify if there were previous records of threatened species occurring within the local area using a 10km radius around the site.
- Review of proposed development was evaluated for potential environmental impacts.

### Results

#### *Base Maps*

- The site is mapped as being within an EEC and in the Biodiversity mapping.
- The PCT within the site is Spotted Gum – Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion.
- The proposal does not trigger entry into the BOS as works are within the existing built upon area.

#### *Current condition*

- The site is highly modified with an existing dwelling and planted landscape areas and hard surface.
- All proposed works are within this existing disturbed area.
- Native vegetation on site is canopy only – Coastal Banksia and a Coastal She-oak the remaining native canopy is on the neighbouring land.
- No significant habitat features, values or landscape corridors will be impacted by the proposed development.

#### *Proposal*

- Construction of second dwelling and garage. No changes to existing house.
- Removal of exotic palms and other non-native vegetation and replacement with native species for this local vegetation community.

#### *Impact*

- No negative impacts expected. Positive outcomes expected from weed removal and replanting.
- Test of significance have considered however none were required as there is no habitat or listed species being impacted.

- Recommendations have been made to assist the long-term sustainability of native flora and fauna.
  - 1 microbat box can be installed (not essential as no loss of habitat occurring)
  - Weed removal
  - Planting with native species – list has been provided in Appendices.

### **Mitigation Measures**

If the development is approved mitigation works required are:

Before works:

- Sediment fencing downslope of activities.
- Removal of weeds to prevent spread of seed (already well in progress).

During works:

- Effective site management to minimise sediment runoff
- Bush hygiene protocols are to be followed to prevent the spread of pathogens including *Phytophthora*.

After completion of works:

- Bushland rehabilitation / landscaping will be conducted, native species are being used and have been recommended NB: Landscaping is covered in bushland management, no separate landscape plan should be required, as the applicant will be restoring the open space areas to bushland within the limits of maintained APZ.
- Species selection has been made in consultation with ecologist to maximise the restoration and to replace weed species with natives. The site will be in better condition due to the proposed removal of exotics and on-going maintenance.

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.

- *Commonwealth 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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# 1 Introduction

## 1.1 Scope of works

Ecological Consultants Australia (ECA) trading as Kingfisher Urban Ecology & Wetlands has been contracted by Terry-Lyn Stevens c/o BAJA Projects 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. 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).

## 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 vegetative 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 Site information and general description

The Subject Site (the “Site”) has an area of 948.6 m<sup>2</sup>. The Site is identified as Lot 17 in DP 26254, in the local government area of Northern Beaches Council.

The Study Area includes the Subject Site, as well as any additional surrounding land traversed during the field survey.

Table 1 - Site Administrative Information

Category	Details
Title Reference (Lot/DP)	17/DP26254
Area (m2)	948.6m <sup>2</sup>
Street Address	110 Wallumatta Rd, Newport NSW 2106

LGA	Northern Beaches Council
Land Zoning	E4 – Environmental Living



Figure 1.1. Site location. Source: SixMaps 2022.

## 1.4 The Proposal

The site currently contains an existing dwelling and driveway. The proposal seeks to construct a second elevated dwelling above the existing driveway. The proposal includes native landscaping and removal of exotic species and replace with local native species. Figure 1.2 shows alterations proposed.



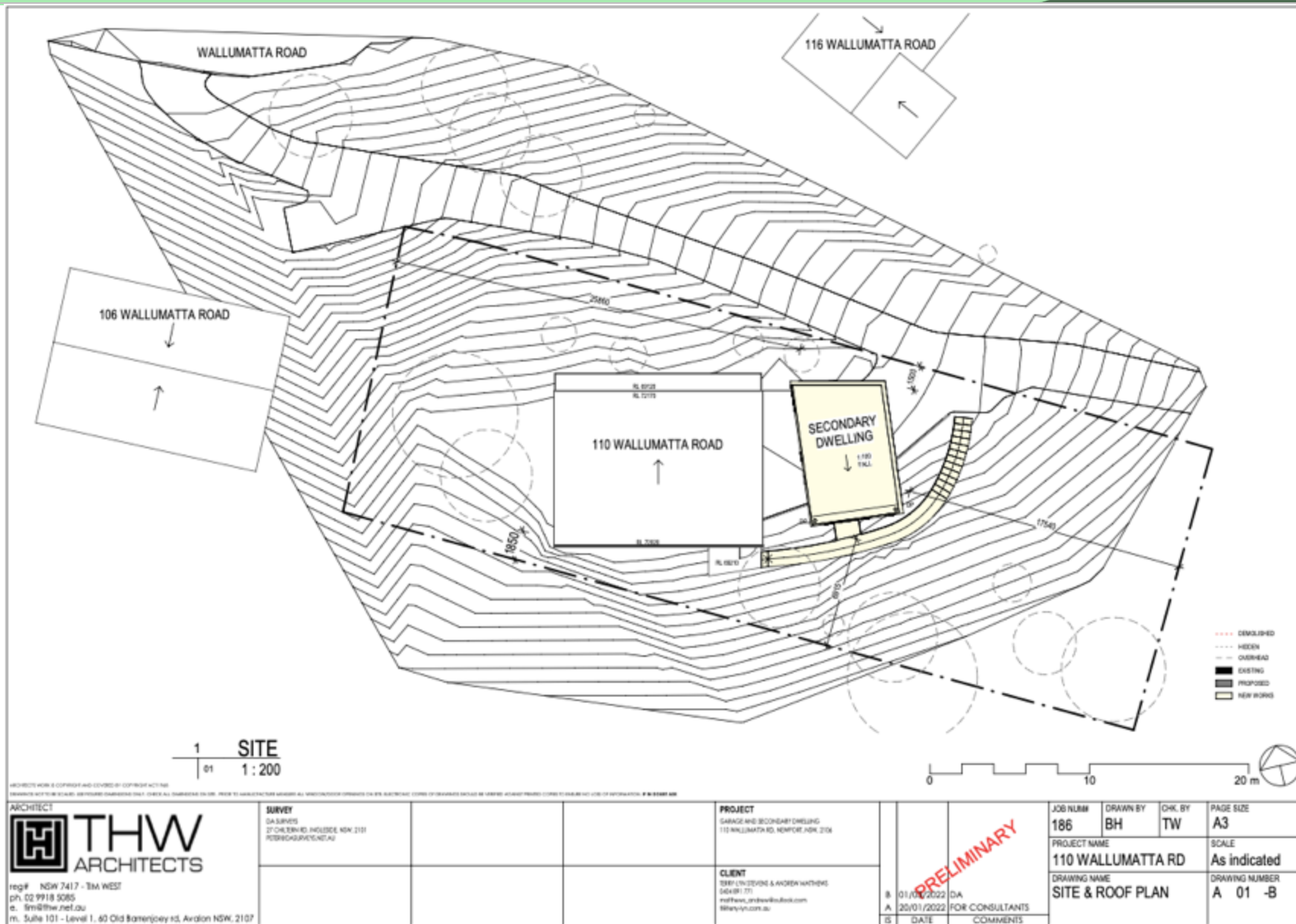


Figure 1.2a. Site and Roof Plan. Source: THW Architects 1/3/2022.

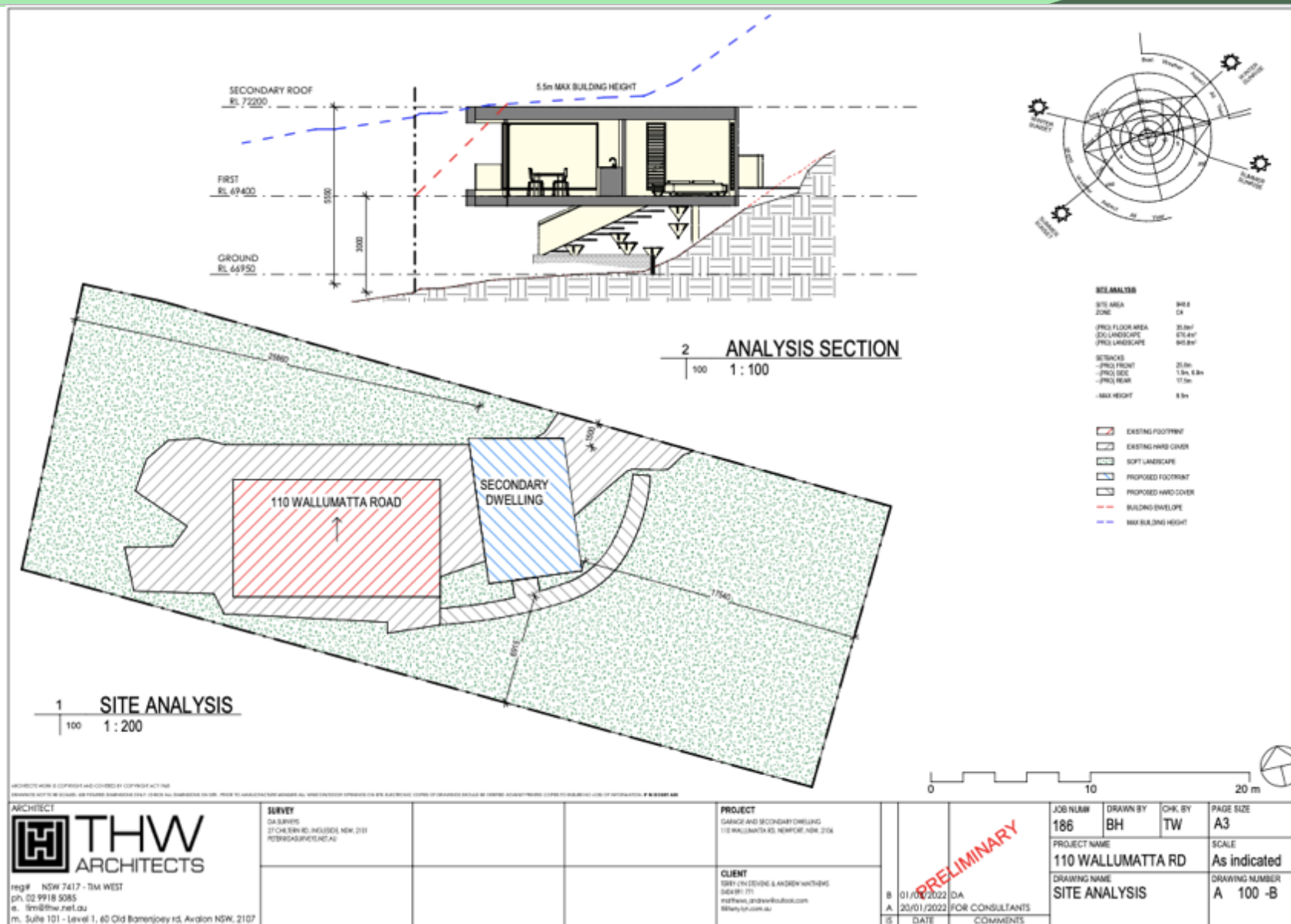


Figure 1.2b. Site Analysis. Source: THW Architects 1/3/2022.

