

Biodiversity Assessment

191 Whale Beach Road

Whale Beach

By Ecological Consultants Australia Pty Ltd TA

Kingfisher Urban Ecology and Wetlands

July 2020 updated March 2022



About this document



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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, Lisa Jones and Julian Reyes 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

Executive Summary

Introduction

- The development will consist of the construction of alts and adds to the residential dwelling.

Methods

- On-ground survey took place on in July 2020 by Senior Ecologist Geraldene Dalby-Ball.
- Flora and fauna observations were recorded on-site using binoculars and physical examination. Notes, photos and samples of flora species were taken 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.

Results

- Proposed works are in cleared areas with remove of some native trees.
Trees proposed for removal are exotic and
 - 5 x *Pittosporum undulatum*,
 - 3 x *Eucalyptus umbra* (20, 21, 22) see photo below and see the Arborist Report.
 - 1 x Bottlebrush (planted *Callistemon saligna*)

(see Arborist report for details).

These were inspected and not currently in use by native fauna for nesting/roosting – blossoms of the *Eucalyptus* would be used for feeding by insects including native bees.

- Environmental weeds are present on-site listed only *Asparagus Fern* (3 plants) were noted and are to be removed as a priority.
- The site does not contain key habitat for threatened species. No threatened flora or fauna species were found on-site during on site searches;
- Themeda Grass lands EEC is not on the site but could be rehabilitated in some areas if shale soils are present. NB None obvious during inspections.

Mitigation Measures

Before works:

- Tree Protection as per Arborist report.
- Removal of Weeds to prevent spread of

seed. During works:

- Dead wood including upright dead trees and fallen logs on the ground should be retained and protected during works as they provide high quality habitat for threatened fauna species, refer to Arborist report.
- Bush hygiene protocols should be followed to prevent the spread of pathogens including *Phytophthora*.

After works:

- Revegetation works will be conducted as per Landscaping Plan for flora species. Additional native species can be added to landscaping – it is recommended these are locally sourced tube-stock.

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).*
- *Fisheries Management Act 1994 (FM Act).*
- *National Parks & Wildlife Act 1974 (NP&W Act).*
- *Biosecurity Act (superseding the Noxious Weed Act 1993) (NW Act).*

Conclusions and Recommendations

- Weed removal and landscaping can enhance the riparian zone buffer.
- Weeds are currently habitat and landscaping includes shrub species to replace that type of habitat.
- Arborist report recommendations to be applied.

Table of Contents

About this document.....	2
Executive Summary	3
1 Introduction and Purpose	6
1.1 Site Location	7
1.2 Ecological attributes of the site	8
1.3 Legislation and Policy.....	12
2 Methods.....	15
2.1 Site Inspections	15
2.2 Previous studies	15
3 Results - Flora.....	16
4 Results - Fauna	18
4.1 Threatened fauna	18
4.2 Fauna findings from site assessment.....	20
4.3 Habitat Corridors	21
5 Proposed Development and Impacts	22
5.1 Proposal.....	22
5.2 Direct Impacts	22
5.2.1 Vegetation disturbance and loss	22
5.3 Indirect Impacts.....	22
5.3.1 Weed growth and invasion.....	22
5.3.2 Introduction of pathogens	22
5.4 Assessment of Significance (5-part tests) Summary	22
6 Recommendations	23
6.1 Mitigation Measures.....	23
6.1.1 Delineation of work areas	23
6.1.2 Vegetation clearing control measures	23
6.1.3 Tree Protection	23
6.1.4 Weed management, bush regeneration and planting	23
6.1.5 Weed Removal Techniques	23
6.1.6 Landscaping	23
6.1.7 Nest boxes.....	23
6.1.8 Pathogen prevention	23
6.1.9 Vertebrate Pests	24
6.2 Appendix I – Threatened Species Habitat Preferences.....	25
6.3 Appendix II– Key Weed Removal Methods	39

6.4 Bushland Hygiene Protocols for Phytophthora	43
6.5 Test of Significance.....	44
Microbats - all species together as the site would be only foraging habitat (if anything)	44
7 Expertise of authors	46

1 Introduction and Purpose

Ecological Consultants Australia (ECA) has been contracted by Akin Atilier Architects on behalf of the site owners to provide the Ecological 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 and consistent with the Biodiversity Conservation (BC) Act 2017.

A full BDAR is not required as the site is not on the Biodiversity Vales Map, see Figure 1.1, does not have threatened species, populations or communities and is below the threshold size for auto DBAR. The 'Assessment of Significance' has been undertaken in accordance with the BAM method and the NSW Department of Planning, Industry and Environment & 'Threatened species assessment guidelines'.

The objectives of this Impact Assessment are to:

- Identify any native vegetation communities, significant species or significant habitat features present within the study area.
- Identify any known or potential habitat for threatened species.
- Review the implications of relevant biodiversity legislation and policy.
- Identify potential impacts on significant ecological communities, species or habitats from the proposed development and provide recommendations to assist with the mitigation of those potential impacts during the construction and operation stages.
- Targeted searches for significant species are based on the authors' knowledge of the site.
- Provide recommendations to sustain biodiversity on site and connecting to the site.

Works included a site survey/assessment (July 2020), review of project designs and the arborist assessments.

Limitations of the Study

Considering the site and habitat availability ECA 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*. The author is also very familiar with this area having lived within 3km for over 30 years.

The site was inspected again in February 2022

[illegible]

Ecological Assessment 191 Whale Beach Road, Whale Beach | March 22

1.2 Ecological attributes of the site

The cliff-top property has 95% exotic vegetation, mostly turf. Native trees are limited to a small *Angophora floribunda* and a group of five *Eucalyptus umbra*. A Cabbage Tree Palm is also present and may be natural or planted. Natural ones are growing nearby in both Horden and Wiltshire Reserves and the properties upslope from these reserves. Searches were made for signs of Themeda grasslands community (EEC) as this occurs on these headlands where the shale outcrops or there is a clay lens. None was observed on-site or over the cliff edge.



Turf area dominated by exotic grasses and over the fence between them own an unknown area of the Cliff top is Buffalo grass and asparagus Fern With other non native species



The Cliff top area is dominated by weed species and would be too dangerous to undertake native plant rehabilitation Unless the person was working from top ropes.



