CENTRAL COAST COUNCIL

Captain Phillip Reserve, Green Point

Foreshore Stabilisation

BIODIVERSITY ASSESSMENT

Job No: 180515

Date: 25 February 2020

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

PO Box 3005 Wamberal NSW 2260
T: 0404 858573 E: kristy@coastecology.com.au W: coastecology.com.au
Kristy McQueen operates as a Sole Trader under registered business name Coast Ecology ABN: 24 924 674 371

This report was prepared by Dr Kristy McQueen, Scientific License: SL100391, BAM Assessor No. BAAS18068, Practicing Member of the Ecological Consultants Association of NSW

Biodiversity Assessment, Captain Phillip Reserve, Green Point Foreshore Stabilisation

Issue	Date	Description	Author
A	25/07/2018	DRAFT	KM
B	20/08/2018	FINAL	KM
C	12/09/2018	FINAL	KM
D	29/11/2019	UPDATE TO BC ACT	KM

PO Box 3005 Wamberal NSW 2260
T: 0404 858573 E: kristy@coastecology.com.au W: coastecology.com.au
Kristy McQueen operates as a Sole Trader under registered business name Coast Ecology ABN: 24 924 674 371

EXECUTIVE SUMMARY

Central Coast Council engaged Coast Ecology to prepare a Review of Environmental Factors (REF) and a Biodiversity Assessment (BA) for proposed foreshore stabilisation works along the foreshore at Captain Phillip Reserve, Green Point (hereafter referred to as the Subject Site). The proposed stabilisation works include gabion wall remediation, saltmarsh berm treatment, beach treatment and rock treatment. Some of the existing boat ramps will be removed while the southern one will be retained.

Following a site inspection, the Subject Site is defined as open space/parkland dominated by lawn and isolated trees. The main tree species were Prickly-leaved Tea Tree *Melaleuca stypheliodes*, Swamp Oak *Casuarina glauca* and Grey Mangrove *Avicennia marina subsp. australasica* the latter occurring below the high-water mark. The middle stratum was largely absent, and the lower stratum was dominated by Buffalo Grass *Stenotaphrum secundatum**.

No threatened species were recorded on the Subject Site. The vegetation on the Subject Site is defined as disturbed and is not considered to fall under the definition of an Endangered Ecological Community or a Threatened Community under state or federal legislation.

State Legislation

BC Act

A BioNet search for records of threatened species and endangered ecological communities listed under the Biodiversity Conservation Act 1995 (BC Act) and the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) which have been recorded within the locality was conducted on 5 July 2018. It returned a total of 1,186 fauna records of 66 fauna species and 188 flora records of 14 flora species. Of these species, the Subject Site contains habitat for seven threatened birds (including wading species) and seven threatened mammals (flying-fox and bats). No endangered ecological communities occur on the Subject Site however Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions occurred just outside of the northern extent of works and was assessed as a precaution.

The proposed works are considered unlikely to have a significant impact on any of these threatened species or endangered ecological communities with potential habitat on or near the Subject Site as the works are minor in nature and require minimal vegetation clearing. The Subject Site provides potential foraging habitat for 14 threatened species however it does not provide nesting or roosting opportunities for these species. As such, it does not provide important habitat for threatened species and short-term impacts on the Subject Site during construction works are unlikely to have an adverse impact on any threatened species in the broader Study Area.

FM Act

Following a search of the NSW Department of Primary Industries (DPI) threatened species list and associated fact sheets, it was determined that the Subject Site does not provide habitat for any aquatic threatened flora or fauna species listed under the Fisheries Management Act.

The NSW Department of Primary Industries Mapping of the estuarine habitats of NSW indicated that Eelgrass *Zostera carpricorni* and Mangroves *Avicennia marina* subsp. *australasica* are likely at the Subject Site. Following a site inspection, both of these aquatic species were present along with Strapweed *Posidonia australis* and their distribution was mapped. All three of these aquatic species are protected under the FM Act however *Posidonia australis* is listed as an endangered population in Port Hacking, Botany Bay, Sydney

Harbour, Pittwater, **Brisbane Water** and Lake Macquarie (NSW Fisheries Scientific Committee, 2010).

Approximately 8,197 m^2 of the threatened population *Posidonia australis* occurs near the Subject Site. The proposed foreshore stabilisation works will not result in any direct impact on this population however indirect effects of shading from excess turbidity can occur as can poor water quality from the disturbance of potential acid sulphate soils (PASS). Mitigation measures provided in this report include appropriate erosion and sediment control and the preparation of an ASS plan of management prior to the commencement of works which will minimise the potential impacts of works on the *P. australis* population. As such, works are considered unlikely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction. The proposed works do not form part of a key threatening process under the Fisheries Management Act.

Federal Legislation

EPBC Act

A Protected Matters search was undertaken 05/07/2018 within a 10x10 km area centred on the Subject Site to determine the likely occurrence of Matters of National Environmental Significance.

The broader Study Area contains three World Heritage Properties, three National Heritage Places, no Great Barrier Reef Marine Park or Commonwealth Marine Areas, one Wetland of International Importance (Hunter Estuary Wetlands), six listed threatened ecological communities (Central Hunter Valley eucalypt forest and woodland, Coastal Swamp oak Forest, Coastal Upland Swamps in the Sydney Basin Bioregion, Littoral Rainforest and Coastal vine thickets, *Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion, Subtropical and Temperate Coastal Saltmarsh), 106 listed threatened species and 76 listed migratory species.

Following a site inspection/desktop assessment and habitat assessment:

- The Subject Site does not contain any World heritage Properties, National Heritage Places or wetlands of international importance
- The Subject Site has one nearby threatened ecological community: *Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion
- The Subject Site provides habitat for 11 threatened species and 17 migratory species.

Eleven threatened species and 17 migratory species have potential habitat on the Subject Site and in the broader Study Area. The proposed foreshore stabilisation works are considered unlikely to substantially impact upon these species as the works are minor in nature and do not require clearing of large areas of native vegetation or dredging of protected or endangered aquatic vegetation. In addition, the Subject Site is likely to provide only sub-optimal habitat for these species as it has been previously disturbed and is relatively public.

The endangered ecological community *Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion occurs near the Subject Site. The proposed works will not directly impact or clear the *P. australis*. Potential impacts include shading from turbidity and poor water quality from disturbance of potential acid sulphate soils (PASS). An Acid Sulphate Soil plan of management is required prior to the commencement of works along with appropriate erosion and sediment control in accordance with NSW Fisheries Policy and Guidelines (NSW DPI, 2013).

Based on the above assessment it is considered that a referral to SEWPaC is not required.

CONTENTS

1. INTRODUCTION

Central Coast Council engaged Coast Ecology to prepare a Review of Environmental Factors (REF) and a Biodiversity Assessment (BA) for proposed foreshore stabilisation works along the foreshore at Captain Phillip Reserve, Green Point (hereafter referred to as the Subject Site).

2. SUBJECT SITE/STUDY AREA

The Study Area (Figure 1) is defined as a 10 x 10 km area centred on the *Subject Sites* and includes the broader local area which may be impacted upon, either directly or indirectly by the proposed works. Database searches are conducted within this Study Area limit.

The *Subject Site* (Figure 2) is located along the eastern foreshore of Brisbane Water at Green Point on the Central Coast, NSW. The Subject Site extends from the Orana Street Boat Ramp in the south to the dinghy storage racks in the north and is approximately 250m in length and between 25-30m wide. It is used for passive recreation and boat launching. A row of residential dwellings fronts on to the reserve and are backed by Bayside Drive. The reserve has past and active erosion along the foreshore.

Brisbane Water is a tidal estuary extending from Broken Bay in the south to Gosford in the north. It contains a number of sub-catchments and tributaries. The Subject Site is located at the northern end of the estuary near the mouth of Erina Creek.

3. PROPOSED WORKS

Four general concept designs for foreshore stabilisation have been developed and relate to sketches provided in Appendix 1 of the REF:

- Rock Treatment (refer Sketch SK4);
- Beach Treatment (refer Sketch SK5);
- Saltmarsh Berm Treatment (refer Sketch SK7); and
- Saltmarsh Walkthrough Treatment (refer Sketch SK6).

Concept designs for remediation of the gabion wall at the southern extent of the site adjacent to the public boat ramp (refer Sketch SK3), and the dinghy skid at the northern extent of the site adjacent to the dinghy storage racks (refer Sketch SK8) have also been developed. Further detail is provided in the Design Report (Royal Haskoning DHV (2014) provided in Appendix 1 of the REF.

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 1. Study Area
Captain Cook Reserve, Green Pt: Proposed Foreshore Stabilisation
Central Coast Council 24/07/2018

Figure 2. Subject Site
Captain Cook Reserve, Green Pt: Proposed Foreshore Stabilisation
Central Coast Council 24/07/2018

4. DESKTOP STUDIES

4.1 Database Searches

A database search was conducted within a 10 x 10 km area centred on the Subject Site from the following databases:

- BioNet website for the Atlas of NSW Wildlife. BioNet is a portal for accessing government held information about plants and animals in NSW. It is supported by several NSW government held agencies including Office of Environment and Heritage (OEH) (National Parks and Wildlife and Royal Botanic Gardens and Domain Trust), Department of Primary Industries (Forests NSW and Fisheries NSW) and the Australian Museum. BioNet contains records for threatened species and endangered ecological communities listed under the Biodiversity Conservation Act 2016 (BC Act) and the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) which have been recorded within the locality. The search was conducted on 5 July 2018 using search coordinates North: -33.40 West: 151.31 East: 151.41 South: -33.50 and returned a total of 1,186 fauna records of fauna 66 species and 188 flora records of 14 flora species. Species listed as being part of the bilateral migratory bird agreements with China (CAMBA), Japan (JAMBA) and Republic of Korea (ROKAMBA) are also listed http://www.bionet.nsw.gov.au/
- Australian Government: Department of the Environment Protected Matters Search Tool for Matters of National Environmental Significance (NES) listed under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) that may occur in the Study Area. A region search was conducted on 5 July 2018 using Central Coast Council Local Government Area (LGA) http://www.environment.gov.au/topics/about-us/legislation/environment-protection-and-biodiversity-conservation-act-1999/protected
- NSW Department of Primary Industries (DPI): Mapping the estuarine habitats of NSW was consulted for seagrass/saltmarsh/mangrove mapping within Brisbane Water. http://www.dpi.nsw.gov.au/research/areas/aquatic-ecosystems/estuarine-habitats-maps
- NSW Department of Primary Industries (DPI): Threatened species and associated profile information.
    - https://www.dpi.nsw.gov.au/fishing/threatened-species/what-current
    - Threatened species profiles www.threatenedspecies.environment.nsw.gov.au/tsprofile/browse_allspecies.aspx
    - Threatened species publications www.nationalparks.nsw.gov.au/npws.nsf/Content/Threatened+species+publications
    - Threatened species on the Fisheries website www.dpi.nsw.gov.au/fisheries/species-protection

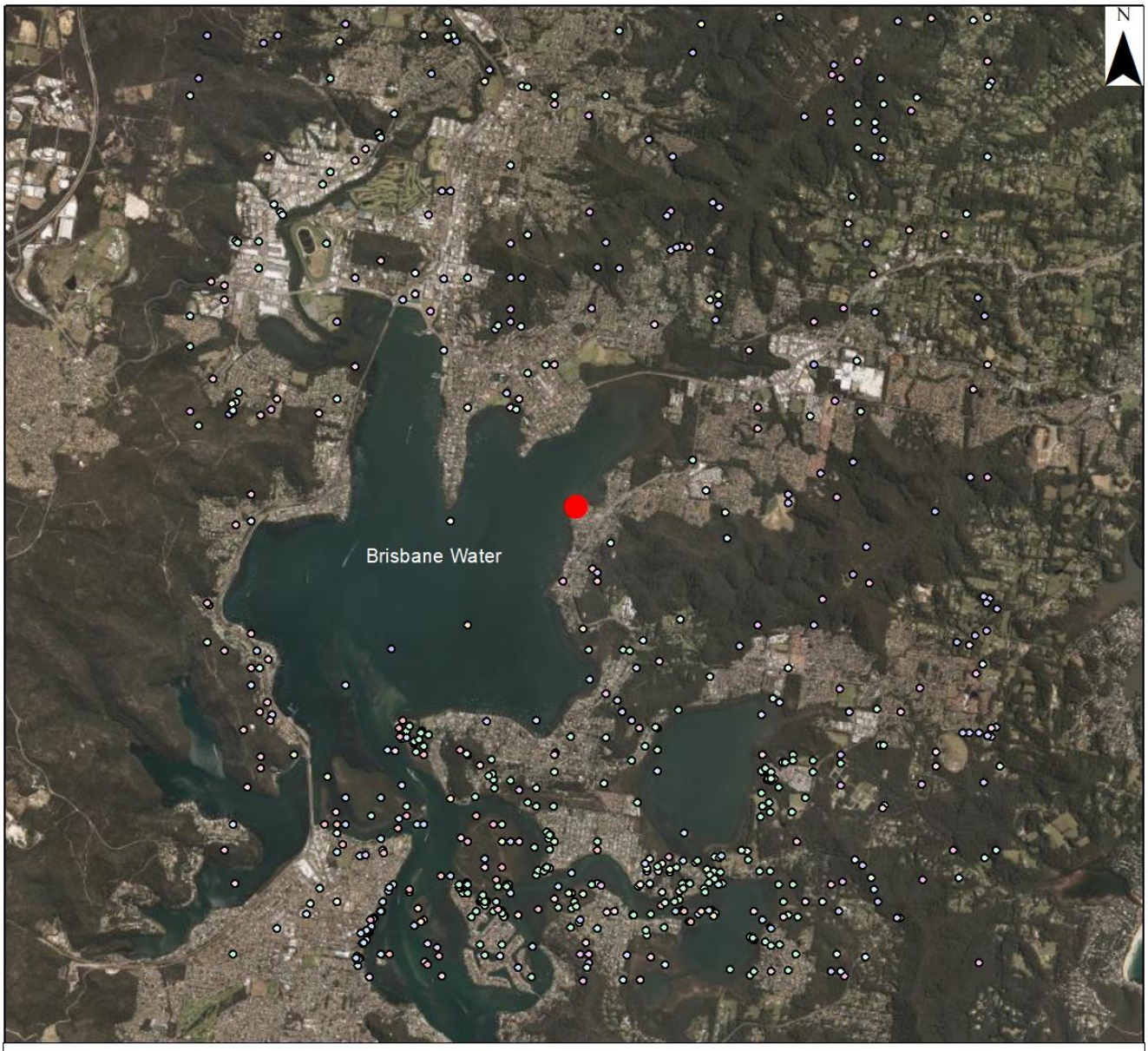
A full list of threatened species (pursuant to the BC Act) and Endangered Ecological Communities (EECs) recorded in the Study Area from database searches are provided in tables A1 and A2 (Appendix A) respectively. The locations of threatened fauna and flora previously recorded within a 10 km radius of the Study Area are shown in Figures 3 and 4 respectively. Results of the protected matters search tool are provided in Tables A3, A4 and A5 (Appendix A).

Mapping of estuarine habitats in NSW prepared by NSW DPI is shown in Figure 5. This mapping shows *Zostera capricorni* and Mangroves at the Subject Site.

A habitat assessment for threatened Aquatic Species with potential habitat in the Study Area is provided in Table A7 and a habitat assessment for terrestrial species is provided in Table A8 (Appendix A).

4.2 Vegetation Mapping

Recent vegetation mapping by Bell (2013) does not map the vegetation on the Subject Site. Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCREMS, 2003) vegetation mapping has mapped the Subject Site as Coastal Narrabeen Moist Forest (Figure 6). Vegetation Mapped within 2 km of the Study Area by LHCCREMS (2003) is provided in Table A6 (Appendix A).