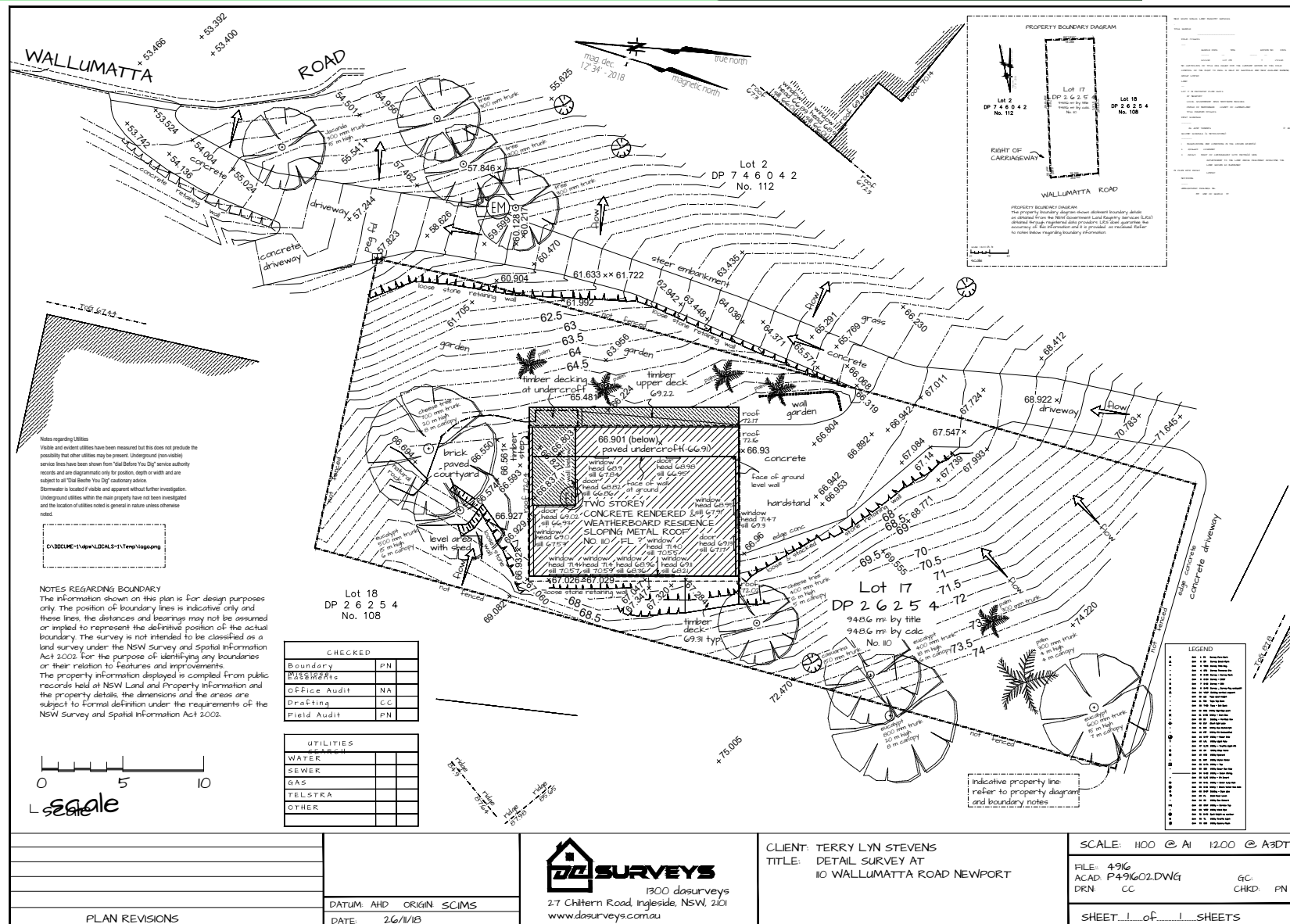


Figure 1.3. Detail Survey at 110 Wallumatta Rd, Newport. DA Surveys 26/11/18.

## 1.5 Sources of information used in the assessment

The following sources of information were used for this assessment:

Bionet, previous studies and the author's knowledge of the local area, were used to determine the possible occurrence of endangered ecological communities and threatened plant species on-site. The Bionet records accessed cover a 10km<sup>2</sup> area extending from the site and include recordings 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).
- NSW Threatened Species Information (DPIE).
- The Native Vegetation of the Sydney Metropolitan Area - Version 3.1 (OEH, 2016) VIS\_ID 4489.
- 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).

Plans and drawings specific to this development;

- 110 Wallumatta Rd Newport for Consultants (Plans/Layouts). THW Architects, 04.02.2022.
- Detail Survey 110 Wallumata Rd, Newport. DA Surveys, 26/11/18.

## 1.6 Legislative context and statutory requirements

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

- *Cwlth 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 'matter 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 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 EPA 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).*

Recently replacing the Threatened Species Conservation Act this includes the test of significance for impacts on threatened species, communities. The test of significance have been conducted and the proposal was found to not have a significant impact on the current ecology of the site. The proposed development is compliant with the BC Act.

- *National Parks & Wildlife Act 1974 (NP&W Act).*

The proposed development is compliant with the NP&W Act.

- *Biosecurity Act (superseding the Noxious Weed Act 1993) (NW Act).*

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.

- Northern Beach Council DCP and LEP

The proposal satisfies provisions outlined in both the Pittwater Local Environmental Plan 2014 -7.6 (Biodiversity protection) and Pittwater Development Control Plan 21 includes requirements for development near other EECs it is noted that these are outside of the site and possible impacts.

No impacts will occur to native vegetation. Removal of exotic weeds will result in improved biodiversity outcomes within the site.

#### **1.6.1 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.

It has been concluded that the development does not trigger the BOS area clearing threshold nor is the site located on the BV map. The area clearing threshold trigger is based on the minimum or actual lot size associated with the property (<1Ha) and the thresholds for clearing which triggers BOS (0.25Ha or more). The building footprint will not remove more than 0.25Ha of native vegetation therefore the development does not trigger the BOS.

#### **Area clearing threshold**



Minimum lot size associated with the property	Threshold for clearing, above which the BAM and offsets scheme apply	Minimum lot size associated with site is <1Ha and the development will not clear >0.25Ha of vegetation.  Thus, the BOS area clearing threshold does not 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	

### Biodiversity Values Map threshold

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

Areas of biodiversity value are mapped across portions of the property. The proposed second dwelling and footprint are located on the boundary of the map as shown in figure 1.5 below. However, field survey resulted in this area consisting of exist sting hardcover in the form of a concrete driveway and exotic species garden bed mapped in figure 1.6. No native species are located within the proposed footprint not planned for removal as a result of the development. Therefore, the development does not trigger the BOS as per the Biodiversity Values Map threshold.

Refer to the survey results and site photos for further detail.



Figure 1.4. The site (red marker) located on the BV map



Figure 1.5 Overlay of Site Plan vs Biodiversity values.

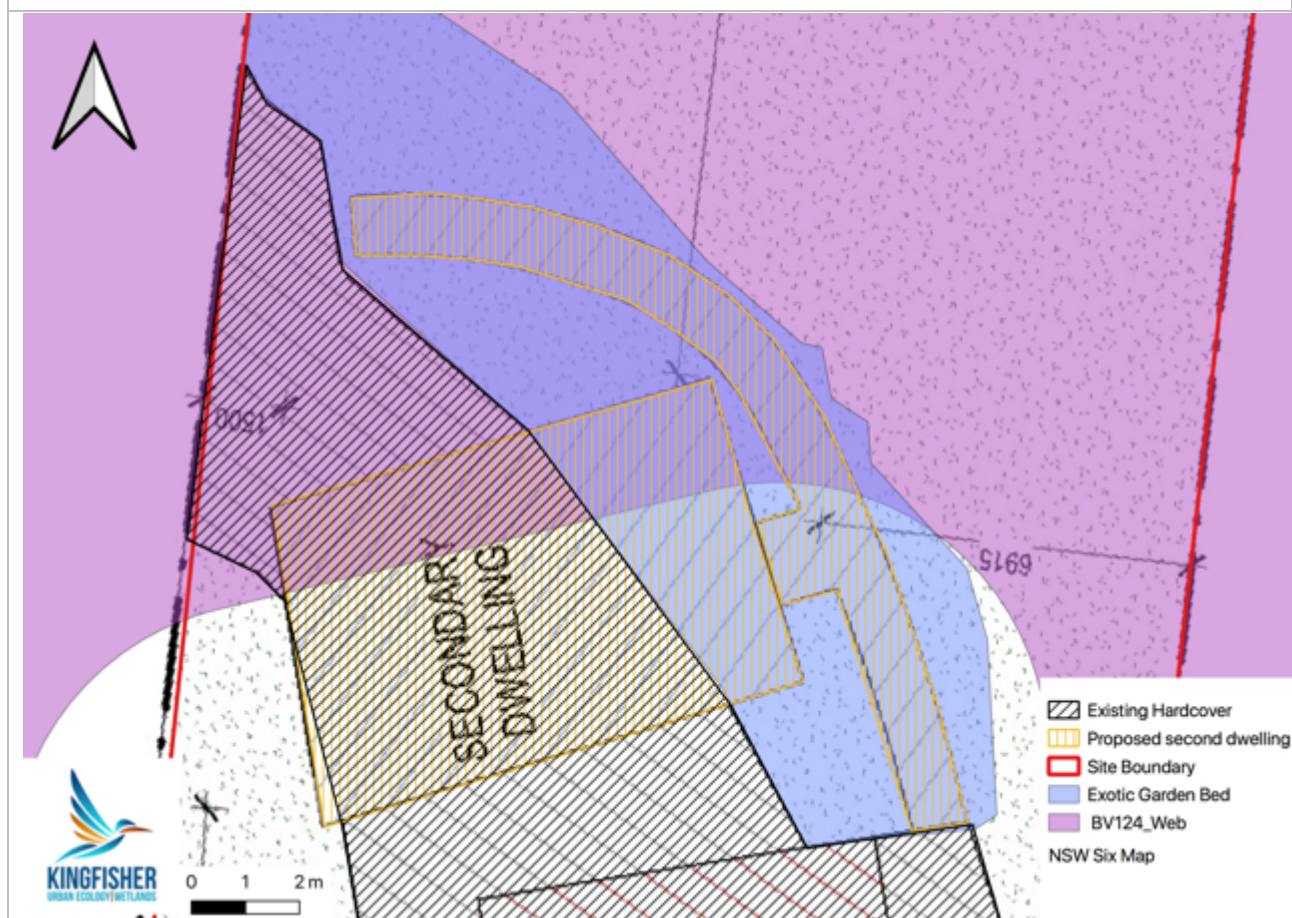


Figure 1.6 Overlay of Site Plan vs Biodiversity Value Map close up scale.