Cabbage Tree Palms are locally native and growing on site. Most other vegetation such as seen here, oleander, fishbone fern, turf etc is exotic



Cabbage Tree Palm



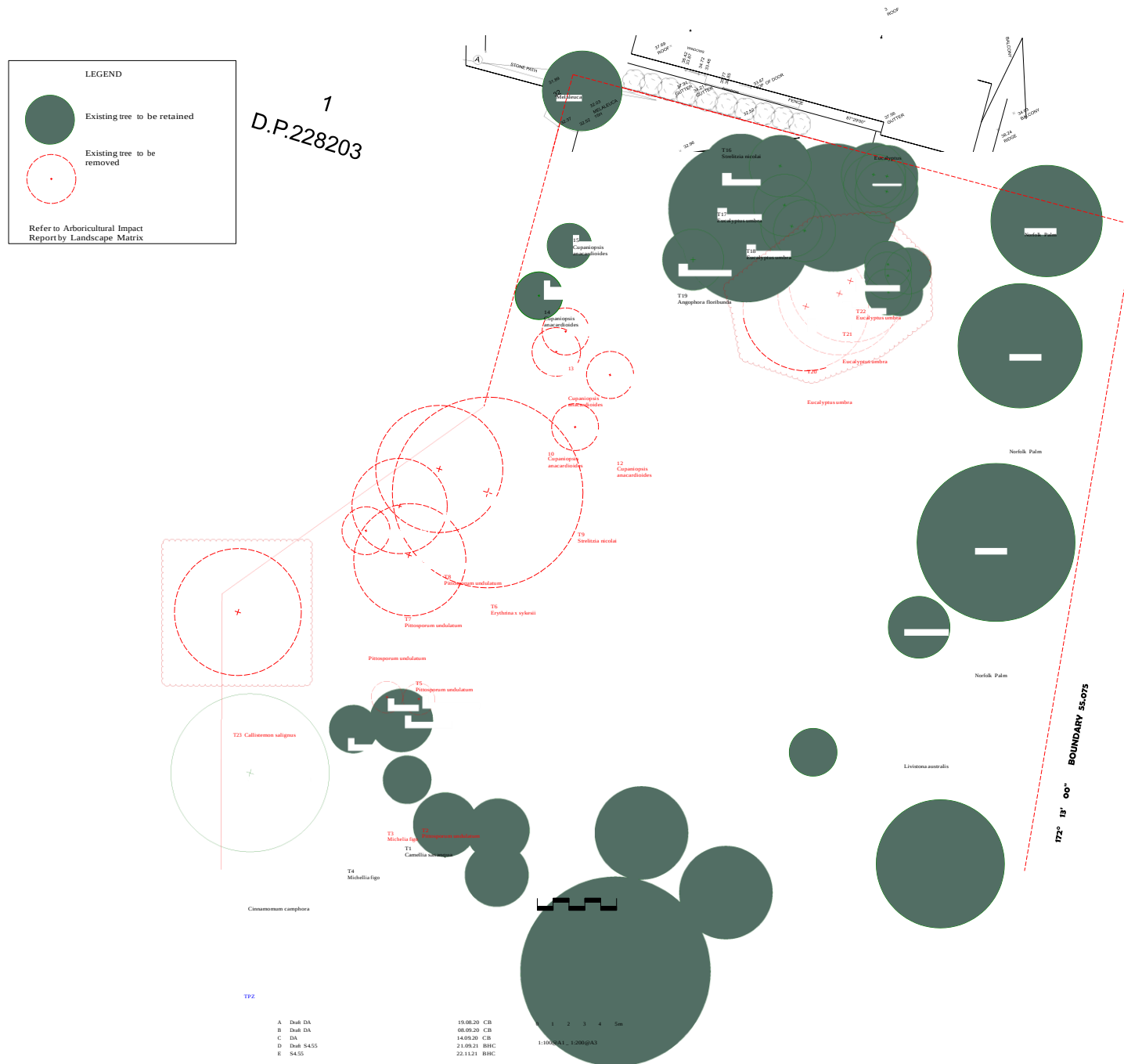
Weed (Asparagus Fern) and NZ Flax



Exotic species dominate and have ecological value for pollinators. There be no significant impact if all the mid and ground vegetation on-site changed.

Turf makes up the major proportion of the site currently.





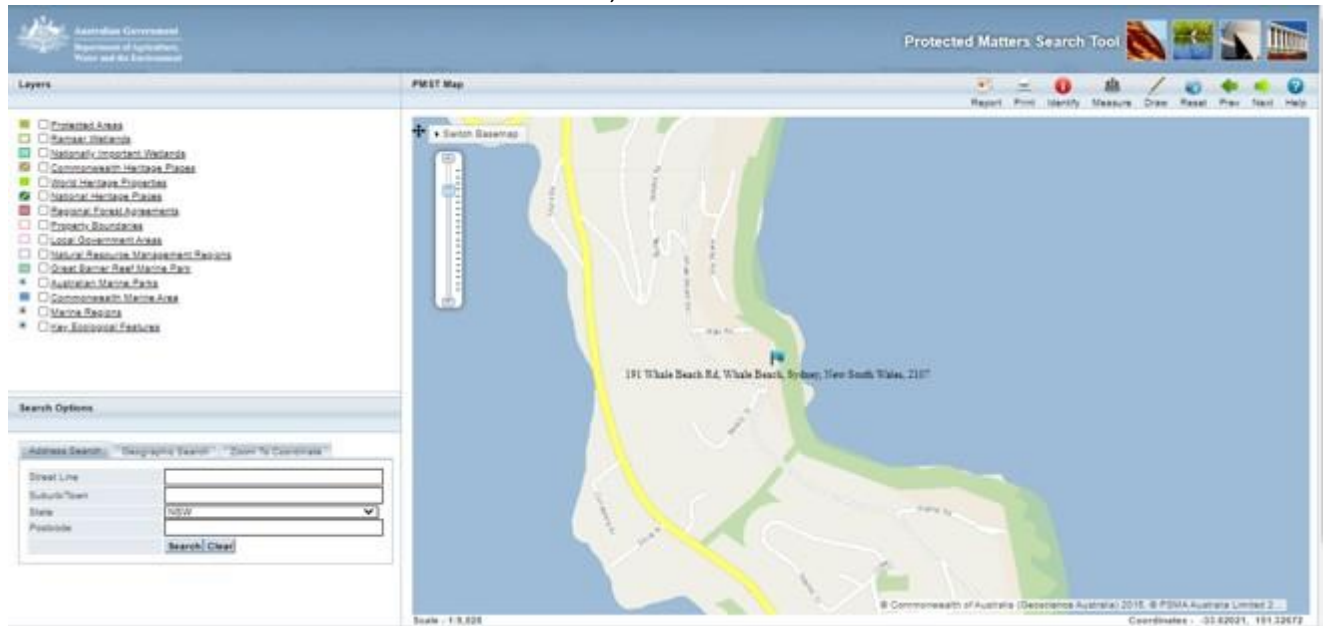
1.3 Legislation and Policy

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

- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).*

A Protected Matters Search was conducted.

