Appendix E

Biodiversity Assessment

advitech

Report

Upgrade of M1 Pacific Motorway Intersection with John Renshaw Dr and Weakleys Dr

Biodiversity Assessment

Aurecon

19 September, 2016
Rev 4 (Final)

Report Details

Upgrade of M1 Pacific Motorway Intersection with John Renshaw Dr and Weakleys Dr - Biodiversity Assessment

Filename: 14027 Aurecon M1 Weakleys Biodiversity Rev3.docx

Job #: J0150324 Folder #: F14027

Revision: 4 (Final), Date: 19 September, 2016

Prepared For

Aurecon

Mike Luger, Project Manager

Email: mike.luger @aurecongroup.com, Telephone: 02 9465 5706

Level 5, 116 Military Road, Neutral Bay, Sydney NSW 2089

Prepared By

Advitech Pty Limited t/a **Advitech Environmental**

ABN: 29 003 433 458

Luke Pickett, Senior Ecologist

Email: luke.pickett@advitech.com.au, Telephone: 02 4924 5400

Facsimile: 02 4967 3772, Web: www.advitech.com.au, General Email: mail@advitech.com.au

7 Riverside Drive Mayfield West NSW 2304

PO Box 207 Mayfield NSW 2304

History

Date	Revision	Comments
13-04-2015	0	Final Issue for Review
12-04-2016	1	Final Issue
17-06-2016	2	Issue for RMS review
08-08-2016	3	Issue for RMS review with revised footprint
19-09-2016	4	Issue for final RMS review

Endorsements

Function	Signature	Name and Title	Date
Prepared by		Luke Pickett Senior Ecologist	19 September, 2016
Checked and Authorised for Release by		Dr Rod Bennison Lead Environmental Scientist	19 September, 2016

TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

Roads and Maritime Services (Roads and Maritime) propose to upgrade the M1 Pacific Motorway, Weakleys Drive and John Renshaw Drive intersection at Beresfield, New South Wales (NSW). In response to existing and projected traffic constraints, Roads and Maritime proposes to replace the existing roundabout with traffic lights (the proposal).

Advitech Pty Limited (trading as Advitech Environmental) was engaged by Aurecon to complete a Biodiversity Impact Assessment to assess the potential ecological impacts associated with proposed works to upgrade the M1 Pacific Motorway intersection with John Renshaw Drive and Weakleys Drive (**Figure 1**). This biodiversity assessment has been prepared to supplement the REF for the proposal.

1.1 Proposal Background

The M1 Pacific Motorway is a route of National significance forming the main road transport corridor between Sydney to Newcastle and is an important link of the M1 Pacific Motorway servicing the northern coast of NSW and coastal south east Queensland. The current roundabout forms a significant congestion point for motorway users, often resulting in significant delays during peak travel times.

The proposed upgrade to traffic lights would help to reduce traffic congestion and delays that regularly occur at the roundabout and increase safety for motorists. The proposal involves construction works of new sections and improvement works of existing sections to provide safer and more efficient travel. The proposal includes the following features:

- A traffic light controlled intersection
- Two through lanes on all approaches
- Additional turning lanes on all approaches including provision of two right turn lanes from the M1 Pacific Motorway to John Renshaw Drive
- Two northbound lanes on Weakleys Drive from the traffic lights to Enterprise Drive
- Upgrading the existing left slip lane to the M1 Pacific Motorway (southbound)
- An additional left turn lane from John Renshaw Drive (westbound) to the M1 Pacific Motorway (southbound) to manage periods of peak holiday southbound traffic
- Drainage, lighting, signage, barriers, fencing, landscaping work, utility relocations, Intelligent Traffic Systems (ITS) and ancillary works such as stockpiling and construction works areas.
- Closing the informal car park located in the south-western corner of the existing intersection which operates as a Driver Reviver site during peak holiday periods
- Closing the oversize over mass truck stop bay on the M1 Pacific Motorway (southbound).

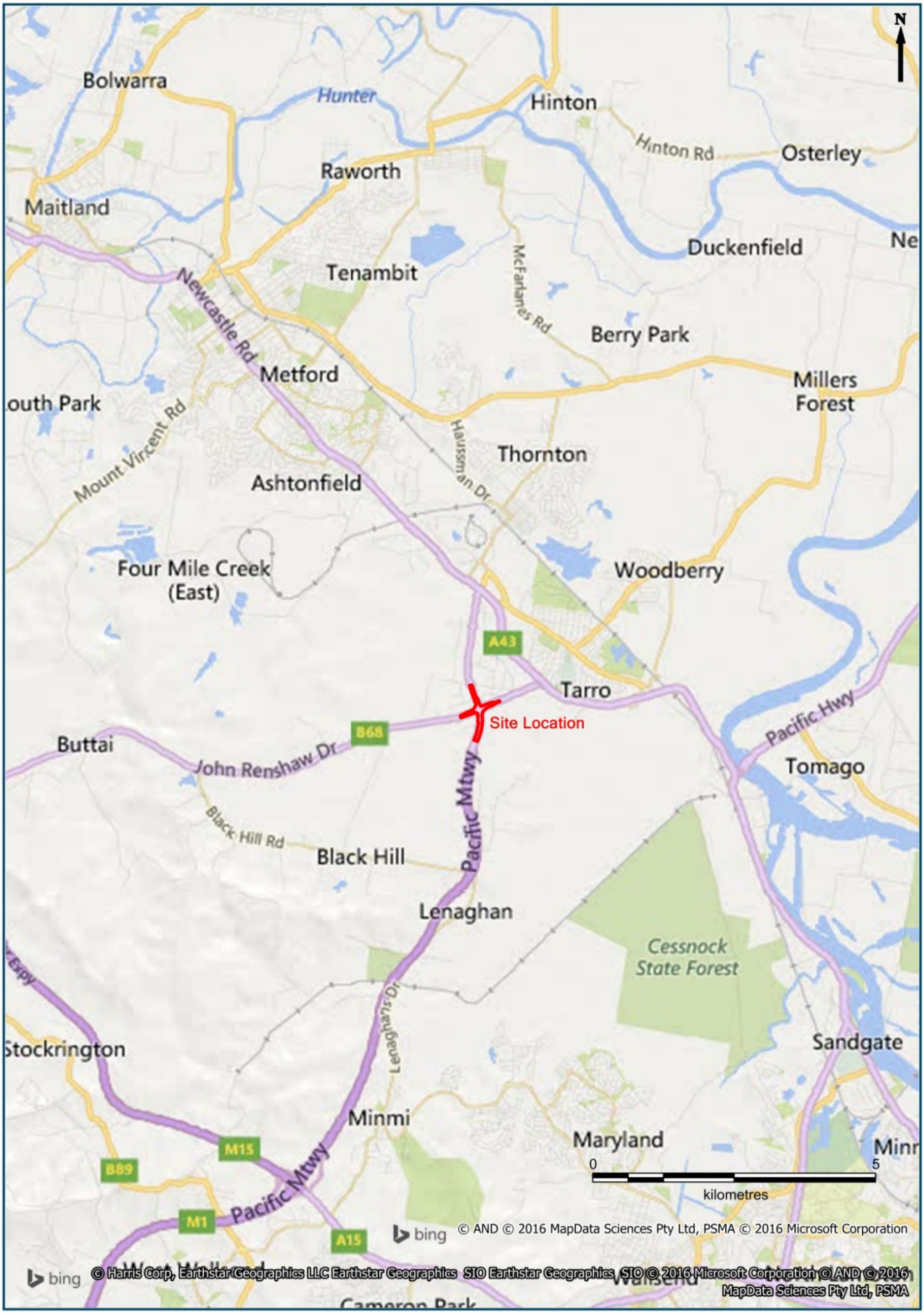


Figure 1 Site location

1.2 Site Description

The following definitions are used throughout this report to refer to locations in the proposal area:

- The 'proposal' is all areas that would be directly impacted by the works. This includes areas subject to vegetation clearing and earthworks and is shown as 'proposal area' in **Figure 2;**
- The 'survey area' includes the proposal and the areas adjacent that may be indirectly impacted by the proposed works;
- The "Vegetation Clearing Limit" refers to the boundary of the area assessed for clearing and is shown in **Figure 2**; and
- The 'locality' refers to a 10 kilometre area surrounding the proposal for the purpose of database searches.

1.3 Legislative Context

This report presents an assessment of the potential impacts to flora and fauna from the proposed development. In particular, this report addresses specific legislative planning requirements relating to flora and fauna, including:

- Effects on threatened species, populations and ecological communities, as listed under the *Threatened Species Conservation Act 1995* (TSC Act), pursuant to section 5A of the *Environmental Planning & Assessment Act 1979* (EPA Act);
- Likely impacts on nationally listed threatened species, populations and ecological communities, as listed under the *Environment Protection and Biodiversity Conservation Act 1999*; and
- Effects on potential Koala habitat pursuant to *State Environmental Planning Policy 44 - Koala Habitat Protection* (SEPP 44).

1.4 Study Aims

This study aims to assess the potential impacts of the proposed works on the biodiversity values of the local area. Specifically, it aims to:

- Describe the existing environment;
- Determine if the proposal is likely to result in any significant impacts to threatened species, populations and ecological communities, or their habitats protected under Federal and State legislation; and
- Recommend measures to minimise any potential impacts to protected biodiversity values.

2. METHODOLOGY

This biodiversity assessment was prepared in accordance with Roads and Maritime *Environmental Planning and Assessment Practice Note – Biodiversity Assessment* (EIA-NO6), *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (RTA, 2011) (Biodiversity Guideline) and *Guidelines for Biodiversity Offsets* (2011) (Biodiversity Offset Guideline).

2.1 Database Searches and Literature Reviews

A desktop assessment included searches of databases and a review of literature relevant to the site and local area, particularly:

- Office of Environment and Heritage (OEH) Atlas of NSW Wildlife database (licensed) for records of threatened species and endangered ecological communities which have been recorded within a 10 kilometre radius (locality) of the proposal (dated 11 April 2016);
- Department of the Environment (DoE) Protected Matters Search Tool for Matters of National Environmental Significance (MNES) listed under the EPBC Act within a 10 kilometre radius from the site (dated 11 April 2016);
- Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy Technical Report and Updated Extant Map (House, 2003);
- *Hunter, Central and Lower North Coast Vegetation Classification and Mapping Project - Vegetation Community Profiles* (Somerville, 2009); and
- Previous reports of studies undertaken within the locality.

2.2 Field Survey

A field survey was conducted throughout the survey area on 27 February and 17 March, 2015. A tree survey was also undertaken on 6 and 7 April, 2016 to identify trees located within the proposal.

2.2.1 Flora

A vegetation survey was undertaken and involved a detailed ground survey using a number of sampling techniques to ensure the survey area was adequately sampled. The survey methods and effort are consistent with the Threatened Species Survey and Assessment Guidelines (working draft) (DEC, 2004). A list of all plant species recorded during fieldwork is listed in **Appendix I**.

2.2.1.1 Quadrat Surveys

A total of three 20 x 20 metre quadrat surveys were undertaken within the survey area. All plants observed within the quadrat are recorded along with detailed information on vegetation structure and species abundance. The location of the quadrat surveys are shown in **Figure 2**.

2.2.1.2 Random Meander Survey

Flora investigations in the manner described by Cropper (1993) as the 'Random Meander Technique' were also undertaken across the site. This involved walking in a random meander throughout the entire survey area, visiting the full range of habitats and recording every plant species observed. The distribution of vegetation communities and habitat features were also recorded using a handheld GPS.

2.2.2 Fauna

Fauna surveys targeted species that may occur within the limited habitat available within the proposal. The sampling methods used to survey fauna habitat within the survey area are detailed below in **Table 1.**

Table 1: Fauna surveys conducted within the survey area

Fauna Group	Surveys	Methods and Survey Effort
Diurnal Birds	Area search	A search was undertaken to identify any birds present. Birds were identified from observations or call identification. A search for nests was also undertaken during the survey.
Herpetofauna	Habitat search	Opportunistic active searches for frogs and reptiles were undertaken during the survey within suitable habitat (i.e. leaf litter, under rocks and long grass). All amphibian surveys are conducted following the Hygiene Protocol for the Control of Disease in Frogs (NPWS, 2000).
Microchiropteran Bats	Culvert roost inspection	An inspection of the culvert beneath the M1 Pacific Motorway was undertaken in search for active and potential microbat roosts.
All	Opportunistic sightings	Any opportunistic sightings of fauna on site were recorded.

2.3 Survey Effort

A summary of the time spent during fieldwork and the prevailing weather conditions at the time is contained below in **Table 2**.

Table 2: Survey dates, times, activities and weather conditions

Date	Time	Activity	Weather
27/02/2015	1030 - 1530	General site inspection Vegetation survey Netted Bottlebrush survey Culvert roost inspection Bird area search Opportunistic searches and sightings	3/8 Cloud cover Wind - SE Mostly Calm Temp - 29^{0}C Humid
17/03/2015	1130 - 1600	Vegetation survey Netted Bottlebrush survey Culvert roost inspection Bird area search Opportunistic searches and sightings	1/8 Cloud cover Wind - Calm Temp - 26^{0}C
06/04/2016	0900 - 1630	Tree survey	0/8 Cloud cover Wind - NW Mostly Calm Temp - 35^{0}C
07/04/2016	0830 - 1600	Tree survey	8/8 Cloud cover Wind - SW Temp - 23^{0}C

2.4 Habitat Assessment for Significant Species

The availability of habitat within the survey area was assessed taking into account a number of factors including:

- Structural and floral diversity;
- Occurrence and extent of habitat types in the general vicinity;
- Continuity with similar habitat adjacent to the survey area, or connection with similar habitat off site by way of corridors;
- Key habitat features such as tree hollows, water bodies, caves and crevices, rocky areas;
- Degree of disturbance and degradation; and
- Topographic features such as aspect and slope.

This information was used to evaluate the survey area as potential habitat for each of the threatened species considered and assign each species with a rating based on their likelihood to occur within the proposal. The 'likelihood of occurrence' categories are detailed in **Table 3**. The habitat assessment is provided in **Appendix III.** Species assigned with a rating of 'Moderate' or higher and are considered to be potentially impacted by the proposed works have been considered further under relevant legislation within the assessment of significance provided in **Appendix IV**.

Table 3: Likelihood of occurrence criteria

Likelihood Rating	Criteria
Known	The species was recorded within the survey area during site surveys.
High	It is likely that a species would inhabit or utilise habitat within the proposal. Criteria for this category may include: ▪ Species recently and/or regularly recorded in contiguous or nearby habitat. ▪ High quality habitat types or resources present within survey area. ▪ Species is known or likely to maintain a resident population surrounding the survey area. ▪ Species is known or likely to visit during migration or seasonal availability of resources.
Moderate	Potential habitat for a species occurs within the proposal. Criteria for this category may include: ▪ Species previously recorded in contiguous habitat albeit not recently (>10 years). ▪ Poor quality, depauperate or modified habitat types and/or resources present within survey area. ▪ Species has potential to utilise habitat during migration or seasonal availability of resources. ▪ Cryptic flora species with potential habitat available within the proposal that have not been seasonally targeted by surveys.
Low	It is unlikely that the species inhabits the area and would likely be considered a transient visitor if ever encountered. Criteria for this category may include: ▪ The proposal or survey area lacks specific habitat types or resources required by the species. ▪ The survey area is beyond the current distribution of the species or is isolated from known populations. ▪ Non cryptic flora species that were found to be absent during targeted surveys. ▪ The survey area only contains common habitat which would not be considered important for the local survival of a threatened species.
None	The habitat within proposal and survey area is unsuitable for the species.

2.5 Limitations

The effectiveness of a survey detecting a given species is influenced by a range of factors. For this type of survey, such limitations are generally related to the short period of time in which the fieldwork was carried out during one season. Given the small period of time spent within the survey area, the detection of certain species may be limited by:

- Seasonal migration (particularly migratory birds);
- Seasonal flowering periods (some species are cryptic and are unlikely to be detected outside of the known flowering period);
- Seasonal availability of food such as blossoms;
- Weather conditions during the survey period (some species may go through cycles of activity related to specific weather conditions, for example some microchiropteran bats, reptiles and frogs can be inactive during cold weather); and
- Species lifecycle (cycles of activity related to breeding).

These limitations have been overcome by applying the precautionary principle in all cases where the survey methodology may have given a false negative result. All species have been assessed on the basis of the presence of their habitat and the likely significance of that habitat to a viable local population.

3. EXISTING ENVIRONMENT

3.1 Threatened Species

The following threatened species, listed in **Table 4,** have the potential to occur within the locality and have been considered in this report.

Table 4: Threatened species with potential to occur in the local area

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
Plants			
Cynanchum elegans	White-flowered Wax Plant	E	E
Rutidosis heterogama	Heath Wrinklewort	V	V
Allocasuarina defungens	Dwarf Heath Casuarina	E	E
Tetratheca glandulosa		V	
Tetratheca juncea	Black-eyed Susan	V	
Maundia triglochinoides		V	
Commersonia prostrata	Dwarf Kerrawang	E	E
Acacia bynoeana	Bynoe's Wattle	E	V
Angophora inopina	Charmhaven Apple	V	V
Callistemon linearifolius	Netted Bottle Brush	V	
Eucalyptus parramattensis ssp. *decadens*	Drooping Red Gum	V	V
Melaleuca biconvexa	Biconvex Paperbark	V	V
Syzygium paniculatum	Magenta Lilly Pilly	E	V
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V
Cymbidium canaliculatum	Tiger Orchid	E2	
Phaius australis	Southern Swamp Orchid	E	E
Pterostylis gibbosa	Illawarra Greenhood	E	E
Grevillea parviflora ssp. *parviflora*	Small-flowered Grevillea	V	V
Asterolasia elegans		E	E
Euphrasia arguta		CE	CE
Zannichellia palustris		E	
Amphibians			
Litoria aurea	Green and Golden Bell Frog	E	V
Litoria littlejohni	Littlejohn's Tree Frog	V	V
Mixophyes balbus	Stuttering Frog	E	V
Mixophyes iteratus	Giant Barred Frog	E	E
Reptiles			
Hoplocephalus bungaroides	Broad-headed Snake	V	V
Hoplocephalus stephensii	Stephen's Banded Snake	V	
Birds			
Anseranas semipalmata	Magpie Goose	V	
Oxyura australis	Blue-billed Duck	V	
Stictonetta naevosa	Freckled Duck	V	
Rostratula australis	Australian Painted Snipe	E	V
Calidris ferruginea	Curlew Sandpiper	E	
Limosa limosa	Black-tailed Godwit	V	
Botaurus poiciloptilus	Australian Bittern	V	E
Ixobrychus flavicollis	Black Bittern	V	
Haematopus longirostris	Pied Oystercatcher	V	
Irediparra gallinacea	Comb-crested Jacana	V	

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
Ephippiorhynchus asiaticus	Black-necked Stock	E	
Circus assimilis	Spotted Harrier	V	
Hamirostra melanosternon	Black-breasted Buzzard	V	
Hieraaetus morphnoides	Little Eagle	V	
Lophoictinia isura	Square-tailed Kite	V	
Falco subniger	Black Falcon	V	
Pandion cristatus	Eastern Osprey	V	
Ptilinopus magnificus	Wompoo Fruit-Dove	V	
Ptilinopus regina	Rose Crowned Fruit-Dove	V	
Ptilinopus superbus	Superb Fruit-Dove	V	
Callocephalon fimbriatum	Gang-gang Cockatoo	V	
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	
Glossopsitta pusilla	Little Lorikeet	V	
Lathamus discolor	Swift Parrot	E	E
Neophema pulchella	Turquoise Parrot	V	
Anthochaera phrygia	Regent Honeyeater	CE	E
Climacteris picumnus ssp. victoriae	Brown Treecreeper	V	
Chthonicola sagittata	Speckled Warbler	V	
Daphoenositta chrysoptera	Varied Sittella	V	
Dasyornis brachypterus	Eastern Bristlebird	E	E
Epthianura albifrons	White-fronted Chat	V	
Melanodryas cucullata ssp. *cucullata*	Hooded Robin	V	
Melithreptus gularis ssp. *gularis*	Black-chinned Honeyeater	V	
Petroica boodang	Scarlet Robin	V	
Pomatostomus temporalis ssp. *temporalis*	Grey-crowned Babbler	V	
Ninox connivens	Barking Owl	V	
Ninox strenua	Powerful Owl	V	
Tyto novaehollandiae	Masked Owl	V	
Tyto longimembris	Eastern Grass Owl	V	
Tyto tenebricosa	Sooty Owl	V	
Mammals			
Dasyurus maculatus ssp. *maculatus*	Spotted-tailed Quoll	V	E
Phascogale tapoatafa	Brush-tailed Phascogale	V	
Phascolarctos cinereus	Koala	V	
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V
Petaurus australis	Yellow-bellied Glider	V	
Petaurus norfolcensis	Squirrel Glider	V	
Potorous tridactylus ssp. *tridactylus*	Long-nosed Potoroo	V	V
Pseudomys novaehollandiae	New Holland Mouse		V
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Chalinolobus dwyeri	Large Pied Bat	V	V
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	
Mormopterus norfolkensis	Eastern Freetail-bat	V	
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	
Miniopterus australis	Little Bentwing-bat	V	
Miniopterus schreibersii ssp. *oceanensis*	Large Bentwing-bat	V	
Myotis macropus	Southern Myotis	V	
Scoteanax rueppellii	Greater Broad-nosed Bat	V	
Vespadelus troughtoni	Eastern Cave Bat	V	

3.2 Flora

3.2.1 Vegetation Communities

Local vegetation mapping (House, 2003) identifies three vegetation communities occurring within the vicinity of the survey area. These included:

- MU 15 - Coastal Foothills Spotted Gum - Ironbark Forest (CFSGIBF);
- MU 17 - Lower Hunter Spotted Gum - Ironbark Forest (LHSGIF) (EEC); and
- MU 5 - Alluvial Tall Moist Forest (ATMF).