## 2 Methods

### 2.1 Site Inspections

Senior Ecologist Geraldene Dalby-Ball assessed the site in 8<sup>th</sup> March 2022. Weather was fine and sunny during day-time then cooler in the evening survey.

During site visits, notes and photos were taken of the vegetation types, flora and fauna present. Due to the small area of proposed impacts (no direct impacts), detailed or systematic surveys were not performed. Surveys were general and opportunistic in nature and were performed by traversing the site. Surveys included one diurnal bird and fauna survey, a single vegetation survey and a general habitat survey in which fauna habitat resources were identified.



## 2.1 Site Photos









## 3 Native vegetation

### 3.1 Desktop results – Plant Community Types (PCTs) and Vegetation Zones

A review of the most up-to-date vegetation mapping, Sydney Metropolitan Area Vegetation Mapping - Version 3.1 (OEH, 2016) VIS\_ID 4489), identified one plant community type (PCT) within site. The PCT is identified as, PCT 1214 - Spotted Gum – Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion.

Table 3.1 – Table of vegetation community synonyms as per NSW and Commonwealth legislation.

NSW PCT Code	PCT Name	BC Act 2016	EPBC Act 1999
1214	Spotted Gum – Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion  Status: Endangered Ecological Community (EEC)	Not listed



Figure 3.1. Current PCT(s) and Vegetation Zones. Source: SEED 2022.

### 3.2 Field survey method – PCTs and Vegetation Zones

#### 3.2.1 Field Survey

Senior Ecologist Geraldene Dalby-Ball assessed the site in March 2022. Geraldene is also very familiar (over 30 years' experience) with the flora and fauna of the locality. Weather was fine and sunny during day-time then cooler in the evening survey.

## 4 Threatened Species

### 4.1 Threatened flora

Bionet results were compared with the list from the BAM calculator to ensure all possible species were considered.

BioNet records within 10km of the study site had 18 species currently listed as vulnerable or endangered under state and/or commonwealth legislation, out of a total of 1,661 species. The vulnerable and endangered species to focus on-site searches for can be seen in **Table 4.1** below. This is based on likelihood of occurrence. All were searched for – none found.

Table 4.1. Threatened flora recorded within a 10km radius since 1993. NSW OEH Bionet 2022.

Family	Scientific Name	Common Name	NSW status	Cwealth status	Records
Rutaceae	<i>Boronia umbellata</i>	Orara Boronia	V,P	V	1
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V,3		4
Euphorbiaceae	<i>Chamaesyce psammogeton</i>	Sand Spurge	E1		6
Orchidaceae	<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V,P,2	V	1
Ericaceae	<i>Epacris purpurascens</i> var. <i>purpurascens</i>		V		1
Myrtaceae	<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	V	V	7
Myrtaceae	<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	4
Orchidaceae	<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E1,P,2	E	1
Proteaceae	<i>Grevillea caleyi</i>	Caley's Grevillea	E4A,3	CE	53
Myrtaceae	<i>Kunzea rupestris</i>		V	V	1
Malvaceae	<i>Lasiopetalum joyceae</i>		V	V	1
Proteaceae	<i>Macadamia integrifolia</i>	Macadamia Nut		V	5
Orchidaceae	<i>Microtis angusii</i>	Angus's Onion Orchid	E1,P,2	E	52
Proteaceae	<i>Persoonia hirsuta</i>	Hairy Geebung	E1,P,3	E	5
Thymelaeaceae	<i>Pimelea curviflora</i> var. <i>curviflora</i>		V	V	1
Myrtaceae	<b><i>Rhodamnia rubescens</i></b>	<b>Scrub Turpentine</b>	E4A	CE	32
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1	V	16
Elaeocarpaceae	<i>Tetratheca glandulosa</i>		V		18

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

## 4.2 Threatened fauna

A total of 451 fauna species have been recorded within 10km of the study site according to BioNet records since 1993. Of these, 53 species are currently listed as vulnerable or endangered under state and/or commonwealth legislation. The vulnerable and endangered species to focus on-site searches for can be seen in **Table 4.2** below, this is based on likelihood of occurrence.

NB: species whose habitat doesn't occur on site have been omitted from this list – those with marginal habitat have been retained on the list.

Table 4.2 **Threatened fauna recorded within a 10km radius since 1993. NSW OEH Bionet 2022.**

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Amphibia	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V,P	V	33
Amphibia	<i>Litoria aurea</i>	Green and Golden Bell Frog	E1,P	V	2
Amphibia	<i>Pseudophryne australis</i>	Red-crowned Toadlet	V,P		47
Aves	<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A,P	CE	39
Aves	<i>Ardenna carneipes</i>	Flesh-footed Shearwater	V,P	J,K	1
Aves	<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V,P		2
Aves	<b><i>Burhinus grallarius</i></b>	<b>Bush Stone-curlew</b>	E1,P		50
Aves	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V,P,3	E	2
Aves	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V,P,2		77
Aves	<i>Daphoenositta chrysoptera</i>	Varied Sittella	V,P		3
Aves	<i>Diomedea exulans</i>	Wandering Albatross	E1,P	E	2
Aves	<i>Esacus magnirostris</i>	Beach Stone-curlew	E4A,P		1
Aves	<i>Glossopsitta pusilla</i>	Little Lorikeet	V,P		9
Aves	<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V,P		7
Aves	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V,P		43
Aves	<i>Hieraaetus morphnoides</i>	Little Eagle	V,P		4
Aves	<i>Hirundapus caudacutus</i>	White-throated Needletail	P	V,C,J,K	9
Aves	<i>Ixobrychus flavicollis</i>	Black Bittern	V,P		7
Aves	<i>Lathamus discolor</i>	Swift Parrot	E1,P,3	CE	17
Aves	<i>Lophoictinia isura</i>	Square-tailed Kite	V,P,3		4
Aves	<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V,P		1

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Aves	<i>Neophema pulchella</i>	Turquoise Parrot	V,P,3		1
Aves	<i>Ninox connivens</i>	Barking Owl	V,P,3		28
Aves	<b><i>Ninox strenua</i></b>	<b>Powerful Owl</b>	V,P,3		477
Aves	<i>Numenius madagascariensis</i>	Eastern Curlew	P	CE,C,J,K	8
Aves	<i>Pandion cristatus</i>	Eastern Osprey	V,P,3		16
Aves	<i>Petroica boodang</i>	Scarlet Robin	V,P		2
Aves	<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	V,P		3
Aves	<b><i>Ptilinopus superbus</i></b>	<b>Superb Fruit-Dove</b>	V,P		4
Aves	<i>Rostratula australis</i>	Australian Painted Snipe	E1,P	E	3
Aves	<i>Thalassarche cauta</i>	Shy Albatross	V,P	V	3
Aves	<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	P	E	1
Aves	<i>Thalassarche melanophris</i>	Black-browed Albatross	V,P	V	1
Aves	<i>Tyto novaehollandiae</i>	Masked Owl	V,P,3		4
Mammalia	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V,P		396
Mammalia	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V,P	V	19
Mammalia	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V,P	E	7
Mammalia	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V,P		3
Mammalia	<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern)	E1,P	E	20
Mammalia	<b><i>Micronomus norfolkensis</i></b>	<b>Eastern Coastal Free-tailed Bat</b>	V,P		20
Mammalia	<b><i>Miniopterus australis</i></b>	<b>Little Bent-winged Bat</b>	V,P		59
Mammalia	<b><i>Miniopterus orianae oceanensis</i></b>	<b>Large Bent-winged Bat</b>	V,P		91
Mammalia	<b><i>Myotis macropus</i></b>	<b>Southern Myotis</b>	V,P		31
Mammalia	<i>Petaurus norfolcensis</i>	Squirrel Glider	V,P		7
Mammalia	<b><i>Phascolarctos cinereus</i></b>	<b>Koala</b>	V,P	E	74
Mammalia	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	P	V	9
Mammalia	<b><i>Pteropus poliocephalus</i></b>	<b>Grey-headed Flying-fox</b>	V,P	V	136

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Mammalia	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V,P		1
Mammalia	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V,P		7
Mammalia	<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V,P		2
Reptilia	<i>Caretta caretta</i>	Loggerhead Turtle	E1,P	E	3
Reptilia	<i>Chelonia mydas</i>	Green Turtle	V,P	V	10
Reptilia	<i>Varanus rosenbergi</i>	Rosenberg's Goanna	V,P		26

### 4.3 Endangered Populations

Two (2) **endangered populations** have been recorded to occur within 10km of the site. Table 4.3 identifies the populations.

The endangered populations are unlikely to be within the study site or a corridor linking populations to those communities. No further assessment is required for these communities.