Report Generation ID: LN61NP Coordinates: -33.61447,151.33225



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that relate to, the area you nominated. Further information is available by scrolling or following the links below. If you are concerned about a significant impact on one or more matters of national environmental significance, please refer to the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	72
Listed Migratory Species:	57

Listed Threatened Ecological Communities

[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Coastal Upland Swamps in the Sydney Basin Bioregion	Endangered	Community may occur within area
Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion	Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Frogs

[Heleioporus australiacus](#)

Giant Burrowing Frog [1973]

Vulnerable

Species or species habitat likely to occur within area

[Litoria aurea](#)

Green and Golden Bell Frog [1870]

Vulnerable

Species or species habitat likely to occur within area

[Litoria littlejohni](#)

Littlejohn's Tree Frog, Heath Frog [64733]

Vulnerable

Species or species habitat likely to occur within area

[Mixophyes balbus](#)

Stuttering Frog, Southern Barred Frog (in Victoria) [1942]

Vulnerable

Species or species habitat may occur within area

Mammals

[Balaenoptera musculus](#)

Blue Whale [36]

Endangered

Species or species habitat may occur within area

[Chalinolobus dwyeri](#)

Large-eared Pied Bat, Large Pied Bat [183]

Vulnerable

Species or species habitat likely to occur within area

[Dasyurus maculatus maculatus \(SE mainland population\)](#)

Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]

Endangered

Species or species habitat known to occur within area

[Eubalaena australis](#)

Southern Right Whale [40]

Endangered

Species or species habitat likely to occur within area

[Isodon obesulus obesulus](#)

Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]

Endangered

Species or species habitat likely to occur within area

[Megaptera novaeangliae](#)

Humpback Whale [38]

Vulnerable

Species or species

- *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 indicate no significant impact on threatened species, populations or communities.

- *Biodiversity Conservation Act 2016 (BC Act).*

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, providing the Mangroves are protected and stormwater is well managed. The proposed development is complaint with the BC Act. Included under this Act is the 'Biodiversity Values Map' – the site is not mapped within this map.



Figure 2.1 Biodiversity Values Map Source:

<https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap>

- *Fisheries Management Act 1994 (FM Act).*

Stormwater from on-site will be managed such that there is to be a positive or neutral impact on the receiving water.

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

The proposed development is complaint 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 is to manage, and eradicate weeds that cause a high level of environmental, economic or social harm. With the removal of Asparagus Fern and management of weeds near the cliff edge then the sites works with be complaint with the objectives of this Act.

2 Methods

2.1 Site Inspections

Senior Ecologist Geraldene Dalby-Ball assessed the site in July 2020. Weather was fine and sunny during time of visit. During site visits, notes and photos were taken of the important vegetation types, flora and fauna present. Due to the small area of proposed 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.

2.2 Previous studies

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 10km² 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 (OEH).
- VIS – Vegetation Mapping information NSW.
- 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).

Other sources of biodiversity information:

- Relevant vegetation mapping, including:
 - Vegetation Information System, VIS Mapping (OEH).

The following reports were also reviewed:

- Arboricultural Impact Report (2020)
- Architectural designs Akin Atelier Architects dated 30/04/2019 and identified as Drawing Number DA D00, Issue B

3 Results - Flora

Arborist report findings

Six native trees are growing on-site all are proposed for retention. Of the exotic species proposed for removal none have significant fauna habitat that warrants the plants retention. Additional 3 extra trees are also bound for removal. It is noted these are small trees and not of a high ecological conservation significance. Additional trees, tube-stock local native species x 3 have been added to the planting plan. See Arborist report and updated landscape plan for details.

Threatened flora

BioNet records within 10km of the study site had 9 species currently listed as vulnerable or endangered under state and/or commonwealth legislation, out of a total of 1,217 species. The vulnerable and endangered species to focus on-site searches for can be seen in **Table 3.1** below. None were observed. The closest *Syzygium paniculatum* plants are 1) Bangalley Headland and 2) on Barrenjoey Road on private property opposite Dark Gully.

Table 3.1 Threatened flora recorded within a 10km radius since 1993. Source: NSW OEH Bionet 2020.

Family	Scientific Name	Common Name	NSW status	Cwealth status	No. of Records
Rutaceae	<i>Asterolasia elegans</i>		E1	E	1
Rutaceae	<i>Boronia umbellata</i>	Orara Boronia	V,P	V	1
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V,3		5
Euphorbiaceae	<i>Chamaesyce psammogeton</i>	Sand Spurge	E1		2
Myrtaceae	<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	1
Orchidaceae	<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E1,P,2	E	2
Proteaceae	<i>Persoonia hirsuta</i>	Hairy Geebung	E1,P,3	E	3
Myrtaceae	<i>Rhodamnia rubescens</i>	Scrub Turpentine	E4A		12
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1	V	13

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

Threatened plant species findings

No threatened plant species were found during site assessments.

Observed Flora

During the site visit a variety of native flora was observed.

Table 3.2. Native Flora observed during the ecological assessment.

Scientific Name	Common Name	NSW Status	Comth. Status
<i>Adiantum aethiopicum</i>	Common Maidenhair	P	
<i>Wstringea fruitcosa</i>	Westringia	P	
<i>Angophora floribunda</i>		P	
<i>Eucalyptus umbra</i>		P	
<i>Livingstonia australia</i>	Cabbage Tree Palm	P	

N/A: None of these are listed at a State or Federal level as endangered species.