Field investigations confirmed the majority of the native vegetation within the proposal is consistent with the endangered ecological community (EEC) Lower Hunter Spotted Gum - Ironbark Forest (LHSGIF). A general description of the vegetation assemblages identified within the survey area is provided below and their distribution is shown in **Figure 3**. A full list of species recorded during the field survey is provided in **Appendix I**.

3.2.2 Lower Hunter Spotted Gum – Ironbark Forest

TSC Act Status:	EEC – Lower Hunter Spotted Gum Ironbark Forest
EPBC Act Status:	Not listed
HCCREMS Extant Mapping:	MU 17 - Lower Hunter Spotted Gum - Ironbark Forest
HCCREMS ID:	MU 68 Red Ironbark/ paperbark shrubby open forest
OEH PCT ID:	Spotted Gum - Broad-leaved Ironbark grassy open forest of dry hills of the lower Hunter Valley, Sydney Basin Bioregion (Dry Sclerophyll Forest – Shrub/Grass Sub-formation)

This assemblage occurs throughout the majority of the survey area merging with MU 17 to the east. The canopy (up to 25 metres high) of this assemblage is characterised by a dominance of *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark).

Other canopy species occur sporadically throughout the assemblage including *E. siderophloia* (Grey Ironbark), *E. crebra* (Narrow-leaved Ironbark) and *E. umbra* (Broad-leaved White Mahogany). *Melaleuca nodosa* (Ball Honeymyrtle) was a common component of the mid stratum, often forming dense stands. Other species of Melaleuca including *M. styphelioides* (Prickly-leaved Paperbark), *M. linearifolia* (Snow-in-Summer) and *M. decora* were also prevalent in low lying areas subject to roadside drainage such as the south eastern side of the M1 Pacific Motorway.

The understorey largely consisted of native shrubs and grasses; however, edge effects including weed incursion and the dumping of waste was evident along the roadside. The vulnerable *Callistemon linearifolius* (Netted Bottlebrush) (TSC Act) was recorded within the understorey and the presence of this species is discussed further in **Section 3.2.6**.

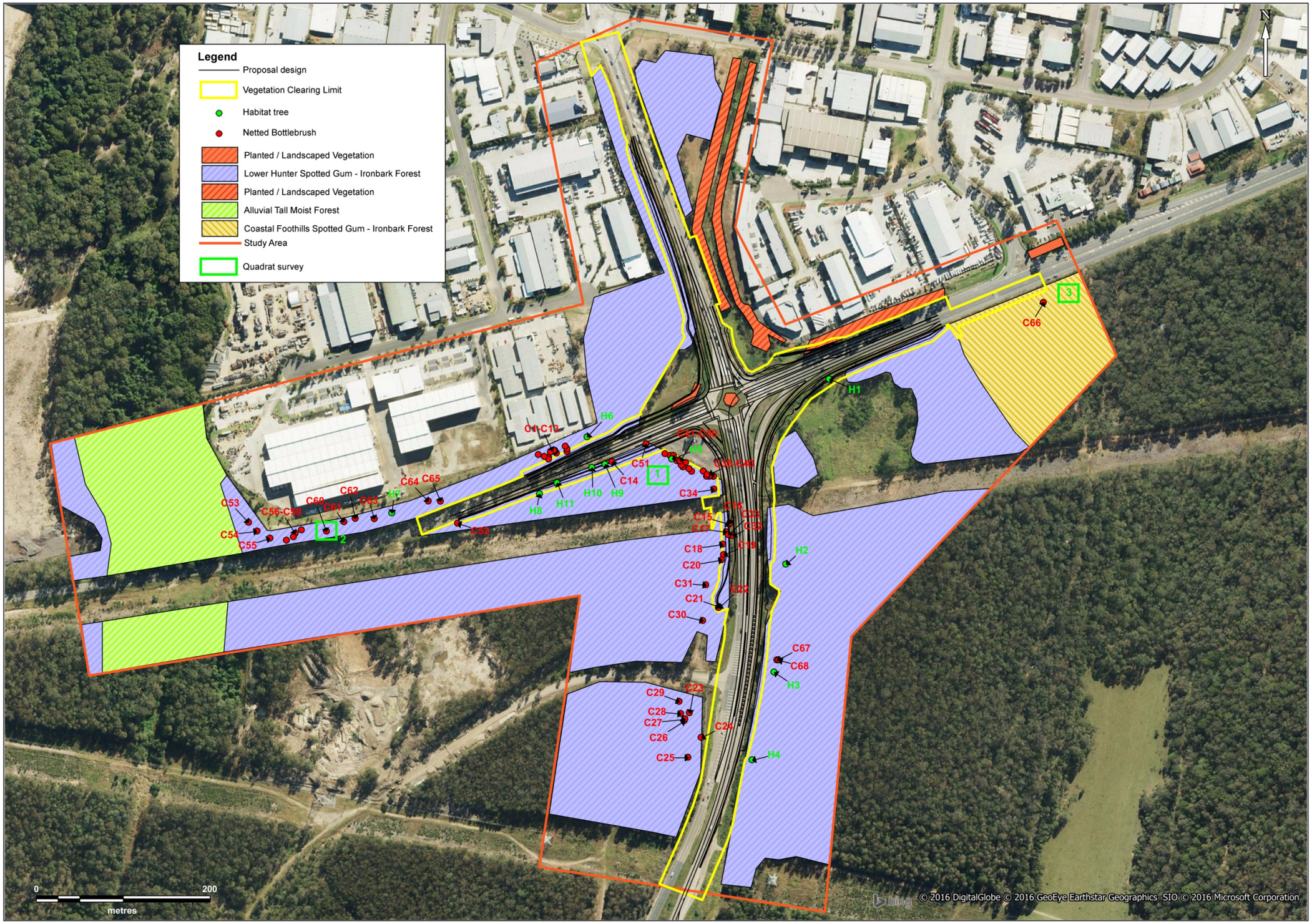


Figure 2 Distribution of Vegetation Assemblages, Netted Bottlebrush and Habitat Trees

Vegetation Structure – Lower Hunter Spotted Gum – Ironbark Forest
Canopy: (to 25m, 25-60% coverage) – *Corymbia maculata, Eucalyptus fibrosa, E. siderophloia, E. crebra, E. umbra, E. acmenoides*

Mid Layer: (to 10m) – *Melaleuca nodosa* (Ball Honeymyrtle), *M.* decora, Juvenile canopy species

Shrub Layer: (to 3m) – *Bursaria spinosa* (Blackthorn), *Daviesia ulicifolia* ssp. *ulicifolia*, *Pultenaea spinosa* (Spiny Bush-pea), ***Callistemon linearifolius*** **(Netted Bottlebrush)**, *C. linearis* (Narrow-leaved Bottlebrush), *Acacia falcata* (Hickory Wattle), *A. fimbriata* (Fringed Wattle), *A. elongata* (Swamp Wattle), *Breynia oblongifolia* (Breynia), *Denhamia silvestris* (Orange Bush), **Lantana camara* (Lantana)

Ground Layer: (to 50cm) - *Entolasia stricta*, *Poa labillardierei* (Tussock Grass), *Aristida vagans*, *Microlaena stipoides, Echinopogon caespitosus* (Tufted Hedgehog Grass), *Cymbopogon refractus* (Barbed-wire Grass), *Themeda australis*, *Eragrostis brownii*, *Dianella caerulea* var*. producta* (Blue Flax Lily), *Lomandra multiflora*, *Pratia purpurascens* (White Root), *Cheilanthes sieberi* ssp. *sieberi* (Mulga Fern), **Hypochaeris radicata*

Climbers: *Parsonsia straminea* (Monkey Rope), *Clematis glycinoides* (Headache Vine), *Geitonoplesium cymosum* (Scrambling Lily), *Cassytha pubescens* (Common Devil's Twine), *Pandorea pandorana* (Wonga Vine)

Photo 1: Roadside LHSGIF on northern side of John Renshaw Drive within dense stand of Ball Honeymyrtle.

Photo 2: Remnant LHSGIF along western side of Weakleys Drive.

3.2.3 Coastal Foothills Spotted Gum – Ironbark Forest

TSC Act Status:	Not listed
EPBC Act Status:	Not listed
HCCREMS Extant Mapping:	MU 17 – Coastal Foothills Spotted Gum - Ironbark Forest
HCCREMS ID:	MU 65 Spotted Gum/ Broad-leaved Mahogany/ Red Ironbark moist shrubby open forest
OEH PCT ID:	Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin Bioregion (Dry Sclerophyll Forest – Shrub/Grass Sub-formation)

This assemblage occurs along the hilly area in the south east of the survey area merging with MU 15 towards the bottom of the slope on the eastern side of the M1 Pacific Motorway. The canopy (up to 25 metres high) of this assemblage is characterised by a dominance of *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark) with the midstorey composed almost entirely of *Allocasuarina torulosa* (Forest Oak).

A number of other canopy species are also common throughout this assemblage including *Corymbia gummifera* (Red Bloodwood), *E. siderophloia* (Grey Ironbark), *E. umbra* (Broad-leaved White Mahogany) and *Angophora costata* (Smooth-barked Apple).

Vegetation Structure – Coastal Foothills Spotted Gum – Ironbark Forest (CFSGIBF)
Canopy: (to 25m, 25-40% coverage) – *Corymbia maculata, Eucalyptus fibrosa, E. siderophloia, E. umbra, Angophora costata, Corymbia gummifera*

Mid Layer: (to 10m) – *Allocasuarina torulosa* (Forest Oak), Juvenile canopy species

Shrub Layer: (to 3m) – *Dodonaea triquetra* (Common Hop Bush) *Bursaria spinosa* (Blackthorn), *Daviesia ulicifolia* ssp. *ulicifolia*, *Polyscias sambucifolia* (Elderberry Panax), *Persoonia linearis* (Narrow-leaved Geebung), *Kunzea ambigua* (Tick Bush), *Pultenaea spinosa* (Spiny Bush-pea), *Callistemon linearis* (Narrow-leaved Bottlebrush), *Acacia longifolia* (Sydney Golden Wattle), *Hakea sericea* (Needlebush), *Breynia oblongifolia* (Breynia), *Denhamia silvestris* (Orange Bush), **Lantana camara* (Lantana)

Ground Layer: (to 50cm) - *Entolasia stricta*, *Aristida vagans*, *Themeda australis*, *Eragrostis brownii*, *Dianella caerulea* var. *producta* (Blue Flax Lily), *Lomandra longifolia* (Spiny Mat-rush), *Lepidosperma laterale*, *Pomax umbellata* (Pomax), *Pseuderanthemum variabile* (Pastel Flower)

Climbers: *Parsonsia straminea* (Monkey Rope), *Cassytha pubescens* (Common Devil's Twine), *Glycine clandestina* (Love Creeper), *Hardenbergia violacea* (False Sarsaparilla), *Pandorea pandorana* (Wonga Vine)

Photo 3: CFSGIBF to the south John Renshaw Drive in the eastern portion of the survey area.

3.2.4 Alluvial Tall Moist Forest

TSC Act Status:	Not listed
EPBC Act Status:	Not listed
HCCREMS Extant Mapping:	MU 5 – Alluvial Tall Moist Forest
HCCREMS ID:	MU 42 White Mahogany / Turpentine moist shrubby open forest
OEH PCT ID:	Turpentine moist open forest of the coastal hills and ranges of the NSW North Coast Bioregion (Wet Sclerophyll Forest – Shrubby Sub-formation)

This assemblage occurs along Viney Creek located to the west of the survey area. This assemblage is typified by tall open forest to 40 metres tall with an enclosed understorey composed of wet forest species. Canopy species include *Corymbia maculata* (Spotted Gum), *Syncarpia glomulifera* (Turpentine), *Eucalyptus siderophloia* (Grey Ironbark) and *E. acmenoides* (White Mahogany).

The understorey of this community was subject to substantial weed growth, particularly dense thickets of *Lantana camara* (Lantana). Native understorey species recorded within this community include *Callistemon salignus* (Willow Bottlebrush), *Glochidion ferdinandi* (Cheese Tree), *Ficus coronata* (Sandpaper Fig), *Myrsine variabilis* (Muttonwood), and *Oplismenus aemulus* (Basket Grass).

Vegetation Structure – Alluvial Tall Moist Forest (ATMF)
Canopy: (to 40m, 50-70% coverage) – *Corymbia maculata, Eucalyptus. siderophloia, E. acmenoides, Syncarpia glomulifera*

Mid Layer: (to 10m) – *Callistemon salignus* (Willow Bottlebrush), *Glochidion ferdinandi* (Cheese Tree), *Melaleuca styphelioides* (Prickly-leaved Paperbark), Juvenile canopy species

Shrub Layer: (to 3m) – *Pittosporum undulatum* (Sweet Pittosporum), *Notelaea longifolia* (Mock Olive), *Zieria smithii* (Sandfly Zieria), *Denhamia silvestris* (Orange Bush), *Myrsine variabilis* (Muttonwood), **Lantana camara* (Lantana), **Ageratina adenophora* (Crofton Weed)

Ground Layer: (to 50cm) - *Oplismenus aemulus* (Basket Grass), *Lomandra longifolia* (Spiny Mat-rush), *Lepidosperma laterale*, *Pseuderanthemum variabile* (Pastel Flower), *Adiantum aethiopicum* (Common Maidenhair Fern), *Doodia aspera* (Rasp Fern), *Dichondra repens* (Kidney Weed), *Gymnostachys anceps*

Climbers: *Parsonsia straminea* (Monkey Rope), *Cayratia clematidea* (Slender Grape), *Clematis glycinoides* (Headache Vine), *Geitonoplesium cymosum* (Scrambling Lily), *Stephania japonica* (Snake Vine), *Pandorea pandorana* (Wonga Vine)

Photo 4: ATMF located along to the south John Renshaw Drive in the eastern portion of the survey area.

3.2.5 Threatened Ecological Communities

The Lower Hunter Spotted Gum Ironbark Forest assemblage recorded within the survey area is consistent with the EEC *Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion* listed under the TSC Act. The assemblage identified within the proposal occurs within the known distribution of this EEC (restricted to a range of about 65 x 35 kilometres centred on the Cessnock – Beresfield area) and closely resembles the species composition detailed within the scientific committee determination (Scientific Committee, 2011)

Up to 0.97 hectares of this community would be directly impacted by the proposed works. An assessment of significance for this EEC is provided in **Appendix IV.**

No other EECs were identified within the proposal.

3.2.6 Threatened Flora

Database searches identified 19 threatened flora species with the potential to occur within the locality of the proposal. A habitat assessment determining the likelihood of these species to be impacted by the proposed works is provided in **Appendix III.**

One threatened flora species, *Callistemon linearifolius* (Netted Bottle Brush), was identified within the proposal. This myrtaceous shrub grows to 3–4 metres high with linear to linear-lanceolate leaves 8–10

cm long, and 5–7 mm wide with an acute apex, thickened margins, and distinct lateral veins. The flowers are typical of bottle brushes comprised of with spikes of red filaments usually 9–10 cm long, c. 50 mm diameter, not leafy; with rachis pubescent at flowering. The capsules are c. 7 mm diameter. The plant flowers in spring and summer (Harden, 1991) with each flower producing a small woody fruit containing hundreds of tiny seeds. These fruits form in clusters along the stem, and are usually held on the plant for two to three years, allowing seed to be collected throughout the year (ANBG, 2016).

A total of 121 specimens were recorded during targeted surveys (**Figure 3**). The proposed works have the potential to directly impact up to 16 specimens within the proposal. An assessment of significance for this species is provided in **Appendix IV.**

It is noted that this species often occurred with another similar species *Callistemon linearis* (Narrow-leaved Bottlebrush) and on occasion there appeared to be some overlap between leaf characteristics of the two species. As a precautionary measure, plants showing features common to both species were also marked and this was indicated on the plant schedule provided in **Appendix V.**

The habitat assessment also identified three threatened flora species, *Rutidosis heterogama* (Heath Wrinklewort), *Tetratheca juncea* (Black-eyed Susan) and *Melaleuca biconvexa* (Biconvex Paperbark) which were considered to have a moderate likelihood of occurring within the survey area. However, given these species are absent from the proposed development area and are unlikely to be impacted by the works, no further assessment is warranted.

3.2.7 Noxious and environmental weeds

Noxious weed species recorded within the survey area and are detailed in **Table 5**.

Apart from Crofton Weed, these noxious weed species occurred sporadically throughout the roadside vegetation within the survey area. Crofton Weed primarily occurred within drainage areas often forming dense clumps around the culverts. Noxious weeds require appropriate control in order to comply with the Noxious Weeds Act. Other weeds recorded which are regionally prohibited in other parts of the state include *Ligustrum sinense* (Narrow-leaf Privet), *Cardiospermum grandiflorum* (Balloon Vine), *Ricinus communis* (Castor Oil Plant), *Ipomoea indica* (Morning Glory) and *Anredera cordifolia* (Madeira Vine). These species should also be controlled within the proposal to avoid further spread.

Other environmental weed species including *Bidens pilosa* (Cobbler's Pegs), *Sida rhombifolia* (Paddy's Lucerne), *Plantago lanceolata* (Ribwort) and a number of exotic grasses were also common along the roadsides throughout the survey area.

Table 5: Noxious weeds recorded within the survey area.