Legend

0 700 1,400 2,800 4,200 5,600
Meters

- Subject Site
- Bar-tailed Godwit
- Barking Owl
- Black Bittern
- Black-breasted Buzzard
- Black-necked Stork
- Bush Stone-curlew
- Caspian Tern
- Cattle Egret
- Common Greenshank
- Common Tern
- Dusky Woodswallow
- Eastern Bentwing-bat
- Eastern Chestnut Mouse
- Eastern Curlew
- Eastern False Pipistrelle
- Eastern Freetail-bat
- Eastern Osprey
- Eastern Pygmy-possum
- Fork-tailed Swift
- Gang-gang Cockatoo
- Giant Burrowing Frog
- Glossy Black-Cockatoo
- Greater Broad-nosed Bat
- Greater Glider
- Green Turtle
- Green and Golden Bell Frog
- Green-thighed Frog
- Grey-headed Flying-fox
- Grey-tailed Tattler
- Koala
- Large-eared Pied Bat
- Lesser Sand-plover
- Little Bentwing-bat
- Little Curlew
- Little Eagle
- Little Lorikeet
- Little Tern
- Long-nosed Potoroo
- Masked Owl
- Parma Wallaby
- Pied Oystercatcher
- Powerful Owl
- Red-crowned Toadlet
- Regent Honeyeater
- Rosenberg's Goanna
- Scarlet Robin
- Sooty Owl
- Sooty Oystercatcher
- Southern Brown Bandicoot (eastern)
- Southern Myotis
- Speckled Warbler
- Spotted-tailed Quoll
- Square-tailed Kite
- Squirrel Glider
- Superb Fruit-Dove
- Swift Parrot
- Terek Sandpiper
- Turquoise Parrot
- Varied Sittella
- Whimbrel
- White-bellied Sea-Eagle
- White-fronted Chat
- White-throated Needletail
- Wood Sandpiper
- Yellow-bellied Glider
- Yellow-bellied Sheathtail-bat

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 3. Threatened Fauna previously recorded in 10x10km Study Area:BioNet
Proposed Foreshore Stabilisation: Captain Cook Reserve, Green Pt
Central Coast Council 07/07/2018

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 4. Threatened Flora previously recorded in 10x10km Study Area:BioNet
Proposed Foreshore Stabilisation: Captain Cook Reserve, Green Pt
Central Coast Council 07/07/2018

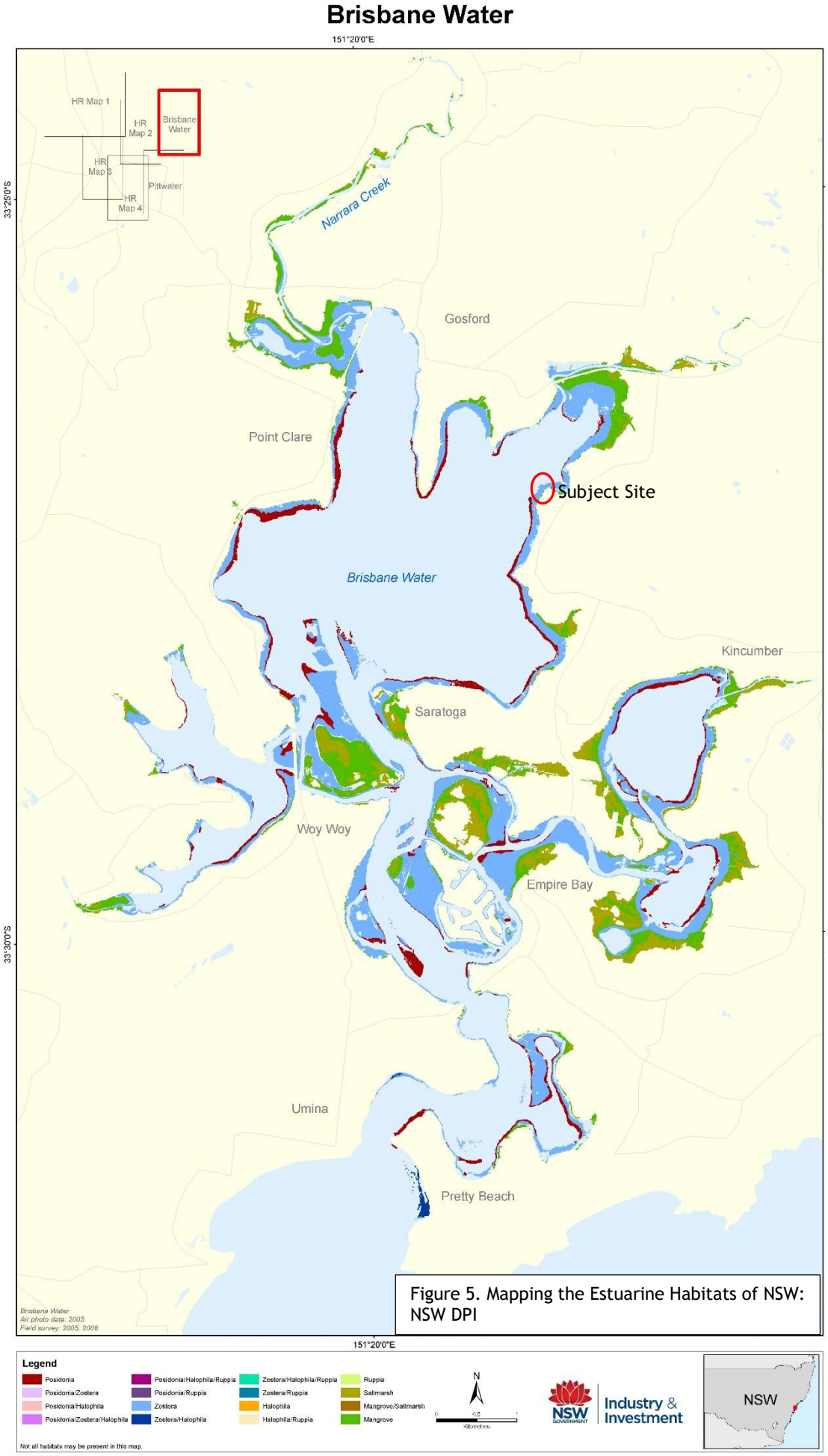


Figure 5. Mapping the Estuarine Habitats of NSW: NSW DPI

5. FIELD SURVEYS

A site assessment was conducted on 20 July 2018.

5.1 Flora/Vegetation Mapping

The majority of the Subject Site has an open space/parkland character and is dominated by lawn and isolated trees. A species list is provided in Appendix A, Table A9. The main tree species were Prickly-leaved Tea Tree *Melaleuca styphelioides*, Swamp Oak *Casuarina glauca* and Grey Mangrove *Avicennia marina subsp. australasica* the latter occurring below the high-water mark. Mistletoe *Amyema cambagei* was common in the *C. glauca*. The middle stratum was largely absent, and the lower stratum was dominated by Buffalo Grass *Stenotaphrum secundatum**. The native Sand Couch *Sporobolus virginicus* occurred along the foreshore margin and the saltmarsh species Austral Seablite *Suadea australis* occurred at the northern end of the Subject Site.

No threatened species were recorded on the Subject Site. The vegetation on the Subject Site is defined as disturbed and is not considered to fall under the definition of an Endangered Ecological Community or a Threatened Community under state or federal legislation.

There is a remnant patch of native vegetation outside the northern extent of works. The vegetation in this area is disturbed and fragmented however it is likely to fall under the definition of a Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. This patch of native vegetation falls outside of the area of works and no clearing will be undertaken within the native vegetation. An assessment of significance of impact of the proposed works (indirect impacts) in accordance with the BC Act were assessed in Appendix B.

Six Swamp Oak *Casuarina glauca* and four Grey Mangrove *Avicennia marina* occur along the high tide mark in the location of the proposed foreshore upgrade works and may be impacted during construction. All efforts to avoid these trees and their roots will be made during construction. The potential removal of Grey Mangroves has been approved by NSW Department of Primary Industry (DPI) as part of the Part 7 permit approval and the Swamp Oak are not threatened species nor are they part of an Endangered Ecological Community (EEC) listed under the BC Act or EPBC Act. These trees do not contain important habitat features such as hollows and replacement planting will offset the impacts if they do require removal.

Table 1 below provides co-ordinates and specifics of the trees that may be impacted by works.

Table 1. Trees within the Area of Impact

ID	Y Projection	X projection	Tree Species	Tree Height (m)	Tree DBH (cm)	Photo
1	6297518	347344.1	Swamp Oak *Casuarina glauca*	18	90	
2	6297530	347351.5	Swamp Oak *Casuarina glauca*	12	15	 Trees 2, 3 & 4
3	6297531	347352.4	Swamp Oak *Casuarina glauca*	13	25	
4	6297533	347353.2	Swamp Oak *Casuarina glauca*	13	30	
5	6297567	347368.6	Swamp Oak *Casuarina glauca*	15	90	

6	6297626	347427.2	Grey Mangrove *Avicennia marina*	1.5	10	 Trees 6, 7 &8
7	6297625	347428.2	Grey Mangrove *Avicennia marina*	1.5	10	
8	6297624	347428.7	Grey Mangrove *Avicennia marina*	1.5	10	
9	6297631	347433.5	Swamp Oak *Casuarina glauca*	10	30	
10	6297637	347440	Grey Mangrove *Avicennia marina*	3	50	

5.2 Aquatic Environment

The Subject Site is exposed sand beds at low tide. Aquatic vegetation mapping was undertaken during field surveys using a mask and snorkel, stand up paddle board and a Garmin 62s GPS. The estuary bed immediately in front of the Subject Site was mapped and included sandy substrate, seagrass and mangroves (Figure 7). Seagrass species present included Eelgrass *Zostera capricorni* and Strapweed *Posidonia australis*. The Eelgrass *Z. capricorni* was the dominant species and occurred from the shoreline out to between 40 to 65 metres from the shoreline to depths of 0.6 metres at low tide. Strapweed *P. australis* occurred in patches at the limit of the *Z. capricorni* to depths of 1 metre at low tide. The Grey Mangrove *A. marina subsp. australasica*. occurred in clumps along the foreshore just below or on the high-water mark. All species are protected under the FM Act however *Posidonia australis* is listed as an endangered population in Port Hacking, Botany Bay, Sydney Harbour, Pittwater, **Brisbane Water** and Lake Macquarie (NSW Fisheries Scientific Committee, 2010). An assessment of significance of impact (7 part test) under the FM Act is provided in Appendix C.

The proposed works will not directly impact seagrass beds and mitigation measures have bee included to ensure there are no indirect impacts on seagrass such as shading from suspended sediments. Four Grey Mangroves occur within the Area of Impact (Table 1) and may require clearing as part of the works. As discussed above, the potential removal of Grey Mangroves has offset through the Part 7 permit approval process.

5.3 Fauna

Opportunistic fauna sightings were recorded during the site visit and are present in Table A9 (Appendix A). Commonly occurring bird species such as Intermediate Egret, Masked Plover, Australian Magpie and Mistletoe birds were recorded.

Common aquatic fauna recorded include: Brown Snails *Bembicium auratum*, Sydney Mud Whelk *Pyrazus ebininus* and Sydney Rock Oyster *Saccostrea glomerata*. Fish species known to commonly occur in Brisbane Water include blackfish, whiting, bream, flathead, leatherjacket, mullet along with crustaceans such as blue swimmer crabs, yabbies' and prawns.

The proposed works are unlikely to directly or indirectly impact terrestrial fauna species commonly occurring in the area.

COAST ECOLOGY
ENVIRONMENTAL ASSESSMENTS

Figure 6. Vegetation Mapping: LHCCREMS, 2003
Proposed Foreshore Stabilisation: Captain Cook Reserve, Green Pt
Central Coast Council 07/07/2018

Figure 7. Aquatic Vegetation Mapping: Coast Ecology
Captain Cook Reserve, Green Pt: Proposed Foreshore Stabilisation
Central Coast Council 20/07/2018

6. ASSESSMENT

Following a habitat assessment (Table A8, Appendix A), species listed in Table 2 were considered to have potential habitat on the Subject Site.

Table 2. Species previously recorded in the Study Area considered to have potential habitat on the Subject Site.

Scientific Name	Common Name	NSW Status	Comm. Status	Records
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	29
Pandion cristatus	Eastern Osprey	V,P,3		32
Burhinus grallarius	Bush Stone-curlew	E1,P		367
Haematopus longirostris	Pied Oystercatcher	E1,P		93
Charadrius mongolus	Lesser Sand-plover	V,P	E,C,J,K	2
Limosa lapponica	Bar-tailed Godwit	P	C,J,K	10
Numenius madagascariensis	Eastern Curlew	P	CE,C,J,K	29
Numenius minutus	Little Curlew	P	C,J,K	1
Numenius phaeopus	Whimbrel	P	C,J,K	13
Tringa brevipes	Grey-tailed Tattler	P	C,J,K	2
Tringa nebularia	Common Greenshank	P	C,J,K	4
Xenus cinereus	Terek Sandpiper	V,P	C,J,K	2
Hydroprogne caspia	Caspian Tern	P	C,J	10
Sterna hirundo	Common Tern	P	C,J,K	4
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		64
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	34
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		10
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat			
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		6
Miniopterus australis	Little Bentwing-bat	V,P		28
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		29
Myotis macropus	Southern Myotis	V,P		8

6.1 ASSESSMENT OF SIGNIFICANCE: BC ACT

An assessment of significance of impact of the proposed works on threatened species, populations and/or communities was undertaken in accordance with the BC Act and is provided in Appendix B.

A BioNet search for records of threatened species and endangered ecological communities listed under the Biodiversity Conservation Act 1995 (BC Act) and the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) which have been recorded within the locality was conducted on 5 July 2018. It returned a total of 1,186 fauna records of 66 fauna species and 188 flora records of 14 flora species.

The Subject Site provides potential foraging habitat for seven birds (including wading species) and seven mammals (bats and flying-foxes) however it does not provide nesting or roosting opportunities for these species. As such, it does not provide important habitat for threatened species and short-term impacts on the Subject Site during construction works are unlikely to have an adverse impact on any threatened species in the broader Study Area. The proposed works are unlikely to have a significant impact on any of these threatened species or endangered ecological communities with potential habitat on or near the Subject Site as the works are minor in nature and require minimal vegetation clearing.

6.2 ASSESSMENT OF SIGNIFICANCE: FM ACT

A habitat assessment is provided in Appendix A and an assessment of significance of impact of the proposed works on a threatened community was undertaken in accordance with the FM Act and is provided in Appendix C.

No threatened species are considered likely to occur in the study area, use habitats on occasion nor will they be influenced by off-site impacts of the proposal. However, approximately 8,197 m^2 of the threatened population *Posidonia australis* occurs near the Subject Site. The proposed foreshore stabilisation works will not result in any direct impact on this population however indirect effects of shading from excess turbidity can occur as can poor water quality from the potential disturbance of acid sulphate soils (ASS). Mitigation measures provided in this report include appropriate erosion and sediment control and the preparation of an ASS plan of management prior to the commencement of works which will minimise the potential impacts of works on the *P. australis* population. As such, works are considered unlikely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction. The proposed works do not form part of a key threatening process under the Fisheries Management Act.

NSW DPI will approve mangrove trimming and removal adjacent to public and private facilities such as jetties, boat ramps and waterway crossings to allow for safe access, and for maintenance works in connection with electricity supply, stormwater or agricultural drains. Where mangrove removal is required, adequate mitigation and compensation measures will generally be required as a condition of consent (NSW DPI, 2013). The proposed works are in accordance with these requirements and appropriate mitigation measures have been provided.

6.3 ASSESSMENT OF SIGNIFICANCE: EPBC ACT

An assessment of significance of impact of the proposed works on threatened species, populations and/or communities was undertaken in accordance with the EPBC Act and is provided in Appendix D.

Eleven threatened species and 17 migratory species have potential habitat on the Subject Site and in the broader Study Area. The proposed foreshore stabilisation works are considered unlikely to substantially impact upon these species as the works are minor in nature and do not require clearing of large areas of native vegetation or dredging of protected or endangered aquatic vegetation. In addition, the Subject Site is likely to provide only sub-optimal habitat for these species as it has been previously disturbed and is relatively public.

