M1 PACIFIC MOTORWAY REPLACEMENT AND WIDENING: TUGGERAH TO DOYALSON

Appendix H – Biodiversity Technical study

Review of environmental factors

MAY 2014

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ACRONYMS

Acronyms	Definition
cm	Centimetres
DoE	Department of Environment (Commonwealth)
ESU	Ecological sampling unit
EEC	Endangered Ecological Community
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
ha	hectare
HCRCMA	Hunter-Central Rivers Catchment Management Authority
km	Kilometres
KTP	Key Threatening Process
LHCCREMS	Lower Hunter Central Coast Regional Environmental Management Strategy
LHSGIF	Lower Hunter Spotted Gum Ironbark Forest
m	Meters
M1	Pacific Motorway 1 (Sydney – Newcastle Motorway, previously F3 Freeway)
MNES	Matters of National Environmental Significance
MU	Mapping Unit
NPWS	National Parks and Wildlife Service, NSW
NSW	New South Wales
OEH	Office of Environment and Heritage, NSW
P&E	Planning and Environment, NSW
PCT	Plant Community Type
RCBC	Reinforced concrete box culvert
REF	Review of Environmental Factors
RFEFCF	River Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Roads and	Roads and Maritime Services

Acronyms	Definition
Maritime	
ROTAP	Rare or Threatened Australian Plants
SEPP	State Environmental Planning Policy
SEPP 14	State Environment Planning Policy No. 14 – Coastal Wetlands
SEPP 44	State Environment Planning Policy No. 44 – koala Habitat Protection
SSFCF	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
SSW	South south-west
TSC Act	*Threatened Species Conservation Act 1995*
WoNS	Weeds of National Significance
Wyong LGA	Wyong Local Government Area

EXECUTIVE SUMMARY

This biodiversity technical study provides an ecological impact assessment of the proposed M1 Pacific Motorway (M1) replacement and widening between Tuggerah and Doyalson. The proposal includes the widening of the Tuggerah to Doyalson section of the motorway from four to six lanes as well as the replacement of the existing pavement. The majority of the proposed widening would incorporate the existing vegetated median and paved areas in the centre of the motorway. Associated infrastructure, including ancillary and stockpile sites, would be located outside the motorway corridor.

The scope of the study was to describe flora and fauna species and habitat within the study area, determine the likelihood of occurrence of threatened species and ecological communities of State or Federal conservation significance, assess the impacts of the proposal on them and recommend mitigation measures to avoid or minimise these impacts. This technical study will be used to inform a Review of Environmental Factors (REF) under Part 5 of the *Environmental Planning and Assessment Act 1979*. To supplement previous surveys of the study area, ecological surveys were undertaken on 17-18 April, 22 May 2013, 5-6 June 2013 and 7 March 2014. Ecological surveys focused on flora and fauna habitat and the validation of previous vegetation mapping within the study area.

The M1 is adjacent to remnant vegetation and a range of plant communities. The central median between Tuggerah and Doyalson revegetated through natural propagation of flora species in the area since it was cleared for construction of the motorway in the early 1960's. Approximately 18 hectares of native vegetation will be removed to accommodate the proposed road widening and upgrade, including for associated ancillary sites and access. About 5.8 hectares of this is modified native vegetation that is either regrowth or canopy only.

Assessments were undertaken for three endangered ecological communities (EEC) Swamp Sclerophyll Forest on Coastal Floodplains, River-Flat Forest on Coastal Floodplains and Lower Hunter Spotted Gum Ironbark Forest, ten flora and 21 fauna species with potential to occur in the study area that are currently listed as threatened under state and federal legislation. It is proposed that approximately 5.5 hectares of EEC will be cleared. This includes 3.4 hectares of the EEC Lower Hunter Spotted Gum Ironbark Forest, 1.12 hectares of the EEC Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF) and 1.0 hectares of River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF). Two threatened flora species, *Tetratheca juncea* and *Grevillea parviflora subsp. parviflora* are known to occur at locations within the proposal area and have the potential to be affected by the proposal. Mitigation measures have been recommended to avoid impacts on these species. It was concluded that the impact on these communities and species would be minor, with the impacts determined not to be significant.