Scientific Name	Common Name	Weed Class[1] Newcastle LGA
Ageratina adenophora	Crofton Weed	Class 4
Asparagus aethiopicus	Asparagus Fern	Class 4
Lantana camara	Lantana	Class 4
Opuntia monacantha	Smooth Tree Pear	Class 4
Rubus fruticosus	Blackberry	Class 4
Senecio madagascariensis	Fireweed	Class 4

[1] Control Classes under the Noxious Weeds Act 1993.

Class 1 & 2 This plant must be eradicated from the land and the land must be kept free of this plant.

Class 3	This plant must be fully and continuously suppressed and destroyed.
Class 4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the LCA. Must also, 'not be sold, propagated or knowingly distributed'.
Class 5	The requirements of the Noxious Weeds Act 1993 for a notifiable weed must be complied with.

3.3 Fauna

3.3.1 Fauna Habitat

Much of the fauna habitat recorded within the survey area is limited given the close proximity of the existing roads with much of the roadside vegetation subject to previous clearing and edge effects such as increased weed growth and rubbish dumping. The roadside vegetation on the southern side of John Renshaw Drive is contiguous with large tracts of native forest that extends to the south. Connectivity to the north of John Renshaw Drive is limited by industrial development although a link to extensive forest areas to the north is available along Viney Creek in the west of the survey area.

Key habitat features of the proposal include:

- Hollow bearing trees occur sporadically throughout the survey area and the proposed works may impact a small number of these trees. These may provide roosting and/or foraging and/or breeding habitat for a range of birds, mammals, reptiles and frogs. Details of the hollow-bearing trees recorded within the survey area are provided in Section 3.3.2;
- Roadside trees and shrubs may provide foraging habitat for a range of birds, mammals, reptiles and frogs. The trees within the survey area may also provide potential nesting sites for nest building birds;
- Ground cover including areas of dense leaf litter and fallen logs may provide habitat and cover for a range of small terrestrial species;
- Viney Creek and the drainage line that extends along the east of the M1 Pacific Motorway and Weakleys Drive contains areas of dense emergent vegetation which may provide habitat for a range of common frogs, reptiles and wetland birds. These water features are somewhat degraded being subject to increased pollutant and sediment loads from road runoff with dense areas of weeds common within these waterways; and
- The culverts within the survey area provide potential nesting and roosting habitat for certain species of birds and microbats. No species were observed using the culverts during the site inspections although access was limited due to inundation and dense weed growth. Breeding habitat for microbats was unlikely to be present; however, the culvert may provide temporary refuge/roosting habitat.

A full list of fauna species observed during the survey is contained in **Appendix III.**

3.3.2 Habitat Trees

Eleven habitat trees were recorded within the survey area. Five of these trees (H1 and H8 to H11) are located within the proposal and may be removed by the proposed works. Trees located close to the edge of the proposal (H4 to H6) would be retained. Details of the habitat trees are provided in **Table 6** and the locations are shown in **Figure 2.**

Table 6: Results of habitat tree survey (Trees proposed for removal shown in orange)

Tree No.	Easting	Northing	Species	DBH (cm)	Habitat Notes.
H1	372384	6368575	*C. maculata*	90	3x Class 3 - suitable for bats only - Likely to be removed
H2	372337	6368362	*E. acmenoides*	60	Arboreal termite nest
H3	372325	6368238	*C. maculata*	110	Very large tree with broken top. No hollows visible but possible Class 2 hollows within broken limb. Lace Monitor scratches on bole
H4	372301	6368137	*C. maculata*	80	1x Class 2
H5	372204	6368481	*C. maculata*	40	1x Class 2, many scratches on bole, Lace Monitor observed sunning itself at hollow entrance - Potentially impacted
H6	372106	6368505	*Stag*	30	Cracks and crevices (Class 3) suitable for bats
H7	371882	6368415	*C. maculata*	75	Hollow trunk with opening at base Scratches on bole, likely Lace Monitor
H8	372052	6368439	*C. maculata*	100	Few Class 3 hollows suitable for bats Likely to be removed
H9	372127	6368474	*C. maculata*	150	3x Class 2, 3x Class 3 Scratches on bole - Likely to be removed
H10	372112	6368470	*C. maculata*	60	2x Class 2
H11	372072	6368452	*E. fibrosa*	100	Cracks and fissures suitable for bats

The habitat classification system employed involved three classes:

Class 1 - large sized hollow openings (i.e. >15cm) suitable for species such as Owls

Class 2 - medium sized hollow-openings (i.e. 5-15cm) suitable for species such as Gliders and Possums

Class 3 - small sized hollow openings (i.e. <5cm) suitable for species such as microchiropteran bats.

3.3.3 Threatened Fauna

The database searches for the survey area identified 61 threatened fauna species with the potential to occur within the locality. A habitat assessment determining the likelihood of these species to be impacted by the proposed works is provided in **Appendix III.**

The habitat assessment identified 11 threatened fauna species with the potential to be impacted by the proposed works and an assessment of significance for these species is provided in **Appendix IV**. These were:

- *Glossopsitta pusilla* Little Lorikeet
- *Neophema pulchella* Turquoise Parrot
- *Climacteris picumnus* ssp. *victoriae* Brown Treecreeper
- *Phascogale tapoatafa* Brush-tailed Phascogale
- *Petaurus norfolcensis* Squirrel Glider
- *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat
- *Mormopterus norfolkensis* East Coast Freetail-bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle
- *Miniopterus australis* Little Bentwing-bat
- *Myotis macropus* Southern Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat

The remaining 53 threatened species assessed were unlikely to occur within the proposal or the habitat available was not considered important for their survival and no further assessment is required.

3.4 Koala Habitat

3.4.1 SEPP 44 Koala Habitat

A single *Eucalyptus tereticornis* (Forest Red Gum), a Koala feed tree, was recorded within the survey area. The survey area did not contain any other listed Koala feed trees and given the paucity of known feed trees, the survey area does not constitute 'core Koala habitat' or 'potential Koala habitat' as defined by SEPP 44.

3.4.2 EPBC Act Draft Referral Guidelines

The site was also assessed under the Draft EPBC Act referral guidelines for the vulnerable Koala (2013). It is considered that no important populations are likely to rely upon the habitat present within the survey area or would the site contain any areas of critical habitat for this species given the paucity of feed trees. Therefore, under the guidelines, the proposed works have a low risk of resulting in a significant impact and a referral is not required.

3.5 Aquatic Habitat

Aquatic habitat occurs within the study area at two primary locations:

- The Viney Creek crossing of John Renshaw Drive located to the west of the proposal. This section of waterway has been previously cleared and is subject to substantial weed growth. Instream vegetation is dominated by *Typha orientalis* (Cumbungi) with dense patches of Crofton Weed and Lantana (**Photo 5**). Up and downstream of the John Renshaw Drive crossing, Viney Creek is in relatively good condition, flowing through intact forest with minimal weed incursion. Whilst Viney Creek is ephemeral in nature, standing pools of water are generally present throughout the year.
- The drainage infrastructure, including drainage lines, culverts and a retention pond associated with the M1 Pacific Motorway are located along the eastern side of the M1 Pacific Motorway and flow into a canalised drain to the north of the proposal. Where present, instream vegetation was typically subject to heavy weed infestation or composed of dense Cumbungi.

The proposal is located wholly within the Hunter River Catchment with all drainage from the site flowing into Viney Creek, which subsequently flows into the Hunter River via the Woodberry Swamp. Based on existing condition, literature review and field observations, the aquatic habitat of the subject area is not considered to hold any significant aquatic ecological value.

Only the introduced *Gambusia holbrookii* (Plague Minnow) was observed during the field inspection and only frogs common to modified environments were heard calling during field inspections.

Photo 5: Viney Creek crossing John Renshaw Drive at western end of study area.

Photo 6: Drainage line along eastern side of M1 Pacific Motorway.

Photo 7: Existing retention pond with dense Cumbungi on eastern side of M1 Pacific Motorway.

4. POTENTIAL IMPACTS

The potential impacts discussed in this section are based on a desktop assessment of the survey area and field investigations. Potential impacts to ecological values (including flora, fauna and vegetation communities) as a result of the proposed works may include the following.

4.1 Avoid and Minimise Impacts

The current development proposal has been scaled back significantly in spatial extent from previous designs, primarily as a result of consideration of ecological impacts. Given the presence of the vulnerable Netted Bottlebrush and the Lower Hunter Spotted Gum – Ironbark Forest EEC, the proposed footprint has been revised to minimise impacts to these features. Previous designs involved the removal of more than two hectares of EEC vegetation, 59 Netted Bottlebrush specimens and up to eight habitat trees.

This proposal has now been revised and would impact up to 16 Netted Bottlebrush specimens, five habitat trees and less than one hectare of EEC vegetation. The proposal, now impacting less than one hectare of EEC, does not trigger the need for offsets to be considered according to the Biodiversity Offsets Guideline.

Given the need for a minimum footprint area to achieve the desired road configuration, impacts on local biodiversity have been minimised as far as possible. There is no further scope to reduce the proposal further and the final design chosen achieves the minimum ecological impact possible.

4.2 Loss of Vegetation and Habitat

The proposed works would result in the potential removal of up to 1.1 hectares of native vegetation. Indirect impacts from the proposal are likely to be negligible given the survey area is already subject to weed invasion and polluted run-off and increased edge effects may not be discernible.

The potential loss of vegetation and habitat associated with the proposal is summarised in **Table 7**. The tree survey identified about 146 trees (minimum size of 30cm DBH) located within the proposed construction zone. A summary of the trees to be impacted is provided in **Table 8** and the tree schedule is provided in **Appendix VI.** The vegetation to be impacted by the proposed works is shown in **Figure 3**.

Table 7: Summary of vegetation to be impacted by the proposed works.

Vegetation community	TSC Act	Direct Impact (ha)	Locality (10 km)[1] (ha)	% impacted within locality
Lower Hunter Spotted Gum – Ironbark Forest	EEC	0.97	4653	0.02
Coastal Foothills Spotted Gum – Ironbark Forest	N/A	0.08	2771	0.003
Planted / Landscaped vegetation	N/A	0.09		

[1]Source: Local vegetation mapping (House, 2003)

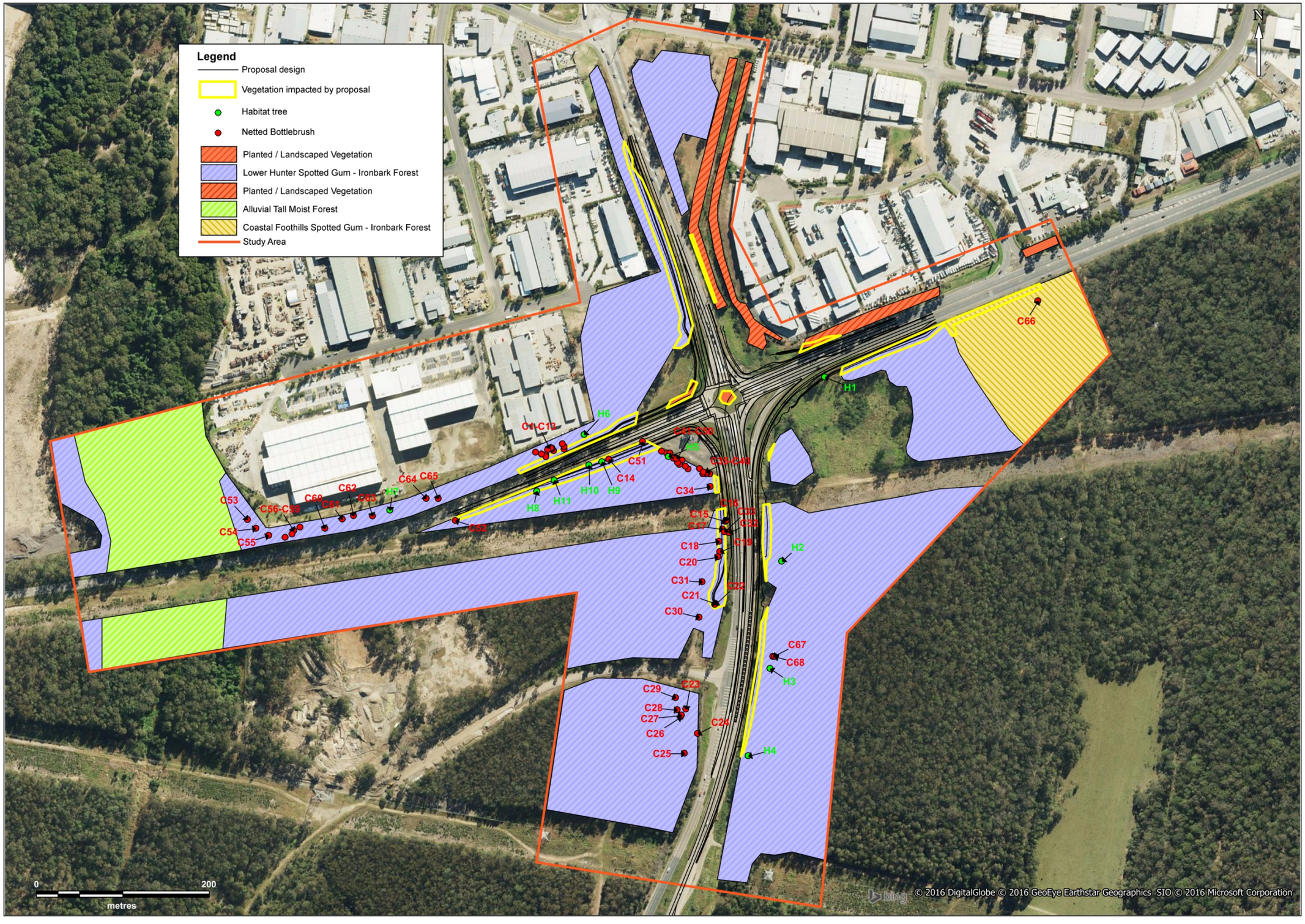


Figure 3 Vegetation and habitat to be impacted by proposed works

Table 8: Summary of trees (minimum size of 30cm DBH) to be impacted by the proposed works.

Species	Number within proposal area
Corymbia gummifera (Red Bloodwood)	1
Corymbia maculata (Spotted Gum)	66
Eucalyptus acmenoides (White Mahogany)	6
Eucalyptus agglomerata (Blue-leaved Stringybark)	6
Eucalyptus fibrosa (Broad-leaved Ironbark)	34
Eucalyptus siderophloia (Grey Ironbark)	19
Eucalyptus tereticornis (Forest Red Gum)	1
Melaleuca decora	12
Stag	1
Total	**146**

The removal of vegetation also has the potential to impact up to 16 Netted Bottlebrush specimens and eight habitat trees. The removal of habitat trees has the potential to directly impact hollow-dependent fauna that may inhabit the trees and reduce this habitat resource in the local area. The removal of Netted Bottlebrush and habitat trees has been minimised wherever possible during the detailed design of the proposal.

The clearing of native vegetation and the removal of hollow-bearing trees are both listed as a Key Threatening Processes under the TSC Act (1995).

4.3 Wildlife Connectivity and Habitat Fragmentation

The removal of vegetation for the proposed works would add to the incremental fragmentation of vegetation within the locality. Consideration has been given as to the potential for Squirrel Gliders and other fauna to use the existing M1 Pacific Motorway as a link to habitat areas in the east and west of the study area.

The existing gap between large trees (trees in excess of 30 metres tall) on either side of the M1 Pacific Motorway is generally in excess of 50 metres and would not be suitable for regular glider movement (van der Ree *et al.* 2010). The heavy traffic along the M1 Pacific Motorway further degrades this option as a regular movement corridor, particularly for terrestrial species. The proposed widening of the proposal is unlikely to significantly impact local wildlife connectivity given the barrier the existing conditions create.

4.4 Weeds

The proposed construction activities would involve clearing and earthworks in areas subject to moderate levels of weed infestation. The movement of soil by machinery and/or water and the disturbance of soil can lead to further weed infestation within the survey area. Increased weed growth has the potential to out-compete native species in the local area and further degrade habitat including that of the threatened Netted Bottle Brush and the existing Lower Hunter Spotted Gum Ironbark Forest EEC.

4.5 Aquatic Impacts

The proposed earthworks including culvert extensions, drain construction and swale reformation have the potential to directly impact local aquatic habitat. These would likely result in the temporary removal of existing riparian and instream vegetation from the proposed impact areas and increase the risk of erosion and sedimentation entering the Viney Creek catchment. The proposed construction works in general also increase the risk of pollutants, such as fuels and oils, entering Viney Creek and the local

drainage network. This could lead to increased sedimentation and or pollution of downstream environments, particularly during periods of high or intense rainfall.

4.6 Noise and Light

The current noise and light levels at the proposal are high given the large volumes of traffic and heavy vehicles. The proposed works would potentially be performed during the night and this is likely to increase noise and light levels. Given the high noise and light levels already present, the potential impacts of increased noise and lighting on resident fauna is likely to be negligible.

4.7 Threatened Ecological Communities

The EEC *Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion* listed under the TSC Act occurs within the proposal and up to 0.97 hectares of this EEC may be directly impacted. The assessment of significance for this EEC, provided in **Appendix IV**, concluded the proposed works are unlikely to have a significant impact upon this community given the small area to be impacted and the abundance of this community in the locality. In accordance with the Biodiversity Offset Guideline, offsets would not need to be considered given the proposal would impact less than one hectare of this EEC.

4.8 Threatened Flora Species

The threatened flora species, *Callistemon linearifolius* (Netted Bottle Brush), listed as vulnerable under the TSC Act, was identified within the proposal. A total of 121 specimens were recorded during targeted surveys and up to 16 specimens may be directly impacted by the works. The assessment of significance for this species, provided in **Appendix IV**, concluded the proposed works are unlikely to have a significant impact upon this flora species given the relatively small number of plants to be directly impacted by the works and safeguards to protect plants during construction.

4.9 Threatened Fauna

The habitat assessment identified the following eleven threatened fauna species with the potential to be impacted by the proposed works.

- *Glossopsitta pusilla* Little Lorikeet
- *Neophema pulchella* Turquoise Parrot
- *Climacteris picumnus* ssp. *victoriae* Brown Treecreeper
- *Phascogale tapoatafa* Brush-tailed Phascogale
- *Petaurus norfolcensis* Squirrel Glider
- *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat
- *Mormopterus norfolkensis* East Coast Freetail-bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle
- *Miniopterus australis* Little Bentwing-bat
- *Myotis macropus* Southern Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat

The assessments of significance pursuant to the TSC Act for these species are provided in **Appendix IV**. In general, these concluded that potential direct and indirect impacts to these species are unlikely to be significant given the small area of habitat to be impacted by the works and the abundance of habitat available in the locality.

5. MITIGATION MEASURES

The following mitigation measures are recommended to minimise the ecological impact of the proposed works. The following measures are recommended for inclusion in the Construction Environmental Management Plan (CEMP) to be developed for the works.