**Table 4.3. Endangered Populations within 10km of site.**

Class	Scientific Name	Common Name	NSW status	Cwealth status	Records
Mammalia	<i>Petaurus norfolcensis</i>	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	E2,V,P		1
Mammalia	<i>Phascolarctos cinereus</i>	Koala in the Pittwater Local Government Area	E2,V,P	E	74

#### **Likelihood of occurrence**

*The likelihood of occurrence is a broad categorisation used by Kingfisher to indicate the potential for a species to occur within the study area. It is based on expert opinion and implies the relative value of a study area for a species. See Appendix III for rationale of likelihood of occurrence.*



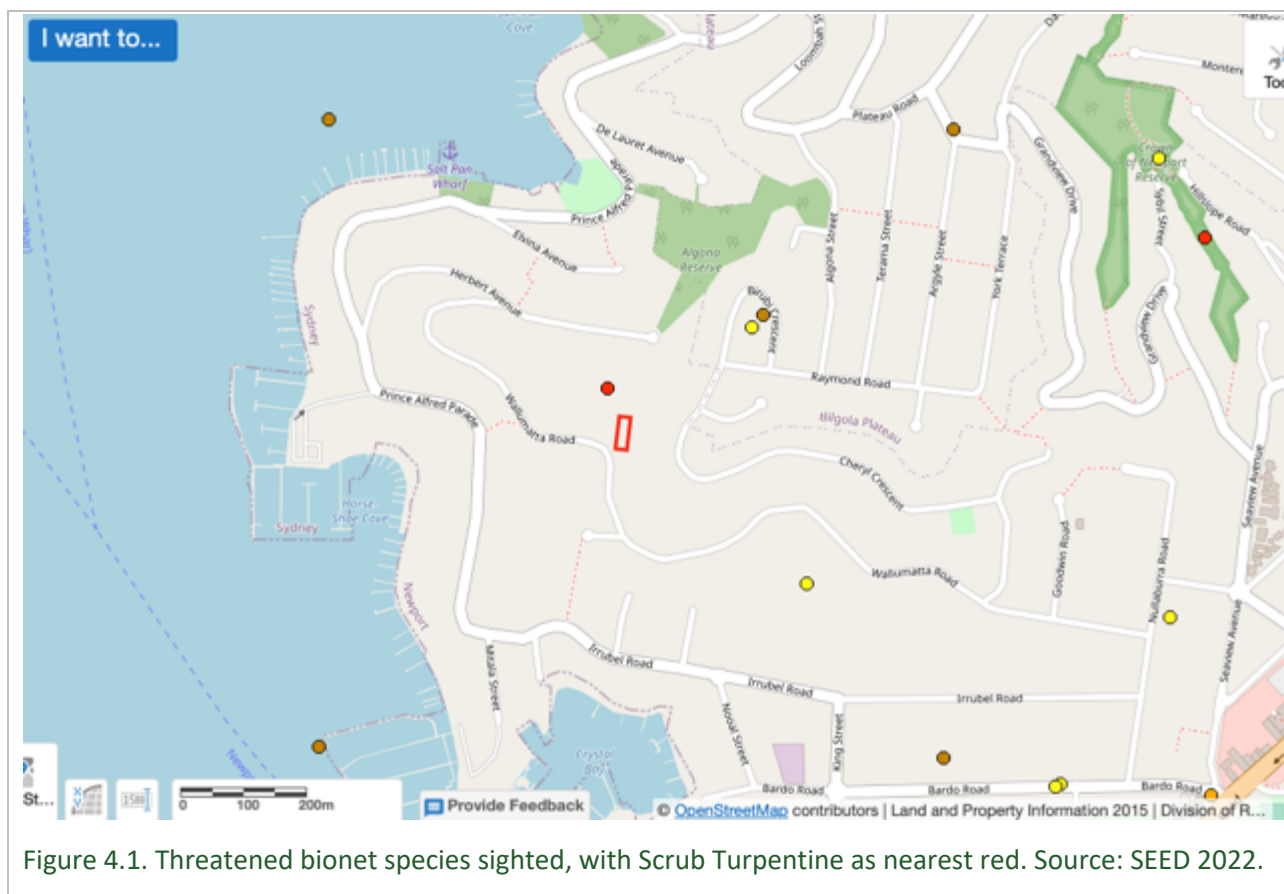


Figure 4.1. Threatened bionet species sighted, with Scrub Turpentine as nearest red. Source: SEED 2022.

## 5 Impacts

### 5.1 Direct Impacts

#### 5.1.1 Vegetation removal

No native vegetation removal is proposed.

### 5.2 Indirect Impacts

#### 5.2.1 Weed growth and invasion

Weed spread – NB: weeds are currently being removed and replaced with native species.

#### 5.2.2 Introduction of pathogens

The introduction of pathogens may occur into 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 for methods to control selected pathogens.

#### 5.2.1 Runoff

The proposed actions may result in transport of sediment from the work zones as the site is sloping. As there is no proposed surface material removal the likelihood of erosion is low.

## 6 Recommendations

### 6.1 Mitigation Measures

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

#### 6.1.1 Delineation of work areas

During construction, impacts on the site and adjacent vegetation should be minimized by the delineation of works zones. Access to the site would be best restricted to small passageways avoiding native vegetation on surrounding land and to prevent soil disturbance in general.

#### 6.1.2 Native species planting

Low impact bushland regeneration methods should also be utilised to meet weed control performance targets. The bushland on site in the northern area is displaying signs of resilience.

Plantings are one of several best practice measures, to retain and support the long-term survival of the vegetation on site. It is recommended that local provenance plants are planted. Landscaping across the site will be selected from locally native ground and shrub species. NB: the area for planting is small.

### **6.1.3 Erosion and runoff**

Where required, sediment controls will be put in place. These will include, but not be limited to sediment fences. Sediment controls will be reviewed during site inspections and/or after significant rainfall (more than 10mm in 24hrs resulting in site runoff).

### **6.1.4 Weed management**

Weed species are present and must be appropriately managed so they do not spread. There must be continuous maintenance of the native vegetation onsite otherwise it may result in increased weed growth, exacerbated by the high abundance of weeds present pre-works.

### **6.1.5 Weed Removal Techniques**

Weed removal proposed for the site will consist of hand removal techniques, manual/mechanical removal using bush regenerator tools and winter thermal (flame) weeding. This approach will reduce the amount of herbicide used and reduce the amount of off-target damage through spot on application.

Woody perennial weeds less than 2 metres in height will require cut and paint or scrape and paint bush regenerator techniques based on the germinating/epicormic behaviour of the plant (especially plants that tend to coppice or sucker).

It is recommended that seed heads are removed prior to commencement of primary works. This would be best performed carefully by hand with secateurs with the aim of avoiding the spread flowers or seeds into planting zones.

See Appendix II for further details. For key weed photo guide see Appendix I.

### **6.1.6 Nest boxes**

Although it is not critical, installation of a single nest box designed for microbats should be added to increase areas of roosting habitat.

Image from: [nestboxes.com.au](http://nestboxes.com.au)

### **6.1.7 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.)



## 7 Appendices


### 7.1 Appendix I– Key Weed Removal Methods

#### Physical removal

Technique	Method	Equipment
<p>Hand Removal</p> 	<p>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.</p> <p>Rolling and raking is suitable for larger infestations of Wandering Jew. The weed can be raked and stems and plants parts rolled. The clump of weed material can then be bagged and removed from site.</p>	<p>Tools: Gloves, Rakes, Knife and Weed Bags</p>
<p>Crowning</p> 	<p>Plants that possess rhizomes or bulbs might not respond to various removal techniques and may need to be treated with crowning.</p> <p>A knife, mattock or trowel is to be driven into the soil surrounding the bulb or rhizome at an angle of approximately 45 degrees with surrounding soil, so as 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</p> <p>Soil disturbance is to be kept to a minimum when using this technique.</p>	<p>Tools: Knife, mattock, trowel, impervious gloves, and all other required P.P.E.</p>



Technique	Method	Equipment
<p>Cut and Paint Stems</p> 	<p>Weed species deemed unsuitable for hand removal shall be cut. Those that have persistent or vigorous growth will be cut and painted with Roundup® Biactive Herbicide or equivalent.</p> <p>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.</p> <p>Apply herbicide to the cut stem immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. Herbicide is not to reach sediment or surrounding non-targeting plants.</p>	<p>Tools: loppers, secateurs, pruning saw, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide and all other required P.P.E.</p>
<p>Scrape and Painting</p> 	<p>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.</p> <p>Weed species will be scraped 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 5 cm a second scrape shall be made on the other side of the trunk.</p> <p>Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. All care must be taken by the contractor not to spill herbicide onto sediment or surrounding non-targeting plants.</p> <p>Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.</p>	<p>Tools: knife, chisel, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.</p>

Technique	Method	Equipment
<p>Cut with a Chainsaw and Paint</p> 	<p>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.</p> <p>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.</p> <p>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 the herbicide is limited. Ensure there is no runoff of poison. All care must be taken by the contractor not to spill herbicide into water, onto sediment, or surrounding non-targeting plants.</p> <p>Follow up treatment will be required. If plants resprout, cut and paint the shoots using the same method.</p>	<p>Tools: chainsaw, ear muffs, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.</p>
Spot Spraying	<p>Spot spraying involves spraying non-seeding annuals and grasses, and for regrowth of weeds once an area has been cleared or brushcut. Works to be carried out by a contractor with a current herbicide license.</p> <p>Herbicide will be mixed up according to the manufacturer's directions for the particular 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.</p>	<p>Tools: protective clothing, safety glasses, herbicide sprayer, impervious gloves, Herbicide, and all other required P.P.E.</p>

### 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.

While flame weeding is not suited to most streetscapes due to the fire hazard nor can it be used on materials such as soft fall and similar playground equipment it is noted that 'flame' weeding in waterways allows weed management in areas where herbicides are not permitted.