Notable weeds

Weeds of Environmental Significance (Biosecurity Act) observed including:

- Asparagus Fern (minor infestation)

Tree Removal

Trees proposed for removal are exotic and

- 5 x *Pittosporum undulatum*,
- 3 x *Eucalyptus umbra* (20, 21, 22) see photo below and see the Arborist Report.
- 1 x Bottlebrush (planted *Callistemon saligna*)

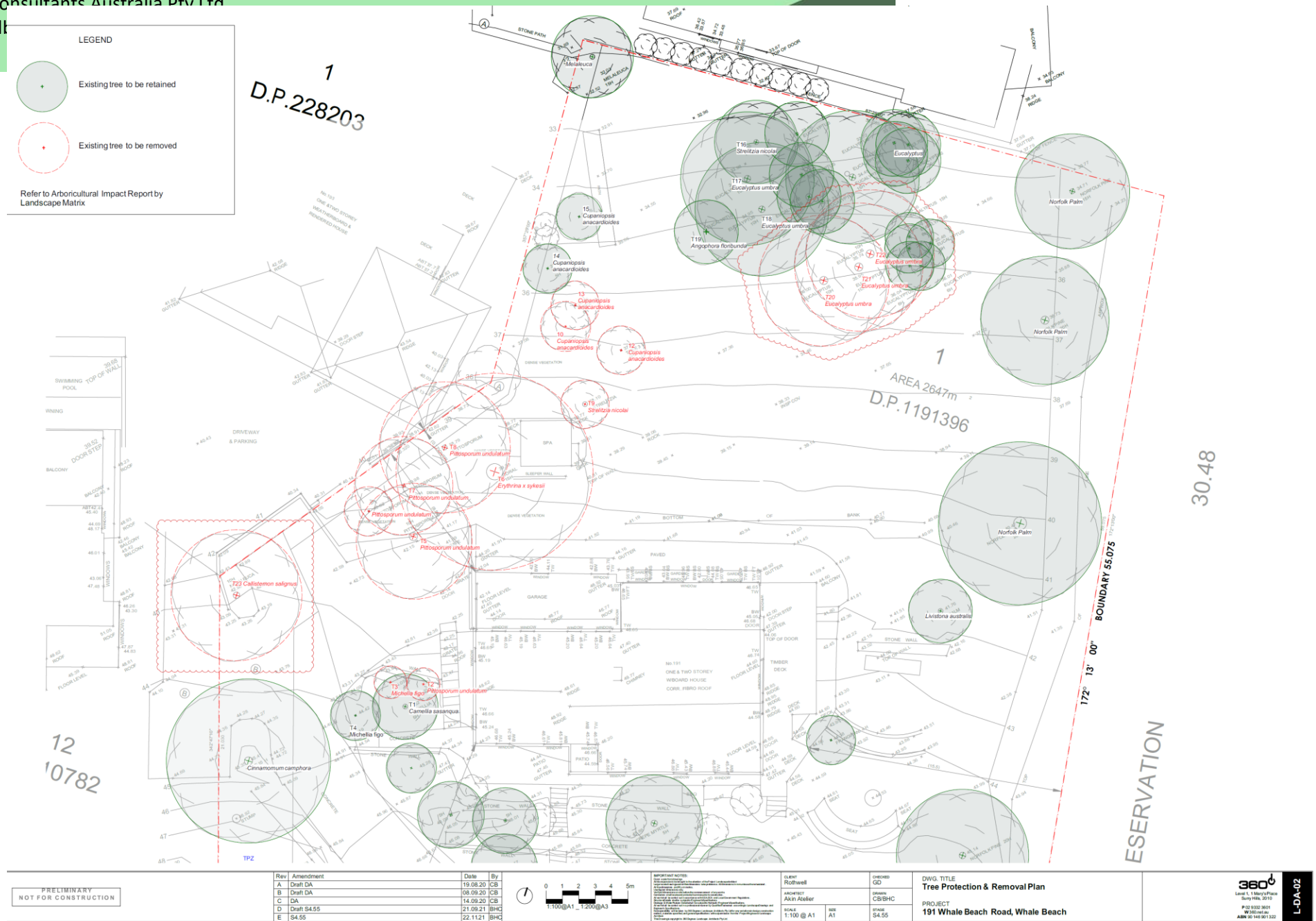
Trees proposed for removal don't contain hollows or provide food for Glossy Black Cockatoos their removal is unlikely to cause any significant impact on their native fauna. Native trees proposed for removal are small trees and not of a high ecological conservation significance (not EEC or key habitat).

Trees have been added to the landscape plan (2 are native). We note the sizes given are 75L and 45L. This is best replaced by Tube stock or max 5L or they will not be locally native.



Photograph 9: Illustrating the location and context of tree numbers 16 to 22.

Native trees proposed for removal



4 Results - Fauna

4.1 Threatened fauna

A total of 361 fauna species have been recorded within 10km of the study site according to BioNet records since 1993. Of these, 46 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 4.1 below, this is based on likelihood of occurrence.

NB: marine animals have been omitted from this list. Habitat is not present for most on the list. Grey-headed Flying-foxes may feed occasionally. Micro-bats are in the area however this site doesn't have key habitat.

Table 4.1 Threatened fauna from Bionet - previous ecological surveys within a 10km radius since 1993.
Source: NSW OEH Bionet 2020.

Class	Scientific Name	Common Name	NSW status	Cwealth status	No. of Records
Amphibia	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V,P	V	3
Amphibia	<i>Pseudophryne australis</i>	Red-crowned Toadlet	V,P		20
Aves	<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A,P	CE	2
Aves	<i>Burhinus grallarius</i>	Bush Stone-curlew	E1,P		50
Aves	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V,P,3		1
Aves	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V,P,2		43
Aves	<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E1,P,2	E	1
Aves	<i>Esacus magnirostris</i>	Beach Stone-curlew	E4A,P		1
Aves	<i>Glossopsitta pusilla</i>	Little Lorikeet	V,P		3
Aves	<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V,P		4
Aves	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V,P		38
Aves	<i>Hieraaetus morphnoides</i>	Little Eagle	V,P		3
Aves	<i>Ixobrychus flavicollis</i>	Black Bittern	V,P		1
Aves	<i>Lathamus discolor</i>	Swift Parrot	E1,P,3	CE	3
Aves	<i>Neophema pulchella</i>	Turquoise Parrot	V,P,3		1
Aves	<i>Ninox connivens</i>	Barking Owl	V,P,3		17