Impact	Environmental safeguards	Responsibility	Timing
General	A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to: • Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas; • Requirements set out in the *Landscape Guideline* (RTA, 2008); • Pre-clearing survey requirements; • Procedures for unexpected threatened species finds and fauna handling; • Procedures addressing relevant matters specified in the *Policy and guidelines for fish habitat conservation and management* (DPI Fisheries, 2013); and • Protocols to manage weeds and pathogens.	Contractor	Detailed design / pre-construction
Reduce Vegetated Clearing Limits	Measures to further avoid and minimise the construction footprint and Vegetated Clearing Limits or hollow-bearing tree removal will be investigated during detailed design and implemented where practicable and feasible. The clearing of native vegetation must be minimised with the objective of reducing impacts to any threatened species, populations and ecological communities to the greatest extent practicable.	Contractor	Detailed design / pre-construction
Pre-clearing process	This would be carried out in accordance with the requirements of the Roads and Maritime's Biodiversity Guidelines (RTA, 2011) - *Guide 1: Pre-clearing process*. Including: • Consult with an ecologist to determine the location of suitable nearby habitat for the release of fauna that may be encountered during the pre-clearing process or habitat removal. Mark the pre-determined habitat identified for fauna release on a map. • Prior to clearing: a) Confirm the locations of biodiversity features including:	Contractor	Pre-construction/ construction

Impact	Environmental safeguards	Responsibility	Timing

- Hollow-bearing trees.
- Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC
- *Callistemon linearifolius* (Netted Bottle Brush)

b) Identify fauna that have the potential to be disturbed as a result of clearing activities.

c) Ensure an ecologist checks for the presence of threatened flora and fauna species that were identified in the environmental assessment as likely to occur, including:

- *Rutidosis heterogama* (Heath Wrinklewort),
- *Tetratheca juncea* (Black-eyed Susan)
- *Melaleuca biconvexa* (Biconvex Paperbark)

Undertake these checks during optimal conditions for the target species where possible.

d) Record the details for all hollow-bearing trees, trees containing threatened fauna and threatened flora.

e) Mark habitat features to be protected during construction.

f) Confirm the location of pre-determined habitat identified for the release of any fauna encountered on site.

g) Submit and updated maps/plans, habitat features and recommended clearing procedures to the project manager and/or environment manager (or equivalent).

- Twenty-four hours before clearing:

a) Licensed wildlife carers and/or ecologists should capture and/or remove fauna that have the potential to be disturbed as a result of clearing activities.

b) Relocate fauna into pre-determined habitat identified for fauna release.

c) All fauna handling should be carried out by licensed wildlife carers and/or ecologists and in accordance with *Guide 9: fauna handling*.

Impact	Environmental safeguards	Responsibility	Timing
	d) Inform clearing contractors of any changes to the sequence of clearing if required. e) Carry out staged habitat removal as outlined in *Guide 4: Clearing of vegetation and removal of bushrock* where fauna habitat features have been identified and marked.		
Exclusion Zones	Locations of the Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion EEC, *Callistemon linearifolius* (Netted Bottle Brush) and hollow-bearing trees that are outside of the Vegetation Clearing Limit will be clearly marked and/or fenced to exclude access during construction. This will be carried out in accordance with the requirements of the Roads and Maritime's Biodiversity Guidelines (RTA, 2011) - *Guide 2: Exclusion Zones*; Including as a minimum: • Mark exclusion zones on a suitable plan. • Select a suitable exclusion fence type. • Allow enough lead time to establish exclusion zones before clearing. • Mark out exclusion zones with temporary markings such as pegs or paint and where possible use a qualified surveyor. • Place exclusion zone fencing outside tree protection zones. • Erect signs to inform personnel of the purpose of exclusion zone fencing. • Ensure all exclusion zones are regularly inspected and repairs to fencing are made where required. • Communicate the importance of exclusion zones, and any changes to the zones, to all site staff and visitors (eg in toolbox talks and inductions). • Ensure that any breaches of the exclusion zone are reported through the Roads and Maritime environmental incident reporting procedure.	Contractor	Pre-construction/ construction
Vegetation Clearing	Trees and vegetation will be removed in accordance with the Roads and Maritime's Biodiversity Guidelines - *Guide 4 – Clearing of Vegetation and Removal of Bushrock*. Vegetation clearing will include as a minimum:	Contractor	Pre-construction/ construction

Impact	Environmental safeguards	Responsibility	Timing
	• Develop a clearing and grubbing plan with reference to the Vegetation Clearing Limit (**Figure 2**) and Biodiversity Guidelines and communicate the requirements of the plan to site staff regularly. • Document the selection of suitable work methods in a clearing and grubbing plan. • Ensure clearing of vegetation and/or removal of bushrock does not go beyond the approved Vegetated Clearing Limits for the project. • A staged habitat removal process is to be used when identified hollow-bearing trees, or bushrock is to be removed. • Carefully clear vegetation so as not to mix topsoil with debris and to avoid impacts to surrounding native vegetation. • Keep stockpiles of cleared vegetation under two metres high in accordance with the RTA's Stockpile Site Management Guideline. • Non-woody vegetation (typically grasses and groundcover species) should be incorporated into the stripping of topsoil to retain any organic materials and nutrients within the topsoil layer.		
Weed and Pathogen Management	Weed and Pathogen management will be done in accordance with the Roads and Maritime's Biodiversity Guidelines – Guide 6 and Guide 7. Including as a minimum: • Develop and implemented a weed management plan for the site • Separate weeds from native vegetation where native vegetation is to be used for mulch. Do not use weeds for mulch. • All weed plant material and topsoil containing weed plant material should be disposed of to an appropriate waste management facility. • Check the Department of Primary Industries (DPI) website (www.industry.nsw.gov.au) for the most up-to-date hygiene protocols for each pathogen and for the most recent locations of contamination.	Contractor	Pre-construction/ construction
Nest boxes	Installation of nest boxes is to be undertaken in accordance with Roads and Maritime *Biodiversity Guidelines - Guide 8: Nest boxes.* Including as a minimum: • Nest boxes are to replace the loss of hollows at a ratio of at least 1:1 (one nest boxes installed for each hollow removed).	Contractor	Pre-construction/ construction

Impact	Environmental safeguards	Responsibility	Timing
	• Where nest boxes are required, an ecologist should be engaged to develop a nest box strategy. • • Consult with an ecologist to assist in the implementation of the nest box strategy including installation and monitoring of nest boxes. • Nest boxes should be supplied for the following species, in line with Table 8.1 and Table 8.2 of Guide 8: a) Microbats b) Squirrel Gliders c) Yellow-bellied Gliders • The nest box lid should overhang the front and sides of the nest box by at least 25 millimetres to prevent water damage. For monitoring and maintenance purposes, consider using a hinged lid. Do not use metal lids or plates on the roof of the nest box lid. • Paint the outside of the nest box with non-toxic, dark-coloured, outdoor, water-based acrylic paint. Avoid toxic substances. • To assist with drainage, drill three small holes in the base of the nest box. • Non-toxic woodchips, wood shavings or sawdust could be placed into possum, glider and bird nest boxes to provide extra insulation in cold climates. • An ecologist should be on site during the installation of nest boxes. • The preferred method of attaching nest boxes to trees is the Habisure© system. Bolting nest boxes to trees is not recommended. • The density and quantity of each nest box type should reflect the proportion of tree hollow types being removed, the proportion of tree hollow types to be retained in adjacent habitat, the availability of adjacent food resources and the assemblage of hollow-dependant fauna known or likely to occur in the project locality. • The location of nest boxes should be as close as possible to the original hollow-bearing tree, consider the type of bark preferred by the target species, be in close proximity to food or other resources, not be installed on trees with existing hollows or where there is a high density of Common Mynas (Acridotheres tristis).		

Impact	Environmental safeguards	Responsibility	Timing
	• Orientate nest boxes between northwest and east and so they are not facing lights from adjacent development. • Install approximately 70 per cent of nest boxes up to one month before the start of any clearing. The remainder of nest boxes would be installed before completion of the project. • Record the nest box identification number, nest box type, GPS location, species and diameter at breast height of the host tree, nest box height and orientation. Undertake ongoing monitoring and maintenance of nest boxes in accordance with the nest box management strategy for the project.		
Fauna Protection	Any fauna handling would be undertaken by an appropriately licenced ecologist in accordance with the Roads and Maritime's Biodiversity Guidelines - *Guide 9 – Fauna handling*. Including as a minimum: • If unexpected threatened fauna or flora species are discovered, stop works immediately and follow the Roads and Maritime *Unexpected Threatened Species Find Procedure* in the RTA Biodiversity Guidelines 2011 – Guide 1 (Pre-clearing process)' • Allow fauna to leave an area without intervention as much as possible. • Contact an animal rescue agency/wildlife care group or vet before works start to ensure they are willing and available to be involved in fauna rescue and assist with injured animals. • Never deliberately kill a snake as all snakes are protected under the National Parks and Wildlife Act 1974 (NSW). If a snake must be handled to remove the risk of harm to the snake or people then handling should only be done by a licensed fauna ecologist or wildlife carer with skills and experience in snake handling. • Follow the Hygiene Protocol for the control of disease in frogs (Wellington and Haering 2008) for all frog handling. • If handling bats, the handler must be vaccinated against the Australian Bat Lyssavirus (ABL) which is a form of rabies. • Release fauna into pre-determined habitat identified for fauna release. • Keep records of fauna captured and relocated.	Contractor	Pre-construction/ construction

Impact	Environmental safeguards	Responsibility	Timing
Revegetation works	Revegetation of areas disturbed by the proposed works would be undertaken in accordance with Roads and Maritime Landscape Plantings QA Specification R179 and the Roads and Maritime Biodiversity Guidelines - *Guide 3: Re-establishment of native vegetation*. Including as a minimum: • Locally indigenous species will be included as part of landscaping and rehabilitation works to promote native fauna habitat. Species identified on site that are suitable for revegetation works are detailed in **Appendix I.** • Collect local native topsoils and leaf litter and store for use in revegetation works. • Soils in areas to be revegetated should match surrounding soil conditions as closely as possible unless adjacent areas are weedy or contaminated. • Consider appropriate shade and drainage conditions when planting. Provide mulching around plants for dry or potentially weedy sites to help retain moisture and suppress weeds.	Contractor	Pre-construction/ construction

6. ASSESSMENT OF SIGNIFICANCE

Table 8 provides a summary of the outcomes of the assessment of significance under the EP&A Act, with the assessment detail provided in **Appendix IV**.

Table 9: Summary of Assessment of Significance (Section 5a NSW EP& Act).

TSC Act significance assessments								
Threatened species, or communities	Significance Assessment question[1]							Likely significant impact?
	a	b	c	d	e	f	g	
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion	X	X	N	Y	N	X	Y	No
Callistemon linearifolius (Netted Bottlebrush)	Y	X	X	Y	N	N	Y	No
Hollow-dependent Birds								
Glossopsitta pusilla (Little Lorikeet) *Neophema pulchella* (Turquoise Parrot) *Climacteris picumnus* ssp. *victoriae* (Brown Treecreeper)	N	X	X	Y	N	N	Y	No
Arboreal Mammals								
Phascogale tapoatafa (Brush-tailed Phascogale) *Petaurus norfolcensis* (Squirrel Glider)	N	X	X	Y	N	N	Y	No
Microchiropteran Bats								
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat) *Mormopterus norfolkensis* (East Coast Freetail-bat) *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) *Miniopterus australis* (Little Bentwing-bat) *Myotis macropus* (Southern Myotis) *Scoteanax rueppellii* (Greater Broad-nosed Bat)	N	X	X	Y	N	N	Y	No

Notes: Y= Yes (negative impact), N= No (no or positive impact), X= not applicable, ?= unknown impact.

1. Significance Assessment Questions as set out in the *Threatened Species Conservation Act 1995/ Environmental Planning and Assessment Act 1979*.
   - 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,
   - 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,
   - 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,
   - 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
     - (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,

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

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

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.

7. CONCLUSION

Flora, fauna and habitat studies have been undertaken to identify and assess the potential impacts resulting from works to upgrade the M1 Pacific Motorway intersection with John Renshaw Drive and Weakleys Drive.

Endangered ecological communities and threatened species that may be impacted by the proposal include:

- Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion (EEC)
- *Callistemon linearifolius* Netted Bottlebrush
- *Glossopsitta pusilla* Little Lorikeet
- *Neophema pulchella* Turquoise Parrot
- *Climacteris picumnus* ssp. *victoriae* Brown Treecreeper
- *Phascogale tapoatafa* Brush-tailed Phascogale
- *Petaurus norfolcensis* Squirrel Glider
- *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat
- *Mormopterus norfolkensis* East Coast Freetail-bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle
- *Miniopterus australis* Little Bentwing-bat
- *Myotis macropus* Southern Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat

The current proposal has been scaled back significantly in spatial extent from previous designs, primarily as a result of consideration of ecological impacts. Given the need for a minimum footprint area to achieve the desired road configuration, impacts on local biodiversity have been minimised as far as possible.

Given the small areas of road side habitat to be impacted by the works, this assessment has determined that the proposal is unlikely to have a significant impact on any of the above threatened species or EECs, under State (TSC Act) or Federal (EPBC Act) legislation.

A number of mitigation measures, listed in **Section 5**, have been provided to help limit the impact of the proposed works on habitat within the survey area.

8. REFERENCES

Australian National Botanic Gardens (2016) *Propogation and Collecting Seeds - Callistemon*, https://www.anbg.gov.au/PROPGATE/collecti.htm

Auld, B.A. and Medd, R.W. (1996). *Weeds: An Illustrated Botanical Guide to the Weeds of Australia.* Inkata Press, Sydney.

Barker, J., Grigg, G.C. and Tyler, M.J. (1995). *A Field Guide to Australian Frogs*. Surrey, Beatty & Sons, New South Wales.

Churchill, S. (2008). *Australian Bats* 2nd Ed. Allen & Unwin, Sydney.

Cropper, S. (1993). *Management of Endangered Plants*. CSIRO Publications, East Melbourne.

Department of Environment and Climate Change (2007). *Threatened species assessment guidelines: the assessment of significance*. NSW, Sydney South.

Harden, G (1991-2000). *Flora of New South Wales. Vols 1-4.* NSW University Press.

House, S. (2003) 'Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy, Technical Report, Digital Aerial Photo Interpretation and Updated Extant Map, May 2003. Lower Hunter and Central Coast Regional Environmental Management Strategy, Callaghan.

Lake Macquarie City Council (2015), *Draft Lake Macquarie Squirrel Glider Planning and Management Guidelines.* LMCC Booragul

NSW Department of Environment and Conservation (2004). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities. Working Draft*.

NSW Roads and Traffic Authority (2011). *Biodiversity Guidelines – Protecting and managing biodiversity on RTA projects*.

Office of Environment and Heritage (OEH) (2012). *Atlas of NSW Wildlife Database.* Licenced database accessed April 2016.

OEH (2012), http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx, Office of Environment and Heritage Threatened Species Profiles website, Date: April 2016.

Richardson, F., Richardson, R. & Sheppard, R. (2011). *Weeds of the South-East – An Identification Guide for Australia*. WeedInfo, Victoria.

Robinson, L. (2003). *Field Guide to the Native Plants of Sydney* (3rd edn.). Kangaroo Press Pty. Ltd., New South Wales.

Simpson, K. & Day, N. (2010). *Field Guide to the Birds of Australia.* Penguin Publishing, Camberwell Victoria.

Somerville, M. (2009), *Hunter, Central & Lower North Coast Vegetation Classification & Mapping Project Volume 2: Vegetation Community Profiles*, report prepared by HVVREMS/Hunter Councils Environment Division for Hunter-Central Rivers Catchment Management Authority, Tocal, NSW.

Strahan, R. (Ed) (1995). *The Mammals of Australia*. Reed Books, Australia.

Triggs, B. (1996). *Tracks, Scats and Other Traces - A Field Guide to Australian Mammals*, Oxford University Press, Melbourne.

Vallee, L., Hogbin, T., Monks, L., Makinson, B., Matthes, M., and Rossetto, M. (2004). *Guidelines for the translocation of threatened plants in Australia*. Second Edition. Australian Network for Plant Conservation, Canberra.

van der Ree, R., Cesarini, S., Sunnucks, P., Moore, J. L., & Taylor, A. (2010). Large gaps in canopy reduce road crossing by a gliding mammal. *Ecology and Society*, 15(4), 35

Wilson, S. & Swan, G. (2010). *A Complete Guide to the Reptiles of Australia.* New Holland Publishing, Sydney, New South Wales.

Appendix I

Flora Species List

Flora Species List

The following is a list of all flora species recorded within the site. It should be noted that such a list cannot be considered comprehensive, but rather indicative of the flora. A period of some years is often required to identify all species present in an area, particularly for cryptic or seasonally detectable species (such as orchids, some grasses and grass-like herbs).

Notes

*Indicates an exotic or non-local native species
Threatened or rare species are listed in **bold** font.
R – Indicates species suitable for revegetation works

Scientific Name	Common Name	
CLASS FILICOPSIDA (FERNS)		
ADIANTACEAE		
Adiantum aethiopicum	Common Maidenhair Fern	R
BLECHNACEAE		
Doodia aspera	Rasp Fern	R
DENNSTAEDTIACEAE		
Pteridium esculentum	Bracken	R
DICKSONIACEAE		
Calochlaena dubia	Soft Bracken Fern	R
SCHIZACEAE		
Cheilanthes sieberi ssp. sieberi	Mulga Fern	R
SINOPTERIDACEAE		
Pellaea falcata ssp. falcata	Sickle Fern	
CLASS MAGNOLIOPSIDA (FLOWERING PLANTS)		
SUBCLASS LILIIDAE (Monocotyledons)		
AGAVACEAE		
**Doryanthes excelsa*	Gymea Lily	
ALLIACEAE		
**Agapanthus africanus*	Agapanthus	
ARACEAE		
Gymnostachys anceps	Settlers Flax	R
**Monstera deliciosa*	Fruit-salad Plant	

ARECACEAE		
**Phoenix canariensis*	Canary Island Palm	
ASPARAGACEAE		
**Asparagus aethiopicus*	Asparagus Fern	
COMMELINACEAE		
Commelina cyanea	Scurvy Weed	
CYPERACEAE		
**Cyperus aggregatus*		
**Cyperus brevifolius*	Mullumbimby Couch	
**Cyperus eragrostis*	Umbrella Sedge	
Gahnia clarkei		R
Lepidosperma laterale		R
JUNCACEAE		
Juncus usitatus	Common Rush	R
LILIACEAE		
Crinum pedunculatum	Swamp Lily	
LOMANDRACEAE		
Lomandra longifolia	Spiny Mat Rush	R
Lomandra multiflora		R
LUZURIAGACEAE		
Eustrephus latifolius	Wombat Berry	R
Geitonoplesium cymosum	Scrambling Lily	R
PHORMIACEAE		
Dianella caerulea var. *producta*	Blue Flax Lily	R
POACEAE		
Anisopogon avenaceus	Oat Speargrass	
Aristida vagans	Three-awn Speargrass	R
**Arundo donax*	Giant Reed	
Austrodanthonia sp.	Wallaby Grass	R
**Briza maxima*	Quaking Grass	
**Chloris gayana*	Rhodes Grass	
**Cortaderia selloana*	Pampass Grass	
Cymbopogon refractus	Barbed-wire Grass	R
Cynodon dactylon	Common Couch	
Dichelachne micrantha	Plume Grass	

Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass	R
**Ehrharta erecta*	Panic Veldt Grass	
Entolasia stricta		R
Eragrostis brownii	Brown's Love Grass	R
Microlaena stipoides	Weeping Grass	R
Oplismenus aemulus	Basket Grass	R
Panicum simile	Two-colour Panic	R
**Paspalum dilatatum*	Paspalum	
**Paspalum urvillei*	Vasey Grass	
**Pennisetum clandestinum*	Kikuyu	
Poa labillardierei	Tussock Grass	R
**Setaria* sp.	Pigeon Grass	
**Sorghum halepense*	Johnson's Grass	
Sporobolus creber	Slender Rat's Tail Grass	
**Stenotaphrum secundatum*	Buffalo Grass	
Themeda triandra	Kangaroo Grass	R
TYPHACEAE		
Typha orientalis	Cumbungi	
XANTHORRHOEACEAE		
Xanthorrhoea sp.	Grass Tree	

SUBCLASS MAGNOLIIDAE (Dicotyledons)