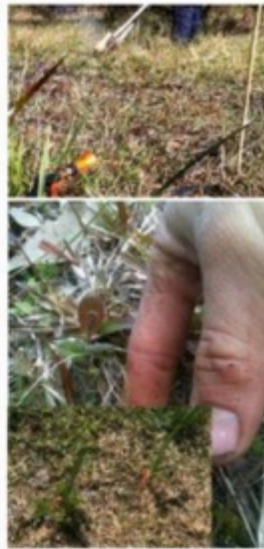
Also for native vegetation areas thermal weeding, with a flame weeder, has been shown to stimulate germination of native plants while killing the seeds of annual weeds such as Devils Pitchfork, *Bidens pilosa*. Flame weeding is also effective in killing persistent weeds like

### 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.

### FLAME WEEDER – ECO BURN

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



Images provided by Dragonfly  
Environmental

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. See native plants regenerating after flame weeding.



## 7.2 Appendix II– Bushland Hygiene Protocols for Phytophthora

- Always assume that the area you are about to work in is free of the 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.
- Arrive at site with clean shoes, i.e.: no dirt encrusted on them.
- If you arrive with shoes that are encrusted with dirt, they will have to be completely soaked in metho or disinfectant and allow a few minutes to completely soak in. NEVER scrape untreated dirt off your shoes onto the ground.
- Before you move onto the site spray the bottom of your shoes with 70 % metho. Bleach solution (1% strength) or household/commercial disinfectant (as per label) are also suitable.
- Check all tools and equipment that comes in contact with soil are clean 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% metho.
- Clean all tools at the end of each work session while still on site ensuring this is done away from drainage lines and adjacent work areas. Knock or brush off encrusted dirt and completely spray with 70 % metho. Replace in storage/transport containers.
- Preferably compost all weed material on site.
- Never drag vegetation with exposed roots and soil through bushland.
- When removing weeds from site, remove as much soil as possible from them in the immediate work area and carefully place vegetative material into plastic bags.
- Try not to get the bag itself dirty; don't put it on/in a muddy area.
- Always work from the lower part of a slope to the upper part.
- Always work in areas known to be free of the pathogen before working in infected areas.
- Minimise activities wherever possible when the soil is very wet.
- Vehicles should not be driven off track or into reserves (unless vehicle decontamination is carried out before and after entering a single work site)
- Only accredited supplies of plants/mulch to be used.

**Kit should contain:** 1 bucket, 1 scrubbing brush, 1 spray bottle (metho 70% solution), 1 bottle tap water, 1 bottle 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*

"Dieback" simply means dying or dead plants. There are many causes of dieback; Phytophthora is just one of them. Often dieback is the result of a combination of factors such as; changed drainage patterns and nutrient loads (e.g.: increased stormwater run-off) or changed soil conditions (e.g.: dumped fill or excavation of/near root zone). Plants that are stressed are more vulnerable to Phytophthora.

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.

***Areas of the near-by Hayden, Hamilton and Attunga Reserves have had, do have, Phytophthora***



### 7.3 Appendix III – Threatened species likelihood of occurrence

Appendix III is based on BioNet records within 10km of the study 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 7.1 – Threatened flora species likelihood of occurrence

Family	Scientific Name	Common Name	Habitat Requirements	Site Suitability
Rutaceae	<i>Boronia umbellata</i>	Orara Boronia	This Boronia grows as an understorey shrub in and around gullies in wet open forest. It appears to regenerate well after disturbance, but it is not known whether prolonged or repeated disturbance affects long-term persistence.	Species is unlikely to occur on site due to previous development and exotic landscaping. May be regenerated in shaded areas outside of the development footprint in less disturbed parts of the property. No further assessment required.
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush	For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. The species was more widespread in the past, and there are currently only 5-6 populations remaining from the 22 populations historically recorded in the Sydney area. Three of the remaining populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve and Spectacle Island Nature Reserve. The species has also been recorded from Yengo National Park. Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers in spring to summer.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Euphorbiaceae	<i>Chamaesyce psammogeton</i>	Sand Spurge	Grows on fore-dunes, pebbly strandlines and exposed headlands, often with Spinifex ( <i>Spinifex sericeus</i> ) and Prickly Couch ( <i>Zoysia macrantha</i> ). Flowering recorded in spring and summer. Sand Spurge seeds float, so some dispersal between beaches may occur. Longevity of the species is approximately 5–30 years with a primary juvenile period of less than 1 year. Plant growth occurs in spring and summer.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.

Family	Scientific Name	Common Name	Habitat Requirements	Site Suitability
Orchidaceae	<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. It appears to prefer open areas in the understorey and is often found in association with the Large Tongue Orchid and the Tartan Tongue Orchid.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Ericaceae	<i>Epacris purpurascens</i> var. <i>purpurascens</i>		Found in a range of habitat types, most of which have a strong shale soil influence. These include ridgetop drainage depressions supporting wet heath within or adjoining shale cap communities e.g. Stringybark and Ironbark woodlands, various shale/sandstone transition forest associations including Turpentine Ironbark Margin Forest, Stringybark/ Scribbly Gum Woodland and Scribbly Gum/ Grey Gum/ Red Bloodwood Woodland. The species also occurs in riparian zones draining into Sydney Sandstone Gully Forest, shale lenses within sandstone habitats and colluvial areas overlying or adjoining sandstone or tertiary alluvium.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Myrtaceae	<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	Restricted distribution at Norah Head, Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park. Recorded in poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas. Associated species frequently include stunted species of <i>E. oblonga</i> Narrow-leaved Stringybark, <i>E. capitellata</i> Brown Stringybark and <i>E. haemastoma</i> Scribbly Gum.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Myrtaceae	<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	It occurs in grassy or sclerophyll woodland in association with many other eucalypts that grow in the area, including <i>E. andrewsii</i> and many of the stringybarks, such as <i>E.</i>	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and

Family	Scientific Name	Common Name	Habitat Requirements	Site Suitability
			<i>caliginosa</i> . Grows on shallow relatively infertile soils on shales and slates; Niangala to Glen Innes. The distribution of this species overlaps with the following EPBC Act-listed threatened ecological communities: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, and Upland Wetlands of the New England Tablelands and the Monaro Plateau.	exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Orchidaceae	<i>Genoplesium baueri</i>	Bauer's Midge Orchid	Grows in dry sclerophyll forest and moss gardens over sandstone.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Proteaceae	<i>Grevillea caleyi</i>	Caley's Grevillea	Restricted to an 8 km square area around Terrey Hills, approximately 20 km north of Sydney. Occurs in three major areas of suitable habitat, namely Belrose, Ingleside and Terrey Hills/Duffys Forest within the Ku-ring-gai, Pittwater and Warringah Local Government Areas. Recorded existing on the ridgetop between elevations of 170 to 240m asl, in association with laterite soils and a vegetation community of open forest, generally dominated by <i>Eucalyptus sieberi</i> and <i>E. gummifera</i> .	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Myrtaceae	<i>Kunzea rupestris</i>		Grows in shallow depressions on large flat sandstone rock outcrops. Characteristically found in short to tall shrubland or heathland. Flowering occurs in spring. It has indehiscent fruits which resist soil entrapment and so may disperse many metres per week. Resprouts from the base after fire or mechanical damage. Seedlings have also been observed after fire.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Malvaceae	<i>Lasiopetalum joyceae</i>		Grows in heath on sandstone. Flowers in spring. The distribution of this species overlaps with the following EPBC	Species was not identified during flora survey. Historical disturbance in the

Family	Scientific Name	Common Name	Habitat Requirements	Site Suitability
			Act-listed threatened ecological communities: Shale/Sandstone Transition Forest, White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, and Turpentine-Ironbark Forest in the Sydney Basin Bioregion.	form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Proteaceae	<i>Macadamia integrifolia</i>	Macadamia Nut	Occurs in drier types of subtropical rainforest north from Currumbin in Qld. It is not known to occur naturally in the wild in N.S.W.; however, it has been recorded from Camden Haven, but it is not known if the tree was cultivated or growing naturally. This species is frequently cultivated for its fruit.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Orchidaceae	<i>Microtis angusii</i>	Angus's Onion Orchid	Currently known from only one site at Ingleside, north of Sydney. The Ingleside population occurs on soils that have been modified but were originally those of the restricted ridgetop lateritic soils in the Duffys Forest - Terrey Hills - Ingleside and Belrose areas.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Proteaceae	<i>Persoonia hirsuta</i>	Hairy Geebung	Usually found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. Usually present as isolated individuals or very small populations. Habitat Preferences: It also favours disturbed heath, shrubby thickets and sandstone scrubs.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Thymelaeaceae	<i>Pimelea curviflora</i> var. <i>curviflora</i>		Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawarra coastal plain. Flowers October to May. Has an inconspicuous cryptic habit as it is fine and scraggly and	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds.

Family	Scientific Name	Common Name	Habitat Requirements	Site Suitability
			often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots.	No further assessment required.
Myrtaceae	<i>Rhodamnia rubescens</i>	Scrub Turpentine	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	Found in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas. Rainforests are often remnant stands of littoral or gallery rainforest. Is thought to tolerate wet and dry conditions on sands.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.
Elaeocarpaceae	<i>Tetratheca glandulosa</i>		Occurs on shale/sandstone transition geology particularly in areas where shale caps occur over sandstone. Associated with Lucas heights, Gynea, Lambert and Faulconbridge soil landscapes. Generally occurs on ridgetops, upper slopes and occasionally mid-slope benches. Prefers shallow soils consisting of yellow clayey/sandy loams.	Species was not identified during flora survey. Historical disturbance in the form of hardstand development and exotic landscaping have reduced the likelihood of viable seed bank recovery in the raised garden beds. No further assessment required.

**Table 7.2 – Threatened fauna species likelihood of occurrence**

Please note – Marine species including Turtles (*Cheloniidae*), Marine Birds (*Diomedidae*, *Procellariidae*) and Whales (*Otariidae*, *Balaenidae*, *Balaenopteridae*, *Physeteridae*) have been omitted from this list.



Class	Scientific Name	Common Name	Habitat Requirements	Site Suitability
Amphibia	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	Sites must have native vegetation. The species has not been found on cleared land. Occurs in hanging swamps on sandstone shelves and along perennial creeks. The species is not restricted to watercourses.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Amphibia	<i>Litoria aurea</i>	Green and Golden Bell Frog	Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow ( <i>Gambusia holbrooki</i> ), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Amphibia	<i>Pseudophryne australis</i>	Red-crowned Toadlet	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Eggs are laid in moist leaf litter, from where they are washed by heavy rain; a large proportion of the development of the tadpoles takes place in the egg. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Anthochaera phrygia</i>	Regent Honeyeater	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a 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. This species has been seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.