Class	Scientific Name	Common Name	NSW status	Cwealth status	No. of Records
Aves	<i>Ninox strenua</i>	Powerful Owl	V,P,3		178
Aves	<i>Numenius madagascariensis</i>	Eastern Curlew	P	CE,C,J,K	8
Aves	<i>Pandion cristatus</i>	Eastern Osprey	V,P,3		6
Aves	<i>Petroica boodang</i>	Scarlet Robin	V,P		1
Aves	<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	V,P		2
Aves	<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V,P		2
Aves	<i>Tyto novaehollandiae</i>	Masked Owl	V,P,3		2
Mammalia	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V,P		21
Mammalia	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V,P	V	6
Mammalia	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V,P	E	1
Mammalia	<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern)	E1,P	E	21
Mammalia	<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V,P		4
Mammalia	<i>Miniopterus australis</i>	Little Bent-winged Bat	V,P		25
Mammalia	<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V,P		27
Mammalia	<i>Myotis macropus</i>	Southern Myotis	V,P		7
Mammalia	<i>Petauroides volans</i>	Greater Glider	P	V	1
Mammalia	<i>Petaurus norfolcensis</i>	Squirrel Glider	V,P		3
Mammalia	<i>Phascolarctos cinereus</i>	Koala	V,P	V	70
Mammalia	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	P	V	1
Mammalia	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V,P	V	84

Class	Scientific Name	Common Name	NSW status	Cwealth status	No. of Records
Mammalia	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V,P		4
Mammalia	<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V,P		1
Reptilia	<i>Varanus rosenbergi</i>	Rosenberg's Goanna	V,P		3

Note: E = Endangered, V = Vulnerable, P = Protected. Species in bold have been identified as having appropriate habitat present on-site.

Likelihood of occurrence

Habitat is not present for most on the list. During the survey, none of the above threatened species were observed on-site. However, marginal foraging habitat and refugee habitat for the Grey-headed Flying-fox, Little Eagle and Large Forest Owls were recorded within the study area. Marginal habitats identified for Microbat species to forage.

Endangered populations

Two endangered populations have been recorded to occur within 10km of the site see Table 4.2. Habitat is not present of either species.

Table 4.2. Endangered Populations in the LGA. Source NSW OEH Bionet 2020.

Endangered Population	Scientific Name	NSW status	Cwealth status	No. of Records
Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	<i>Petaurus norfolcensis</i>	E2,V,P		1
Koala in the Pittwater Local Government Area	<i>Phascolarctos cinereus</i>	E2,V,P	V	70

4.2 Fauna findings from site assessment

Table 4.3 provides a list of vertebrate fauna recorded during the site visit.

Table 4.3. Fauna recorded on the site.

Class	Scientific Name	Common Name	NSW Status	Comth. Status
Reptilia	<i>Lampropholis delicata</i>	Dark-flecked Garden Sunskink	P	
Aves	<i>Ocyphaps lophotes</i>	Crested Pigeon	P	
Aves	<i>Falco cenchroides</i>	Nankeen Kestrel	P	

Class	Scientific Name	Common Name	NSW Status	Comth. Status
Aves	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	P	
Aves	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	P	

N/A: None of these are listed at a State or Federal level as endangered species.

4.3 Habitat Corridors

Cliff-tops are important areas for linking fauna habitats. This location has a very narrow bank of vegetation that would otherwise link the crown land reserve to the South with the Dune and headland vegetation to the North.



Figure 4.1 Habitat Corridor possibilities. Source: Google Maps 2020.

5 Proposed Development and Impacts

5.1 Proposal

Residential home on residential block. See architectural drawings for details.

5.2 Direct Impacts

5.2.1 Vegetation disturbance and loss

Turf and exotic garden plants will be removed. Additional planting is proposed See Landscape Plan includes *Eucalyptus botryoides* and *Banksia integrifolia* (x3) see 2022 Landscape Plan

5.3 Indirect Impacts

The proposed actions will not make the site any lower in biodiversity values. Currently the turf edge is to the top of the cliff-top with exotic and native plants growing on the cliff below.

5.3.1 Weed growth and invasion

Weed species may arise within the direct works zone and surrounding remnant bushland through soil disturbance or by being brought in as seed on work machinery, tools, equipment and worker clothes (e.g. boots). Soil disturbance combined with the elevated nutrients and increased light exposure may result in increased weed growth, aggravated by the high abundance of weeds present pre-works.

5.3.2 Introduction of pathogens

The introduction of pathogens may occur into the site, and surrounding remnant bushland, 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.

5.4 Assessment of Significance (5-part tests) Summary

None required. Following is general information on species that are in the general area and mobile.

Microbats

Threatened Microbat species (Eastern Freetail-bat, Yellow-bellied Shearwater Bat, Eastern False Pipistrelle, Eastern Bentwing-bat and Southern Myotis) were identified as having potential foraging habitat within the site. Proposed trees to be removed do not contain hollows, flaking bark or other roosting habitat for microbat species. These trees may contain marginal foraging habitat for species which feed on insects in or above the canopy. This habitat may be disturbed during proposed works.

Grey-headed Flying-Fox

The threatened Grey-headed Flying-Fox (*Pteropus poliocephalus*) was identified as having potential foraging habitat within the site. There are no endangered populations of Grey-headed Flying-foxes existing at near the site.

Bushfire

Bushfire risk absent

6 Recommendations

6.1 Mitigation Measures

6.1.1 Delineation of work areas

During construction, impacts on the site and native trees is to be minimized by the delineation of works zones.

6.1.2 Vegetation clearing control measures

Most of the vegetation planned for clearing (areas within the footprints of driveways and building envelopes) are trees, turf and weeds. In this case, no vegetation clearing control measures are necessary other than tree removal. Refer to Arborist report.

6.1.3 Tree Protection

Tree protection will be consistent with the Arborist report.

6.1.4 Weed management, bush regeneration and planting

Weed management, landscaping and bush regeneration will occur as per Landscaping Plan. (See Landscaping Plan)

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).

6.1.6 Landscaping

Landscaping will follow the Landscaping Plan and include locally native species.