ACANTHACEAE		
Pseuderanthemum variabile	Pastel Flower	
AMYGDALACEAE		
**Prunus persica*	Peach / Nectarine	
APIACEAE		
**Foeniculum vulgare*	Fennel	
APOCYNACEAE		
Parsonsia straminea var.straminea	Monkey Rope	R
ARALIACEAE		
Polyscias sambucifolia	Elderberry Panax	
ASCLEPIADACEAE		
**Gomphocarpus fruticosus*	Narrow-leaf Cotton Bush	
ASTERACEAE		

**Ageratina adenophora*	Crofton Weed	
**Ambrosia artemisiifolia*	Annual Ragweed	
**Bidens pilosa*	Cobbler's Pegs	
Cassinia aculeata	Dolly Bush	R
**Cirsium vulgare*	Spear Thistle	
**Conyza bonariensis*	Flaxleaf Fleabane	
**Gnaphalium pensylvanicum*	Cudweed	
**Helianthus annuus*	Sunflower	
**Hypochaeris radicata*	Cat's Ear	
**Senecio madagascariensis*	Fireweed	
**Sonchus oleraceus*	Common Sowthistle	
**Tagetes minuta*	Stinking Roger	
Vernonia cinerea var. cinerea		
BASSELLACEAE		
**Anredera cordifolia*	Madeira Vine	
BIGNONIACEAE		
Pandorea pandorana	Wonga Vine	R
CACTACEAE		
**Opuntia monacantha*	Smooth Tree Pear	
CAESALPINACEAE		
**Senna* sp.	Senna	
CASUARINACEAE		
Allocasuarina torulosa	Forest Oak	R
Casuarina glauca	Swamp Oak	
Casuarina cunninghamiana	River Oak	
CONVOLVULACEAE		
Dichondra repens	Kidney Weed	
CELASTRACEAE		
Denhamia silvestris	Orange Bush	R
CONVOLVULACEAE		
**Ipomoea indica*	Morning Glory	
CRASSULACEAE		
**Bryophyllum delagoense*	Mother of Millions	
DILLENIACEAE		

Hibbertia aspera	Rough Guinea Flower	R
ERICACEAE		
Lissanthe strigosa ssp. strigosa	Native Cranberry	R
Monotoca elliptica	Tree Broom-heath	R
EUPHORBIACEAE		
Breynia oblongifolia	Breynia	
Glochidion ferdinandi	Cheese Tree	
**Ricinus communis*	Castor Oil Plant	
FABACEAE		
Daviesia ulicifolia ssp. *ulicifolia*	Gorse Bitter Pea	R
Desmodium varians	Slender Tick Tree-foil	R
Dillwynia retorta ssp. *retorta*	Heathy Parrot Pea	R
Glycine clandestina	Love Creeper	R
Hardenbergia violacea	False Sarsaparilla	R
Pultenaea spinosa	Spiny Bush-pea	R
Pultenaea villosa	Hairy Bush-pea	R
**Vicia sativa*	Common Vetch	
GOODENIACEAE		
Goodenia hederacea var. *hederacea*	Violet-leaved Goodenia	R
LAMIACEAE		
Plectranthus parviflorus		
LAURACEAE		
Cassytha pubescens	Common Devil's Twine	
LOBELIACEAE		
Pratia purpurascens	White Root	
MALVACEAE		
**Sida rhombifolia*	Paddy's Lucerne	
MENISPERMACEAE		
Stephania japonica var. discolor	Snake Vine	
MIMOSACEAE		
Acacia elongata	Swamp Wattle	R
Acacia falcata	Falcate Wattle	R
Acacia fimbriata	Fringed Wattle	R
Acacia parvipinnula	Silver-stemmed Wattle	R

Acacia ulicifolia	Prickly Moses	R
Acacia longifolia	Sydney Wattle	R
MORACEAE		
Ficus coronata	Sandpaper Fig	
MYRSINACEAE		
Myrsine variabilis	Muttonwood	
MYRTACEAE		
Angophora costata	Smooth-barked Apple	R
Corymbia gummifera	Red Bloodwood	R
Corymbia maculata	Spotted Gum	R
Callistemon linearifolius	**Netted Bottle Brush**	R
Callistemon linearis	Narrow-leaved Bottlebrush	R
Callistemon salignus	Willow Bottlebrush	R
Eucalyptus acmenoides	White Mahogany	R
Eucalyptus crebra	Narrow-leaved Ironbark	R
Eucalyptus fibrosa	Broad-leaved Ironbark	R
Eucalyptus siderophloia	Grey Ironbark	R
Eucalyptus umbra	Broad-leaved White Mahogany	R
Kunzea ambigua	Tick Bush	R
Leptospermum polygalifolium	Lemon-scented Tea-Tree	R
Melaleuca decora	White Feather Honeymyrtle	R
Melaleuca lineariifolia	Snow-in-summer	R
Melaleuca nodosa	Ball Honeymyrtle	R
Melaleuca styphelioides	Prickly-leaved Paperbark	R
Syncarpia glomulifera	Turpentine	R
PHYLLANTHACEAE		
Phyllanthus hirtellus	Thyme Spurge	R
OLEACEAE		
**Ligustrum sinense*	Narrow-leaf Privet	
Notelaea longifolia	Mock Olive	R
OXALIDACEAE		
Oxalis perennans		
PITTOSPORACEAE		
Bursaria spinosa	Blackthorn	R
Pittosporum undulatum	Sweet Pittosporum	
PLANTAGINACEAE		

**Plantago lanceolata*	Ribwort / Lamb's Tongues	
PROTEACEAE		
Banksia spinulosa	Hair-pin Banksia	R
Hakea sericea	Needlebush	R
Persoonia linearis	Narrow-leaved Geebung	R
RANUNCULACEAE		
Clematis aristata	Old Man's Beard	R
Clematis glycinoides	Forest Clematis	R
RHAMNACEAE		
Alphitonia excelsa	Red Ash	R
ROSACEAE		
**Rubus fruticosus*	Blackberry	
RUBIACEAE		
Pomax umbellata	Pomax	R
**Richardia* sp.	White Eye	
RUTACEAE		
Correa reflexa var. reflexa		R
Zieria smithii	Sandfly Zieria	R
SANTALACEAE		
Exocarpus cupressiformis	Cherry Ballart	R
SAPINDACEAE		
**Cardiospermum grandiflorum*	Balloon Vine	
Dodonaea triquetra	Common Hop Bush	R
SOLANACEAE		
**Solanum nigrum*	Blackberry Nightshade	
**Solanum mauritinanum*	Wild Tobacco	
THYMELAEACEAE		
Pimelea linifolia	Slender Rice Flower	R
ULMACEAE		
Trema tomentosa	Poison Peach	
VERBENACEAE		
**Lantana camara*	Lantana	

**Verbena bonariensis*	Purple Top	
VITACEAE		
Cayratia clematidea	Slender Grape	R

Appendix II

Fauna Species List

Fauna Species List

The following is a list of all fauna species recorded within the site during the survey period.

Observation Type:

O – Observed	**B** - Burnt	**F** - Tracks/scratchings
T - Trapped or netted	**H** - Hair, feathers, or skin	**Y** - Bone or teeth
R - Road kill	**P** - Scat	**D** - Dog kill
W - Heard call	**C** - Cat kill	**Z** - In raptor/owl pellet
V - Fox kill	**E** - Nest/roost	**K** - Dead
M - Miscellaneous	**X** - In scat	**U** - Bat Recording

Notes

Threatened species appear in **bold** font.

? – Indicates a species identified without certainty or to a Genus level only.

* – Indicates an introduced species.

Scientific Name	Common Name	TSC Act	EPBC Act	Obs Type
BIRDS				
Family Columbidae				
Macropygia amboinensis	Brown Cuckoo-Dove			O
Family Pachycephalidae				
Pachycephala pectoralis	Golden Whistler			O
Family Psittacidae				
Platycercus eximius	Eastern Rosella			O
Family Maluridae				
Malurus cyaneus	Superb Fairy-Wren			O
Family Pardalotidae				
Pardalotus punctatus	Spotted Pardalote			W
Family Meliphagidae				
Manorina melanocephala	Noisy Miner			O
Manorina melanophrys	Bell Miner			O
Lichenostomus chrysops	Yellow-faced Honeyeater			O
Meliphaga lewinii	Lewin's Honeyeater			W,O
Family Centropodidae				
Centropus phasianinus	Pheasant Coucal			O
Family Dicruridae				
Rhipidura leucophrys	Willie Wagtail			O

	Scientific Name	Common Name	TSC Act	EPBC Act	Obs Type
Family Artamidae					
	Cracticus nigrogularis	Pied Butcherbird			O
	Gymnorhina tibicen	Australian Magpie			O
	Strepera graculina	Pied Currawong			O
REPTILES					
Family Scinidae					
?	*Lampropholis delicata*	Grass Skink			O
Family Varanidae					
	Varanus varius	Lace Monitor			O
AMPHIBIANS					
Family Myobatrachidae					
	Crinia signifera	Common Eastern Froglet			W
Family Hylidae					
	Litoria fallax	Dwarf Tree Frog			W
	Litoria peronii	Peron's Tree Frog			W

Appendix III

Threatened Species Habitat Assessment

An assessment of the likelihood of each threatened plant considered in this report occurring on site is provided in **Table A1**.

Table A1: Habitat Assessment for Threatened Flora Species

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Plants			
Cynanchum elegans White-flowered Wax Plant	TSC Act - E EPBC Act - E ROTAP 3ECi	Occurs in scattered coastal localities from the QLD-NSW border south to Wollongong. Found in dry, littoral or subtropical rainforest, and occasionally in scrub and woodland from sea level to about 600m ASL.	Low
Rutidosis heterogama Heath Wrinklewort	TSC Act - V EPBC Act - V ROTAP 2VCa	Grows mostly in heath, often along disturbed roadsides; chiefly in coastal districts from MacLean to the Hunter Valley, and inland to Torrington. Has also been recorded within moist areas in open forest and in the Hunter Valley has been recorded within Spotted Gum - Ironbark Forest and Kurri Sand Swamp Forest.	Low This species was not recorded despite targeted searches throughout the survey area.
Allocasuarina defungens Dwarf Heath Casuarina	TSC Act-E EPBC Act - E ROTAP 2E	A small erect shrub that grows mainly in tall heath on sand, but can also occur on clay soils and sandstone. Is only found from the Nabiac area and farther north in the NSW North Coast Region.	None
Tetratheca juncea Black-eyed Susan	TSC Act - V EPBC Act - V ROTAP 3VCa	Heath and dry sclerophyll forests on low nutrient soil with a dense understorey of grasses. Is most commonly found associated with species including, *Angophora costata* (Smooth-barked Apple), *Eucalyptus globoidea* (White Stringybark), *Corymbia gummifera* (Red Bloodwood) and *Acacia myrtifolia* (Myrtle Wattle).	Low This species was not recorded despite targeted searches throughout the survey area.
Maundia triglochinoides	TSC Act - V	Grows in swamps, creeks or shallow freshwater 30-60cm deep on heavy clay with low nutrients.	Low
Commersonia prostrata Dwarf Kerrawang	TSC Act - E EPBC Act - E ROTAP - 2ECi	Mainly in gullies along the escarpment, south from Picton Lakes, with a disjunct occurrence at the Tomago Sandbeds near Newcastle. In the Tomago sandbeds area it occurs locally as a pioneer species in ecotonal swamp forest containing *Eucalyptus haemastoma*, *Eucalyptus robusta* and *Melaleuca quinquenervia*, on heavy organic sandy soils in Pleistocene sands.	None

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Angophora inopina Charmhaven Apple	TSC Act – V EPBC Act – V	Found in shallow sandy soils within open woodland/forest assemblages in co-dominant distribution with *Eucalyptus haemastoma* (Scribbly Gum), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus capitellata* (Brown Stringybark), as well as within wet-dry heath, and swamp forest communities. The main occurrences of this species are in the Wyong and Lake Macquarie LGA. Disjunct populations have also been found south of Karuah in the Port Stephens LGA and north of Karuah in the Great Lakes LGA.	Low
Callistemon linearifolius Netted Bottle Brush	TSC Act – V ROTAP – 2RCi	Grows in dry sclerophyll forest on the coast and adjacent ranges from the Georges River to the Hawkesbury River in the Sydney area, and north to Nelson Bay.	**Known**
Eucalyptus parramattensis spp. *decadens* Drooping Red Gum	TSC Act – V EPBC Act – V ROTAP – 2V	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with a dry heath understorey. It also occurs as an emergent in dry or wet heathland.	Low
Melaleuca biconvexa Biconvex Paperbark	TSC Act – V EPBC Act – V	Occurs in dense stands adjacent to watercourses, in association with other *Melaleuca* species or as an understorey species in wet forest.	Low This species was not recorded despite targeted searches throughout the survey area.
Syzygium paniculatum Magenta Lilly Pilly	TSC Act – E EPBC Act – V ROTAP 3RCi	Occurs in a narrow coastal distribution in rainforests on sandy soils or stabilised coastal dunes from Jervis Bay to Bulahdelah in NSW.	Low
Cryptostylis hunteriana Leafless Tongue Orchid	TSC Act-V EPBC Act-V ROTAP 3VC-	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*) often in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*).	Low

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Cymbidium canaliculatum Tiger Orchid (Endangered Population)	TSC Act - E2	Occurs within dry sclerophyll forests and woodlands of NSW tablelands and western slopes, growing in the hollows of trees. This species is an endangered population within the Hunter River catchment. Specimens in the Hunter catchment are most commonly associated with *Eucalyptus albens* (White Box).	Low
Phaius australis Southern Swamp Orchid	TSC Act - E EPBC Act - E	Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas. Occurs in Queensland and north-east NSW as far south as Coffs Harbour. Historically, it extended farther south, to Port Macquarie.	Low
Pterostylis gibbosa Illawarra Greenhood	TSC Act - E EPBC Act - E ROTAP - 2E	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark, Forest Red Gum and Black Cypress Pine.	None
Grevillea parviflora ssp. *parviflora* Little Flower Grevillea	TSC Act - V EPBC Act - V	Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest and is found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Common canopy species vary greatly with community type but generally are species that favour soils with a strong lateritic influence including *Eucalyptus fibrosa, E. parramattensis, Angophora bakeri* and *Eucalyptus sclerophylla.*	Low
Asterolasia elegans	TSC Act - E EPBC Act - E	Found in sheltered forests on Hawkesbury Sandstone. Associated with canopy species *Syncarpia glomulifera*, *Angophora costata*, *Eucalyptus piperita*, *Allocasuarina torulosa* and *Ceratopetalum gummiferum.*	None
Euphrasia arguta	TSC Act - E4A EPBC Act - CE	Recently rediscovered near Nundle. Current known populations are located in the Nundle State Forest in eucalypt forest with a mixed grass and shrub understorey.	None
Zannichellia palustris	TSC Act - E1 ROTAP 3R	Grows in fresh or slightly saline stationary or slowly flowing water.	Low

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Frogs			
Litoria aurea Green and Golden Bell Frog	TSC Act-E EPBC Act-E	Inhabits a range of waterbodies including swamps, lagoons, streams and ponds as well as dams, drains and storm water basins, particularly those containing bullrushes (*Typha* sp.) or spikerushes (*Eleocharis* sp.). 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.	Low
Litoria littlejohni Little John's Tree Frog	TSC Act - V EPBC Act - V	Appears to be restricted to sandstone woodland and heath communities at mid to high altitude. Breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation.	Low
Mixophyes balbus Stuttering Frog	TSC Act - E1 EPBC Act - V	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor.	Low
Mixophyes iteratus Giant Barred Frog	TSC Act - E EPBC Act - E	Giant Barred Frogs forage and live amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m. Require shallow, flowing rocky streams for breeding.	Low
Reptiles			
Hoplocephalus bungaroides Broad-headed Snake	TSC Act - V EPBC Act - V	This species is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within about 250 km of Sydney. Found under large slabs of rock or crevices on sandstone outcrops.	None
Hoplocephalus stephensii Stephens' Banded Snake	TSC Act - V	Distributed along the coast and ranges from Southern Queensland to Gosford in NSW. Occurs in a variety of habitats rainforests, wet and dry sclerophyll and rocky outcrops. Shelters beneath loose bark, among epiphytes, hollows and rock crevices.	Low
Birds			
Anseranas semipalmata Magpie Goose	TSC Act - V	Inhabits shallow wetlands (especially those with a dense growth of rushes or sedges), drying ephemeral swamps, wet grasslands and floodplains, often roosting in fringing Paperbarks (*Melaleuca* sp.).	Low

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Oxyura australis Blue-billed Duck	TSC Act - V	This duck is almost wholly aquatic, preferring deep water in large permanent wetlands or dams where aquatic flora is abundant.	Low
Stictonetta naevosa Freckled Duck	TSC Act - V	Open lakes and wetlands surrounded by thick vegetation, especially swamps in which lignum, cumbungi or paperbarks grow. Permanent or temporary wetlands of varying salinity are known to be used.	Low
Rostratula australis Australian Painted Snipe	TSC Act - E EPBC Act - V	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	Low
Calidris ferruginea Curlew Sandpiper	TSC Act - E	Migratory species arriving in Australia between August and November, and departing between March and mid-April. It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration.	Low
Limosa limosa Black-tailed Godwit	TSC Act - V	Primarily coastal, including tidal mudflats, river edges, sandy beaches, brackish swamps as well as the shallows of lakes, reservoirs and sewage farms. However, this species also occurs inland on mudflats, muddy lakes and swamps at low tide.	Low
Botaurus poiciloptilus Australasian Bittern	TSC Act - E EPBC Act - E	Lives alone or in loose groups and favours permanent fresh-waters dominated by sedges, rushes, reeds or cutting grasses (eg. *Phragmites, Scirpus, Eleocharis, Juncus, Typha, Baumea* and *Gahnia*).	Low
Ixobrychus flavicollis Black Bittern	TSC Act - V	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.	Low
Haematopus longirostris Pied Oystercatcher	TSC Act - V	Roosts on sandy beaches, spits, dunes, lagoons and inlets, particularly if there are mud flats nearby. They forage on exposed sand, mud, rock or coral for molluscs, worms, crabs and small fish.	None
Irediparra gallinacea Comb-crested Jacana	TSC Act - V	Inhabits mostly deep permanent freshwater wetlands with floating aquatic vegetation that forms dense mats or rafts on the surface of the water (eg. *Nymphaeaceae, Myriophyllum lacifolium, Marsilea* and *Riccia*). Occurs from the north-east Kimberley Region through to the Hunter Region (NSW).	None

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Ephippiorhynchus asiaticus Black-necked Stork	TSC Act - V	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. It has also been recorded on farm dams and sewage treatment ponds.	Low
Circus assimilis Spotted Harrier	TSC Act - V	Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Hamirostra melanosternon Black-breasted Buzzard	TSC Act - V	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. This species is not commonly found east of the Great Dividing Range.	Low
Hieraaetus morphnoides Little Eagle	TSC Act - V	Occupies open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Lophoictinia isura Square-tailed Kite	TSC Act - V	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Falco subniger Black Falcon	TSC Act - V	Widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be attributable to the Brown Falcon.	Low
Pandion cristatus Eastern Osprey	TSC Act - V	Open and swamp forest adjacent to the coast or estuaries, fishing mainly in brackish or salt water.	None

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Ptilinopus magnificus Wompoo Fruit-Dove	TSC Act - V	Inhabits the canopy of sub-tropical, warm-temperate and littoral rainforests. Favoured feed trees include Figs, Laurels, Myrtles and native Tamarind.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Ptilinopus regina Rose Crowned Fruit-Dove	TSC Act - V	Inhabits rainforest, though it also frequents nearby drier forests as well as mangroves. It usually feeds on Figs or other fruit and berry-bearing trees.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Ptilinopus superbus Superb Fruit-Dove	TSC Act - V	Lives mainly in rainforest but will feed in adjacent mangroves or eucalypt forest, venturing into coastal habitats.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Callocephalon fimbriatum Gang-gang Cockatoo	TSC Act - V	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Moves to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Often found in urban areas.	Moderate Low quality / common habitat present with hollows to be impacted not suitable for this species. Not considered further.
Calyptorhynchus lathami Glossy Black-Cockatoo	TSC Act - V	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of She-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur.	Moderate Low quality / common habitat present with hollows to be impacted not suitable for this species. Not considered further.