The endangered ecological community *Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion occurs in the vicinity of the Subject Site. The proposed works will not directly impact or clear the *P. australis*. Potential impacts include shading from turbidity and poor water quality from disturbance of potential acid sulphate soils (PASS). An Acid Sulphate Soil plan of management is required prior to the commencement of works along with appropriate erosion and sediment control in accordance with NSW Fisheries Policy and Guidelines (NSW DPI, 2013).

Based on the above assessment it is considered that a referral to SEWPaC is not required.

6.4 SEPP 44 KOALA HABITAT PROTECTION

The provisions of SEPP 44 Koala Habitat Protection apply to all lands within Wyong/Gosford Local Government Area.

This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

(a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and

(b) by encouraging the identification of areas of core koala habitat, and

(c) by encouraging the inclusion of areas of core koala habitat in environment protection zones.

In this Policy:

core koala habitat means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

potential koala habitat means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Land to which this Part applies

This Part applies to land:

(a) that is land to which this Policy applies, and

(b) that is land in relation to which a development application has been made, and

(c) that:

(i) has an area of more than 1 hectare, or

(ii) has, together with any adjoining land in the same ownership, an area of more than 1 hectare,

whether or not the development application applies to the whole, or only part, of the land.

The size of the *Subject Sites* is assumed to be > 1 hectare, thus SEPP 44 is triggered.

Step 1—Is the land potential koala habitat?

The vegetation around the *Subject Site* does not contain any schedule 2 Feed Tree under this SEPP and none of the trees on the Subject Site are listed as a *main koala food trees* under Central Coast by the Office of Environment and Heritage (NSW OEH, undated). As such, The *Subject Site* does not contain potential koala habitat and no further assessment is required.

6.5 SEPP 62 AQUACULTURE

Brisbane Water has approximately 130 oyster leases although not all are currently operational. Oysters are filter feeding bivalves that rely on clean water to maintain health and resistance to disease. The oyster industry has suffered large losses over the past years as a result of diseases, which is often associated with poor water quality. As such, any works within an oyster growing area must ensure that they do not result in negative impacts on this industry.

A preliminary ASSA has recommended at ASS plan of management to ensure works do not result in a negative impact to water quality. Increased turbidity resulting from construction is likely to be short term only, as the estuary is tidal and will flush with each tide. Thus, with regard to SEPP 62, while the proposed works are in an oyster growing area, they are unlikely to result in any significant impacts on water quality.

7. MITIGATION MEASURES

The following mitigation measures are recommended the minimise potential negative impacts of the proposed works:

7.1 Water Quality

- Appropriate erosion and sediment control measures are to be installed prior to the commencement of works in accordance with Policy and guidelines for fish habitat conservation and management (NSW DPI, 2013). This includes deployment of environmental safeguards (silt curtains, booms, etc) before, during and as long as necessary after construction of works to ensure there is no escape of turbid water into the aquatic environment. NSW DPI strongly recommends the use of *The Blue Book* –

Managing Urban Stormwater: Soils and Construction (Landcom 2004) (see www.landcom.nsw.gov.au/news/publications-and-programs/the-blue-book.aspx) when planning sediment and erosion controls in or adjacent to aquatic environments. Environmental safeguards should include:

- Programming of work to ensure that it takes place during low flow periods (neap tides).
- Directions on the use of sediment and erosion controls for in-stream works to avoid impacts on water quality and fish passage. Sediment or silt screens should be inspected daily and maintained to prevent the escape of suspended sediments. Sediment control devices should not be removed until the risk of sedimentation and erosion is negligible and the site has been stabilised or revegetated following construction. Screens or other guards should be carefully removed after the work is completed. Silt screens should generally only be used in still water conditions. When placed in higher flows, water either spills over the top or lifts the curtains.
- Providing direction on the stockpiling of fill or excavated materials on flood prone lands to avoid sedimentation. Particular care should be made in siting stockpiles. Preferred sites should be situated either above the highest astronomical tide or be secure from a 1 in 10 year flood and have effective sediment control measures in place to contain any runoff.
- Ensuring that only natural material is used as fill during reclamation works. Contaminated material, tyres, building and demolition rubble or acid sulfate soils (ASS) should not be used as fill in any aquatic environment.
- Ensuring that the area is rehabilitated after completion of works.
- Ensuring that foreshore works in estuaries are restricted to calm weather conditions. This helps prevent the suspension of fine sediment particles into the water column and ensures the silt screen is not disturbed by wave action.

7.2 Ecological

- No dredging or mooring of construction equipment over *Posidonia australis* seagrass beds
- Works should avoid dredging within seagrass beds (*Z. carpricorni*) where possible.
- Works should avoid clearing of mangroves (A. marina) where possible.
- Works should avoid damage to pneumatophores (mangrove roots) where possible.
- No stockpiling is to be placed within the dripline of retained native vegetation
- Exposed soils above high water mark are to be stabilised with mulch and planted as appropriate as soon as possible.
- Planting of saltmarsh (Seablite *Suaeda australis* and Samphire *Sarcocornia quinqueflora*) at approximately 0.7m AHD to form saltmarsh berms. Other native vegetation may also be required to stabilize the soil. Additional species suitable for planting include Sand Couch *Sporobolus virginicus*, Prickly Couch *Zoysia macrantha* and Saltmarsh Rush *Juncus kraussii subsp. australiensis*.
- Saltmarsh treatment/planting is to include the placement of seagrass wrack as mulch around plants. Wrack is to be collected from the Subject Site.

7.3 Soil

- An Acid Sulphate Soil Plan of Management is to be prepared for the management of alluvial soils prior to the commencement of works in accordance with the *Preliminary Acid Sulfate Soil Assessment (PASSA) and Preliminary in Situ Waste Classification* report (Douglas Partners, 2018).

- Soil waste classification is to be confirmed by a qualified environmental consultant ex situ prior to and during bulk excavation in accordance with the *Preliminary Acid Sulfate Soil Assessment (PASSA) and Preliminary in Situ Waste Classification* report (Douglas Partners, 2018).

8. REFERENCES

Bell SJ, 2013. Review of vegetation mapping, Gosford LGA: addressing vegetation loss since 2004, November 2013. Report to Gosford City Council PO Box 21 Gosford NSW 2250.

LHCCREMS (2003). Lower Hunter Central Coast Regional Environmental Management Strategy: Vegetation Survey, Classification and Mapping.

Menkhorst P & Knight F, 2004. A field guide to the Mammals of Australia, 2nd Edition, published by Oxford University Press.

NSW DPI (undated). Mapping the estuarine habitats of NSW: http://www.dpi.nsw.gov.au/research/areas/aquatic-ecosystems/estuarine-habitats-maps

NSW DPI, 2013. Policy and Guidelines for fish habitat conservation and management. http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/468927/Policy-and-guidelines-for-fish-habitat.pdf

NSW Fisheries Scientific Committee 2010. The seagrass Posidonia australis as Endangered Populations in Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie (NSW). https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/636503/FD44-Posidonia-australis.pdf

NSW OEH, undated. Koala habitat and feed trees. http://www.environment.nsw.gov.au/topics/animals-and-plants/native-animals/native-animal-facts/koala/koala-habitat

NSW OEH. eSpade: NSW Soil and Land Information. http://www.environment.nsw.gov.au/eSpadeWebApp/

NSW Scientific Committee, 2004. Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10945

OEH undated. Threatened species profiles and references therein. http://www.environment.nsw.gov.au/threatenedSpeciesApp/

Pizzey G, & Knight F 2003. The field guide to the birds of Australia, published by HarperCollins Publishers, 25 Ryde Rd, Pymble, Sydney, NSW 2073 Australia.

9. APPENDIX A: DESKTOP RESULTS

Table A1. BioNet Search Results for threatened species listed under the BC Act and EPBC Act within the Study Area.

Scientific Name	Common Name	NSW Status	Comm. Status	Records
AMPHIBIANS				
Heleioporus australiacus	Giant Burrowing Frog	V,P	V	3
Pseudophryne australis	Red-crowned Toadlet	V,P		11
Litoria aurea	Green and Golden Bell Frog	E1,P	V	18
Litoria brevipalmata	Green-thighed Frog	V,P		1
REPTILES				
Chelonia mydas	Green Turtle	V,P	V	10
Varanus rosenbergi	Rosenberg's Goanna	V,P		1
AVES				
Ptilinopus superbus	Superb Fruit-Dove	V,P		4
Apus pacificus	Fork-tailed Swift	P	C,J,K	2
Hirundapus caudacutus	White-throated Needletail	P	C,J,K	2
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P		1
Ardea ibis	Cattle Egret	P	C,J	11
Ixobrychus flavicollis	Black Bittern	V,P		6
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	29
Hamirostra melanosternon	Black-breasted Buzzard	V,P,3		1
Hieraaetus morphnoides	Little Eagle	V,P		1
Lophoictinia isura	Square-tailed Kite	V,P,3		3
Pandion cristatus	Eastern Osprey	V,P,3		32
Burhinus grallarius	Bush Stone-curlew	E1,P		367
Haematopus fuliginosus	Sooty Oystercatcher	V,P		2
Haematopus longirostris	Pied Oystercatcher	E1,P		93
Charadrius mongolus	Lesser Sand-plover	V,P	E,C,J,K	2
Limosa lapponica	Bar-tailed Godwit	P	C,J,K	10
Numenius madagascariensis	Eastern Curlew	P	CE,C,J,K	29
Numenius minutus	Little Curlew	P	C,J,K	1
Numenius phaeopus	Whimbrel	P	C,J,K	13
Tringa brevipes	Grey-tailed Tattler	P	C,J,K	2
Tringa glareola	Wood Sandpiper	P	C,J,K	1
Tringa nebularia	Common Greenshank	P	C,J,K	4
Xenus cinereus	Terek Sandpiper	V,P	C,J,K	2
Hydroprogne caspia	Caspian Tern	P	C,J	10
Sterna hirundo	Common Tern	P	C,J,K	4
Sternula albifrons	Little Tern	E1,P	C,J,K	1
Callocephalon fimbriatum	Gang-gang Cockatoo	V,P,3		3
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		64
Glossopsitta pusilla	Little Lorikeet	V,P		6
Lathamus discolor	Swift Parrot	E1,P,3	CE	4
Neophema pulchella	Turquoise Parrot	V,P,3		1
Ninox connivens	Barking Owl	V,P,3		8
Ninox strenua	Powerful Owl	V,P,3		73
Tyto novaehollandiae	Masked Owl	V,P,3		6
Tyto tenebricosa	Sooty Owl	V,P,3		67
Chthonicola sagittata	Speckled Warbler	V,P		1
Anthochaera phrygia	Regent Honeyeater	E4A,P	CE	5
Epthianura albifrons	White-fronted Chat	V,P		1
Daphoenositta chrysoptera	Varied Sittella	V,P		6
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		1

Petroica boodang	Scarlet Robin	V,P		1
MAMMALS				
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	43
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	E1,P	E	1
Phascolarctos cinereus	Koala	V,P	V	5
Cercartetus nanus	Eastern Pygmy-possum	V,P		1
Petaurus australis	Yellow-bellied Glider	V,P		36
Petaurus norfolcensis	Squirrel Glider	V,P		10
Petauroides volans	Greater Glider	P	V	22
Potorous tridactylus	Long-nosed Potoroo	V,P	V	2
Macropus parma	Parma Wallaby	V,P		1
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	34
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		2
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		10
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V	3
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		6
Miniopterus australis	Little Bentwing-bat	V,P		28
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		29
Myotis macropus	Southern Myotis	V,P		8
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P		18
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	V,P		3
FLORA				
Hibbertia procumbens	Spreading Guinea Flower	E1,P		3
Tetratheca juncea	Black-eyed Susan	V,P	V	2
Epacris purpurascens var. purpurascens		V,P		2
Chamaesyce psammogeton	Sand Spurge	E1,P		1
Acacia pubescens	Downy Wattle	V,P	V	1
Prostanthera askania	Tranquility Mintbush	E1,P	E	8
Lindsaea fraseri	Fraser's Screw Fern	E1,P,3		1
Darwinia glaucophylla		V,P		5
Eucalyptus camfieldii	Camfield's Stringybark	V,P	V	1
Eucalyptus glaucina	Slaty Red Gum	V,P	V	1
Melaleuca biconvexa	Biconvex Paperbark	V,P	V	145
Syzygium paniculatum	Magenta Lilly Pilly	E1,P	V	16
^^*Dendrobium melaleucaphilum*	Spider orchid	E1,P,2		1
Persoonia hirsuta	Hairy Geebung	E1,P,3	E	1

Table A2. Endangered Ecological Communities under the BC Act and EPBC Act within the Study Area.

Endangered Ecological Community	NSW Status	Comm Status
Blue Gum High Forest in the Sydney Basin Bioregion	E4B	CE
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V
Coastal Upland Swamp in the Sydney Basin Bioregion	E3	E
Duffys Forest Ecological Community in the Sydney Basin Bioregion	E3	
Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion	E3	E
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	E3	
Kincumber Scribbly Gum Forest in the Sydney Basin Bioregion	E4B	
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE
Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion	E3	
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E3	CE
Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	E3	
Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion	E3	
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Shale Sandstone Transition Forest in the Sydney Basin Bioregion	E4B	CE
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	E3	
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E3	
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3	
Umina Coastal Sandplain Woodland in the Sydney Basin Bioregion	E3	
Western Sydney Dry Rainforest in the Sydney Basin Bioregion	E3	CE

Table A3. Protected Matters Search Tool Summary for Matters of National Environmental Significance under the EPBC Act within the Study Area.

NES	Summary
World Heritage Properties:	3 1. Australian Convict Sites (Old Great Nth Rd buffer) 2. Australian Convict Sites (Old Great Nth Rd) 3. The Greater Blue Mountains Area
National Heritage Places:	3 1. Ku-ring-gai Chase National Park, 2. Lion. Long and spectacle Island Nature Reserves 3. The Greater Blue Mountains Area
Wetlands of International Importance:	1 1. Hunter estuary wetlands
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	1. Central Hunter Valley eucalypt forest and woodland 2. Coastal Swamp oak Forest 3. Coastal Upland Swamps in the Sydney Basin Bioregion 4. Littoral Rainforest and Coastal vine thickets 5. *Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion 6. Subtropical and Temperate Coastal Saltmarsh
Listed Threatened Species:	106 (See below)
Listed Migratory Species:	76 (See below)

Table A4. Protected Matters Search Tool Results for Threatened Species listed under the EPBC Act within the Study Area.