Class	Scientific Name	Common Name	Habitat Requirements	Site Suitability
Aves	<i>Ardena carneipes</i>	Flesh-footed Shearwater	Nest on Lord Howe Island in forests on sandy soils from Ned's Beach to Clear Place, with smaller colonies below Transit Hill and at Old Settlement Beach. Eggs are laid at the end of a burrow 1 - 2 metres in length.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	Woodlands and dry open forests with preference for those dominated by eucalypts with mallee associations. May also be found in shrublands, heaths and occasionally in modified habitats and wet forests.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Burhinus grallarius</i>	Bush Stone-curlew	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. Two eggs are laid in spring and early summer.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Calyptorhynchus lathami</i>	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	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.

Class	Scientific Name	Common Name	Habitat Requirements	Site Suitability
			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.	
Aves	<i>Daphoenositta chrysoptera</i>	Varied Sittella	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Esacus magnirostris</i>	Beach Stone-curlew	The Beach Stone-curlew has been recorded around the north coast of Australia, mainly between mid-north Western Australia and north-east NSW. The species has largely disappeared from the south-east of its former range and is now rarely recorded on ocean beaches in NSW. Occurs on open, undisturbed beaches, islands, reefs, and estuarine intertidal sandflats and mudflats; beaches with estuaries or mangroves nearby are preferred; may also frequent river mouths, offshore sandbars and rock platforms. Individuals forage with slow deliberate heron-like actions. The diet consists of crabs and other marine invertebrates. Less strictly nocturnal than the Bush Stone-curlew. Breeding occurs from September to November, with nests being located on sandbanks, spits or islands in estuaries, among mangroves, or in sand surrounded by short grasses and scattered casuarinas. One egg is laid, and both parents care for the young until independence is reached at seven to twelve months.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Glossopsitta pusilla</i>	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.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.

Class	Scientific Name	Common Name	Habitat Requirements	Site Suitability
Aves	<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	Inhabits rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels. Breeds in spring and summer, almost exclusively on offshore islands, and occasionally on isolated promontories.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion. White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession. The nest can be located in a tree up to 30m above the ground, but may also be placed on the ground or on rocks, where there are no suitable trees. At the start of the breeding season, the nest is lined with fresh green leaves and twigs.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Hieraaetus morphnoides</i>	Little Eagle	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.



Class	Scientific Name	Common Name	Habitat Requirements	Site Suitability
			nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	
Aves	<i>Hirundapus caudacutus</i>	White-throated Needletail	White-throated Needletails often occur in large numbers over eastern and northern Australia. They arrive in Australia from their breeding grounds in the northern hemisphere in about October each year and leave somewhere between May and August. They are aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity. The White-throated Needletail feeds on flying insects, such as termites, ants, beetles and flies. They catch the insects in flight in their wide gaping beaks. Birds usually feed in rising thermal currents associated with storm fronts and bushfires and they are commonly seen moving with wind fronts. White-throated Needletails are non-breeding migrants in Australia.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Ixobrychus flavicollis</i>	Black Bittern	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Feeds on frogs, reptiles, fish and invertebrates, including snails, dragonflies, shrimps and crayfish, with most feeding done at dusk and at night. During the day, roosts in trees or on the ground amongst dense reeds.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Lathamus discolor</i>	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 <i>Eucalyptus robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> ,	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.

Class	Scientific Name	Common Name	Habitat Requirements	Site Suitability
			and White Box <i>E. albens</i> . Commonly used lerp infested trees include Grey Box <i>E. microcarpa</i> , Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i> . Return to home foraging sites on a cyclic basis depending on food availability.	
Aves	<i>Lophoictinia isura</i>	Square-tailed Kite	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	Primarily found in the upper levels of dry open forests and woodlands. Prefers vegetation dominated by box and ironbark Eucalypts but may be found in areas of smooth-barked gums, stringybarks, river sheoaks (nesting) and tea-trees.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Neophema pulchella</i>	Turquoise Parrot	Occurs on edges of eucalypt woodlands, ridges through forests and creeks. Prefers shading for ground foraging.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Ninox connivens</i>	Barking Owl	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or the dense clumps of canopy leaves in large Eucalypts. Feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. Live alone or	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.

Class	Scientific Name	Common Name	Habitat Requirements	Site Suitability
			in pairs. Territories range from 30 to 200 hectares and birds are present all year. Three eggs are laid in nests in hollows of large, old eucalypts including River Red Gum ( <i>Eucalyptus camaldulensis</i> ), White Box ( <i>Eucalyptus albens</i> ), (Red Box) <i>Eucalyptus polyanthemus</i> and Blakely's Red Gum ( <i>Eucalyptus blakelyi</i> ). Breeding occurs during late winter and early spring.	
Aves	<i>Ninox strenua</i>	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.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Numenius madagascariensis</i>	Eastern Curlew	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. The Eastern Curlew mainly forages on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The Eastern Curlew roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. It occasionally roosts on reef-flats, in the shallow water of lagoons and other near-coastal wetlands.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Pandion cristatus</i>	Eastern Osprey	Inhabits coastal areas, especially the mouths of large rivers, lagoons and lakes. Feeds on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.

Class	Scientific Name	Common Name	Habitat Requirements	Site Suitability
Aves	<i>Petroica boodang</i>	Scarlet Robin	Ideal habitat includes eucalypt forests and woodlands with an open and grassy understorey with few shrubs. Can occur in mature or regrowth vegetation. Sometimes seen in mallee, wet forests, wetlands and tea-tree swamps. Habitat generally contains many logs and fallen timber.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	Coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. 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. They are shy pigeons, not easy to see amongst the foliage, and are more often heard than seen. They feed entirely on fruit from vines, shrubs, large trees and palms, and are thought to be locally nomadic as they follow the ripening of fruits. Some populations are migratory in response to food availability - numbers in north-east NSW increase during spring and summer then decline in April or May.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Ptilinopus superbus</i>	Superb Fruit-Dove	The species is found in rainforests, rainforest margins, mangroves, wooded stream-margins, and even isolated figs, lilly pilies and pittosporums. The Superb Fruit-Dove may migrate to New Guinea in winter, but little is known of its movements, or the reasons for its sometimes southerly flights as far as Tasmania. Feeds almost exclusively on fruit, mainly in large trees.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Aves	<i>Rostratula australis</i>	Australian Painted Snipe	Inhabits fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.



Class	Scientific Name	Common Name	Habitat Requirements	Site Suitability
Aves	<i>Tyto novaehollandiae</i>	Masked Owl	The species prefers dry eucalypt forests and woodlands and hunts along the edges and forests and roadsides. Mainly preys upon arboreal and ground mammals, primarily rats. Requires tree hollows in moist gullies for breeding.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Mammalia	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Found in rainforests communities to sclerophyll (including Box-Ironbark) forests, woodland and heath. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes, soft fruits are eaten when flowers are unavailable and insects.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Mammalia	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal animal feeding on medium-sized (500g-5kg) mammals.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Mammalia	<i>Isoodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern)	Species found in heath or open forest with a heathy understorey on sandy or friable soils. They feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogenous (underground-fruiting) fungi.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Mammalia	<i>Petaurus norfolcensis</i>	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.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Mammalia	<i>Phascolarctos cinereus</i>	Koala	Inhabit eucalypt woodlands and forests. Feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.

Class	Scientific Name	Common Name	Habitat Requirements	Site Suitability
Mammalia	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. Lives predominantly in burrows shared with other individuals.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Mammalia	<i>Pteropus poliocephalus</i>	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.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.
Reptilia	<i>Varanus rosenbergi</i>	Rosenberg's Goanna	Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. Individuals require large areas of habitat. Feeds on carrion, birds, eggs, reptiles and small mammals. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens.	Suitable habitat is not present within the development area or immediately surrounding the area. No further assessment required.

#### Microbats

Scientific Name	Common Name	Habitat Requirements	Site Suitability
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	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 ( <i>Petrochelidon ariel</i> ), frequenting low to mid-elevation dry open forest and woodland close to these features.	Suitable habitat is not present within the development area or immediately surrounding the area. No roosting habitat is present on the property. Marginal foraging habitat in the form

Scientific Name	Common Name	Habitat Requirements	Site Suitability
			of native canopy is present, however no trees are proposed for removal. No further assessment required.
<i>Falsistrellus tasmaniensis</i>	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.	Suitable habitat is not present within the development area or immediately surrounding the area. No roosting habitat is present on the property. Marginal foraging habitat in the form of native canopy is present, however no trees are proposed for removal. No further assessment required.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-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 a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.	Suitable habitat is not present within the development area or immediately surrounding the area. No roosting habitat is present on the property. Marginal foraging habitat in the form of native canopy is present, however no trees are proposed for removal. No further assessment required.
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	Roosts in tree hollows but may be found in buildings. Primarily found in gullies and river systems that drain the Great Dividing Range. Occurs in a range of habitats including woodlands to moist or dry eucalypt forest, rainforest with greatest preference for tall wet forests. Forages along creeks and river corridors.	Suitable habitat is not present within the development area or immediately surrounding the area. No roosting habitat is present on the property. Marginal foraging habitat in the form of native canopy is present, however no trees are proposed for removal. No further assessment required.
<i>Vespadelus troungtoni</i>	Eastern Cave Bat	Roosts in caves, mine shafts. Generally found in dry open forest and woodlands. Prefers areas near cliffs and rocky overhangs.	Suitable habitat is not present within the development area or immediately surrounding the area. No roosting habitat is present on the property. Marginal foraging habitat in the form

Scientific Name	Common Name	Habitat Requirements	Site Suitability
			of native canopy is present, however no trees are proposed for removal. No further assessment required.
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed 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.	Suitable habitat is not present within the development area or immediately surrounding the area. No roosting habitat is present on the property. Marginal foraging habitat in the form of native canopy is present, however no trees are proposed for removal. No further assessment required.
<i>Miniopterus australis</i>	Little Bent-winged Bat	Moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows 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. In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats ( <i>M. schreibersii</i> ) and appears to depend on the large colony to provide the high temperatures needed to rear its young.	Suitable habitat is not present within the development area or immediately surrounding the area. No roosting habitat is present on the property. Marginal foraging habitat in the form of native canopy is present, however no trees are proposed for removal. No further assessment required.
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	Primarily roosts in caves but will utilise mine shafts, storm-water tunnels, buildings and other man-made structures. Forms colonies within a maternity cave and disperse within a 300km range. Forage in forested areas in the tree canopy.	Suitable habitat is not present within the development area or immediately surrounding the area. No roosting habitat is present on the property. Marginal foraging habitat in the form of native canopy is present, however no trees are proposed for removal. No further assessment required.
<i>Myotis macropus</i>	Southern Myotis	Roosts in groups of 10-15 in areas close to water. Will utilise caves, mine shafts, tree hollows, storm water drains, buildings, bridges and dense foliage. Forages over water bodies catching insects and small fish.	Suitable habitat is not present within the development area or immediately surrounding the area. No roosting habitat is present on the property.