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Glossopsitta pusilla Little Lorikeet	TSC Act - V	Forages primarily in the canopy of open Eucalypt forest and woodland, yet also forages on Angophoras, Melaleucas and other tree species. Riparian habitats are often utilised. Isolated flowering trees in open country, eg paddocks, roadside remnants and urban trees also help sustain viable populations of the species.	Moderate Low quality / common foraging habitat available. A small number of hollows suitable for this species may be impacted by the works therefore impacts are considered further within Assessment of Significance (**Appendix IV**).
Lathamus discolor Swift Parrot	TSC Act - E EPBC Act - E	Migrates to the Australian south-east mainland between March and October. Generally occur in areas where eucalypts are flowering profusely or where there are abundant lerp infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark and White Box.	Moderate Low quality / common habitat present with hollows to be impacted not likely to be utilised by this species. Not considered further.
Neophema pulchella Turquoise Parrot	TSC Act - V	Lives on the edges of Eucalypt woodland adjoining clearings and on timbered ridges and creeks in farmland. It has also been recorded utilising roadside verges and orchards. Nests in small hollow branches of Eucalypts.	Moderate Low quality / common foraging habitat available. A small number of hollows suitable for this species may be impacted by the works therefore impacts are considered further within Assessment of Significance (**Appendix IV**).
Anthochaera phrygia Regent Honeyeater	TSC Act - CE EPBC Act - E	Inhabits eucalypt open forests and woodlands, predominantly box-ironbark types, but also Spotted Gum and Swamp Mahogany on the coast. The species also inhabits River She-oak gallery forest with *Amyema cambagei* (Needle-leaf Mistletoe). It is estimated that the NSW population of Regent Honeyeaters may now be fewer than 250 mature individuals.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Climacteris picumnus ssp. *victoriae* Brown Treecreeper	TSC Act - V	Found in eucalypt woodlands and dry open forest of the inland slopes and plains generally inland of the Great Dividing Range although has been recorded less commonly, in similar woodland habitats on the coastal ranges and plains. Mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey. Requires hollows for nesting and fallen timber is an important habitat component for foraging.	Moderate Low quality / common foraging habitat available. A small number of hollows suitable for this species may be impacted by the works therefore impacts are considered further within Assessment of Significance (**Appendix IV**).
Chthonicola sagittata Speckled Warbler	TSC Act - V	Lives in a wide range of eucalypt-dominated vegetation that typically includes 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. This species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast.	Low
Daphoenositta chrysoptera Varied Sittella	TSC Act - V	Inhabits eucalypt forests and woodlands, especially 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 from small branches and twigs in the tree canopy.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Dasyornis brachypterus Eastern Bristlebird	TSC Act - E EPBC Act - E	Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW occurs in open forest with tussocky grass understorey; all of these vegetation types are fire prone.	None
Epthianura albifrons White-fronted Chat	TSC Act - V	Occurs in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands. The species is sensitive to human disturbance and is rarely found in built areas.	None

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Melanodryas cucullata ssp. *cucullata* Hooded Robin	TSC Act - V	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. This species generally requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Melithreptus gularis ssp. *gularis* Black-chinned Honeyeater	TSC Act - V	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark, White Box, Inland Grey Box, Yellow Box and Forest Red Gum. Has also been recorded within open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. It is rarely recorded east of the Great Dividing Range but has been recorded very rarely at a few scattered sites in the Hunter, Central Coast and Illawarra regions.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Petroica boodang Scarlet Robin	TSC Act - V	Primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. This species lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. Habitat usually contains abundant logs and fallen timber and these are important components of its habitat.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Pomatostomus temporalis ssp. *temporalis* Grey-crowned Babbler	TSC Act - V	Open forest, woodland, scrubland, farmland and outer suburbs. Prefers woodlands with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Ninox connivens Barking Owl	TSC Act - V	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 (eg western NSW) due to the higher density of prey on these fertile soils.	Moderate Low quality / common habitat present with hollows to be impacted not suitable for this species. Not considered further.

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Ninox strenua Powerful Owl	TSC Act - V	Inhabits a wide range of vegetation types from wet eucalypt forests with a rainforest understorey to dry open forests and woodlands. Requires large hollow-bearing trees for nesting and dense canopy vegetation for roosting.	Moderate Low quality / common habitat present with hollows to be impacted not suitable for this species. Not considered further.
Tyto longimembris Eastern Grass Owl	TSC Act - V	Found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains.	Low
Tyto novaehollandiae Masked Owl	TSC Act - V	Lives in dry eucalypt forests and woodlands from sea level to 1100 m and often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	Moderate Low quality / common habitat present with hollows to be impacted not suitable for this species. Not considered further.
Tyto tenebricosa Sooty Owl	TSC Act - V	Occurs along the coastal margins of eastern Australia Prefers dense dimly lit forests, inhabiting pockets of rainforest and wet sclerophyll forest mainly in mountainous areas, often in southeast facing gullies.	Low
Mammals			
Dasyurus maculatus ssp. *maculatus* Tiger Quoll	TSC Act - V EPBC Act - 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 crevices, boulder fields and rocky-cliff faces as den sites with basking and latrine sites often nearby.	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Phascogale tapoatafa Brush-tailed Phascogale	TSC Act - V	Prefers dry sclerophyll open forest with a sparse groundcover of herbs, grasses, shrubs or leaf litter but is also known to inhabit heath, swamps, rainforest and wet sclerophyll forest. Nests and shelters in tree hollows with entrances 2.5 - 4 cm wide and uses many different hollows over a short time span.	**High** Recorded within contiguous forest to the west. Limited foraging and nest habitat present within proposal. Some hollows may be removed therefore impacts are considered further within assessment of significance. (**Appendix IV**)
Phascolarctos cinereus Koala	TSC Act - V	Inhabits eucalypt woodland and forest containing suitable food trees. Key food trees in the local area include *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus microcorys* (Tallowwood) and *Eucalyptus punctata* (Grey Gum).	Moderate Low quality / common habitat present with only negligible impacts anticipated. Not considered further.
Petrogale penicillata Brush-tailed Rock-wallaby	TSC Act - E EPBC Act - V	Found in steep rocky sites in sclerophyll forests with a grassy understorey.	None
Petaurus australis Yellow-Bellied Glider	TSC Act - V	Occurs 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.	Low
Petaurus norfolcensis Squirrel Glider	TSC Act - V	Inhabits dry sclerophyll forests and woodlands preferably with a canopy composed of multiple species, a shrub or Acacia midstorey and a heath understorey. Requires abundant tree hollows for refuge and nest sites.	**High** Recorded within contiguous forest to the west. Limited foraging and nest habitat present within proposal. Some hollows may be removed therefore impacts are considered further within assessment of significance. (**Appendix IV**)
Potorous tridactylus ssp. *tridactylus* Long-nosed Potoroo	TSC Act - V EPBC Act - V	Known from a variety of habitats, including Rainforest, Open Forests and Woodlands with dense groundcover, and dense, wet coastal heathlands. Soft (often sandy) substrates are preferred by this species.	Low

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Pseudomys novaehollandiae New Holland Mouse	EPBC Act - V	Is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	Low
Pteropus poliocephalus Grey-headed Flying-Fox	TSC Act - V EPBC Act - 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 and in vegetation with a dense canopy.	High Common foraging habitat present with only negligible impacts anticipated. Not considered further.
Chalinolobus dwyeri Large-eared Pied Bat	TSC Act - V EPBC Act - V	Occupies dry sclerophyll forest and woodland. Roosts in caves, abandoned mud-nests of Fairy Martins and mine tunnels.	Low
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	TSC Act - V	Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	**Moderate** Potential foraging and limited roost habitat present within proposal. Some hollows may be removed therefore impacts are considered further within assessment of significance. (**Appendix IV**)
Mormopterus norfolkensis East Coast Freetail-bat	TSC Act - V	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.	**Moderate** Potential foraging and limited roost habitat present within proposal. Some hollows may be removed therefore impacts are considered further within assessment of significance. (**Appendix IV**)

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Falsistrellus tasmaniensis Eastern False Pipistrelle	TSC Act - V	Inhabits sclerophyll forests preferring moist habitats with trees taller than 20m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	**Moderate** Potential foraging and limited roost habitat present within proposal. Some hollows may be removed therefore impacts are considered further within assessment of significance. (**Appendix IV**)
Miniopterus australis Little Bentwing-bat	TSC Act - V	Inhabits a range of generally well-timbered habitats including but not restricted to rainforest, vine thickets, wet and dry sclerophyll forest coastal forests and Banksia scrub. Requires caves for breeding but has been recorded roosting within tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings.	**Moderate** Potential foraging and limited roost habitat present within proposal. Some hollows may be removed therefore impacts are considered further within assessment of significance. (**Appendix IV**)
Miniopterus schreibersii ssp. *oceanensis* Large Bentwing-bat	TSC Act - V	Inhabits a range of timbered habitats. Caves are the primary roosting habitat, but may also use derelict mines, storm-water tunnels, buildings and other human made structures.	High Common foraging habitat present with only negligible impacts anticipated. Not considered further.
Myotis macropus Southern Myotis	TSC Act - V	Various habitats of the coast and adjacent ranges with suitable waterbodies for hunting; caves or similar structures for roosting. It occasionally uses tree hollows.	**Moderate** Potential foraging and limited roost habitat present within proposal. Some hollows may be removed therefore impacts are considered further within assessment of significance. (**Appendix IV**)

Species	Status	Habitat Description and Locally Known Populations	Likelihood of Occurrence
Scoteanax rueppellii Greater Broad-nosed Bat	TSC Act - V	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. Usually roosts in tree hollows but has also been recorded in buildings.	**Moderate** Potential foraging and limited roost habitat present within proposal. Some hollows may be removed therefore impacts are considered further within assessment of significance. (**Appendix IV**)
Vespadelus troughtoni Eastern Cave Bat	TSC Act - V	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	High Common foraging habitat present with only negligible impacts anticipated. Not considered further.

Appendix IV

Assessments of Significance

Considerations under Section 5A of the EP&A Act 1979

Endangered Ecological Communities and threatened species that have the potential to be impacted by the proposed works have been assessed under the guidelines of Section 5A of the *Environmental Planning & Assessment Act* (1979) and this is provided below in the form of a seven-part test.

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.

Threatened Flora

Callistemon linearifolius (Netted Bottlebrush)

One threatened flora species, *Callistemon linearifolius* (Netted Bottle Brush), was identified within the proposal. A total of 121 specimens were recorded during targeted surveys and up to 16 specimens may be directly impacted by the works. The full extent of the local population of this species is not known but would at least constitute the plants identified within the survey area. Potential habitat for this species also extends throughout the forested areas that broadly surround the survey area. The potential loss of 16 plants represents about 13 per cent of the number of specimens known to occur within the survey area and would result in an incremental decline of this species in the local area. Vegetation clearing has been reduced wherever possible during detailed design minimising the number of plants potential impacted by the proposed works. Where plants cannot be avoided, it is proposed that seed collection and propagation be undertaken to source Netted Bottlebrush plants for landscaping works to help maintain genetic diversity within the local population.

The population on site was actively recruiting with juvenile specimens observed throughout the site. The proposed works are unlikely to impact the reproduction of this species on site given that no additional impediments to pollinator movement (insects and birds) or seed dispersal would occur.

In respect to the above, provided the mitigation measures outlined in Section 5 of the report are implemented, it is considered that the proposed works are unlikely to impact on the lifecycle of this species such that the local population is placed at risk of extinction.

Threatened Fauna

Hollow-dependent Birds

There is potential for the following hollow-dependent birds to utilise hollow-bearing trees within the survey area:

- *Glossopsitta pusilla* **Little Lorikeet**
- *Neophema pulchella* **Turquoise Parrot**
- *Climacteris picumnus* ssp. *victoriae* **Brown Treecreeper**

Two hollow-bearing trees with hollows suitable for these species may be impacted by the proposed works (H9 and H10); however, the likelihood of these trees being utilised is reduced given their close proximity to the road. At most, the removal of these trees may impact a very small number of individuals that may nest or roost within the trees. Measures outlined within the Roads and Maritime Biodiversity Guidelines (2011) would be implemented to minimise the impact on any animals that may utilise these trees. The trees across the site also constitute potential foraging habitat for these species although the

impact of the proposed works on foraging habitat is considered to be negligible given the abundance of foraging habitat available in the local area. Taking into account the small number of habitat trees to be impacted and given the abundance of habitat available in the local area, it is considered that the proposed works are unlikely to have an adverse impact on the life cycle of any of these hollow dependent bird species such that a viable local population is placed at risk of extinction.

Arboreal Mammals – Brush-tailed Phascogale and Squirrel Glider

Phascogale tapoatafa (Brush-tailed Phascogale) and *Petaurus norfolcensis* (Squirrel Glider) have both been previously recorded within forest contiguous to the west of the survey area (OEH Wildlife Atlas, 2015). There is potential for these two species to seasonally forage within forest areas and utilise hollow-bearing trees within the survey area.

Currently, movement from patches of vegetation to the east and west of the proposal is likely to be limited by the existing M1 Pacific Motorway for both species. For practical purposes, road gaps in excess of 35 metres are considered a potential barrier to glider movement (LMCC, 2015) and a canopy gap of at least 50 metres appears to be almost a complete barrier to glide crossings (van der Ree *et al.* 2010). The existing gap between large trees (trees in excess of 30m) on either side of the M1 Pacific Motorway is generally in excess of 50 metres and would not be suitable for regular glider movement. The heavy traffic along the M1 Pacific Motorway further degrades this option as a regular movement corridor for both of these species. The proposed widening of the M1 Pacific Motorway within the proposal is unlikely to significantly impact the local movement of these species given the barrier the existing conditions create.

Two hollow-bearing trees with potential to be utilised by these species may be impacted by the proposed works (H9 and H10); however, the likelihood of these trees being utilised is reduced given their close proximity to the road. Both of these species tend to utilise a number of hollow-bearing trees within their home range and at most, the removal of these three trees may impact a very small number of individuals that may occasionally nest within the trees.

Measures outlined within the Roads and Maritime Biodiversity Guidelines (2011) would be implemented to minimise the impact on any animals that may utilise these trees. The impact of the proposed works on foraging habitat is considered to be negligible given the abundance of foraging habitat available in the local area. Taking into account the small number of habitat trees to be impacted and given the abundance of habitat available in the local area, it is considered that the proposed works are unlikely to have an adverse impact on the life cycle of any of these arboreal mammals such that a viable local population is placed at risk of extinction.

Microchiropteran Bats

The following threatened microchiropteran bat species have been previously recorded in the local area and the proposed clearing and culvert works have the potential to impact on these species.

- *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat (T)
- *Mormopterus norfolkensis* East Coast Freetail-bat (T)
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle (T)
- *Miniopterus australis* Little Bentwing-bat
- *Myotis macropus* Southern Myotis (T)
- *Scoteanax rueppellii* Greater Broad-nosed Bat (T)

The hollow bearing trees and culverts recorded within the survey area have the potential to be utilised by the above species to roost and or seek refuge. Species indicated with (T) are also known to utilise hollow-bearing trees for maternity roosts. At most, the potential removal of five habitat trees may impact a very small number of individuals that may occasionally roost within the trees. Measures outlined within the Roads and Maritime Biodiversity Guidelines (2011) would be implemented to minimise the impact on any animals that may utilise these trees. The proposed removal of vegetation would also modify foraging habitat for these species although this impact is considered negligible given the range of foraging habitat available in the local area.

Construction works on the culverts within the site may also temporarily restrict their use by any species that may roost or seek refuge within the culvert. No specimens or signs thereof were observed during the field inspection and breeding habitat is unlikely due to the small size and often restricted access to the culverts.

Taking into account the small number of habitat trees to be impacted and given the abundance of habitat available in the local area, it is considered that the proposed works are unlikely to have an adverse impact on the life cycle of any of these microchiropteran bats such that a viable local population is placed at risk of extinction.

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.

No endangered populations were identified within the survey area. Therefore, the proposed works are unlikely to impact upon any endangered population or place a viable local population 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.

The remnant Lower Hunter Spotted Gum – Ironbark found across the proposal is a listed EEC. The proposed works are likely to result in the removal of up to 0.97 hectares of this community from the local area. The vegetation to be impacted is located along the roadside and is generally subject to substantial edge effects including increased weed growth and rubbish dumping. Approximately 4653 hectares of this EEC has been mapped within 10km of the site (House, 2003) and the removal and modification of 0.97 hectares represents 0.02 per cent of this EEC within the 10 km extent. It is unlikely that the proposed works would substantially modify the composition of the vegetation to be retained although there is potential for edge effects to further impact retained vegetation boundaries. Given the limited extent of vegetation removal from the site, the proposed works are unlikely to place the local occurrence of this EEC at risk of extinction.

Please note that the local area calculation was based on extent mapping undertaken in 2003 and does not take into account the incremental decline of this community since this time.

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**

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 removal of habitat for each threatened species and EEC is discussed below.

Lower Hunter Spotted Gum – Ironbark Forest (LHSGIBF) EEC	
i)	The proposed works have the potential to remove up to 0.97 hectares of this EEC to accommodate the proposed road widening. The amount of vegetation to be impacted has been substantially reduced during detailed design.
ii)	The proposal is situated in an area already fragmented by major roads and industrial areas. The proposed works will slightly decrease the patch size of this EEC adding to the incremental fragmentation of vegetation within the local area.
iii)	This EEC is common in the local area with about 4653 hectares recorded within the search area (10 km) and large tracts extending to the west of the site. The removal and modification of 0.97 hectares of this EEC is not likely to be important for the long-term survival of this EEC in the local area.

Callistemon linearifolius (Netted Bottle Brush)	
i)	Habitat is generally available for this species throughout the forested areas on site. The proposal is likely to remove up to 1.1 hectares of potential habitat for this species resulting in the removal of up to 16 specimens. The removal of Netted Bottlebrush has been minimised where possible during the detailed design of the proposal and measures to protect plants during construction would be implemented.
ii)	The small area to be impacted by the proposed works is unlikely to impede pollinators or seed dispersal of this species such that the local population will become isolated.
iii)	The proposed removal and modification of habitat for *C. linearifolius* will result in the removal of up to 16 individual specimens. *C. linearifolius* is relatively common within the understorey of Lower Hunter Spotted Gum – Ironbark Forest in the survey area with 121 specimens recorded. The removal of 16 plants from the site represents about 13 per cent of the number of specimens known to occur within the survey area and would result in an incremental decline of this species in the local area. Where plants cannot be avoided after detailed design, it is proposed that seed collection and propagation be undertaken to source Netted Bottlebrush plants for landscaping works and help maintain genetic diversity within the local population. Provided the mitigation measures outlined within this report are implemented the proposal is unlikely to impact the long-term survival of this species in the locality.