Scientific Name	Common Name	Comm Status	Habitat Potential
Anthochaera phrygia	Regent Honeyeater	CE	N
Botaurus poiciloptilus	Australasian Bittern	E	Y
Calidris canutus	Red Knot	E	Y
Calidris ferruginea	Curlew Sandpiper	CE	Y
Calidris tenuirostris	Great Knot	CE	Y
Charadrius mongolus	Lesser Sand Plover	E	Y
Dasyornis brachypterus	Eastern Bristlebird	E	N
Diomedea antipodensis	Antipodean Albatross	V	N
Diomedea antipodensis gibsoni	Gibson's Albatross	V	N
Diomedea epomophora (sensu stricto)	Southern Royal Albatross	V	N
Diomedea exulans (sensu lato)	Wandering Albatross	V	N
Diomedea sanfordi	Northern Royal Albatross	E	N
Fregetta grallaria grallaria	White-bellied Storm-Petrel (Tasman Sea),	V	N
Grantiella picta	Painted Honeyeater	V	N
Lathamus discolor	Swift Parrot	CE	N
Limosa lapponica baueri	Bar-tailed Godwit	V	Y
Limosa lapponica menzbieri	Bar-tailed Godwit (menzbieri)	CE	Y
Macronectes giganteus	Southern Giant-Petrel,	E	N
Macronectes halli	Northern Giant Petrel	V	N
Numenius madagascariensis	Eastern Curlew,	CE	Y
Pachyptila turtur subantarctica	Fairy Prion (southern)	V	N

Phoebetria fusca	Sooty Albatross	V	N
Pterodroma leucoptera leucoptera	Gould's Petrel,	E	N
Pterodroma neglecta neglecta	Kermadec Petrel (western)	V	N
Rostratula australis	Australian Painted Snipe	E	Y
Sternula nereis nereis	Australian Fairy Tern	V	N
Thalassarche bulleri	Buller's Albatross,	V	N
Thalassarche bulleri platei	Northern Buller's Albatross	V	N
Thalassarche cauta cauta	Shy Albatross,	V	N
Thalassarche cauta steadi	White-capped Albatross	V	N
Thalassarche eremita	Chatham Albatross	E	N
Thalassarche impavida	Campbell Albatross,	V	N
Thalassarche melanophris	Black-browed Albatross	V	N
Thalassarche salvini	Salvin's Albatross	V	N
Epinephelus daemelii	Black Rockcod,	V	N
Macquaria australasica	Macquarie Perch	E	N
Prototroctes maraena	Australian Grayling	V	N
Heleioporus australiacus	Giant Burrowing Frog	V	N
Litoria aurea	Green and Golden Bell Frog	V	N
Litoria littlejohni	Littlejohn's Tree Frog,	V	N
Mixophyes balbus	Stuttering Frog,	V	N
Mixophyes iteratus	Giant Barred Frog,	E	N
Balaenoptera musculus	Blue Whale	E	N
Chalinolobus dwyeri	Large-eared Pied Bat,	V	Y
Dasyurus maculatus maculatus (SE mainland population)	Spot-tailed Quoll,	E	N
Eubalaena australis	Southern Right Whale	E	N
Isoodon obesulus obesulus	Southern Brown Bandicoot	E	N
Megaptera novaeangliae	Humpback Whale	V	N
Petauroides volans	Greater Glider	V	N
Petrogale penicillata	Brush-tailed Rock-wallaby	V	N
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	Koala	V	N
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)	V	N
Pseudomys novaehollandiae	New Holland Mouse,	V	N
Pteropus poliocephalus	Grey-headed Flying-fox	V	Y
Acacia bynoeana	Bynoe's Wattle,	V	N
Acacia pubescens	Downy Wattle	V	N
Allocasuarina glareicola		E	N
Angohora iopoina	Charmhaven Apple	V	N
Asterolasia elegans	,	E	N
Astrotricha crassifolia	Thick-leaf Star-hair	V	N
Baloskion longipes	Dense Cord-rush	V	N
Caladenia tessellate	Thick-lipped Spider Orchid	V	N
Corunastylis insignis	Wyong Midge Orchd	Ce	N
Corunastlis sp Charmhaven	Wyong Midge Orchid2	CE	N

Cryptostylis hunteriana	Leafless Tongue-orchid	V	N
Cynanchum elegans	White-flowered Wax Plant	E	N
Diuris praecox	Newcastle Doubletail	V	N
Eucalyptus camfieldii	Camfield's Stringybark	V	N
Genoplesium baueri	Yellow Gnat-orchid	E	N
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	N
Leptospermum deanei	Deane's Tea-tree	V	N
Melaleuca biconvexa	Biconvex Paperbark	V	N
Pelargonium sp. Striatellum (G.W.Carr 10345)	Omeo Stork's-bill	E	N
Prostanthera askania	Tranquillity Mintbush,	E	N
Pultenaea glabra	Smooth Bush-pea,	V	N
Rhizanthella slateri	Eastern Underground Orchid	E	N
Syzygium paniculatum	Magenta Lilly Pilly,	V	N
Tetratheca juncea	Black-eyed Susan	V	N
Thelymitra adorata	Wyong Sun Orchid	CE	N
Thesium australe	Austral Toadflax	V	N
Caretta caretta	Loggerhead Turtle	E	N
Chelonia mydas	Green Turtle	V	N
Dermochelys coriacea	Leatherback Turtle,	E	N
Eretmochelys imbricata	Hawksbill Turtle	V	N
Hoplocephalus bungaroides	Broad-headed Snake	V	N
Natator depressus	Flatback Turtle	V	N
Carcharias taurus (east coast population)	Grey Nurse Shark (east coast population)	CE	N
Carcharodon carcharias	White Shark,	V	N
Rhincodon typus	Whale Shark	V	N

Table A5. Protected Matters Search Tool Results for Migratory Species listed under the EPBC Act with 10 km of the Study Area.

Scientific Name	Common Name	Status	Habitat Potential
Terrestrial Species			
Cuculus optatus	Oriental Cuckoo	M	N
Hirundapus caudacutus	White-throated Needletail	M	N
Monarcha melanopsis	Black-faced Monarch	M	N
Monarcha trivirgatus	Spectacled Monarch	M	N
Motacilla flava	Yellow Wagtail	M	N
Myiagra cyanoleuca	Satin Flycatcher	M	N
Rhipidura rufifrons	Rufous Fantail	M	N
Wetlands Species			
Actitis hypoleucos	Common Sandpiper	M	Y
Arenaria interpres	Ruddy Turnstone	M	N
Calidris acuminata	Sharp-tailed Sandpiper	M	Y
Calidris alba	Sanderling	M	Y
Calidris canutus	Red Knot	E,M	Y
Calidris ferruginea	Curlew Sandpiper	CE,M	Y
Calidris melanotos	Pectoral Sandpiper	M	Y
Calidris ruficollis	Red-necked Stint	M	Y
Calidris tenuirostris	Great Knot	CE,M	Y
Charadrius bicinctus	Double-banded Plover	M	Y
Charadrius mongolus	Lesser Sand Plover,	E,M	Y
Gallinago hardwickii	Latham's Snipe,	M	Y
Gallinago megala	Swinhoe's Snipe	M	N
Gallinago sterura	Pin-tailed Snipe	M	N
Heteroscelus brevipes	Grey-tailed Tattler	M	Y
Limosa lapponica	Bar-tailed Godwit	M	Y
Limosa limosa	Black-tailed Godwit	M	Y
Numenius madagascariensis	Eastern Curlew	CE,M	Y
Numenius minutus	Little Curlew,	M	Y
Numenius phaeopus	Whimbrel	M	Y
Pandion haliaetus	Osprey	M	N
Pluvialis fulva	Pacific Golden Plover	M	Y
Pluvialis squatarola	Grey Plover	M	Y
Tringa nebularia	Common Greenshank	M	Y
Tringa stagnatilis	Marsh Sandpiper,	M	Y
Xenus cinereus	Terek Sandpiper	M	Y

Table A6. Vegetation Mapped within 2 km of the Study Area (LHCCREMS, 2002)

MU	Name
1	Coastal Wet Gully Forest
1a	Coastal Warm Temperate-subtropical Rainforest
5	Alluvial Tall Moist Forest
6	Coastal Narrabeen Moist Forest
22	Coastal Narrabeen Shrub Forest
37	Swamp Mahogany-Paperbark Forest
40	Swamp Oak – Rushland Forest
47	Mangrove-Estuarine Complex

Table A7. Habitat Assessment for threatened Aquatic Species previously recorded in the Study Area

Common Name	Scientific Name	Status			Habitat	Potential?
		EPBC Act	BC Act	FM Act		
Black Rockcod	*Epinephelus daemelii*	V		V	Found in caves, gutters and beneath bommies on rocky reefs	N
Macquarie Perch	*Macquaria australasica*	E		E	Found in upper reaches of rivers and lakes	N
Australian Grayling	*Prototroctes maraena*	V			Spawn in lower freshwater reaches of rivers, drift downstream into open ocean	N
Blue Whale	*Balaenoptera musculus*	E			Open ocean	N
Southern Right Whale	*Eubalaena australis*	E			Open ocean	N
Humpback Whale	*Megaptera novaeangliae*	V			Open ocean	N
Green Turtle	*Chelonia mydas*	V	V		tropical and sub-tropical seas	Y
Loggerhead Turtle	*Caretta caretta*	E	E		tropical and sub-tropical seas	N
Leatherback Turtle	*Dermochelys coriacea*	E	E		tropical and temperate waters	N
Hawksbill Turtle	*Eretmochelys imbricata*	V			northern Great Barrier Reef and Torres Strait	N
Flatback Turtle	*Natator depressus*	V			tropical waters of northern Australia	N
Grey Nurse Shark	*Carcharias Taurus* (east coast population)	CE		CE	southern Queensland and around south-east Australia	N
Great White Shark	*Carcharodon carcharias*	V		V	temperate and sub-tropical regions, frequently found off southern Australia	N
Whale Shark	*Rhincodon typus*	V			Whale sharks have a broad distribution in tropical and warm temperate seas, usually between latitudes 30°N and 35°S	N
Strap Weed	*Posidonia australis*			EP	endemic to the temperate waters of the south-eastern, southern and south-western coasts of Australia	Y

E = Endangered; CE = Critically Endangered; EP = Endangered Population; V = Vulnerable
Y = Yes there is potential breeding and/or feeding habitat at the Subject Site
N = There is no potential habitat for this species at the Subject Site

Table A8. Habitat Assessment of Threatened Species Recorded in the Study Area

Family	Scientific Name	Common Name	NSW status	Comm. status	Habitat Preference	Records	Likelihood of Occurrence
AMPHIBIANS							
Myobatrachidae	*Heleioporus australiacus*	Giant Burrowing Frog	V,P	V	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are approximately 0.04 ha in size. Individuals move into the breeding site either immediately before or following heavy rain and occupy these sites for up to 10 days. Most individuals will not attempt to breed every year. The Giant Burrowing Frog has a generalist diet and studies to date indicate that they eat mainly invertebrates including ants, beetles, cockroaches, spiders, centipedes and scorpions. When breeding, frogs will call from open spaces, under vegetation or rocks or from within burrows in the creek bank. Males show strong territoriality at breeding sites. This species breeds mainly in autumn, but has been recorded calling throughout the year. Egg masses are foamy with an average of approximately 500-800 eggs and are laid in burrows or under vegetation in small pools. After rains, tadpoles are washed into larger pools where they complete their development in ponds or ponded areas of the creekline. Tadpole development ranges from around 12 weeks duration to up to 12 months with late developing tadpoles overwintering and completing development when warmer temperatures return. Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water. This frog is a slow growing and long-lived species, living up to 10 years of age, possibly longer. Adult specimens difficult to detect at times other than when calling during warm weather, late spring	3	Low No suitable habitat

					summer and after rains; distinctive tadpoles are readily observable for lengthy periods.		
Myobatrachidae	*Pseudophryne australis*	Red-crowned Toadlet	V,P		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. Red-crowned Toadlets have not been recorded breeding in waters that are even mildly polluted or with a pH outside the range 5.5 to 6.5. 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. Red-crowned Toadlets are quite a localised species that appear to be largely restricted to the immediate vicinity of suitable breeding habitat. Red-crowned Toadlets are usually found as small colonies scattered along ridges coinciding with the positions of suitable refuges near breeding sites. Due to this tendency for discrete populations to concentrate at particular sites, a relatively small localised disturbance may have a significant impact on a local population if it occurs on a favoured breeding or refuge site.	11	Low No suitable habitat
Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E1,P	V	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), 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. Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation.	18	Low No suitable habitat

					Tadpoles feed on algae and other plant-matter; adults eat mainly insects, but also other frogs. Preyed upon by various wading birds and snakes.		
Hylidae	*Litoria brevipalmata*	Green-thighed Frog	V,P		Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range, but extends into drier forests in northern NSW and southern Queensland. Breeding occurs following heavy rainfall from spring to autumn, with larger temporary pools and flooded areas preferred. Frogs may aggregate around breeding sites and eggs are laid in loose clumps among waterplants, including water weeds. The larvae are free swimming. The frogs are thought to forage in leaf-litter. Identifiable from October to March within 3 days of heavy rains (5 cm plus in 24 hours)	1	Low No suitable habitat
REPTILES							
Cheloniidae	*Chelonia mydas*	Green Turtle	V,P	V	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. Identifiable: Can be opportunistic; breeding period when they leave the water to breed; when they occur in estuaries particularly during warmer months of the year	10	Low. No nesting habitat, sporadic visitor only
Varanidae	*Varanus rosenbergi*	Rosenberg's Goanna	V,P		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. Runs along the ground when pursued (as opposed to the Lace Monitor, which climbs trees). Lays up to 14 eggs in a termite mound; the hatchlings dig themselves out of the mounds.	1	Low No suitable habitat

					Generally slow moving; on the tablelands likely only to be seen on the hottest days. Detectable only in warm to hot weather.		
AVES							
Columbidae	*Ptilinopus superbus*	Superb Fruit-Dove	V,P		Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic. There are records of single birds flying into lighted windows and lighthouses, indicating that birds travel at night. At least some of the population, particularly young birds, moves south through Sydney, especially in autumn. Breeding takes place from September to January. The nest is a structure of fine interlocked forked twigs, giving a stronger structure than its flimsy appearance would suggest, and is usually 5-30 metres up in rainforest and rainforest edge tree and shrub species. The male incubates the single egg by day, the female incubates at night. Identifiable all year.	4	Low No suitable habitat
Apodidae	*Apus pacificus*	Fork-tailed Swift	P	C,J,K	The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. The Fork-tailed Swift leaves its breeding grounds in Siberia from August–September and usually arrives in Australia around October. In their breeding range, they nest on mountain cliffs or island rock caves, inside narrow crevices or in cracks on vertical cliff faces.	2	Low No suitable habitat
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	P	C,J,K	In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. The White-throated Needletail is widespread in eastern and south-eastern Australia. After breeding in eastern Siberia, north-eastern China and Japan, the species leaves the breeding grounds between late August and October, flying singly or in scattered flocks and enter Australia via the Torres Strait, usually during September and October.	2	Low No suitable habitat
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1,P		Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Storks usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to	1	Low sub-optimal habitat and outside of range

					their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish). Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the floodplain habitat). In NSW, breeding activity occurs May - January; incubation May - October; nestlings July - January; fledging from September. Parents share nest duties and in one study about 1.3-1.7 birds were fledged per nest. The NSW breeding population has been estimated at about 75 pairs. Territories are large and variable in size. They have been estimated to average about 9,000ha, ranging from 3,000-6,000ha in high quality habitat and 10,000-15,000ha in areas where habitat is poor or dispersed.		
Ardeidae	*Ardea ibis*	Cattle Egret	P	C,J	The Cattle Egret breeds in colonies, either mono-specific or with other Egrets/Herons. In Australia the principal breeding sites are the central east coast from about Newcastle to Bundaberg. It also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes). Non-breeding Cattle Egret may remain in breeding areas, but most migrate elsewhere. The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands.	11	Low No suitable habitat
Ardeidae	*Ixobrychus flavicollis*	Black Bittern	V,P		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. When disturbed, freezes in a characteristic bittern posture (stretched tall, bill pointing up, so that shape and streaked pattern blend with upright stems of reeds), or will fly up to a branch or flush for cover where it will freeze again. Generally solitary, but occurs in pairs during the breeding season, from December to March. Like other bitterns, but unlike most herons, nesting is solitary. Nests, built in spring are located on a branch overhanging water and consist of a bed of sticks and reeds on a base of larger sticks.	6	Low Habitat lacks dense vegetation

					Between three and five eggs are laid and both parents incubate and rear the young.		
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	P	C	The White-bellied Sea-Eagle is distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. It also extends inland along some of the larger waterways, especially in eastern Australia. The White-bellied Sea-Eagle feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion and offal.	29	Moderate Foraging habitat only
Accipitridae	*Hamirostra melanosternon*	Black-breasted Buzzard	V,P,3		Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands. Not a powerful hunter, despite its size, mostly taking reptiles, small mammals, birds, including nestlings, and carrion. Also specialises in feeding on large eggs, including those of emus, which it cracks on a rock. Breeds from August to October near water in a tall tree. The stick nest is large and flat and lined with green leaves. Normally two eggs are laid.	1	Low No suitable habitat
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V,P		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.	1	Low No suitable habitat
Accipitridae	*Lophoictinia isura*	Square-tailed Kite	V,P,3		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. Appears to occupy large hunting ranges of more than 100km2.	3	Low No suitable habitat

				Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.		
Accipitridae	*Pandion cristatus*	Eastern Osprey	V,P,3	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed 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. . Incubation of 2-3 eggs, usually by the female, is about 40 days. Female remains with young almost until they fly, usually after about nine weeks in the nest.	32	Moderate Foraging habitat only
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E1,P	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.	367	Moderate. Suitable habitat although most records are further south
Haematopodidae	*Haematopus fuliginosus*	Sooty Oystercatcher	V,P	Favours 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. The nest is a shallow scrape on the ground, or small mounds of pebbles, shells or seaweed when nesting among rocks.	2	Low Sub-optimal habitat
Haematopodidae	*Haematopus longirostris*	Pied Oystercatcher	E1,P	Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones.	93	Moderate. Suitable habitat although most records are further south

					Two to three eggs are laid between August and January. The female is the primary incubator and the young leave the nest within several days.		
Charadriidae	*Charadrius mongolus*	Lesser Sand-plover	V,P	C,J,K	Almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms. Highly gregarious, frequently seen in flocks exceeding 100 individuals; also often seen foraging and roosting with other wader species. Roosts during high tide on sandy beaches, spits and rocky shores; forage individually or in scattered flocks on wet ground at low tide, usually away from the water's edge. Diet includes insects, crustaceans, molluscs and marine worms. Prey is usually detected visually with the birds making short, quick runs, with abrupt stops to lunge at the ground or look for prey. Identifiable from September – April.	2	Moderate
Scolopacidae	*Limosa lapponica*	Bar-tailed Godwit	P	C,J,K	The Bar-tailed Godwit has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria, including the offshore islands. The Bar-tailed Godwit breeds in the north of Scandinavia, Russia and north-west Alaska. The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips.	10	Moderate
Scolopacidae	*Numenius madagascariensis*	Eastern Curlew	P	CE,C,J,K	It generally occupies coastal lakes, inlets, bays and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets	29	Moderate

					It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. It 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. The Eastern Curlew is carnivorous, mainly eating crustaceans (including crabs, shrimps and prawns), small molluscs, as well as some insects. The birds may delay breeding until three to four years of age. Within Australia, immature birds, which do not migrate, move northward in winter. Identifiable from September to March.		
Scolopacidae	*Numenius minutus*	Little Curlew	P	C,J,K	Little Curlews generally spend the non-breeding season in northern Australia from Port Hedland in Western Australia to the Queensland coast. There are records of the species from inland Australia, and widespread but scattered records on the east coast. The species has also been recorded on Lord Howe Island, Cocos-Keeling Island and Christmas Island. The species is recorded in Australia between September and April and there are few winter records. the Little Curlew has been recorded breeding in Siberia. The Little Curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used.	1	Moderate
Scolopacidae	*Numenius phaeopus*	Whimbrel	P	C,J,K	The Whimbrel is a regular migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records of Whimbrels in all regions. It is found in all states but is more common in the north. The Whimbrel breeds in north and west Alaska. The Whimbrel generally forages on intertidal mudflats, along the muddy banks of estuaries and in coastal lagoons, either in open unvegetated areas or among mangroves. They sometimes forage on sandy beaches or among rocks. It has occasionally been sighted feeding on exposed coral or rocky reefs and rock platforms. It is	13	Moderate

					known to probe holes and crevices among rubble and on reef flats, but not on reef crests.		
Scolopacidae	*Tringa brevipes*	Grey-tailed Tattler	P	C,J,K	Within Australia, the Grey-tailed Tattler has a primarily northern coastal distribution and is found in most coastal regions. In NSW the Grey-tailed Tattler is distributed along most of the coast from the Queensland border, south to Tilba Lake. It is more heavily distributed along coastal regions north of Sydney. The species breeds in north Siberia; they usually place their nests in shallow depressions, often on a stony riverbed and occasionally in deserted nests in trees. The Grey-tailed Tattler usually forages in shallow water, on hard intertidal substrates, such as reefs and rock platforms, in rock pools and among rocks and coral rubble, over which water may surge. It has also been recorded foraging on exposed intertidal mudflats, especially with mangroves and possibly seagrass nearby. Occasionally it forages on intertidal sandflats, around banks of seaweed or protruding rocks or lumps of coral Identifiable from September to April.	2	Moderate
Scolopacidae	*Tringa glareola*	Wood Sandpiper	P	C,J,K	The Wood Sandpiper has its largest numbers recorded in north-west Australia. In NSW there are records east of the Great Divide, from Stratheden and Casino, south to Nowra and elsewhere, mostly from the Riverina, but also from the Upper and Lower Western Regions. The Wood Sandpiper breeds across Eurasia, mostly in Scandinavia, the Baltic countries and Russia. The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially Melaleuca and River Red Gums Eucalyptus camaldulensis and often with fallen timber. They also frequent inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops.	1	Low Suboptimal habitat
Scolopacidae	*Tringa nebularia*	Common Greenshank	P	C,J,K	The Common Greenshank occurs in all types of wetlands and has the widest distribution of any shorebird in Australia. In NSW, the species has been recorded in most coastal regions. It is widespread west of the Great Dividing Range, especially between the Lachlan and Murray Rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions.	4	Moderate

					The Common Greenshank breeds in Eurasia, the northern British Isles, Scandanavia, east Estonia and north-east Belarus. The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores.		
Scolopacidae	*Xenus cinereus*	Terek Sandpiper	V,P	C,J,K	In Australia, has been recorded on coastal mudflats, lagoons, creeks and estuaries. Favours mudbanks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools. Generally roosts communally amongst mangroves or dead trees, often with related wader species. Breaks up into smaller flocks or even solitary birds when feeding in open intertidal mudflats. The diet includes worms, crabs and other crustaceans, small shellfish and the adults and larvae of various flies, beetles and water-bugs. Feeding is undertaken by moving rapidly and erratically over soft, wet mud, pecking or probing at the surface. Identifiable from September to May.	2	Moderate
Laridae	*Hydroprogne caspia*	Caspian Tern	P	C,J	Breeds occurs in North America, Africa and Eurasia. Within Australia, the Caspian Tern has a widespread occurrence and can be found in both coastal and inland habitat. In NSW it is widespread east of the Great Divide, mainly in coastal regions, and also in the Riverina and Lower and Upper Western Regions, with occasional records elsewhere The Caspian Tern is mostly found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred. They also occur on near-coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks. They also use artificial wetlands, including reservoirs, sewage ponds and	10	Moderate

					saltworks. In offshore areas the species prefers sheltered situations, particularly near islands, and is rarely seen beyond reefs. Large numbers may shelter along the coast, behind coastal sand-dunes or coastal lakes during rough weather, and have been recorded inland after storms.		
Laridae	*Sterna hirundo*	Common Tern	P	C,J,K	This species breeds in North America and Eurasia. In Australia, Common Terns are mainly found along the eastern coast, where they are widespread and common from south-eastern Queensland to eastern Victoria though less often recorded south of Port Hacking in NSW. Common Terns are marine, pelagic and coastal. In Australia, they are recorded in all marine zones, but are commonly observed in near-coastal waters, both on ocean beaches, platforms and headlands and in sheltered waters, such as bays, harbours and estuaries with muddy, sandy or rocky shores. However, off Wollongong, NSW, Common Terns were recorded in all marine zones but generally recorded in offshore and pelagic waters, 11–55 km from shore. Occasionally they are recorded in coastal and near-coastal wetlands, either saline or freshwater, including lagoons, rivers, lakes, swamps and saltworks. Sometimes they occur in mangroves or saltmarsh and, in bad weather, in coastal sand-dunes or coastal embayments.	4	Moderate
Laridae	*Sternula albifrons*	Little Tern	E1,P	C,J,K	Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands. The nest is a scrape in the sand, which may be lined with shell grit, seaweed or small pebbles. Both parents incubate up to three well-camouflaged eggs for up to 22 days, aggressively defending the nest against intruders until the young fledge at 17 - 19 days. Often seen feeding in flocks, foraging for small fish, crustaceans, insects, worms and molluscs by plunging in the shallow water of channels and estuaries, and in the surf on beaches, or skipping over the water surface with a swallow-like flight. Locally breeding population present September to March.	1	Low Suboptimal habitat

Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V,P,3	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. May also occur in sub-alpine Snow Gum (Eucalyptus pauciflora) woodland and occasionally in temperate rainforests. 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.	3	Low No suitable habitat
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (Allocasuarina littoralis) and Forest Sheoak (A. torulosa) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, Allocasuaraina diminuta, and A. gymnathera. Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (Casuarina cristata). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.	64	Moderate
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V,P	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards Gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Flocks numbering hundreds are still	6	Low Suboptimal habitat

					occasionally observed and may have been the norm in past centuries. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like Allocasuarina. Nesting season extends from May to September. In years when flowering is prolific, Little Lorikeet pairs can breed twice, producing 3-4 young per attempt. However, the survival rate of fledglings is unknown.		
Psittacidae	*Lathamus discolor*	Swift Parrot	E1,P,3	E	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Mugga Ironbark E. sideroxylon, and White Box E. albens. Commonly used lerp infested trees include Inland Grey Box E. microcarpa, Grey Box E. moluccana and Blackbutt E. pilularis. Return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum Eucalyptus globulus. Identifiable from March to September.	4	Low Suboptimal habitat
Psittacidae	*Neophema pulchella*	Turquoise Parrot	V,P,3		Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter.	1	Low No suitable habitat

				Forages quietly and may be quite tolerant of disturbance. However, if flushed it will fly to a nearby tree and then return to the ground to browse as soon as the danger has passed. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.		
Strigidae	*Ninox connivens*	Barking Owl	V,P,3	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Can catch bats and moths on the wing, but typically hunts by sallying from a tall perch. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats. Two or three eggs are laid in hollows of large, old trees. Living eucalypts are preferred though dead trees are also used. Nest sites are used repeatedly over years by a pair, but they may switch sites if disturbed by predators (e.g. goannas). Nesting occurs during mid-winter and spring but is variable between pairs and among years. As a rule of thumb, laying occurs during August and fledging in November. The female incubates for 5 weeks, roosts outside the hollow when chicks are 4 weeks old, then fledging occurs 2-3 weeks later. Young are dependent for several months. Territorial pairs respond strongly to recordings of Barking Owl calls from up to 6 km away, though humans rarely hear this response farther than 1.5 km. Because disturbance reduces the pair's foraging time, and can pull the female off her eggs even on cold nights, recordings should not be broadcast unnecessarily nor during the nesting season.	8	Low No suitable habitat

				Calls at all time of year, but strongest response in March-June. Avoid early nesting (July-Sept) when surveys pull the female off eggs on cold nights.		
Strigidae	*Ninox strenua*	Powerful Owl	V,P,3	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine Syncarpia glomulifera, Black She-oak Allocasuarina littoralis, Blackwood Acacia melanoxylon, Rough-barked Apple Angophora floribunda, Cherry Ballart Exocarpus cupressiformis and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. There may be marked regional differences in the prey taken by Powerful Owls. For example in southern NSW, Ringtail Possum make up the bulk of prey in the lowland or coastal habitat. At higher elevations, such as the tableland forests, the Greater Glider may constitute almost all of the prey for a pair of Powerful Owls. Flying foxes are important prey in some areas; birds comprise about 10-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him. Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter, but is slightly earlier in north-eastern NSW (late summer - mid autumn). Clutches consist of two dull white eggs and incubation lasts approximately 38 days. Identifiable all year.	73	Low No suitable habitat

Tytonidae	*Tyto novaehollandiae*	Masked Owl	V,P,3	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Identifiable all year.	6	Low No suitable habitat
Tytonidae	*Tyto tenebricosa*	Sooty Owl	V,P,3	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (Pseudocheirus peregrinus) or Sugar Glider (Petaurus breviceps). Nests in very large tree-hollows.	67	Low No suitable habitat
Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	V,P	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. A side entrance allows the bird to walk directly inside. A clutch of 3-4 eggs is laid, between August and January, and both parents feed the nestlings. The eggs are a glossy red-brown, giving rise to the unusual folk names ‘Blood Tit’ and ‘Chocolatebird’.	1	Low No suitable habitat

					Some cooperative breeding occurs. The species may act as host to the Black-eared Cuckoo. Speckled Warblers often join mixed species feeding flocks in winter, with other species such as Yellow-rumped, Buff-rumped, Brown and Striated Thornbills. Present all year. Sedentary. Quiet and unobtrusive, but not shy		
Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	E4A,P	CE	he Regent Honeyeater is a flagship threatened woodland bird whose conservation will benefit a large suite of other threatened and declining woodland fauna. 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. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast. In the last 10 years Regent Honeyeaters have been recorded in urban areas around Albury where woodlands tree species such as Mugga Ironbark and Yellow Box were planted 20 years ago. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: Eucalyptus microcarpa, E. punctata, E. polyanthemos, E. moluccana, Corymbia robusta, E. crebra, E. caleyi, C. maculata, E.mckieana, E. macrorhyncha, E. laevopinea, and Angophora floribunda. Nectar and fruit from the mistletoes Amyema miquelii, A. pendula and A. cambagei are also eaten during the breeding season. When nectar is scarce lerp and honeydew comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings. A shrubby understorey is an important source of insects and nesting material. Colour-banding of Regent Honeyeater has shown that the species can undertake large-scale nomadic movements in the order of hundreds of kilometres. However, the exact nature of these movements is still poorly understood. It is likely that movements are dependent on spatial and temporal flowering and other resource patterns. To successfully manage the recovery of this species a full	5	Low No suitable habitat

				understanding of the habitats used in the non-breeding season is critical. There are three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks. Also nest in mistletoe haustoria. An open cup-shaped nest is constructed of bark, grass, twigs and wool by the female. Two or three eggs are laid and incubated by the female for 14 days. Nestlings are brooded and fed by both parents at an average rate of 23 times per hour and fledge after 16 days. Fledglings fed by both parents 29 times per hour. Potentially identifiable, any time of year. Nomadic and/or possibly migratory; coastal visitor mostly March –August.		
Meliphagidae	*Epthianura albifrons*	White-fronted Chat	V,P	Gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground. Have been observed breeding from late July through to early March, with 'open-cup' nests built in low vegetation. Nests in the Sydney region have also been seen in low isolated mangroves. Nests are usually built about 23 cm above the ground (but have been found up to 2.5 m above the ground). Two to three eggs are laid in each clutch, and the complete nesting cycle from nest-building to independent young is approximately 50 days Birds can breed at one year of age and are estimated to live for five years.	1	Low No suitable habitat
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V,P	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 decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. Generation length is estimated to be 5 years.	6	Low No suitable habitat

Petroicidae	*Petroica boodang*	Scarlet Robin	V,P	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. The Scarlet Robin is primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees. The Scarlet Robin is a quiet and unobtrusive species which is often quite tame and easily approached. Birds forage from low perches, fence-posts or on the ground, from where they pounce on small insects and other invertebrates which are taken from the ground, or off tree trunks and logs; they sometimes forage in the shrub or canopy layer. Scarlet Robin pairs defend a breeding territory and mainly breed between the months of July and January; they may raise two or three broods in each season. This species' nest is an open cup made of plant fibres and cobwebs and is built in the fork of tree usually more than 2 metres above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub. Eggs are pale greenish-, bluish- or brownish-white, spotted with brown; clutch size ranges from one to four. Birds usually occur singly or in pairs, occasionally in small family parties; pairs stay together year-round. In autumn and winter, the Scarlet Robin joins mixed flocks of other small insectivorous birds which forage through dry forests and woodlands.	1	Low No suitable habitat
Artamidae	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P	The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia. In New South Wales it is widespread from	1	Low No suitable habitat

					coast to inland, including the western slopes of the Great Dividing Range and farther west. It is sparsely scattered in, or largely absent from, much of the Upper Western region The Dusky Woodswallow is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. At sites where Dusky Woodswallows are recorded the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath. The ground cover may consist of grasses, sedges or open ground, often with coarse woody debris. Birds are also often observed in farm land, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber. In western New South Wales this species is primarily associated with River Red Gum/Black Box/Coolibah open forest/woodland associated with larger river/creek systems and is less common and far more patchily distributed in other communities such as mallee and cypress-pine woodland.		
MAMMALS							
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	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, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl.	43	Low No suitable habitat

					Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines. Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.		
Peramelidae	*Isoodon obesulus obesulus*	Southern Brown Bandicoot (eastern)	E1,P	E	Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only 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 hypogeous (underground-fruiting) fungi. Their searches for food often create distinctive conical holes in the soil. Males have a home range of approximately 5-20 hectares whilst females forage over smaller areas of about 2-3 hectares. Nest during the day in a shallow depression in the ground covered by leaf litter, grass or other plant material. Nests may be located under Grass trees Xanthorrhoea spp., blackberry bushes and other shrubs, or in rabbit burrows. The upper surface of the nest may be mixed with earth to waterproof the inside of the nest. Mating occurs any time of the year, usually following heavy rain. Two or three litters of 2-4 young may be produced annually. The gestation period of 11-12 days is the shortest known of any marsupial while young remarkably become independent around 60 days after being born.	1	Low No suitable habitat
Phascolarctidae	*Phascolarctos cinereus*	Koala	V,P	V	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. Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.	5	Low No suitable habitat

Burramyidae	*Cercartetus nanus*	Eastern Pygmy-possum	V,P		Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Also feeds on insects throughout the year; this feed source may be more important in habitats where flowers are less abundant such as wet forests. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (Pseudocheirus peregrinus) dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Appear to be mainly solitary, each individual using several nests, with males having non-exclusive home-ranges of about 0.68 hectares and females about 0.35 hectares. Young can be born whenever food sources are available, however most births occur between late spring and early autumn. Agile climbers, but can be caught on the ground in traps, pitfalls or postholes; generally nocturnal. Frequently spends time in torpor especially in winter, with body curled, ears folded and internal temperature close to the surroundings.	1	Low No suitable habitat
Petauridae	*Petaurus australis*	Yellow-bellied Glider	V,P		Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. Live in small family groups of two - six individuals and are nocturnal.	36	Low No suitable habitat

					Den, often in family groups, in hollows of large trees. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources.		
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	V,P		Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Live in family groups of a single adult male one or more adult females and offspring. Require 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.	10	Low No suitable habitat
Petauridae	*Petauroides Volans*	Greater Glider		V	They are locally common in wet and damp sclerophyll forest on the ranges and coastal plains from near Mossman ne Queensland to Daylesford, Victoria. The require large tree hollows for shelter.	22	Low No suitable habitat
Potoroidae	*Potorous tridactylus*	Long-nosed Potoroo	V,P	V	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. The fruit-bodies of hypogeous (underground-fruiting) fungi are a large component of the diet of the Long-nosed Potoroo. They also eat roots, tubers, insects and their larvae and other soft-bodied animals in the soil. Often digs small holes in the ground in a similar way to bandicoots. Mainly nocturnal, hiding by day in dense vegetation - however, during the winter months animals may forage during daylight hours. Individuals are mainly solitary, non-territorial and have home range sizes ranging between 2-5 ha. Breeding peaks typically occur in late winter to early summer and a single young is born per litter. Adults are capable of two reproductive bouts per annum.	2	Low No suitable habitat
Macropodidae	*Macropus parma*	Parma Wallaby	V,P		Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	1	Low No suitable habitat

					Typically feed at night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas. During the day they shelter in dense cover.			
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.	34	Moderate	foraging habitat
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		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.	2	Moderate	
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V,P		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.	10	Moderate	

					Usually solitary but also recorded roosting communally, probably insectivorous.		
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	V	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.	3	Low No suitable habitat
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		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. Identifiable from mid spring to mid autumn.	6	Low No suitable habitat
Vespertilionidae	*Miniopterus australis*	Little Bentwing-bat	V,P		Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (Miniopterus	28	Moderate

				schreibersii) and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites /maternity colonies are known in Australia. Identifiable Mid spring to mid-autumn		
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V,P	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops. hibernate from June to August	29	Moderate
Vespertilionidae	*Myotis macropus*	Southern Myotis	V,P	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December. Identifiable from October to March	8	Moderate
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m.	18	Low Suboptimal habitat

					Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young. Identifiable mid spring to mid autumn		
Muridae	*Pseudomys gracilicaudatus*	Eastern Chestnut Mouse	V,P		In NSW the Eastern Chestnut Mouse is mostly found, in low numbers, in heathland and is most common in dense, wet heath and swamps. In the tropics it is more an animal of grassy woodlands. Optimal habitat appears to be in vigorously regenerating heathland burnt from 18 months to four years previously. By the time the heath is mature, the larger Swamp Rat becomes dominant, and Eastern Chestnut Mouse numbers drop again. Feeds at night via runways through the grassy and sedge understorey, within an area of less than half a hectare. It has a broad diet of grass stems, invertebrates, fungi and seeds, with the relative significance of each component varying seasonally. Up to three litters are produced from spring to autumn; this strategy allows rapid build-up of numbers in years following fire.	3	Low No suitable habitat
PLANTS							
Dilleniaceae	*Hibbertia procumbens*	Spreading Guinea Flower	E1,P		Majority of known populations occur within Banksia ericifolia–Angophora hispida–Allocasuarina distyla scrub/heath on skeletal sandy soils. May also be found associated with 'hanging swamp' vegetation communities on sandy deposits. Flowers in summer. Is capable of resprouting following fire and has a persistent soil-stored seed bank. Identifiable when flowering, generally between December and March depending on prevailing climatic conditions.	3	Low
Elaeocarpaceae	*Tetratheca juncea*	Black-eyed Susan	V,P	V	It is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape.	2	Low

					While some studies show the species has a preference for cooler southerly aspects, it has been found on slopes with a variety of aspects. It generally prefers well-drained sites below 200m elevation and annual rainfall between 1000 - 1200mm. The preferred substrates are sandy skeletal soil on sandstone, sandy-loam soils, low nutrients; and clayey soil from conglomerates, pH neutral. It usually spreads via underground stems which can be up to 50 cm long. Consequently, individual plants may be difficult to identify. It also reproduces sexually but this requires insect pollination. Large populations of this species are particularly important. Cryptic, only detectable when in flower generally July to December but may be irregular due to prevailing climatic conditions.		
Ericaceae	*Epacris purpurascens var. purpurascens*		V,P		Found in a range of habitat types, most of which have a strong shale soil influence. Lifespan is recorded to be 5-20 years, requiring 2-4 years before seed is produced in the wild. Killed by fire and re-establishes from soil-stored seed. Identifiable all year, but easiest during flowering (July-Sept. on coast, mainly Oct.-Nov. on tablelands)	4	Low
Euphorbiaceae	*Chamaesyce psammogeton*	Sand Spurge	E1,P		Grows on fore-dunes, pebbly strandlines and exposed headlands, often with Spinifex (Spinifex sericeus) and Prickly Couch (Zoysia macrantha) 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.	1	Low
Fabaceae (Mimosoideae)	*Acacia pubescens*	Downy Wattle	V,P	V	A spreading shrub, 1 - 5 m high with brilliant yellow flowers, bipinnate leaves (divided twice pinnately) and conspicuously hairy branchlets. Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon.	1	Low

					Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. Longevity is unknown, but clonal species have been known to survive for many decades. Flowers from August to October. Pollination of Acacia flowers is usually by insects and birds. The pods mature in October to December. Recruitment is more commonly from vegetative reproduction than from seedlings. The percentage of pod production and seed fall for this species appears to be low. Acacia species generally have high seed dormancy and long-lived persistent soil seedbanks. It is thought that the species needs a minimum fire free period of 5 - 7 years to allow an adequate seedbank to develop.		
Lamiaceae	*Prostanthera askania*	Tranquility Mintbush	E1,P	E	Occurs adjacent to, but not immediately in, drainage lines on flat to moderately steep slopes formed on Narrabeen sandstone and alluvial soils derived from it. Occurs in moist sclerophyll forest and warm temperate rainforest communities, and the ecotone between them. These communities are generally tall forests with a mesic understorey; Sydney Blue Gum Eucalyptus saligna and Turpentine Syncarpia glomulifera are usually present, though canopy species present can be highly variable. Ecological knowledge about this species is very limited. The species is likely to be fire-sensitive given the moist forest habitats it occupies, however, its fire ecology is currently unknown. May be a colonising species that takes advantage of increased light following natural canopy-cover disturbance. May be out competed by invading weed species such as Lantana. Appears in some locations to propagate vegetatively by 'stem-layering' where prostrate branches take root where they remain in contact with the soil. This characteristic and the species' tendency at many sites to form dense clumps make accurate counting of individual plants within populations difficult.	8	Low

					Flowering usually occurs in spring, however, it is known that the timing of both flowering and fruiting can be variable. Most easily identifiable when in flower between September to December, if conditions are favourable.		
Lindsaeaeae	*Lindasaea fraseri*	Fraser's Screw Fern	E1,P		Fraser's Screw Fern is a ground fern with a creeping underground root that throws up new fronds at intervals. The fronds are slender, reaching up to 60 cm in length, and tend to thread themselves inconspicuously through other vegetation. Widely spaced, triangular, light-green leaflets lie on either side of a straw-coloured stem. The leafless part of the stem is less than half of the frond length. The spores are produced under a narrow flap that runs almost entirely around the leaflet margin. In NSW it is known only from two areas - near Hastings Point on the Tweed coast and in the Pillar Valley east of Grafton. Also occurs in far north and south-east Queensland. Poorly drained, infertile soils in swamp forest or open eucalypt forest, usually as part of a ferny understorey.	1	Low
Myrtaceae	*Darwinia glaucophylla*		V,P		Occurs in sandy heath, scrub and woodlands often associated with sandstone rock platforms or near hanging swamps and friable sandstone shallow soils. Associated species in scrub include: Banksia ericifolia, Acacia terminalis, A. oxycedrus, Angophora hispida, Hakea teretifolia, Bauera rubioides, and in woodland: Corymbia gummifera, C. eximia, Eucalyptus haemastoma and E. punctata. Flowers winter and spring. Seed is dispersed by ants. Germination is from soil stored seed which requires heat to break seed dormancy. Germination is unlikely in the absence of fire. Killed by fire and populations may flucuate in relation to time since the last fire. Highly sensitive to too frequent and infrequent fire. Recommended fire interval is 5-10 years. Hybrids with D. fascicularis are readily identifiable by their erect habit. Identifiable all year, but best when flowering (May to December)	285	Low
Myrtaceae	*Eucalyptus camfieldii*	Camfield's Stringybark	V,P	V	Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges.	1	Low

					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 E. oblonga Narrow-leaved Stringybark, E. capitellata Brown Stringybark and E. haemastoma Scribbly Gum. Population sizes are difficult to estimate because its extensive lignotubers may be 20 m across. A number of stems arise from these lignotubers giving the impression of individual plants. Flowering period is irregular, flowers recorded throughout the year. Poor response to too frequent fires.		
Myrtaceae	*Eucalyptus glaucina*	Slaty Red Gum	V,P	V	A medium-sized tree to 30 m tall. The bark is smooth and mottled white to slaty grey. The juvenile leaves are oval in shape and blue-green with a whitish bloom, and the buds and fruit are similarly coloured. The flowers are white, or occasionally pink, and are produced between August and December. The fruits are oval-shaped and 7– 10 mm long. The three to five raised valves are surrounded by a domed disk raised above the fruit. Found only on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, west of Maitland. Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils.	1	Low
Myrtaceae	*Melaleuca biconvexa*	Biconvex Paperbark	V,P	V	Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October. Resprouts following fire.	145	Moderate however this species was not present on the Subject Site
Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	E1,P	V	On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	16	Moderate however this species was not present on the Subject Site
Orchidaceae	*Dendrobium melaleucaphilum*	Spider orchid	E1,P,2		An orchid which grows on other plants (sometimes on rocks), with stems spreading to drooping, thin and wiry in the basal half, succulent, swollen and square in cross section in the upper half, tapering towards the tip, rooting only at the base, 6 – 45 cm long, 7 – 9 mm in diameter, with 2 – 4 leaves at apex. Roots are smooth and creeping. Leaves spreading to erect, elliptic in shape, 4.5 – 9 cm long, 15 – 25 mm wide, folded flat together lengthwise, gradually tapering to a point, thin, and smooth. Inflorescences (groups of flowers) 0.7 – 4 cm long, comprising 2 – 8 flowers. Sepals and lateral petals green to deep	1	Low

					dull yellow with reddish margins or other markings; dorsal sepal 38 – 60 mm long, 2 – 5 mm wide; labellum cream with reddish striations, 10 – 16 mm long, 7 – 9 mm wide. Column 2.5 – 4 mm long; column foot 6 – 10 mm long. Very similar to the closely related D. tetragonum which has dorsal sepal 19 – 30 mm long and labellum only up to 10 mm long. Occurs in coastal districts and nearby ranges, extending from Queensland to its southern distributional limit in the lower Blue Mountains. In NSW, it is currently known from seven recent collections. There has been no subsequent confirmation from the locations of three earlier (pre-1922) collections and it is possible that these are now extinct. Grows frequently on Melaleuca styphelioides, less commonly on rainforest trees or on rocks in coastal districts. Flowers July–October.		
Proteaceae	*Persoonia hirsuta*	Hairy Geebung	E1,P,3	E	The Hairy Geebung is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. It is usually present as isolated individuals or very small populations. It is probably killed by fire (as other Persoonia species are) but will regenerate from seed. Best identified during flowering (summer and autumn)	1	Low

TABLE A9. AQUATIC AND TERRESTRIAL SPECIES LIST

Scientific Name	Common Name	Family
FLORA		
Amyema cambagei	Mistletoe	Loranthaceae
*Araucaria heterophylla**	Norfolk Island Pine	Araucariaceae
Avicennia marina subsp. *australasica*	Grey Mangrove	Acanthaceae
Casuarina glauca	Swamp Oak	Casuarinaceae
*Juncus acutus**	Sharp Rush	Juncaceae
Melaleuca quinquenervia	Broad-leaved Paperbark	Myrtaceae
Melaleuca styphelioides	Prickly-leaved Tea Tree	Myrtaceae
Posidonia australis	Strap Weed	Posidoniaceae
*Senna pendula var glabrata**		Caesalpinioideae
Sporobolus virginicus	Sand Couch	Poaceae
*Stenotaphrum secundatum **	Buffalo Grass	Poaceae
Suadea australis	Austral Seablite	Chenopodiaceae
Tetragonia tetragonioides	New Zealand Spinach	Aizoaceae
Zostera capricorni	Eel Grass	Zosteraceae
AVES		
Ardea intermedia	Intermediate Egret	Ardeidae
Dicaeum hirundinaceum	Mistletoebird	Dicaeidae
Gymnorhina tibicen	Australian Magpie	Artamidae
Vanellus miles	Masked Plover	Charadriidae
INVERTEBRATES		
Bembicium auratum	Brown Snails	Littorinidae
Pyrazus ebininus	Sydney Mud Whelk	Batillariidae
Saccostrea glomerata	Sydney Rock Oyster	Ostreidae

10. APPENDIX B: ASSESSMENT OF SIGNIFICANCE: BC ACT

Following review of BioNet, a site inspection and habitat assessment, the following species are considered to have potential habitat on the *Subject Site* and as such are subjected to an assessment of significance of impact (5-part test) from the proposed foreshore stabilisation works under the Biodiversity Conservation Act.

Scientific Name	Common Name	NSW Status	Comm. Status	Records
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	29
Pandion cristatus	Eastern Osprey	V,P,3		32
Burhinus grallarius	Bush Stone-curlew	E1,P		367
Haematopus longirostris	Pied Oystercatcher	E1,P		93
Charadrius mongolus	Lesser Sand-plover	V,P	E,C,J,K	2
Xenus cinereus	Terek Sandpiper	V,P	C,J,K	2
^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		64
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	34
Mormopterus norfolkensis	Eastern Freetail-bat	V,P		10
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V,P		
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P		6
Miniopterus australis	Little Bentwing-bat	V,P		28
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P		29
Myotis macropus	Southern Myotis	V,P		8

Unless otherwise cited, information was obtained from the OEH species profiles and references contained therein.
http://www.environment.nsw.gov.au/threatenedSpeciesApp/

10.1 Effects on a Threatened Species

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

10.1.1 White-bellied Sea Eagle

The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways.