6.1.7 Nest boxes

Although it is not critical, installation of a single nest box designed for microbats should be added to the site to replace potential loss of roosting habitat.

Image from: nestboxes.com.au

6.1.8 Pathogen prevention

To prevent the introduction of pathogens, Bushland Hygiene Protocols should be followed. The site is considered to be an area which may promote the spread



of Phytophthora (a group of fungus-like diseases affecting plants) due to its moist soil and proximity to water. It is recommended that Bushland Hygiene Protocols be followed closely.



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



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

6.1.9 Vertebrate Pests

Vertebrate pests (cats, dogs, foxes) would not be considered a significant problem at the site and no actions are suggested for their control.

6.2 Appendix I – Threatened Species Habitat Preferences

Likelihood of Occurrence

Family	Scientific Name	Common Name	BC Status	EPBC Status	Habitat Preferences	Site Suitability
Rutaceae	<i>Asterolasia elegans</i>		E1	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Found in sheltered forests on mid-to lower slope sand valleys, e.g. in or adjacent to gullies which support sheltered forest.	Not present
Rutaceae	<i>Boronia umbellata</i>	Orara Boronia	V,P	V	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.	Not present
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V,3		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.	Not present
Euphorbiaceae	<i>Chamaesyce psammogeton</i>	Sand Spurge	E1		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.	Not present

Myrtaceae	<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	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. 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.	Not present
Orchidaceae	<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E1,P,2	E	Grows in dry sclerophyll forest and moss gardens over sandstone.	Not present
Proteaceae	<i>Persoonia hirsuta</i>	Hairy Geebung	E1,P,3	E	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	Not present
Myrtaceae	<i>Rhodamnia rubescens</i>	Scrub Turpentine	E4A		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.	Not present
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1	V	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.	Not present – possible but only if sheltered

Fauna

Class	Scientific Name	Common Name	BC Status	EPBC Status	Records	Habitat Preferences	Site Suitability
Amphibia	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V,P	V	3	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.	Not present
Amphibia	<i>Pseudophryne australis</i>	Red-crowned Toadlet	V,P		20	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.	Not present
Aves	<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A,P	CE	2	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.	Not present
Aves	<i>Burhinus grallarius</i>	Bush Stone-curlew	E1,P		50	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	Not present

						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.	
Aves	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V,P,3		1	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.	Not present
Aves	<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V,P,2		43	Lives in coastal woodlands and drier forest areas, open inland woodlands or timbered watercourses where casuarinas (or sheoaks), its main food trees, are common. Glossy black-cockatoos occasionally eat seeds from eucalypts, angophoras, acacias and hakeas, as well as eating insect larvae. Prefers to nest in the hollows of large, old eucalypt trees, alive or dead. The typical nest site will be around 3 to 30 metres above the ground.	Not present
Aves	<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E1,P,2	E	1	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	Not present
Aves	<i>Diomedea exulans</i>	Wandering Albatross	E1,P	E	3	The Wandering Albatross visits Australian waters extending from Fremantle, Western Australia, across the southern water to the Whitsunday Islands in Queensland between June and September. It has been recorded along the length of the NSW coast. At other times birds roam the southern oceans and commonly follow fishing vessels for several days. Wandering albatross spend the majority of their time in flight, soaring over the southern oceans. They breed on a number of islands just north of the Antarctic Circle: South Georgia Island (belonging to the UK), Prince Edward and Marion Islands (South Africa), Crozet and Kerguelen Islands (French Southern	Not present

						Territories) and Macquarie Island (Australia). Breeding takes place on exposed ridges and hillocks, amongst open and patchy vegetation. Wandering albatross pairs mate for life; these long-lived birds do not reach sexual maturity until 9-11 years of age. Wandering Albatross breed biennially in small, loose colonies among grass tussocks, using a large mud nest. A single egg is laid; both parents incubate the egg (that hatches after two months) and feed the growing chick, which remains on the nest for around 9 months. They feed in pelagic, offshore and inshore waters, often at night, taking fish and cephalopods such as squid, crustaceans and carrion, and will often follow ships feeding on the refuse they trail.	
Aves	Diomedea gibsoni	Gibson's Albatross	V,P	V	1	Essentially endemic to the Auckland Islands of New Zealand. The non-breeding range is poorly known however the species probably disperses across the southern Pacific. The species is regularly encountered on trans-Tasman shipping routes and at seas off Sydney, and regularly occurs off the NSW coast usually between Green Cape and Newcastle. This species is known only to breed on the Adams, Disappointment and Auckland Islands in the sub-Antarctic Auckland Island group. Breeds biennially in colonies among grass tussocks on isolated sub-Antarctic islands, using the wind to travel great distances both during and between breeding seasons. Most eggs are laid in December and January, with chicks fledging the following year in January and February. The annual breeding population is relatively small and has been estimated at 6,077 pairs. This species regularly occurs off the NSW coast from Green Cape to Newcastle. Although representing a small proportion on its total foraging area, potential forage in NSW waters during the winter is nonetheless considered significant for the species. Forage for Gibson's Albatross is extremely patchy, both spatially and temporally, and individuals traverse great distances in search of food. This species feeds pelagically on squid, fish and crustaceans. Satellite tracking studies have shown that foraging areas used by males and females are mutually exclusive; females frequent the	Not present

						Tasman Sea, whereas males disperse to lower latitudes or move north-east into the mid-Pacific Ocean.	
Aves	Esacus magnirostris	Beach Stone-curlew	E4A,P		1	Beach Stone-curlews are found exclusively along the coast, on a wide range of beaches, islands, reefs and in estuaries, and may often be seen at the edges of or near mangroves. They forage in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves. Beach Stone-curlews breed above the littoral zone, at the backs of beaches, or on sandbanks and islands, among low vegetation of grass, scattered shrubs or low trees; also, among open mangroves. They are usually seen alone or in pairs, but sometimes occur in small groups. Birds forage by stalking slowly like a heron or with quicker dashes after prey. The diet consists of crabs and other marine invertebrates. They are mainly active at dawn, dusk and at night, but birds are often seen when they shift or move about sedately during the day. Less strictly nocturnal than the related Bush Stone-curlew (<i>Burhinus grallarius</i>).	Not present
Aves	Glossopsitta pusilla	Little Lorikeet	V,P		3	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.	Not present
Aves	Haematopus fuliginosus	Sooty Oystercatcher	V,P		4	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.	Not present
Aves	Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P		38	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	Not present