Hollow-dependent Birds - *Glossopsitta pusilla, Neophema pulchella, Climacteris picumnus ssp. victoriae*	
i)	Potential foraging habitat is available for the bird species throughout the forested areas on site and nesting habitat is present in the form of hollow-bearing trees. The proposal has the potential to remove up to 1.1 hectares of potential foraging habitat and result in the removal of two habitat trees (H9 and H10) that may be suitable for nesting or roosting.
ii)	The proposed removal of vegetation consists of disturbed edges along the road corridor, and is unlikely to further fragment or inhibit travel paths, for these highly mobile species. No habitat would be isolated as a result of the proposal.
iii)	Two hollow-bearing trees with hollows suitable for these species may be impacted by the proposed works (H9 and H10); however, the likelihood of these trees being utilised is reduced

	given their close proximity to the road. At most, the removal of these two trees may impact a very small number of individuals that may nest or roost within the trees. The trees across site also constitute potential foraging habitat for these species. The proposed removal of habitat is not considered important for the long-term survival of this highly mobile species in the locality given the abundance of habitat present in the local area.

Arboreal Mammals *Phascogale tapoatafa* and *Petaurus norfolcensis*	
iv)	Potential foraging habitat is available for each of these two arboreal mammals throughout the forested areas on site and nesting habitat is present in the form of hollow-bearing trees. The proposal has the potential to remove up to 1.1 hectares of potential foraging habitat and result in the removal of two habitat trees (H9 and H10) that may be suitable for nesting.
v)	The proposed removal of vegetation consists of disturbed edges along the road corridor, and is unlikely to further fragment or inhibit travel paths for these species. The M1 Pacific Motorway is already likely to impede movement to the east and west given the existing gap is generally in excess of 50 metres between larger trees and not suitable for regular glider crossings (van der Ree *et al.* 2010). No habitat would be isolated as a result of the proposal.
vi)	The impact of the proposed works on foraging habitat is considered to be negligible given the abundance of foraging habitat available in the local area. Both of these species tend to utilise a number of hollow-bearing trees within their home range and at most, the proposed removal of the two habitat trees suitable for these species may impact a very small number of individuals that may occasionally nest within the trees. The likelihood of these trees being utilised is also reduced given their close proximity to the road. The small area of habitat to be impacted by the proposed works is not considered important for the long-term survival of this species in the locality given the abundance of habitat present in the local area.

Microchiropteran Bats – *S. flaviventris, M. norfolkensis, F. tasmaniensis, M. australis, S. rueppellii*	
i)	Potential foraging habitat is available for microchiropteran bats throughout the survey area and roosting habitat is present in the form of hollow-bearing trees and culverts. The proposal is likely to modify up to 1.1 hectares of potential foraging habitat due to the opening of the canopy and result in the removal of up to five habitat trees that may be suitable for roosting.
ii)	The proposed removal of vegetation consists of disturbed edges along the road corridor, and would not further fragment potential habitat further, or inhibit travel paths, for these highly mobile species. No habitat would be isolated as a result of the proposal.
iii)	The hollow bearing trees and culverts recorded within the survey area have the potential to be utilised by the above species to roost and / or seek refuge. At most, the removal of the five habitat trees may impact a very small number of individuals that may occasionally roost within the trees. The culverts to be impacted by the proposed works lack suitable breeding habitat and the temporary exclusion of microbats is unlikely to affect the long-term survival of these species in the local area. The proposed modification of foraging habitat and removal of potential roosting habitat within the proposal is also unlikely to impact the long-term survival of these species given the abundance of habitat present in the local area.

e) Whether the action proposed is likely to have an adverse effect on critical habitat.

No area identified as critical habitat is present within the survey area.

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

Nine interim management actions have been identified to maximise the extent of occurrence and condition of the LHSGIBF EEC under the 'Saving our Species' program. The proposal would not be inconsistent with the objectives of the management actions given the minimal potential impact to this community.

Thirteen State-wide conservation actions have been identified for *C. linearifolius* under the 'Saving our Species' program. The majority of these actions are not directly relevant to the proposed works as they primarily relate to further study and actions for OEH. The identification, mapping and survey of habitat is relevant to the proposal given the known presence of this species within the survey area and this has been undertaken as part of the works.

No recovery action plans are available for *P. tapoatafa, P. norfolcensis* or the threatened microbats considered above. Activities to assist the recovery of these species have been identified by OEH, which are primarily concerned with the retention and rehabilitation of important habitat. Actions relevant to the proposed works may include:

- Retain den/roost trees and recruitment trees (future hollow-bearing trees);
- In urban and rural areas retain and rehabilitate habitat to maintain or increase the total area of habitat available, reduce edge effects, minimise foraging distances and increase the types of resources available; and
- Provide nest boxes in areas where tree-hollows have been removed.

The proposal would implement controls consistent with Roads and Maritime Biodiversity Guidelines (2011) to minimise the potential impact to local habitat, including the provision of nest boxes to replace removed hollows.

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.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act relevant to the site are listed below:

Key Threatening Process	Applicability to proposed works
Clearing of Native Vegetation	The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The proposed clearing of 1.1 hectares of native vegetation is unlikely to significantly increase the impact of this key threatening process in the local area.
Loss of hollow-bearing trees	The proposal involves the possible removal of up to five hollow-bearing trees. The proposal would implement controls consistent with Roads and Maritime Biodiversity Guidelines (2011), which includes the provision of nest boxes to replace removed hollows.
Invasion and establishment of exotic vines and scramblers	This threatening process is already present with *Ipomoea indica* (Morning Glory) and *Anredera cordifolia* (Madeira Vine) recorded within the survey area. Weed management protocols will be implemented during construction. It is unlikely that the proposal will further exacerbate invasion of exotic vines and scramblers.

Key Threatening Process	Applicability to proposed works
Invasion of native plant communities by exotic perennial grasses	This threatening process is already present with introduced grasses common throughout the survey area. Weed management protocols will be implemented during construction. It is unlikely that the proposal will further exacerbate invasion by exotic grasses.
Invasion, establishment and spread of *Lantana camara*	This threatening process is already present with introduced Lantana common within the median vegetation. Weed management protocols will be implemented during construction. It is unlikely that the proposal will further exacerbate invasion by Lantana in the local area.

Mitigation measures for the proposed works will be implemented to minimise the impact of these key threatening processes.

Conclusion

Based on the considerations above, the proposed works are unlikely to have a significant impact on any threatened species, population or EEC such that a local population is placed at risk of extinction.

Considerations under the EPBC Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires approval of the Commonwealth Minister representing the Department of the Environment, for actions that may have a significant impact on Matters of National Environmental Significance (MNES). The EPBC Act also requires Commonwealth approval for certain actions on Commonwealth land.

MNES protected under the EPBC Act include:

- World Heritage properties;
- National Heritage places;
- RAMSAR wetlands of international importance;
- threatened species or ecological communities listed in the EPBC Act;
- migratory species listed in the EPBC Act;
- the Great Barrier Reef Marine Park;
- Commonwealth marine environment; and
- nuclear actions.

With regard to flora and fauna, the only MNES relevant to the proposal are nationally listed threatened species and migratory species. The DoE protected matters search for the site is provided in **Appendix VII**. An assessment has been made to determine whether or not the proposal would have, or is likely to have a significant impact on these MNES and is provided below.

No nationally threatened species were recorded within the survey area. The habitat assessment, provided in **Appendix III,** identified a number of species that may utilise habitat available in the local area; however, only negligible impacts were anticipated as a result of the proposal and no further assessment under the provisions of the EPBC Act is warranted.

8.1.1 Migratory species protected under international agreements

Eleven nationally listed terrestrial migratory species were recorded on the DoE on-line database or are considered to have potential habitat available within 10km of the site as listed in **Table A2**. Pelagic and wetland specific species were not included given the sites proximity to marine and wetland environments.

Table A2: Listed migratory species with the potential to occur in the local area.

Apus pacificus	Fork-tailed Swift
Ardea alba	Great Egret
Ardea ibis	Cattle Egret
Haliaeetus leucogaster	White-bellied Sea-Eagle
Hirundapus caudacutus	White-throated Needletail
Merops ornatus	Rainbow Bee-eater
Monarcha melanopsis	Black-faced Monarch
Monarcha trivirgatus	Spectacled Monarch
Myiagra cyanoleuca	Satin Flycatcher
Rhipidura rufifrons	Rufous Fantail
Gallinago hardwickii	Latham's Snipe

The proposed works are unlikely to impact on any area considered to be 'important habitat' for the above migratory species, or likely to impact a significant proportion of a migratory population given the small area of vegetation to be impacted.

Appendix V

Netted Bottlebrush Schedule

Identifier	Easting	Northing	Number Individuals	Notes
C1	372083	6368488	1	
C2	372083	6368491	1	
C3	372071	6368486	1	
C4	372081	6368494	2	
C5	372069	6368488	1	
C6	372069	6368489	1	
C7	372066	6368489	4	
C8	372068	6368489	1	
C9	372064	6368487	6	
C10	372062	6368481	6	
C11	372062	6368479	1	Previously marked N10
C12	372057	6368482	1	Previously marked N14
C13	372050	6368484	1	Resprout or seedling (small)
C14	372135	6368477	2	
C15	372271	6368407	1	
C16	372272	6368408	1	
C17	372268	6368398	1	
C18	372264	6368384	1	2.5m tall
C19	372265	6368372	1	3m tall
C20	372263	6368366	1	3m tall, Cup shaped nest
C21	372261	6368312	1	2.5m tall
C22	372260	6368311	1	2.5m tall
C23	372228	6368190	1	2m tall
C24	372242	6368162	1	2.5m tall
C25	372227	6368139	4	2.5m tall, possibly C linearis
C26	372222	6368181	3	
C27	372223	6368183	1	
C28	372218	6368189	1	
C29	372216	6368203	1	
C30	372242	6368296	1	Possible intergrade with C linearis
C31	372245	6368337	1	
C32	372275	6368394	3	
C33	372270	6368395	1	

Identifier	Easting	Northing	Number Individuals	Notes
C34	372253	6368447	4	Previously flagged
C35	372254	6368465	1	
C36	372251	6368466	1	
C37	372249	6368465	1	
C38	372246	6368465	1	
C39	372245	6368462	1	Previously marked shrub dead nearby
C40	372242	6368471	1	
C41	372227	6368467	4	
C42	372224	6368470	5	
C43	372220	6368477	5	
C44	372217	6368472	5	
C45	372215	6368474	3	
C46	372210	6368479	1	
C47	372209	6368485	2	
C48	372206	6368485	1	
C49	372202	6368485	4	
C50	372196	6368487	1	
C51	372174	6368498	1	Next to end of fence going west
C52	371958	6368404	1	
C53	371717	6368402	1	
C54	371727	6368392	1	Coppiced, many stems
C55	371742	6368384	4	
C56	371761	6368382	1	Young plant
C57	371769	6368386	2	
C58	371771	6368390	1	
C59	371778	6368394	1	
C60	371807	6368393	1	
C61	371827	6368404	1	Next to fence
C62	371840	6368408	1	Next to fence
C63	371862	6368408	1	
C64	371924	6368429	1	
C65	371938	6368429	1	
C66	372630	6368666	1	Possibly C linearis

Identifier	Easting	Northing	Number Individuals	Notes
C67	372328	6368252	3	
C68	372330	6368252	2	