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. Hunts its prey from a perch or whilst in flight (by circling slowly, or by sailing along

10–20 m above the shore). Prey is usually carried to a feeding platform or (if small) consumed in flight, but some items are eaten on the ground. May be solitary, or live in pairs or small family groups consisting of a pair of adults and dependent young. Typically lays two eggs between June and September with young birds remaining in the nest for 65-70 days.

The Subject Site does not provide suitable terrestrial habitat, including nesting habitat, for this species as it lacks emergent eucalypts. As such, the proposed works are considered unlikely 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.

10.1.2 Eastern Osprey

The Osprey has a global distribution with four subspecies previously recognised throughout its range. However, recent studies have identified that there are two species of Osprey - the Western Osprey (*P. halietus*) with three susbpecies occurring in Europe, Asia and the Americas and the Eastern Osprey (*P. cristatus*) occurring between Sulawesi (in Indonesia), Australia and New Caledonia. Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas.

- Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.
- Feed 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.
- Incubation of 2-3 eggs, usually by the female, is about 40 days. Female remains with young almost until they fly, usually after about nine weeks in the nest.

The Subject Site does not provide suitable nesting habitat for this species as it lacks emergent, dead trees. As such, the proposed works are considered unlikely 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.

10.1.3 Bush Stone Curlew

The Bush Stone-curlew stands about 55 cm tall. It has a grey to light brown back, marked with black blotches, and a streaked rump. It has buff and white underparts with dark streaks, and a black band that runs from near its eye down its neck. This species has large, bright yellow eyes and a hunch-shouldered stance on long spindly legs. When disturbed it lies flat on the ground, with its head and neck outstretched. Its call is a loud eerie wailing "wee-loo", mostly heard at night.
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.

A number of studies have been undertaken in the last 20 years on the local population of Bush Stone- curlew. In 2002, Gosford City Council commissioned the preparation of a report on the *Conservation Status of the Bush Stone-curlew in the Brisbane Water Area* (Morris, 2002). The study found that the main areas of potential and known Bush Stone-curlew habitat in the Brisbane Waters Area include the extensive mangroves, saltmarshes and adjacent areas of Kincumber, South Kincumber, Bensville, Empire Bay, Cockle Bay wetlands, Cockle Bay Nature Reserve, Rileys Bay, the St Huberts Island foreshore reserves, Rileys Island Nature Reserve, Davistown east and west wetlands, Illoura Waters wetlands, Saratoga wetlands, Pelican Island Nature Reserve, and the environs of the Kincumber Water Treatment Works. Based on a review of the literature and field surveys, a minimum of eight pairs, possibly 10 pairs, were located in the Brisbane Water study area in 2002. It was concluded that the Brisbane Water population (together with the breeding pair in similar habitat at Careel Bay, Pittwater), was an isolated breeding population, with no breeding reports from the south for many years and the nearest breeding population to the north at Port Stephens, itself an apparent isolated population (Morris, 2002).

Based on two censuses carried out in 2007, the Gosford LGA Bush Stone-curlew population was estimated at between 8-9 individual (including 2 breeding pairs) with a further 4 Bush Stone-curlew potentially added to this population via successful breeding events during the 2007/2008 season.

Excluding the four chicks reared to flight age in the 2007/2008 breeding season, it was concluded that the local Bush Stone-curlew population had decreased in size since the previous surveys were carried out in 2005. In 2005 it was estimated that 10-12 birds (including 3 breeding pairs) occupied the Gosford LGA while earlier studies of the local population had previously estimated a population size of 14-20 birds (including 8-10 breeding pairs) in 2002 and 17 birds (including 5 breeding pairs) in 2004 (cited from Pygmy Possum Ecological Consulting, 2008).

More recent data is not available however in 2015 a breeding pair abandoned a long-standing foraging roosting site at Saratoga peninsula. Thus, it is likely that the local population has declined further.

The Brisbane Water foreshore is known habitat for this species however the Subject Site is not known habitat for this species. As the works are minor in nature and short-term, they are considered unlikely 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.

10.1.4 Pied Oystercatcher

The Pied Oystercatcher is an unmistakable, large, black and white wader, reaching 50 cm in length. The sexes are similar, yet may be separable when together with the female having a slightly longer, more slender bill. When not in flight, the Pied Oystercatcher appears entirely black above, with white underparts. The back, head and breast are black, and the belly, rump and tail are white. The tail is tipped black. The wings are black with a narrow white bar on the upperwing and white underwing coverts. The eye-ring, iris and bill of the Pied Oystercatcher are brilliant scarlet and its legs are stout and coral pink. The most often heard call is a loud, sharp, high-pitched ‘kurvee-kurvee-kurvee’, usually given in alarm, which increases in pitch and rapidity when a nest site is approached. The South Island Pied Oystercatcher (H. finschi) has recently been recorded as a vagrant in NSW. This New Zealand native can be distinguished by a combination of subtle differences, including a shorter bill and legs and differences in the extent of white on the back and wings.
The species is distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria, such as Corner Inlet. In NSW the species is thinly scattered along the entire coast, with fewer than 200 breeding pairs estimated to occur in the State. 'Pied' Oystercatchers are occasionally recorded on Lord Howe island but it is uncertain which species is involved.

- Favours intertidal flats of inlets and bays, open beaches and sandbanks.
- Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish.
- Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones.

Two to three eggs are laid between August and January. The female is the primary incubator and the young leave the nest within several days.

The Subject Site is exposed to human and dog traffic and as such is unlikely to provide suitable nesting habitat. It may however provide some foraging habitat however the proposed works will only impact foraging habitat in the short term during construction. As such, the proposed works are considered unlikely 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.

10.1.5 Lesser Sand-plover

The non-breeding Lesser Sand-plover has a grey-brown crown, nape, back and breast patches. The forehead, lores, bill and upperwing are dark; ear coverts are dusky. There is prominent white plumage on the forehead, chin, throat and underparts, including the underwing. The Lesser Sand-plover is distinguished from the Greater Sand-plover by a smaller body with a more upright stance, more compact appearance and dark grey (rather than greenish) legs. When breeding in the Northern Hemisphere, the plumage on the breast, crown and nape changes to a dull brick-red and the ear coverts become black. The brick-red breast is separated from the white throat by a narrow black line. Elements of this plumage may be visible in some Australian birds just after arrival in spring or prior to departure in autumn, and in some overwintering birds.
The Lesser Sand-plover breeds in central and north eastern Asia, migrating further south for winter. In Australia the species is found around the entire coast but is most common in the Gulf of Carpentaria, and along the east coast of Queensland and northern NSW. Individuals are rarely recorded south of the Shoalhaven estuary, and there are few inland records.

- Almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms.
- Highly gregarious, frequently seen in flocks exceeding 100 individuals; also often seen foraging and roosting with other wader species.
- Roosts during high tide on sandy beaches, spits and rocky shores; forage individually or in scattered flocks on wet ground at low tide, usually away from the water's edge.
- Diet includes insects, crustaceans, molluscs and marine worms.
- Prey is usually detected visually with the birds making short, quick runs, with abrupt stops to lunge at the ground or look for prey.
- Identifiable from September – April

The Subject Site does not provide suitable nesting habitat as this species breeds in the northern hemisphere. It may however provide some foraging habitat however the proposed works will only impact foraging habitat in the short term during construction. As such, the proposed works are considered unlikely 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.

10.1.6 Terek Sandpiper

The Terek Sandpiper is a medium-sized wader. Individuals are greyish-brown above and white below, with some white on the outer tail feathers and a noticeable white bar on the tips of the secondaries. The species may be distinguished from other waders by its long, slender, upturned black bill, which is dull orange at the base, and by its orange legs and feet.
A rare migrant to the eastern and southern Australian coasts, being most common in northern Australia, and extending its distribution south to the NSW coast in the east. The two main sites for the species in NSW are the Richmond River estuary and the Hunter River estuary. The latter has been identified as nationally and internationally important for the species.

- In Australia, has been recorded on coastal mudflats, lagoons, creeks and estuaries.
- Favours mudbanks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools.
- Generally roosts communally amongst mangroves or dead trees, often with related wader species.
- Breaks up into smaller flocks or even solitary birds when feeding in open intertidal mudflats.
- The diet includes worms, crabs and other crustaceans, small shellfish and the adults and larvae of various flies, beetles and water-bugs.
- Feeding is undertaken by moving rapidly and erratically over soft, wet mud, pecking or probing at the surface.
- Identifiable from September to May.

The Subject Site does not provide suitable nesting habitat as this species breeds in the northern hemisphere. It may however provide some foraging habitat however the proposed works will only impact foraging habitat in the short term during construction. As such, the proposed works are considered unlikely 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.

10.1.7 Glossy Black Cockatoo

The Glossy Black-Cockatoo is a small brown-black cockatoo with a massive, bulbous bill and a short crest. Males have a prominent red tail panel, while that of females is yellow to orange-red. The coloured tail panel is barred black in juvenile birds, with the extent of barring decreasing with age. The female usually has irregular pale-yellow markings on the head and neck, and may have yellow flecks on the underparts and underwing. They are usually seen in pairs or small groups feeding quietly in sheoaks.
The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia.

- Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (A. torulosa) are important foods.
- Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, *Allocasuaraina diminuta*, and A. gymnathera. Belah is also utilised and may be a critical food source for some populations.

- In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (Casuarina cristata).
- Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill.
- Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.

The Subject Site does not provide suitable nesting habitat as it lacks hollow bearing trees. The she oak on the Subject Site provide potential foraging habitat however the works are considered relatively minor and no she oak require clearing. As such, the proposed works are considered unlikely 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.

10.1.8 Grey-headed Flying-fox

The Grey-headed Flying-fox is the largest Australian bat, with a head and body length of 23 - 29 cm. It has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. The wing membranes are black and the wingspan can be up to 1 m. It can be distinguished from other flying-foxes by the leg fur, which extends to the ankle.

Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations.

- Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.
- Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.
- Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.
- Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.
- Site fidelity to camps is high; some camps have been used for over a century.
- Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km.
- Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.
- Also forage in cultivated gardens and fruit crops.

The *Subject Site* provides foraging habitat for this species however it is not a roost/nesting location. The proposed works are minor and clearing of potential foraging habitat is unlikely. Thus, the proposed works are considered unlikely 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.

10.1.9 Eastern Freetail Bat

The Eastern Freetail-bat has dark brown to reddish brown fur on the back and is slightly paler below. Like other freetail-bats it has a long (3 - 4 cm) bare tail protruding from the tail membrane. Freetail-bats are also known as mastiff-bats, having hairless faces with wrinkled lips and triangular ears. They weigh up to 10 grams.

The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW.

- 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.

The Subject Site provides foraging habitat for this species however it does not provide roost/nesting habitat. The proposed works are minor and clearing of potential foraging habitat is unlikely. Thus, the proposed works are considered unlikely 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.

10.1.10 Yellow-bellied Sheathtail-bat

The Yellow-bellied Sheathtail-bat is a very distinctive, large, insectivorous bat up to 87 mm long. It has long, narrow wings, a glossy, jet-black back, and a white to yellow belly extending to the shoulders and just behind the ear. Characteristically, it has a flattened head and a sharply-pointed muzzle. The tail is covered with an extremely elastic sheath that allows variation in the tail-membrane area. Males have a prominent throat pouch; females have a patch of bare skin in the same place.

The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes.

- 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.

The Area of Impact within each of the *Subject Sites* lacks habitat trees and buildings for roosting. The *Subject Site* provides foraging habitat for this species however the proposal requires only minor vegetation clearing. Thus, the proposed works are considered unlikely 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.

10.1.11 Eastern False Pipistrelle

The Eastern False Pipistrelle is relatively large with a head-body length of about 65 mm. It weighs up to 28 grams. It is dark to reddish-brown above and paler grey on its underside. It has long slender ears set well back on the head and some sparse hair on the nose.

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.
- Identifiable from mid spring – mid autumn.

The Area of Impact within each of the *Subject Site*s lacks habitat trees and buildings for roosting. The *Subject Site* provides foraging habitat for this species however the proposal requires only minor vegetation clearing. Thus, the proposed works are considered unlikely 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.

10.1.12 Little Bentwing-bat

Little Bentwing-bats are small dark chocolate brown insectivorous bats with a body length of about 45 mm. The tip of the wing is formed by a particularly long joint of the third finger, folded back and bent under the wing while the bat is at rest. The fur is long and thick, especially over the crown and around the neck, and is slightly lighter in colour on the belly. They have distinctly short muzzles, and short, rounded roughly triangular shaped ears. Distinguished from the Common Bentwing-bat by its smaller size.

East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW.

- Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.
- Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.
- They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters.
- In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (Miniopterus schreibersii) and appears to depend on the large colony to provide the high temperatures needed to rear its young.
- Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer.
- Only five nursery sites /maternity colonies are known in Australia.
- Identifiable Mid spring to mid-autumn

The Area of Impact within each of the *Subject Site*s lacks roosting habitat for this species. The *Subject Site* provides foraging habitat for this species however the proposal requires only minor vegetation clearing. Thus, the proposed works are considered unlikely 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.

10.1.13 Eastern Bentwing Bat

The Eastern Bentwing-bat has chocolate to reddish-brown fur on its back and slightly lighter coloured fur on its belly. It has a short snout and a high 'domed' head with short round ears. The wing membranes attach to the ankle, not to the base of the toe. The last bone of the third finger is much longer than the other finger-bones giving the "bent wing"

appearance. It weighs up to 20 grams, has a head and body length of about 6 cm and a wingspan of 30 - 35 cm.
Eastern Bentwing-bats occur along the east and north-west coasts of Australia.

- Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.
- Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.
- Maternity caves have very specific temperature and humidity regimes.
- At other times of the year, populations disperse within about 300 km range of maternity caves.
- Cold caves are used for hibernation in southern Australia.
- Breeding or roosting colonies can number from 100 to 150,000 individuals.
- Hunt in forested areas, catching moths and other flying insects above the tree tops.
- Hibernate from June to August

The Area of Impact within each of the Subject Sites lacks roosting habitat for this species. The Subject Site provides foraging habitat for this species however the proposal requires only minor vegetation clearing. Thus, the proposed works are considered unlikely 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.

10.1.14 Southern Myotis

This species is now most often referred to as Myotis macropus or the Southern Myotis, but has previously been called the Large-footed Myotis (M. adversus). It has disproportionately large feet; more than 8 mm long, with widely-spaced toes which are distinctly hairy and with long, curved claws. It has dark-grey to reddish brown fur above and is paler below. It weighs up to 15 grams and has a wingspan of about 28 cm.

The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers.

- Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.
- Forage over streams and pools catching insects and small fish by raking their feet across the water surface.
- In NSW females have one young each year usually in November or December.
- Identifiable from October to March

The Area of Impact within each of the *Subject Site*s lacks roosting habitat for this species. The *Subject Site* provides foraging habitat for this species however the proposal requires only minor vegetation clearing. Thus, the proposed works are considered unlikely 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.

10.2 Effects on an Endangered Ecological Community

(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

The Subject Site and extent of works do not contain any EEC listed under the BC Act. A small patch of native vegetation occurs outside of the northern limit of works. This vegetation falls under the definition of *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* based on its proximity to water and its dominance of Swamp Oak *C. glauca*. The proposed works do not require clearing of this EEC and they are considered unlikely to indirectly affect this community assuming mitigation measures are adhered to. As such, the proposed works are unlikely 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 and are unlikely 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.

10.3 Effect on Habitat of a Threatened Species

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

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

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

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

The proposed works require the stabilisation of the foreshore and as such, may impact some of the mangroves along the high tide mark. However, clearing of vegetation will be kept to a minimum. The threatened species with potential habitat on the Subject Site are mostly wading species or terrestrial species that don't rely on the mangroves for habitat. As such, the proposed works are unlikely to impact any important habitat or result in the fragmentation or isolation of habitat for threatened species or ecological communities such that works might impact the long-term survival of a threatened species or EEC in the locality.