Scientific Name	Common Name	Habitat Requirements	Site Suitability
			Marginal foraging habitat in the form of native canopy is present, however no trees are proposed for removal. No further assessment required.

## 7.4 Appendix IV – Recommended planting.

For particular species for this location:

<https://files.northernbeaches.nsw.gov.au/sites/default/files/documents/general-information/native-plants/pittwaternativegardeningbooklet.pdf>



See map 4 and the site is mapped as

■ Sandstone Crests

■ Shale Slopes

So species of these groups would be suitable – as well as most in this areas PCT

For images see:

<https://www.northernbeaches.nsw.gov.au/environment/native-plants/native-plant-list>

### 4. SHALE SLOPES

These are usually steep slopes which either occur below the Hawkesbury Sandstones, or have Narrabeen Shales and sandstones as the parent material. They generally support open forest communities.

#### A. OPEN FOREST

COMMON NAME	SCIENTIFIC NAME	CHARACTERISTIC
<b>Trees</b>		
Black She-oak	<i>Allocasuarina littoralis</i>	Good screen tree. Deep fissured bark and cones cylindrical with flat apex.
Forest Oak	<i>Allocasuarina torulosa</i>	Good screen tree. Deep fissured bark and cones ball-like.
Sydney Red Gum/ Smooth-barked Apple	<i>Angophora costata</i>	Orange to salmon coloured smooth bark. Branches contort and twist.
Roughbarked Apple	<i>Angophora floribunda</i>	Bark is brown and fibrous on all limbs with contorted upper limbs.
NSW Christmas Bush	<i>Ceratopetalum gummiferum</i>	Flowers small and white. Fruits swell to an attractive bright red in summer.
Bangalay Gum	<i>Eucalyptus botryoides</i>	Rough reddish bark with salt resistant leaves.
Spotted Gum	<i>Eucalyptus maculata</i>	Tall tree with smooth spotted-skin bark.
Blueberry Ash	<i>Elaeocarpus reticulatus</i>	Small tree with attractive fringed and bell shaped white flowers.
Grey Gum	<i>Eucalyptus punctata</i>	Grey bark with large cream patches. Favoured koala food tree.
Bastard Mahogany	<i>Eucalyptus umbra</i>	Deep fibrous bark with leaves thick and tough.
Port Jackson Fig	<i>Ficus rubiginosa</i>	Small tree. Purple figs with warty markings. Leaves have furry layer of rusty coloured hairs on the lower surface.
Turpentine	<i>Syncarpia glomulifera</i>	Straight trunk with deep fibrous bark and flowers cream to white in clusters
<b>Shrubs :</b>		
Matchheads	<i>Comesperma ericinum</i>	Slender shrub with bright pink to purple clusters of matchhead-like flowers.
Hop Bush	<i>Dodonaea triquetra</i>	Soft leafy shrub with thin textured leaves.
Pink Spider Flower	<i>Grevillea sericea</i>	Flowers are pink to purple tolerating dry, open areas.
White Spider Flower	<i>Grevillea linearifolia</i>	Graceful slender shrub with flowers a variety of white/red/pink in colour.
Dogwood	<i>Jacksonia scoparia</i>	Grey to green leafless shrub. Flowers are yellow with red markings.
Paperbark Tea-tree	<i>Leptospermum trinervium</i>	Stout trunk and papery-flaky bark with white flowers.

Burrwong Palm	Macrozamia communis	Large tufted fern-like shrub with long spiky leaves and fleshy red seeds.
Mock Olive	Notelaea longifolia	Leaves are olive green. Fruits black olive-like.
Bleeding Heart	Omalanthus populifolius	Large heart-shaped leaves turning red before falling.
Native Holly	Oxycobium ilicifolium	Erect spiky shrub, flowers yellow with red markings.
Everlasting or Paper Daisy	Ozothamnus diosmitifolium	Leaves are tiny narrow and dark green. Flowers are white and daisy-like.
Flat-pea	Platylobium formosum	Scrambling pea-shrub with leaves heart-shaped and flowers yellow with red markings.
Carrot Tops	Platysace linearifolia	White flowers in dense clusters and soft thread-like foliage.
Elderberry Panax	Polyscias sambucifolia	Flowers green to yellow in clusters with purple fruits.
Elliptical Bush-pea	Pultenaea elliptica	Small erect shrub with flowers rich yellow with dark red markings.
Rapanea	Rapanea variabilis	Tiny pale-yellow flowers clustered on old wood.
Waratah	Telopea speciosissima	Spectacular crimson flower. Rare in Pittwater due to illegal picking of flowers.
Native Peach	Trema aspera	Leaves are an elegantly shaped like peach tree leaves with bisexual flowers.
Wikstroemia	Wikstroemia indica	Leaves hairless and soft with shiny red fruiting berries.
Wikiea	Wikiea huegeliana	Stiff leathery leaves with yellow flowers.
Grass Tree	Xanthorrhoea spp.	Long grass-like leaves with a tall flower spike. The rich nectar is food for birds and insects.
Zieria	Zieria smithii	Strong fragrant foliage with tiny pink flowers.
<b>Herbs, Climbers, Grasses and Scramblers</b>		
Appleberry	Billardiera scandens	Slender climber or scrambler with edible purple fruits.
Barbed Wire Grass	Cymbopogon refractus	Seed head looks like the twist in a barbed wire. Tall wiry stems and greyish-green aromatic leaves.
Wallaby Grass	Danthonia species	Erect clumping grass. Fluffy open seed spikelets. Good feature plant.
Desmodium	Desmodium rhytidophyllum	Scrambler with rusty felt all over leaves and tiny pink flowers.
Plume Grass	Dichelachne sp.	Distinctive flowering plume. Delicate tufting grass. Excellent landscaping feature.
Kangaroo Grape	Cissus antarctica	Robust woody climber with glossy black edible fruit.
Entolasia	Entolasia species	Erectly sprawling grass with leaves angled at right angles to stem. Slender seed heads.

False Sansparilla/ Sweet Tea	Hardenbergia violacea	Attractive twiner with rich purple pea flowers. Leaves boil to a tea.
Twining Guinea Flower	Hibbertia dentata	Scrambling vine with toothed leaves and yellow flowers.
Dusky Coral Pea	Kennedia rubicunda	Robust twiner with large red pea-flowers: black markings.
Basket Grass	Opismenus species	Creeping broad leaved grass. Alternative lawn. Prolific grower.
Weeping Meadow Grass	Microleana stipoides	Softly weeping clumping grass. Alternative lawn. Non-allergenic or asthmatic.
Jasmine Morinda	Morinda jasminoides	Scrambling climber. Flowers cream with orange-blossom fragrance.
Wonga-Wonga Vine	Pandorea pandorana	Tall woody climber with white cascades of flowers in Spring.
Snake Vine	Stephania japonica	Climber with leaves heart-shaped and fruit shiny yellow to orange or red.
<b>Ferns</b>		
Blechnum	Blechnum spp.	Fern with leathery fronds.
Rasp Fern	Doodia aspera	Small erect fern with rough fronds.
Common Maidenhair	Adiantum aethiopicum	Delicate fern found in dense colonies.
Umbrella Fern	Sticherus flabellatus	Erect fern to 1m high with fronds finely toothed.
Woolly Xanthosia	Xanthosia pilosa	Small herbaceous groundcover. Woolly leaves and tiny cluster of greenish-white flowers.
<b>B. COASTAL HEATHS (ON SHALE SLOPES)</b>		
<b>Trees:</b>		
Lilly Pilly/ Broad-leaf	Acmena smithii	Dense dark glossy foliage with fruit succulent and edible.
Lillypilly	Allocasuarina distyla	Dense and bushy with male flowers a rust red in colour.
Coastal She-Oak	Allocasuarina verticillata	Softly drooping grey-green foliage. Found at Mona Vale, Bungan Beach and Newport.
Drooping She-oak	Banksia integrifolia	Leaves are a stiff, leathery dark-green above with white hairs below.
<b>Shrubs:</b>		
Sydney Golden Wattle	Acacia longifolia var. sophorae	Robust sprawling shrub; flower heads a golden-yellow. Quick grown. Sunny position.
Myrtle Wattle	Acacia myrtifolia	Attractive red-tinged foliage with flower heads pale yellow. Small compact shrub to 0.5m.
Sweet-Scented Wattle	Acacia suaveolens	Pale yellow perfumed balls of flowers and blue-green leaves.
Breyia	Breyia oblongifolia	Flowers are tiny reddish with leaves an oblong green.