						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.	
Aves	Hieraaetus morphnoides	Little Eagle	V,P		3	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 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.	Not present
Aves	Ixobrychus flavicollis	Black Bittern	V,P		1	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.	Not present
Aves	Lathamus discolor	Swift Parrot	E1,P,3	CE	3	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> , and White Box <i>E. albens</i> . Commonly used lerp	Not present

						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	Macronectes giganteus	Southern Giant Petrel	E1,P	E	1	The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20° S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory. A single chick is raised and although breeding occurs annually, approximately 30% of the potential breeding population does not nest. It is an opportunistic scavenger and predator, and scavenges from fishing vessels and animal carcasses on land. It is also an active predator of cephalopods and euphausiids, as well as smaller birds (particularly penguins) both at land and at sea. Birds will desert their nests if disturbed at the breeding colony.	Not present
Aves	Neophema pulchella	Turquoise Parrot	V,P,3		1	Occurs on edges of eucalypt woodlands, ridges through forests and creeks. Prefers shading for ground foraging.	Not present
Aves	Ninox connivens	Barking Owl	V,P,3		17	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 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 polyanthemos</i> and Blakely's Red Gum (<i>Eucalyptus blakelyi</i>). Breeding occurs during late winter and early spring.	Not present

Aves	<i>Ninox strenua</i>	Powerful Owl	V,P,3		178	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.	Not present
Aves	<i>Numenius madagascariensis</i>	Eastern Curlew	P	CE,C,J, K	8	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.	Not present
Aves	<i>Onychoprion fuscata</i>	Sooty Tern	V,P		1	The Sooty Tern is found over tropical and sub-tropical seas and on associated islands and cays around Northern Australia. Occasionally seen along coastal NSW, especially after cyclones. Large flocks can be seen soaring, skimming and dipping but seldom plunging in off shore waters. Breeds in large colonies in sand or coral scrapes on offshore islands and cays including Lord Howe and Norfolk Islands.	Not present
Aves	<i>Pandion cristatus</i>	Eastern Osprey	V,P,3		6	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.	Not present
Aves	<i>Petroica boodang</i>	Scarlet Robin	V,P		1	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.	Not present

Aves	<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	V,P		2	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.	Not present but within 800m
Aves	<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V,P		2	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.	Not present but within 800m
Aves	<i>Tyto novaehollandiae</i>	Masked Owl	V,P,3		2	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.	Not present
Mammalia	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V,P		21	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.	Not present
Mammalia	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V,P	V	6	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.	Not present
Mammalia	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V,P	E	1	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	Not present

						faces as den sites. Mostly nocturnal animal feeding on medium-sized (500g-5kg) mammals.	
Mammalia	<i>Isoodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern)	E1,P	E	21	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-fruited) fungi.	Not present
Mammalia	<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V,P		4	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.	Unlikely – possible foraging
Mammalia	<i>Miniopterus australis</i>	Little Bent-winged Bat	V,P		25	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.	Unlikely – possible foraging
Mammalia	<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V,P		27	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.	Unlikely – possible foraging
Mammalia	<i>Myotis macropus</i>	Southern Myotis	V,P		7	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.	Unlikely – possible foraging
Mammalia	<i>Petauroides volans</i>	Greater Glider	P	V	1	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their	Not present

						time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	
Mammalia	Petaurus norfolcensis	Squirrel Glider	V,P		3	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.	Not present
Mammalia	Petaurus norfolcensis	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	E2,V,P		1	NSW: Occurs on the coast in a range of habitats including low scrubby eucalypt woodlands and banksia thickets to tall, wet eucalypt forests bordering on rainforest . The availability of a year-round supply of carbohydrates (nectar, sap, gum, and honeydew) appears to be an important habitat feature. In NSW, this corresponds to a high diversity of tree and shrub species, including a high nectar producing species and one or more winter flowering species. In Pittwater, important food sources are likely to be the winter flowering Coast Banksia (<i>Banksia integrifolia</i>) and Spotted Gum (<i>Corymbia maculata</i>) and the summer flowering Old Man Banksia (<i>B. serrata</i>) and Grey Ironbark (<i>Eucalyptus paniculata</i>). Other likely food sources include <i>Angophora costata</i>, <i>Banksia spinulosa</i>, <i>Corymbia gummifera</i>, <i>Eucalyptus botryoides</i>, <i>E. punctata</i>, <i>E. robusta</i>, <i>Melaleuca quinquernervia</i>, mistletoes and <i>Xanthorrhoea</i> species. This animal will gouge and lick incisions on the trunks and main branches of <i>Eucalyptus</i>, <i>Corymbia</i> and <i>Angophora</i> trees to feed on sap and on Acacia trees and shrubs to feed on gum, especially when nectar is in short supply.	Not present

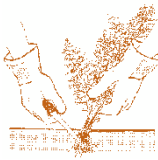
						Tree hollows are an important habitat feature providing den sites for raising young. Hollows can be found in trees of the following genera <i>Eucalyptus</i> , <i>Corymbia</i> and <i>Angophora</i> . Other species such as <i>Melaleuca quinquenervia</i> can also provide suitable hollows.	
Mammalia	<i>Phascolarctos cinereus</i>	Koala	V,P	V	70	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.	Not present
Mammalia	<i>Phascolarctos cinereus</i>	Koala in the Pittwater Local Government Area	E2,V,P	V	70	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	Not present
Mammalia	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	P	V	1	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	Not present
Mammalia	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V,P	V	84	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.	Unlikely – possible foraging
Mammalia	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V,P		4	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.	Not present
Mammalia	<i>Vespadelus troungtoni</i>	Eastern Cave Bat	V,P		1	Roosts in caves, mine shafts. Generally found in dry open forest and woodlands. Prefers areas near cliffs and rocky overhangs.	Unlikely – possible foraging
Reptilia	<i>Caretta caretta</i>	Loggerhead Turtle	E1,P	E	2	Loggerhead Turtles are ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals. The female comes	Not present

						ashore to lay her eggs in a hole dug on the beach in tropical regions during the warmer months.	
Reptilia	<i>Chelonia mydas</i>	Green Turtle	V,P	V	6	Ocean-dwelling species spending most of its life at sea. Carnivorous when young but as adults they feed only on marine plant material. Eggs laid in holes dug in beaches throughout their range. Scattered nesting records along the NSW coast.	Not present
Reptilia	<i>Eretmochelys imbricata</i>	Hawksbill Turtle	P	V	2		Not present
Reptilia	<i>Varanus rosenbergi</i>	Rosenberg's Goanna	V,P		3	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.	Not present

Note: Species in **bold** have been assumed as having appropriate habitat present on-site.