Appendix VI

Tree Schedule

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
1	372182	6368495	E. fibrosa	60	
2	372166	6368482	E. fibrosa	50	
3	372176	6368477	E. fibrosa	40	
4	372174	6368476	C. maculata	30	
5	372170	6368478	M. decora	30	
6	372163	6368482	C. maculata	40	
7	372156	6368488	C. maculata	50	
8	372153	6368488	C. maculata	40	
9	372154	6368482	C. maculata	30	
10	372153	6368477	E. fibrosa	60	
11	372152	6368468	E. fibrosa	30	
12	372158	6368468	E. fibrosa	50	
13	372164	6368463	E. fibrosa	30	
14	372163	6368462	E. fibrosa	40	
15	372158	6368462	E. fibrosa	40	
16	372152	6368461	E. fibrosa	30	
17	372150	6368457	E. fibrosa	30 (20)	
18	372149	6368452	C. maculata	40	
19	372142	6368463	E. fibrosa	50	
20	372142	6368464	E. fibrosa	30	
21	372137	6368455	C. maculata	40	
22	372137	6368449	C. maculata	30	
23	372141	6368448	E. fibrosa	35	
24	372128	6368452	E. fibrosa	50	
25	372129	6368460	E. fibrosa	35	
26	372134	6368459	C. maculata	30	
27	372128	6368462	E. fibrosa	40	
28	372132	6368470	E. fibrosa	30 (15)	
29	372127	6368474	C. maculata	150	3x Class 2, 3x Class 3 Scratches on bole
30	372138	6368476	C. maculata	35 (20)	
31	372145	6368478	E. fibrosa	40	
32	372148	6368481	C. maculata	30	
33	372129	6368467	C. maculata	25 (20)	
34	372121	6368457	E. fibrosa	30	
35	372112	6368470	C. maculata	60	
36	372107	6368467	E. fibrosa	30	
37	372106	6368464	C. maculata	30	
38	372107	6368461	E. fibrosa	35	
39	372109	6368460	E. fibrosa	30	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
40	372111	6368456	E. fibrosa	25 (15)	
41	372110	6368452	E. fibrosa	45	
42	372113	6368447	C. maculata	35	
43	372115	6368443	E. fibrosa	30	
44	372121	6368441	E. fibrosa	35	
45	372113	6368443	E. fibrosa	35	
46	372107	6368443	E. fibrosa	35	
47	372107	6368444	E. fibrosa	30	
48	372103	6368445	C. maculata	30	
49	372104	6368440	E. fibrosa	30	
50	372101	6368434	C. maculata	60 (25)	
51	372094	6368435	E. fibrosa	45	
52	372083	6368425	C. maculata	35	
53	372077	6368427	E. fibrosa	30	
54	372077	6368427	C. maculata	45	
55	372081	6368430	C. maculata	35	
56	372085	6368436	C. maculata	30	
57	372083	6368437	C. maculata	30	
58	372088	6368441	C. maculata	30	
59	372099	6368448	E. fibrosa	40	
60	372096	6368460	C. maculata	55	
61	372097	6368463	E. fibrosa	30	
62	372095	6368463	C. maculata	25 (25)	
63	372090	6368457	C. maculata	30	
64	372072	6368452	E. fibrosa	100	
65	372065	6368449	C. maculata	35 (15)	
66	372065	6368451	C. maculata	60 (30)	
67	372055	6368436	E. fibrosa	55	
68	372052	6368439	C. maculata	100	Few Class 3 hollows suitable for bats
69	372050	6368428	C. maculata	30	
70	372047	6368424	C. maculata	70	
71	372035	6368420	E. fibrosa	100	
72	372033	6368418	C. maculata	35	
73	372036	6368434	C. maculata	35	
74	372035	6368436	E. fibrosa	30	
75	372019	6368430	E. fibrosa	70	1.5m from pavement
76	372022	6368419	C. maculata	35	
77	372019	6368416	C. maculata	60	
78	372023	6368413	C. maculata	45	
79	372006	6368420	C. maculata	30	
80	372007	6368418	E. fibrosa	30	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
81	372005	6368419	C. maculata	30	
82	372001	6368417	E. fibrosa	35	
83	371999	6368417	C. maculata	35	
84	372002	6368408	C. maculata	30	
85	372001	6368409	C. maculata	35	
86	371994	6368405	E. acmenoides	35 (25)	
87	371993	6368403	C. maculata	45	
88	371988	6368413	E. siderophloia	35	
89	371986	6368414	E. fibrosa	40	
90	371984	6368411	C. maculata	40	
91	371972	6368409	C. maculata	50	
92	371970	6368408	C. maculata	40	
93	371963	6368400	C. maculata	50	
94	371960	6368401	M. decora	30	
95	371953	6368401	M. decora	40	
96	371943	6368396	M. decora	35	
97	371942	6368396	M. decora	35 (20)	
98	371935	6368392	M. decora	35	
99	371929	6368390	M. decora	30	
100	371925	6368390	C. maculata	30	
101	371927	6368391	M. decora	30	
102	371922	6368391	M. decora	30	
103	371909	6368385	E. fibrosa	45	
104	371905	6368385	M. decora	40 (20)	
105	371867	6368403	E. fibrosa	35	
106	371872	6368402	E. fibrosa	40	
107	371870	6368407	E. fibrosa	35	
108	371876	6368404	E. fibrosa	40	
109	371880	6368404	E. fibrosa	25 (30)	
110	371880	6368406	E. fibrosa	30	
111	371884	6368406	E. fibrosa	30	
112	371886	6368406	E. fibrosa	30	
113	371887	6368403	C. maculata	40	
114	371882	6368415	C. maculata	75	Hollow trunk with opening at base Scratches on bole, likely Lace Monitor
115	371889	6368415	E. fibrosa	30	
116	371895	6368410	C. maculata	40	
117	371896	6368409	E. fibrosa	30	
118	371895	6368408	C. maculata	70	
119	371904	6368419	M. decora	40	
120	371915	6368417	C. maculata	30	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
121	371918	6368417	C. maculata	60	
122	371934	6368426	E. fibrosa	35	
123	371936	6368423	E. fibrosa	40	
124	371943	6368433	E. fibrosa	90	
125	371954	6368433	E. fibrosa	40	
126	371955	6368432	E. fibrosa	30	
127	371959	6368435	E. fibrosa	30	
128	371963	6368442	E. fibrosa	30	
129	371964	6368440	C. maculata	40	
130	371967	6368435	E. siderophloia	45	
131	371980	6368447	E. fibrosa	30	
132	371983	6368443	C. maculata	30	
133	371982	6368442	E. fibrosa	40	
134	372164	6368530	E. tereticornis	50	
135	372166	6368532	E. acmenoides	45	
136	372165	6368530	C. maculata	30	
137	372152	6368525	E. acmenoides	45	
138	372155	6368521	E. acmenoides	30	
139	372140	6368515	M. decora	25 (25)	
140	372137	6368510	E. acmenoides	45	
141	372131	6368513	C. maculata	75	
142	372134	6368507	E. acmenoides	30	
143	372133	6368507	C. maculata	35	
144	372132	6368505	M. decora	25 (15)	
145	372127	6368506	C. maculata	30 (30)	
146	372126	6368507	E. acmenoides	30	
147	372122	6368512	M. decora	30	
148	372124	6368503	C. gummifera	30 (20,20)	
149	372117	6368499	C. maculata	30	
150	372106	6368505	Stag	30	Cracks and crevices (Class 3) suitable for bats
151	372105	6368505	C. maculata	35	
152	372106	6368495	C. maculata	80	
153	372104	6368498	C. maculata	60	
154	372098	6368494	C. maculata	30	
155	372095	6368498	C. gummifera	30 (20)	
156	372098	6368491	C. maculata	30	
157	372094	6368491	M. decora	40	
158	372092	6368491	C. maculata	40	
159	372089	6368497	M. decora	30	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
160	372077	6368492	C. maculata	40	
161	372076	6368487	M. decora	25 (25)	
162	372081	6368485	C. maculata	30	
163	372084	6368488	C. maculata	30	
164	372082	6368487	M. decora	30	
165	372068	6368483	C. maculata	40	
166	372069	6368479	E. fibrosa	30	
167	372071	6368476	E. fibrosa	40	
168	372057	6368479	E. fibrosa	80	
169	372057	6368479	C. maculata	30	
170	372056	6368482	E. fibrosa	35	
171	372044	6368478	C. maculata	45	
172	372044	6368472	C. maculata	35	
173	372035	6368469	C. maculata	40	
174	372034	6368476	C. maculata	40	
175	372030	6368471	C. maculata	35 (30,25)	
176	372026	6368475	E. fibrosa	30	
177	372025	6368471	E. fibrosa	30	
178	372023	6368459	E. fibrosa	45	
179	372019	6368463	E. fibrosa	30	
180	372018	6368462	C. maculata	30	
181	372011	6368461	C. maculata	35	
182	372012	6368454	C. maculata	40	
183	372011	6368454	C. maculata	30	
184	371996	6368458	E. acmenoides	30 (20)	
185	371992	6368448	E. siderophloia	40	
186	372108	6368493	C. maculata	90	
187	372180	6368549	C. maculata	35	
188	372183	6368557	C. maculata	30	
189	372193	6368575	M. decora	30 (25)	
190	372197	6368582	E. fibrosa	70	
191	372214	6368606	C. maculata	45	
192	372216	6368614	E. acmenoides	30 (15)	
193	372219	6368620	C. maculata	30	
194	372234	6368619	C. maculata	30	
195	372226	6368627	C. maculata	100	
196	372217	6368631	C. maculata	30 (15)	
197	372218	6368633	C. maculata	30	
198	372215	6368633	M. decora	25 (20)	
199	372218	6368643	C. maculata	30	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
200	372216	6368643	C. maculata	30	
201	372224	6368644	C. maculata	40	
202	372226	6368645	C. maculata	75 (40)	
203	372223	6368649	C. maculata	30	
204	372222	6368655	E. siderophloia	30	
205	372222	6368658	C. maculata	35	
206	372220	6368667	E. fibrosa	100	
207	372219	6368669	C. maculata	30	
208	372219	6368672	C. maculata	30	
209	372217	6368674	C. maculata	30	
210	372214	6368679	E. siderophloia	30	
211	372212	6368683	C. maculata	40	
212	372213	6368686	E. siderophloia	30	
213	372211	6368684	E. siderophloia	35 (15)	
214	372211	6368686	E. siderophloia	45	
215	372211	6368690	C. maculata	30	
216	372212	6368691	E. siderophloia	30	
217	372210	6368692	E. siderophloia	30	
218	372209	6368700	E. siderophloia	50 (45)	
219	372205	6368703	C. maculata	35	
220	372204	6368703	E. siderophloia	40	
221	372200	6368708	E. siderophloia	30	
222	372204	6368715	E. siderophloia	35	
223	372205	6368716	Stag	35	
224	372201	6368718	E. siderophloia	30	
225	372202	6368722	E. siderophloia	30	
226	372199	6368724	C. maculata	30	
227	372197	6368723	C. maculata	30	
228	372190	6368710	E. siderophloia	35	
229	372188	6368720	E. siderophloia	30	
230	372185	6368719	E. siderophloia	40	
231	372193	6368728	E. siderophloia	75	
232	372194	6368729	C. maculata	60	
233	372194	6368737	C. maculata	30	
234	372191	6368738	C. maculata	40	
235	372191	6368742	E. siderophloia	40	
236	372187	6368744	E. siderophloia	40	
237	372188	6368747	C. maculata	100	
238	372186	6368749	E. siderophloia	30	
239	372185	6368761	E. siderophloia	90	
240	372172	6368758	C. maculata	30	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
241	372176	6368779	C. maculata	75	
242	372174	6368785	E. agglomerata	45	
243	372171	6368786	E. agglomerata	30	
244	372170	6368787	E. agglomerata	35	
245	372173	6368792	C. maculata	30	
246	372162	6368778	C. maculata	40	
247	372162	6368795	E. fibrosa	30	
248	372161	6368794	C. maculata	40	
249	372170	6368798	E. agglomerata	70 (30)	
250	372170	6368795	E. agglomerata	40	
251	372158	6368802	E. agglomerata	65	
252	372150	6368813	E. siderophloia	30	
253	372150	6368819	E. siderophloia	45	
254	372158	6368824	E. siderophloia	60	
255	372153	6368833	E. agglomerata	35 (25)	
256	372143	6368852	C. maculata	55	
257	372142	6368855	C. maculata	40	
258	372139	6368860	C. maculata	30	
259	372137	6368859	E. siderophloia	45	
260	372133	6368851	E. siderophloia	30	
261	372133	6368851	E. siderophloia	30	
262	372133	6368868	E. fibrosa	30	
263	372136	6368872	C. maculata	30	
264	372136	6368873	E. siderophloia	30	
265	372136	6368877	C. maculata	45	
266	372127	6368868	E. siderophloia	30	
267	372125	6368880	E. siderophloia	35	
268	372134	6368885	C. maculata	30	
269	372133	6368885	C. maculata	30	
270	372132	6368890	C. maculata	40	
271	372129	6368890	E. siderophloia	30	
272	372130	6368895	C. maculata	40	
273	372129	6368900	C. maculata	45 (30)	
274	372125	6368913	C. maculata	40	
275	372119	6368912	C. maculata	30	
276	372115	6368929	E. fibrosa	35 (15)	
277	372115	6368927	E. siderophloia	30	
278	372121	6368898	E. siderophloia	30	
279	372188	6368489	E. fibrosa	50	
280	372186	6368487	E. fibrosa	40	
281	372195	6368490	E. fibrosa	40	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
282	372194	6368488	E. fibrosa	30	
283	372201	6368486	E. fibrosa	30	
284	372204	6368481	C. maculata	40	1x Class 2, many scratches on bole, Lace Monitor observed sunning itself at hollow entrance
285	372199	6368479	E. fibrosa	50	
286	372200	6368473	E. fibrosa	50	
287	372201	6368469	E. fibrosa	30	
288	372206	6368476	E. fibrosa	35	
289	372212	6368482	C. maculata	35 (30)	
290	372214	6368481	M. decora	30	
291	372221	6368472	E. fibrosa	30	
292	372219	6368470	E. fibrosa	30	
293	372221	6368469	E. fibrosa	30	
294	372226	6368464	E. fibrosa	35	
295	372229	6368462	C. maculata	30	
296	372235	6368472	E. fibrosa	35	
297	372242	6368466	E. fibrosa	30	
298	372242	6368463	E. fibrosa	30	
299	372246	6368461	E. fibrosa	40	
300	372253	6368456	C. maculata	30	
301	372257	6368459	E. fibrosa	30	
302	372263	6368454	E. fibrosa	40	
303	372265	6368457	E. fibrosa	30	
304	372264	6368456	E. fibrosa	30	
305	372264	6368449	E. fibrosa	40	
306	372253	6368447	E. fibrosa	30 (20)	
307	372252	6368445	E. fibrosa	40	
308	372264	6368419	E. fibrosa	50	
309	372265	6368418	M. decora	30	
310	372258	6368403	E. fibrosa	30	
311	372260	6368399	E. fibrosa	30	
312	372261	6368398	E. fibrosa	45	
313	372261	6368396	E. fibrosa	30	
314	372265	6368355	E. fibrosa	30	
315	372261	6368351	C. maculata	35	
316	372261	6368347	E. fibrosa	30	
317	372258	6368337	E. fibrosa	30	
318	372232	6368243	C. maculata	30	
319	372231	6368243	C. maculata	30 (30)	
320	372235	6368142	E. fibrosa	30	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
321	372242	6368122	E. fibrosa	30	
322	372230	6368115	C. maculata	45	
323	372304	6368039	C. maculata	35	
324	372292	6368046	M. decora	35	
325	372289	6368049	M. decora	30	
326	372291	6368053	C. maculata	50	
327	372289	6368064	M. decora	45 (30)	
328	372293	6368074	C. maculata	35	
329	372292	6368078	C. maculata	30	
330	372295	6368081	C. maculata	30	
331	372299	6368094	C. maculata	40	
332	372307	6368092	C. maculata	35	
333	372302	6368102	C. maculata	30	
334	372297	6368114	S. glomulifera	40	
335	372293	6368113	C. maculata	40	
336	372293	6368114	C. maculata	60	
337	372295	6368119	C. maculata	35	
338	372296	6368118	C. maculata	30	
339	372298	6368121	C. maculata	30	
340	372302	6368121	C. maculata	30	
341	372300	6368122	C. maculata	30	
342	372303	6368126	M. decora	40	
343	372304	6368127	C. maculata	40	
344	372301	6368137	C. maculata	80	1x Class 2
345	372308	6368137	M. decora	35	
346	372307	6368144	C. maculata	35	
347	372308	6368158	C. maculata	30	
348	372309	6368161	C. maculata	30	
349	372303	6368169	C. maculata	40	
350	372306	6368172	C. maculata	30	
351	372310	6368180	E. fibrosa	45	
352	372311	6368187	C. maculata	40	
353	372310	6368190	M. decora	35	
354	372317	6368195	C. maculata	35	
355	372319	6368202	M. decora	45	
356	372306	6368209	C. maculata	40	
357	372310	6368213	E. fibrosa	40	
358	372317	6368210	E. fibrosa	35	
359	372317	6368218	M. decora	30	
360	372324	6368220	C. maculata	30	
361	372323	6368224	C. maculata	35	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
362	372317	6368223	M. decora	35	
363	372313	6368228	M. decora	35	
364	372325	6368238	C. maculata	110	Very large tree with broken top. No hollows visible but possible Class 2 hollows within broken limb. Lace Monitor scratches on bole
365	372314	6368238	M. decora	35	
366	372320	6368243	M. decora	30	
367	372322	6368254	C. maculata	30	
368	372316	6368259	M. decora	80	
369	372317	6368267	E. fibrosa	40	
370	372323	6368265	C. maculata	30	
371	372327	6368267	E. acmenoides	40	Callistemon linearifolius next to tree
372	372328	6368264	C. maculata	45	Callistemon linearifolius next to tree
373	372331	6368262	E. fibrosa	50	Callistemon linearifolius next to tree
374	372328	6368284	E. acmenoides	30	
375	372326	6368293	C. maculata	30	
376	372329	6368297	E. fibrosa	35	
377	372327	6368301	E. fibrosa	35	
378	372342	6368326	C. maculata	30	
379	372344	6368329	E. fibrosa	70	
380	372339	6368355	C. maculata	90	
381	372337	6368362	E. acmenoides	60	Aboreal termite nest
382	372316	6368355	C. maculata	40	
383	372321	6368359	E. acmenoides	50	
384	372336	6368374	M. decora	30	
385	372324	6368383	E. acmenoides	40	
386	372339	6368385	M. decora	30	
387	372338	6368389	M. decora	35	
388	372333	6368393	M. decora	30	
389	372329	6368399	M. decora	30	
390	372322	6368417	M. decora	30	
391	372322	6368418	C. maculata	45	
392	372324	6368419	C. maculata	40	
393	372327	6368420	C. maculata	40 (40)	
394	372322	6368426	E. fibrosa	30 (20)	
395	372324	6368428	E. fibrosa	45	
396	372325	6368427	M. decora	30	
397	372328	6368429	C. maculata	45	
398	372523	6368684	C. maculata	40	
399	372518	6368684	C. maculata	40	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
400	372514	6368680	E. agglomerata	45	
401	372512	6368677	C. maculata	40	
402	372501	6368675	C. maculata	50	
403	372497	6368671	C. gummifera	35	
404	372494	6368670	C. gummifera	30	
405	372489	6368669	C. maculata	40 (30)	
406	372488	6368669	C. maculata	40	
407	372483	6368667	E. agglomerata	35	
408	372481	6368667	C. gummifera	50	
409	372470	6368659	C. maculata	50	
410	372470	6368659	C. maculata	35	
411	372467	6368659	C. gummifera	30	
412	372460	6368659	C. gummifera	40	
413	372455	6368656	E. siderophloia	50 (30)	
414	372449	6368650	C. gummifera	60	
415	372446	6368648	C. maculata	45	
416	372440	6368651	Stag	45	
417	372437	6368647	C. maculata	40	
418	372437	6368647	E. agglomerata	30	
419	372434	6368644	C. maculata	40	
420	372434	6368642	C. maculata	45	
421	372434	6368643	C. maculata	30	
422	372431	6368641	C. gummifera	30	
423	372428	6368643	E. agglomerata	30	
424	372424	6368642	C. maculata	35	
425	372424	6368642	E. siderophloia	35	
426	372421	6368638	C. maculata	35	
427	372418	6368638	E. fibrosa	45	
428	372414	6368636	C. maculata	40	
429	372408	6368633	E. agglomerata	30	
430	372406	6368632	C. maculata	40	
431	372401	6368630	C. maculata	35 (30)	
432	372401	6368630	E. agglomerata	35	
433	372399	6368628	E. agglomerata	30	
434	372391	6368623	E. agglomerata	30	
435	372388	6368627	E. agglomerata	35	
436	372385	6368624	C. maculata	35	
437	372383	6368623	C. maculata	35	
438	372383	6368623	E. acmenoides	30	
439	372380	6368626	C. maculata	30	
440	372372	6368623	C. maculata	45 (30)	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
441	372369	6368624	C. maculata	40	
442	372370	6368617	C. maculata	40 (25)	
443	372224	6368762	E. acmenoides	50	
444	372227	6368771	E. tereticornis	35	
445	372328	6368465	E. resinifera	90	
446	372330	6368465	C. maculata	50	
447	372332	6368467	M. decora	40	
448	372334	6368470	C. maculata	50	
449	372336	6368479	C. maculata	35	
450	372334	6368481	C. maculata	35	
451	372334	6368481	C. maculata	30	
452	372333	6368482	C. maculata	30	
453	372333	6368486	C. maculata	40	
454	372338	6368488	E. fibrosa	40	
455	372339	6368499	M. decora	30	
456	372339	6368501	E. fibrosa	45	
457	372340	6368504	E. fibrosa	30	
458	372350	6368519	M. decora	30	
459	372374	6368572	M. decora	30	
460	372384	6368575	C. maculata	90	3x Class 3 - suitable for bats only
461	372410	6368576	C. maculata	40	
462	372415	6368579	C. maculata	30	
463	372418	6368582	C. maculata	45	
464	372425	6368583	C. maculata	40	
465	372426	6368583	E. fibrosa	30	
466	372428	6368587	C. maculata	40	
467	372428	6368586	E. acmenoides	30	
468	372429	6368585	C. maculata	40	
469	372431	6368585	C. maculata	30	
470	372435	6368584	C. maculata	35	
471	372433	6368590	C. maculata	35	
472	372433	6368591	C. maculata	30	
473	372447	6368596	C. maculata	70	
474	372447	6368596	E. fibrosa	40	
475	372447	6368589	E. siderophloia	30	
476	372481	6368610	C. maculata	70	
477	372489	6368609	E. fibrosa	30	
478	372489	6368613	E. acmenoides	30	
479	372493	6368610	C. maculata	40	
480	372492	6368608	E. fibrosa	30	
481	372493	6368607	C. maculata	60	

ID	Easting	Northing	Species	DBH (cm)	Habitat Features
482	372498	6368620	E. fibrosa	70	
483	372499	6368621	E. fibrosa	30	
484	372504	6368621	E. fibrosa	30	
485	372507	6368623	E. fibrosa	40	
486	372514	6368622	C. maculata	30	
487	372516	6368623	E. acmenoides	40	
488	372520	6368627	E. agglomerata	30	
489	372528	6368632	C. maculata	45	
490	372533	6368626	C. maculata	30	
491	372543	6368633	C. maculata	30	
492	372549	6368631	E. fibrosa	35	
493	372561	6368637	E. fibrosa	70	
494	372565	6368645	Stag	40	
495	372584	6368650	C. gummifera	30	
496	372589	6368649	C. maculata	35	
497	372592	6368652	C. gummifera	30	
498	372599	6368652	C. maculata	35	

Figure A1: Tree locations

Appendix VII

Matters of National Environmental Significance Search

Australian Government
Department of the Environment

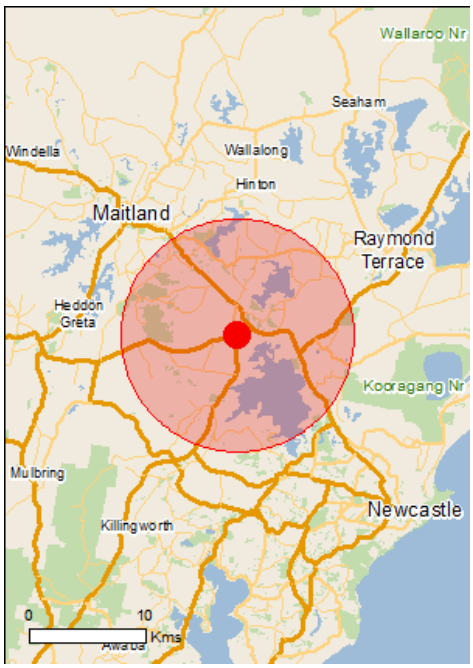
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

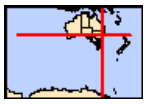
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/04/16 09:05:42



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	54
Listed Migratory Species:	63

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	7
Commonwealth Heritage Places:	None
Listed Marine Species:	66
Whales and Other Cetaceans:	1
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	4
Regional Forest Agreements:	1
Invasive Species:	47
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Hunter estuary wetlands	Within Ramsar site

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Roosting known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora epomophora Southern Royal Albatross [25996]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora sanfordi Northern Royal Albatross [82331]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans exulans Tristan Albatross [82337]	Endangered	Species or species habitat may occur within area
Diomedea exulans gibsoni Gibson's Albatross [82271]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew [847]	Critically Endangered	Roosting known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta salvini Salvin's Albatross [82343]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris impavida Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Asterolasia elegans [56780]	Endangered	Species or species habitat likely to occur within area
Commersonia prostrata Dwarf Kerrawang [87152]	Endangered	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus parramattensis subsp. decadens Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat known to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Rutidosis heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat likely to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Pocket-less	Vulnerable	Species or species

Name	Status	Type of Presence
Brush Cherry, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]		habitat likely to occur within area
Tetratheca juncea		
Black-eyed Susan [21407]	Vulnerable	Species or species habitat known to occur within area
Thesium australe		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hoplocephalus bungaroides		
Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena		
Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto)		
Southern Royal Albatross [1072]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato)		
Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni		
Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered*	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus		
Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Roosting known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]		Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area

Name	Threatened	Type of Presence
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew [847]	Critically Endangered	Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Director of Defence Service Homes
Commonwealth Land - Director of War Service Homes

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Roosting known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]		Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
[Diomedea sanfordi](#) Northern Royal Albatross [64456]	Endangered*	Foraging, feeding or related behaviour likely to occur within area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
[Gallinago megala](#) Swinhoe's Snipe [864]		Roosting likely to occur within area
[Gallinago stenura](#) Pin-tailed Snipe [841]		Roosting likely to occur within area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
[Heteroscelus brevipes](#) Grey-tailed Tattler [59311]		Roosting known to occur within area
[Himantopus himantopus](#) Black-winged Stilt [870]		Roosting known to occur within area
[Hirundapus caudacutus](#) White-throated Needletail [682]		Species or species habitat known to occur within area
[Lathamus discolor](#) Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
[Limicola falcinellus](#) Broad-billed Sandpiper [842]		Roosting known to occur within area
[Limosa lapponica](#) Bar-tailed Godwit [844]		Species or species habitat known to occur within area
[Limosa limosa](#) Black-tailed Godwit [845]		Roosting known to occur within area
[Macronectes giganteus](#) Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
[Macronectes halli](#) Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat known to occur within area
[Monarcha trivirgatus](#) Spectacled Monarch [610]		Species or species habitat known to occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat known to occur within area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat known to occur within area
[Numenius madagascariensis](#) Eastern Curlew [847]	Critically Endangered	Roosting known to occur within area

Name	Threatened	Type of Presence
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Reptiles		

Name	Threatened	Type of Presence
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Blue Gum Hills	NSW
Hexham Swamp	NSW
Hunter Wetlands	NSW
Pambalong	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis		
Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding		Species or species

Name	Status	Type of Presence
Pine [20780]		habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Hexham Swamp	NSW
Kooragang Nature Reserve	NSW
Shortland Wetlands Centre	NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.81369 151.63576

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111