Common Correa	Correa reflexa	Leaves are papery and heart shaped with flowers a red-white-green mix.
Stiff Bottlebrush	Callistemon rigidus	Leaves are stiff and rough and flowers have red filaments.
Saw Sedge	Gahnia melonocarpa	Taller leafy sedge. Great feature plant with spikelets developing masses of shiny black nuts.
Goodenia	Goodenia ovata	Leaves are broad and glossy with flowers yellow.
Dagger Hakea	Hakea teretifolia	Stiff prickly shrub with small white flowers and 'mountain devil' type fruit. Excellent screen plant.
Dogwood	Jacksonia scoparia	Unusual erect shrub with greyish-green leafless foliage and prolific yellow and red pea flowers. Flowers have scent.
Butterfly Bush/ White Flowering Kurzea	Kurzea ambigua	Leaves are tiny and clustered with flowers white.
Rusty Petals	Lasiopetalum ferrugineum	Flowers a rusty colour. Attractive foliage; long green leaves and white undersides.
Coastal Tea Tree	Leptospermum laevigatum	Tall coastal shrub with white flowers.
Native Parsley Bush	Lomatia silaifolia	Rigid and highly divided leaves forming a tuft with white flowers.
Toothed Daisy Bush/ Native Daisy	Olearia tomentosa	Attractive coastal shrub. Soft hairy leaves. White-yellow daisy flowers.
Melaleuca	Melaleuca hypericifolia	Aromatic leaves and flowers with large rusty-red spikes.
Rough Fruit	Pittosporum revolutum	Yellow fragrant flowers with a large fruit pod opening to reveal brilliant red seeds.
Native Parsnip	Platysace lanceolata	Spear-shaped thin leaves with white flowers in dense clusters.
Elderberry Panax	Polyscias sambucifolia	Tough wooded shrub, flowers are greenish with yellow anthers.
Large-leaved Bush-pea	Pultenaea daphnoides	Slender attractive shrub with yellow flowers with red markings.
Elliptical Bush-pea	Pultenaea elliptica	Small erect shrub bearing rich yellow flowers with dark red markings.
Rapanea	Rapanea variabilis	Flowers are a pale yellow and tiny, found clustered on old wood.
Coastal Rosemary	Westringia fruticosa	Dense spreading shrub with long narrow throat white flowers.
Zieria	Zieria smithii	Strong fragrant foliage with tiny pink flowers.
<b>Herbs, Climbers, Grasses and Scramblers</b>		

Flannel Flowers	Actinotus helianthi	Stunning white softly hairy daisy type flowers tipped with green on edge of petals.
Appleberry	Billardiera scandens	Slender climber or scrambler with edible purple fruits.
Centella	Centella asiatica	Creeping herb with serrated leaves.
Native Clematis	Clematis species	Vigorous twining dense climber with fluffy clusters of white flowers in Spring.
Desmodium	Desmodium varians	Beautiful tiny leaved creeper with prolific sprays of pink pea flowers most of the year.
Dianella	Dianella caerulea	Tufted herb with rich blue flowers.
Knobbly Club Rush	Ficinia nodosa	Clump forming sedge with spikelets in dense globular clusters.
Love Creeper	Glycine sp.	Slender twiner. Flowers are variable in colour pink-mauve to blue sprays in Spring-Summer.
Hop Goodenia	Goodenia ovata	Small bushy herb. Soft glossy leaves. Bright yellow flowers. Attracts butterflies.
Golden Guinea Flower	Hibbertia scandens	Vigorous scrambler with spectacular flowers. Brilliant red succulent fruits attract birds.
Dusky Coral Pea	Kennedia rubicunda	Robust twiner with large red pea flowers and black markings.
Spiny-headed Mat-rush	Lomandra longifolia	Large tufted herb with tough strap-like leaves and edible, scented flowers.
Snake Vine	Stephania japonica var. discolor	Climber or scrambler with leaves heart-shaped and fruits a shiny yellow/orange.
Kangaroo Grass	Themeda australis	Tufted grass with brown to purplish spikelet clusters and a long, wiry flowering stem.
<b>C. CLOSED FORESTS (RAINFORESTS) (SHALE SLOPES):</b>		
<b>Trees</b>		
Hickory Wattle	Acacia implexa	Light willowly foliage with pale yellow flower heads.
Lilly Pilly/ Broad-leaf	Acmena smithii	Dense dark, glossy foliage with winter fruit edible.
Lillypilly	Allocasuarina torulosa	Beautiful rounded shaped tree with softly drooping foliage.
Forest She-oak	Allocasuarina myrtifolia	Flowers are cream with leaves a dark green.
Grey Myrtle	Backhousia myrtifolia	Small tree with papery bark and yellow-white bottlebrush flowers.
Willow Bottlebrush	Callistemon salignus	Leaves fragrant when crushed and masses of white flowers.
Murrogun	Cryptocarya microneura	Flowers are white with fruit a shiny black berry and leaves an oblong shape.
Black Plum	Diospyros australis	Rough reddish bark, short trunk and spreading crown.
Bangalay	Eucalyptus botryoides	

Guloo	<i>Guloo semiglauc</i>	Flowers are small, fruit is a 3 winged capsule and leaf undersurface grey/green.
Coachwood	<i>Ceratopetalum apetalum</i>	Bark smooth and mottled with leaves stiff and toothed and small white flowers.
Sandpaper Fig	<i>Ficus coronata</i>	Very rough leaves with figs eaten by many birds and mammals.
Port Jackson Fig.	<i>Ficus rubiginosa</i>	Rusty leaf undersides with figs eaten by bats, birds, flying foxes.
Cheese Tree	<i>Glochidion ferdinandi</i>	Bushy shrub with pale yellow fruits.
Cabbage Tree Palm	<i>Livistona australis</i>	Tall mop-headed palm with tough, shiny leaves. Only native palm tree.
Turnipwood	<i>Rapanea howittiana</i>	Leaves are glossy and hairless with flowers small and cluster on old wood.
Crab Apple	<i>Schizomeria ovata</i>	Leaves are glossy, toothed and dense. Flowers are white and fruit fleshy.
Turpentine	<i>Syncarpia glomulifera</i>	Straight trunked tree with deep fibrous bark and cream/white flower clusters.
Blue Lillypilly	<i>Syzygium oleosum</i>	Dark dense foliage with a succulent blue fruit edible by animals.
Magenta Lily Pilly	<i>Syzygium paniculatum</i>	Glossy green foliage. Pretty edible succulent pink to red fruits in Summer.
<b>Shrubs:</b>		
Native Hydrangea	<i>Abrophyllum ornans</i>	Elegant. Large soft irregularly toothed leaves, small green-yellowish spray of flowers in Summer. Dark purple berries.
Red Fruited Olive Plum	<i>Cassine australis</i>	Broad green leaves with wavy margins. Bright orange fruit.
Orange Thorn	<i>Citriobatus pauciflorus</i>	Stiff wiry shrub with fine thorns and small delicate leaves. Fine white flowers developing into a bright orange berry. Great bird habitat.
Brittle Wood	<i>Claonylon australe</i>	Broad leaf with greenish flowers in Summer.
Clerodendrum	<i>Clerodendrum tomentosum</i>	Young plants common with soft furry leaves with flowers moth pollinated.
Native Guava	<i>Eupomatia laurina</i>	Flowers white with fruits yellow-purple and edible.
Burrawang Palm	<i>Macrozamia communis</i>	Large tufted, fern-like shrub with long spiky leaves and fleshy red seeds.
Everlasting Paper Daisy	<i>Ozothamnus diosmifolium</i>	Attractive shrub. Mildly scented leaves with dense white clusters of small white flowers.
Rough-fruit Pittosporum	<i>Pittosporum revolutum</i>	Flowers are yellow and fragrant with fruit an orange warty box-shape which is favoured by birds.
Elderberry Panex	<i>Polycias sambucifolia</i>	Tough woody shrub with greenish flowers and yellow anthers.
Scentless Rosewood	<i>Syncorn glandulosum</i>	Leafy shrub with red capsule fruit and flowers a creamy-white to pink mix.

Native Peach	<i>Trema aspera</i>	Fast grower. Good screening shrub. Small black berries attractive to birds.
Tree Heath	<i>Trochocarpa laurina</i>	Unusual large shrub with leaves forming red drooping umbrella-like clusters at the tips of the branches. Small white flower spikes.
Wilkiea	<i>Wilkiea huegeliana</i>	Stiff leathery, toothed leaves with flowers yellow and fruiting. It is favoured by a rare butterfly.
<b>Herbs, Climbers, Grasses and Scramblers</b>		
Gum Vine	<i>Aphanopetalum resinocum</i>	Woody climber with leaves glossy and toothed and flowers greenish.
Native Sedge	<i>Carex appressa</i>	Graceful attractive sedge with dense, bright green narrow leaves and attractive flower spikelets.
Kangaroo Grape	<i>Cissus antarctica</i>	Robust woody climber with glossy black, edible fruit.
Water vine	<i>Cissus hypoglauca</i>	Robust woody vine with black grape-like fruits edible by animals.
Swordsedge	<i>Gahnia sieberiana</i>	Tall leafy sedge found in dense thickets.
Settlers Flax	<i>Gymnostachys anceps</i>	Unusual, attractive and tall flax. Dark shiny black fruit.
Branching Flag Grass	<i>Liberia paniculata</i>	Tufted herb with strap leaves to 0.5m with tall sprays of white flower heads in Spring.
Spiny-headed Mat-rush	<i>Lomandra longifolia</i>	Tough strappy leaved tufted shrub. Sweetly pale yellow flower spike in Spring.
Jasmine Morinda	<i>Morinda jasminoides</i>	Scrambling climber with masses of soft leaves and orange fragrant flowers.
Basket Grass	<i>Opismenus imbecillis</i>	Creeping broad leaved grass. Excellent groundcover. Prolific grower in Summer.
Wonga-Wonga Vine	<i>Pandorea pandorana</i>	Tall woody climber with white flowers in large drooping masses.
<b>Ferns:</b>		
Rough Tree Fern	<i>Cyathea australis</i>	Treefern with warty projections on it's stalk.
Necklace Fern	<i>Asplenium flabellifolium</i>	A weak fern with trailing fronds.
Umbrella Fern	<i>Sticherus flabellatus</i>	Erect fern with fronds fanning in fine toothed segments.
Blechnum	<i>Blechnum</i> spp.	Fern with leathery fronds.
Rasp Fern	<i>Doodia aspera</i>	Small erect fern with rough fronds.
Common Maidenhair	<i>Adiantum aethiopicum</i>	Delicate fern found in dense colonies.



## 8 Expertise of author

With over 20 years wetland and urban ecology experience, a great passion for what she does, and extensive technical and on-ground knowledge make Geraldene 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. Geraldene was a key contributor to the recent set of Guidelines commissioned by South East 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

#### QUALIFICATIONS 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