Recommendations to minimise the impacts of the proposal include:

Pre-construction

- Minimise risk to fauna in remnant vegetation to be removed/modified by the proposal
- Minimise loss of EECs to the proposed development activities

- Retention of threatened flora species
- Maintenance of habitat corridor and wildlife connectivity
- Retention of native vegetation, habitat trees (including hollow bearing trees) and potential koala habitat during pre-construction
- Site specific environmental induction
- Replace nest boxes removed during construction
- Biodiversity Offsets for potential losses relating to three Endangered Ecological Communities.

During construction

- Staged habitat removal
- Minimise risk of establishment and spread of invasive species and disease due to the proposed development activities
- Flora and fauna encountered
- Management of erosion and sediment control
- Retention of native vegetation, threatened flora, habitat trees (including hollow bearing trees) and potential koala habitat during construction.

Post-construction

- Re-establishment of any native vegetation disturbed or removed by the proposal.

With the adoption of specific mitigation measures, the overall impact of the proposal on biodiversity would be low.

1 INTRODUCTION

1.1 Overview of proposal

Roads and Maritime Services (Roads and Maritime) proposes to replace and widen around 12.3 kilometres of the M1 Pacific Motorway (M1) to six lanes between Wyong Road, Tuggerah, and the Doyalson Link Road, Kiar.

The proposal would generally involve the following:

- On the southern three kilometre section between Wyong Road and Wyong River the additional lane in each direction would be achieved by constructing a widened flexible (asphalt) pavement section in the median, placing an asphalt overlay over the existing traffic lanes, and then implementing new line-marking to achieve three lanes on each carriageway.
- Replacement of the existing pavement and stabilisation of the subgrade through full removal and reconstruction of around 9.3 kilometres of rigid concrete pavement (north of the Wyong River).
- Upgrades to the existing Warnervale Interchange (Sparks Road) including a new separated northbound G-loop entry ramp that connects with the motorway north of the Doyalson Link Road off ramp, reconfiguration of intersections and approaches, and provision of a new pedestrian overbridge at Sparks Road.
- Provision of a new signalised intersection on Sparks Road and the southbound off ramp and northbound on ramp to the motorway.
- Upgrades to the Doyalson Link Road Interchange including reconstruction of the Doyalson Link Road northbound off ramp to extend over the proposed Sparks Road northbound extended on ramp.
- Provision for future southbound off ramp on to Doyalson Link Road and a new motorway northbound on ramp from Doyalson Link Road including a new bridge over the motorway (subject to further investigation including traffic modelling).
- Provision of an additional lane by new line-marking on five northbound and six southbound bridges
- Provision of an additional lanes by bridge widening and new line-marking on the northbound bridge over St Johns Road
- Ancillary facilities to support construction activities including stockpiling, storage, concrete batching and crushing.

The full description of the proposal is provided in Section 3 of the Review of Environmental Factors (REF) that this Biodiversity Technical Study supports. An overview of the proposal is provided in Figure 1.