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

The *Subject Site* has not been declared as an area of outstanding biodiversity value.

10.4 Constitutes a Key Threatening Process

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

The proposal does contribute to the Key Threatening Process *Clearing of Native Vegetation*. The vegetation that will be cleared as part of the proposed works would be at most 5 mangrove trees.

Recovery plans have been prepared for the following relevant species:

1. Bush Stone-curlew *Burhinus grallarius*

The specific objectives of this plan include:

Objective 1: Expand existing Bush Stone-curlew community conservation programs.

This is outside the scope of the current proposal.

Objective 2: Raise community recognition of the Bush Stone-curlew and interest in the recovery program.

This is outside the scope of the current proposal.

Objective 3: Increase the total area of Bush Stone-curlew habitat protected and managed for conservation on public and private lands by 25% in each CMA.

This is outside the scope of the current proposal.

Objective 4: Supplement declining wild populations with a robust and well-funded captive-breeding and translocation program.

This is outside the scope of the current proposal.

Objective 5: Ensure the conservation status of the Bush Stone-curlew is adequately recognised under NSW and Commonwealth legislation.

This is outside the scope of the current proposal.

Objective 6: Ensure that impacts on Bush Stone-curlews and their habitat are accurately assessed during planning and environmental assessment processes.

The Bush Stone-curlew has only marginal habitat on the Subject Site and it has not been previously recorded on the Subject Site. The proposed works are minor and will not result in the reduction of potential habitat for this species.

Objective 7: Increase understanding of the ecology of the Bush Stone-curlew.

This is outside the scope of the current proposal.

Objective 8: Increase understanding of threatening processes affecting Bush Stonecurlews.

This is outside the scope of the current proposal.

Objective 9: Increase understanding of the significance of the Bush Stone-curlew to indigenous Australians.

This is outside the scope of the current proposal.

Objective 10: Integrate the recovery plan with other conservation plans and programs to maximise the efficient use of resources and benefits to biodiversity.

This is outside the scope of the current proposal.

Objective 11: Implement a well-funded and coordinated recovery program across NSW

This is outside the scope of the current proposal.

In summary, the proposed works are consistent with the objectives/actions of relevant recovery plan/threat abatement plans (TAP).

10.5 Conclusion

The proposed works are unlikely to have a significant impact on any threatened species or endangered ecological communities with potential habitat on or near the Subject Site as the works are minor in nature and require minimal clearing only. The Subject Site provides potential foraging habitat for seven birds (including wading species) and seven mammals (bats and flying-foxes) however it does not provide nesting or roosting opportunities for these species. As such, it does not provide important habitat for threatened species and short-term impacts on the Subject Site during construction works are unlikely to have an adverse impact on any threatened species in the broader Study Area.

11. APPENDIX C: ASSESSMENT OF SIGNIFICANCE: FM ACT

a) in the case of a threatened species, whether the action proposed 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

A habitat assessment concluded that the Subject Site is unlikely to provide habitat for any threatened species listed under the FM Act.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Approximately 8,197 m^2 of two patches of Strapweed *Posidonia australis* was mapped in the immediate vicinity of the Subject Site (Figure 7). The proposed foreshore stabilisation works will not result in any direct impact on this population however indirect effects of shading from excess turbidity can occur as can poor water quality from the disturbance of acid sulphate soils. Mitigation measures provided in this report will minimise the potential impacts of works on the *P. australis* population and as such, works are considered unlikely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
- *(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*

N/A

d) in relation to the habitat of a threatened species, population or ecological community:
- *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and Threatened Species Assessment Guidelines, February 2008 7*
- *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*

The proposed works will not result in the direct removal or alteration of the extent of habitat of the *P. australis* population not will they result in fragmentation or isolation of the population. The *P. australis* near the Subject Site is not a large bed and has not been mapped on the NSW DPI estuarine habitat mapping as being present. As such, they are not considered to be an important population of this species.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for this population has been identified on the Subject Site.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No threat abatement plan has been prepared for this threatened population.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Key threatening processes include:

- Degradation of native riparian vegetation along New South Wales water courses
- Hook and line fishing in areas important for the survival of threatened fish species
- Human-caused climate change
- Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams
- Introduction of fish to waters within a river catchment outside their natural range
- Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales
- Removal of large woody debris from New South Wales rivers and streams
- The current shark meshing program in New South Wales waters

The proposed works do not form part of a KTP under the FM Act.

11.1 Conclusion

No threatened species are considered likely to occur in the study area, use habitats on occasion nor will they be influenced by off-site impacts of the proposal. Approximately 8,197 m^2 of the threatened population *Posidonia australis* however occurs near the Subject Site. The proposed foreshore stabilisation works will not result in any direct impact on this population however indirect effects of shading from excess turbidity can occur as can poor water quality from the potential disturbance of acid sulphate soils (ASS). Mitigation measures provided in this report include appropriate erosion and sediment control and the preparation of an ASS plan of management prior to the commencement of works which will minimise the potential impacts of works on the *P. australis* population. As such, works are considered unlikely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction. The proposed works do not form part of a key threatening process under the Fisheries Management Act.

12. APPENDIX D: ASSESSMENT OF SIGNIFICANCE: EPBC ACT

A Protected Matters search was undertaken 05/07/2018 within a 10x10 km area centred on the Subject Site to determine the likely occurrence of Matters of National Environmental Significance.

A summary of matters of National Environmental Significance is provided in Table A3 (Appendix 1), results of the Protected Matters Search Tool Results for Threatened Species listed under the EPBC Act within the Central Coast Council LGA are provided in Table A4 (Appendix 1) and results of the Protected Matters Search Tool Results for Migratory Species listed under the EPBC Act are provided in Table A5 (Appendix A).

The Study Area contains three World Heritage Properties, three National Heritage Places, no Great Barrier Reef Marine Park or Commonwealth Marine Areas, one Wetland of International Importance (Hunter Estuary Wetlands), six listed threatened ecological communities (Central Hunter Valley eucalypt forest and woodland, Coastal Swamp oak Forest, Coastal Upland Swamps in the Sydney Basin Bioregion, Littoral Rainforest and Coastal vine thickets, *Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion, Subtropical and Temperate Coastal Saltmarsh), 106 listed threatened species and 76 listed migratory species.

Following a site inspection/desktop assessment and habitat assessment:

- The Subject Site does not contain any World heritage Properties, National Heritage Places or wetlands of international importance
- The Subject Site does have one threatened ecological community in the vicinity: *Posidonia australis* seagrass meadows.
- The Subject Site provides habitat for 11 threatened species and 17 migratory species.

Significant Impact Guidelines (DEHWA, 2009) have been prepared in order to decide whether an action is likely to have a significant impact. In determining the nature and magnitude of an action's impact, it is important to consider matters such as:

- all on-site and off-site impacts,
- all direct and indirect impacts,
- the frequency and duration of the action,
- the total impact which can be attributed to that action over the entire geographic area affected, and over time,
- the sensitivity of the receiving environment, and
- the degree of confidence with which the impacts of the action are known and understood.

The following species listed under the EPBC Act have potential habitat within the Study Area.

Scientific Name	Common Name	Comm Status
Botaurus poiciloptilus	Australasian Bittern	E
Calidris canutus	Red Knot	E,M
Calidris ferruginea	Curlew Sandpiper	CE,M
Calidris tenuirostris	Great Knot	CE,M
Charadrius mongolus	Lesser Sand Plover	E,M
Limosa lapponica baueri	Bar-tailed Godwit	V
Limosa lapponica menzbieri	Bar-tailed Godwit (menzbieri)	CE
Numenius madagascariensis	Eastern Curlew	CE,M
Rostratula australis	Australian Painted Snipe	E
Chalinolobus dwyeri	Large-eared Pied Bat	V
Pteropus poliocephalus	Grey-headed Flying-fox	V
Actitis hypoleucos	Common Sandpiper	M
Calidris acuminata	Sharp-tailed Sandpiper	M
Calidris alba	Sanderling	M
Calidris melanotos	Pectoral Sandpiper	M
Calidris ruficollis	Red-necked Stint	M
Charadrius bicinctus	Double-banded Plover	M
Gallinago hardwickii	Latham's Snipe,	M
Heteroscelus brevipes	Grey-tailed Tattler	M
Limosa lapponica	Bar-tailed Godwit	M
Limosa limosa	Black-tailed Godwit	M
Numenius minutus	Little Curlew,	M
Numenius phaeopus	Whimbrel	M
Pluvialis fulva	Pacific Golden Plover	M
Pluvialis squatarola	Grey Plover	M
Tringa nebularia	Common Greenshank	M
Tringa stagnatilis	Marsh Sandpiper,	M
Xenus cinereus	Terek Sandpiper	M

CE – Critically Endangered, V – Vulnerable under the EPBC Act
C,J,K – Migratory species protected under the CAMBA, JAMBA, ROKAMBA - identify species known to be regular and predictable migrants between the agreement countries.

12.1 Critically Endangered/Endangered Threatened Species

The following threatened species have potential habitat within the Study Area:

1. *Botaurus poiciloptilus* Australasian Bittern E
2. *Calidris canutus* Red Knot E,M
3. *Calidris ferruginea* Curlew Sandpiper CE,
4. *Calidris tenuirostris* Great Knot CE
5. *Numenius madagascariensis* Eastern Curlew CE
6. *Limosa lapponica menzbieri* Bar-tailed Godwit CE
7. *Charadrius mongolus* Lesser Sand Plover E,M
8. *Rostratula australis* Australian Painted Snipe E

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

a) lead to a long-term decrease in the size of a population

The proposed action will not result in a reduction in size of the population of these threatened wading bird species as the works are minor and these species do not rely on the Subject Site for breeding/nesting.

b) reduce the area of occupancy of the species

These species are migratory, and their movements extend over many continents. The Subject Site does not occur at the limit of distribution or area of occupancy for any of these species.

c) fragment an existing population into two or more populations

The proposed works require minor works along the foreshore and will not result in the fragmentation of an existing population of any of these listed threatened species.

d) adversely affect habitat critical to the survival of a species

The Subject Site does not represent critical habitat to any of these threatened species

e) disrupt the breeding cycle of a population

These species breed in the northern hemisphere and as such, the proposal will not disrupt their breeding cycle.

f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal requires minor modifications only and will not alter the habitat to the extent that these species are likely to decline.

g) result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

The proposed works will not result in the establishment of any invasive species.

h) introduce disease that may cause the species to decline, or

The proposed works will not result in an introduction of a disease that may cause these species to decline.

i) interfere with the recovery of the species.

The proposed works are minor, and the Subject Site does not provide important habitat for any of these listed threatened species. As such, the works will not affect the recovery of these species.

12.2 Vulnerable threatened Species

Vulnerable species with potential habitat in the Study Area:

1. *Limosa lapponica baueri* — *Bar-tailed Godwit* — *V*
2. *Chalinolobus dwyeri* — *Large-eared Pied Bat* — *V*
3. *Pteropus poliocephalus* — *Grey-headed Flying-fox* — *V*

Under the meaning of the Act, an "important" population is one that is necessary for a species' long-term survival and recovery and may include key source populations for breeding and dispersal, populations necessary for maintaining genetic diversity and populations near the limit of the species range.

While the Subject Site has potential habitat for the vulnerable threatened species listed above, there have been only isolated occurrences of these species in the broader Study Area and the Subject Site does not support a key source population for breeding and dispersal, or populations considered necessary for maintaining genetic diversity and populations near the limit of their range. Thus, the populations with potential to occur on the Subject Site are not considered 'important' populations and works are therefore unlikely to lead to a long-term decrease in the size, area of occupancy, lead to fragmentation, affect critical habitat, disrupt the breeding cycle, or modify habitat of an important population. Works will not result in the establishment of invasive species, spread of disease or interfere with the recovery of any of these vulnerable species.

12.3 Migratory species

Migratory species with habitat within the Study Area:

1. *Actitis hypoleucos*	Common Sandpiper	M
2. *Calidris acuminata*	Sharp-tailed Sandpiper	M
3. *Calidris alba*	Sanderling	M
4. *Calidris melanotos*	Pectoral Sandpiper	M
5. *Calidris ruficollis*	Red-necked Stint	M
6. *Charadrius bicinctus*	Double-banded Plover	M
7. *Gallinago hardwickii*	Latham's Snipe,	M
8. *Heteroscelus brevipes*	Grey-tailed Tattler	M
9. *Limosa lapponica*	Bar-tailed Godwit	M
10. *Limosa limosa*	Black-tailed Godwit	M
11. *Numenius minutus*	Little Curlew,	M
12. *Numenius phaeopus*	Whimbrel	M
13. *Pluvialis fulva*	Pacific Golden Plover	M
14. *Pluvialis squatarola*	Grey Plover	M
15. *Tringa nebularia*	Common Greenshank	M
16. *Tringa stagnatilis*	Marsh Sandpiper,	M
17. *Xenus cinereus*	Terek Sandpiper	M

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

a) substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species

The Subject Site is a foreshore reserve designed for public use and it is therefore not ideal habitat for migratory species and thus unlikely to be important habitat for migratory species recorded in the Study Area. It provides sub-optimal foraging habitat only while the broader estuary has areas of more suitable habitat that is less disturbed and away from people and dogs.

b) result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or

The proposed works will not result in an introduction of an invasive species that is harmful to migratory species.

c) seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The proposal will not result in a disruption to the lifecycle of an ecologically significant proportion of the population of any of these migratory species as these species do not breed in the broader Study Area.

12.4 Threatened Ecological Community

The Subject Site contains isolated saltmarsh species however it has not been mapped as a Saltmarsh community and is not defined here as Subtropical and Temperate Coastal Saltmarsh which is listed as a vulnerable ecological community under the EPBC Act.

The endangered ecological community *Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion occurs in the vicinity of the Subject Site and is assessed below for indirect impacts.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

a) reduce the extent of an ecological community

The proposed works will not directly impact or clear the *P. australis*. Potential impacts include shading from turbidity and poor water quality from disturbance of potential acid sulphate soils (PASS)

b) fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

No fragmentation of the P. australis ecological community will result from the proposed foreshore stabilization works.

c) adversely affect habitat critical to the survival of an ecological community

The Subject Site is not critical habitat.

d) modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

There will be short-term impacts to the soil and water quality in the Subject Site however it is unlikely to modify or destroy abiotic factors necessary for the communities survival.

e) cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting

The proposed works are unlikely to change the species composition as works are at a minimum, 40m from the *P.australis* beds.

f) cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

   I. assisting invasive species, that are harmful to the listed ecological community, to become established, or

   II. causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or

The proposed works are minor and are unlikely to result in assisting invasive species to become established. There is potential for works to mobilise acid sulphate soils hence an

ASS plan of management is required prior to the commencement of works. A number of mitigation measures have been provided to limit the potential impacts of poor water quality on the broader ecological community.

g) interfere with the recovery of an ecological community.

The proposed works are unlikely to interfere with the recover of this community as they will not result in a direct impact on it.

12.5 Conclusion

Eleven threatened species and 17 migratory species have potential habitat on the Subject Site and in the broader Study Area. The proposed foreshore stabilisation works are considered unlikely to substantially impact upon these species as the works are minor in nature and do not require clearing of large areas of native vegetation or dredging of protected or endangered aquatic vegetation. In addition, the Subject Site is likely to provide only sub-optimal habitat for these species as it has been previously disturbed and is relatively public.

The endangered ecological community *Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion occurs in the vicinity of the Subject Site. The proposed works will not directly impact or clear the *P. australis*. Potential impacts include shading from turbidity and poor water quality from disturbance of potential acid sulphate soils (PASS). As such, an Acid Sulphate Soil plan of management is required prior to the commencement of works along with appropriate erosion and sediment control in accordance with NSW Fisheries Policy and Guidelines (NSW DPI, 2013).

Based on the above assessment it is considered that a referral to SEWPaC is not required.