6.3 Appendix II– Key Weed Removal Methods

Physical removal

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

Technique	Method	Equipment
Scrape and Painting 	More resilient weed species, where other techniques are less reliable are to be scraped with a knife or chisel and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current herbicide license. Weed species will be 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 $\frac{3}{4}$ of the plants height. Where trunk diameters exceed approximately 5 cm a second scrape shall be made on the other side of the trunk. 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. Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.	Tools: knife, chisel, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.
Cut with a Chainsaw and Paint	Larger size weed species, too large for cutting with hand tools, shall be cut with a chainsaw and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current chainsaw and herbicide license. Larger weed species will be cut with a chainsaw at base of plant, and herbicide applied via applicator bottle. Cut the stem horizontally as close to the ground as possible, using the chainsaw. Remove upper branches to reduce bulk of plant. If cutting at the base is impractical, cut higher to get rid of the bulk of the weed, then cut again at the base and apply herbicide. Make cuts horizontal to prevent the herbicide running off the stump. Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of 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. Follow up treatment will be required. If plants resprout, cut and paint the shoots using the same method.	Tools: chainsaw, ear muffs, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.

Technique	Method	Equipment
Spot Spraying	Spot spraying involves spraying non-seeding annuals and grasses, and for regrowth of weeds once an area has been cleared or brushcut. Works to be carried out by a contractor with a current herbicide license. Herbicide will be mixed up according to the manufacturer's directions for the 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.	Tools: protective clothing, safety glasses, herbicide sprayer, impervious gloves, Herbicide, and all other required P.P.E.

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.



6.4 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.

6.5 Test of Significance

Microbats - all species together as the site would be only foraging habitat (if anything)

Species of microbat were assessed as having the potential to occur within the study area based on Bionet records. The following species have the potential to occur in the site or surrounding bushland:

- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Little Bentwing-bat (*Miniopterus australis*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Southern Myotis (*Myotis macropus*)



Microbats are mobile but do tend to use and re-use suitable areas and roost trees. Although these species have differing habitat requirements, they have been assessed together as the trees to be removed are habitat either directly for roosting (cracks, crevices, hollows) or indirectly for food (flying insects) for all eight species.

5-Part Test

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

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

The trees that may need to be removed were not observed to be bearing hollows suitable for tree roosting micro-bat species including the Eastern Free-tail-bat. The low number of recorded sightings tree roosting species suggest that the area is not currently being used as primary breeding habitat (Bionet, 2018). This indicates a low potential for the life cycles of local populations to be put at risk as the site may be used primarily for foraging resources. The proposed actions would be expected to have a lesser impact upon cave

dwelling species including the Eastern Bentwing-bat and the Southern Myotis. Trees do not comprise breeding habitat for these species and would not impact their life cycles. The Eastern Freetail Bat, the Eastern Bentwing Bat and the Southern Myotis have relatively higher recorded sightings within a 10km are surrounding the site (Bionet, 2018). This indicates that the site may be used frequently for foraging resources by these species and that the proposed actions would not impact the life-cycles of cave dwelling species.

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

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

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

Microbats are not an EEC but they do live within EECs and re key pollinators of some species so to that extent they are part of the EEC.

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

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

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

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

Trees may contain marginal foraging habitat for species which feed on insects in or above the canopy.

Removal of habitat by way of crevices/hollows/loosebark in trees and this may have an adverse effect on the life cycles of individual microbats however this site alone is not expected to result in the loss of local populations.

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

Declared areas of outstanding biodiversity value have not yet been declared in this area.

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

Vegetation removal is part of a key threatening process as it results in the loss of habitat for microbats.

Conclusion

The proposed actions will not remove habitat by way of crevices/hollows/loosebark in trees and this is not expected to result in the loss of local populations.

7 Expertise of authors

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

Laura has great passion about the natural environment, sustainable development and biodiversity conservation. Laura is in her last semester of her double degree of Environmental Engineering and Science at the University of New South Wales.

Laura has valuable on-ground experience working with conservation organisations in different parts of the world, as well as contributing to environmental educational projects. Laura has participated in educational talks focused on ecological and sustainability matters and currently volunteers for organisations around the globe to help raise awareness, promote sustainable living and natural protection.

Laura has attended fundamental courses and workshops such as Sustainability in Construction; Environmental Frameworks, Law and Economics; Applied Geotechnics and Engineering Geology; and Contaminant Transport. Laura participated as one of the leading members of the Environmental Committee at her University in Colombia organising various campaigns promoting environmental awareness.

Laura has also prepared two theses, one on Orica's Botany Industrial Park Groundwater Clean-up Plan based on remediation technologies for contaminated land and groundwater; and the other one on Environmental Impacts in Port Stockton Development: Air, Water and Noise Pollution, based on the proposal of creating a new port as an extension to Port of Newcastle.

Laura Conde-Barona ENVIRONMENTAL ENGINEER INTERN



SPECIALISATIONS

- Creative and sustainable solutions in environmental engineering, particularly in waterways and wetlands, sustainable design and development.
- Engineering and environmental project management focusing on creating environmental and social outcomes.
- Engaging others in environmental protection and sustainability.

CAREER SUMMARY

- **Environmental Consulting Internship**, Ecological Consultants Australia, 2018 present
- **Marine Turtle Internship Program**, Conflict Island's Conservation Initiative, 2017

QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of Environmental Engineering and Marine Science**, University of New South Wales (Expected June 2018)
- **Study Abroad Program in Science**, University of New South Wales (2015)
- **Initiated Bachelor's Degree in Environmental Engineering and Biology**, Universidad de los Andes, Bogotá, Colombia (Transferred to UNSW in 2016)
- **Practicing member** Australian Herpetological Society
- Emergency First Response Certificate (2016)
- PADI Rescue Diver (2016)