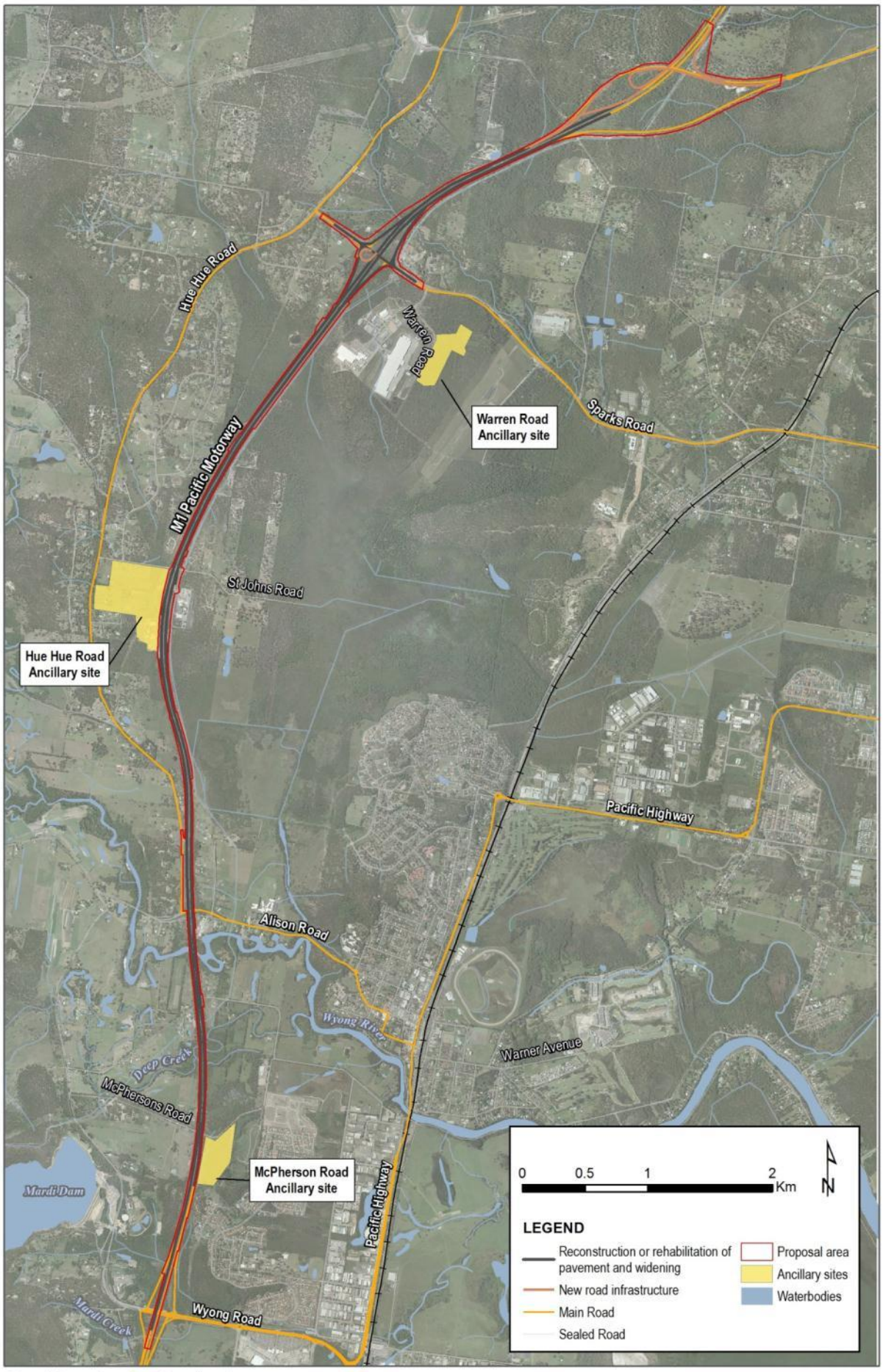


Figure 1 Proposal overview with ancillary sites

1.2 Legislative context

This biodiversity specialist report has been prepared as part of the environmental assessment and technical considerations prepared to support the REF. This technical report has been prepared to consider the potential environmental impact of the proposal, in keeping with the legislative requirements of Part 5 of the *Environmental Planning and Assessment Act 1999* (EP&A Act). The EP&A Act provides the statutory basis for planning and environmental assessment is New South Wales (NSW).

State Environmental Planning Policies (SEPP) made under the EP&A Act and considered in this report are SEPP 44 (koala Habitat Protection) and SEPP 14 (Coastal Wetlands) as areas identified under these SEPPs may be affected by the proposal.

The objective of SEPP 44 is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. The SEPP requires the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat.

The objective of SEPP 14 is to ensure that coastal wetlands are preserved and protected in the environmental and economic interests of the state. The SEPP requires that land clearing, drainage work or filling may only be carried out within these wetlands with the consent of the local council and the agreement of the Director-General of Planning and Environment (P&E).

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires that Commonwealth approval be obtained for certain actions, and establishes an assessment and approvals system for actions that have a significant impact on matters of National Environmental Significance (MNES). The *Threatened Species Conservation Act 1995* (TSC Act) protects threatened flora and fauna species, endangered populations and ecological communities and their habitats within NSW. The *Fisheries Management Act 1994* (FM Act) protects threatened fish, marine plants and other living resources of Australian waters. Particular emphasis in this report has therefore been placed on possible impacts on threatened species, populations and communities, listed under the TSC Act, FM Act or the EPBC Act, that occur or could potentially occur in the study area.

1.3 Study aims

The key aims of this study are to:

- Undertake a review of published documentation and a desktop study of flora and fauna relevant to the study area, identifying species and communities that may be present.
- Conduct a field survey (flora and fauna habitat assessment) of the study area, with particular attention to impacts on species listed under the TSC Act and the EPBC Act.
- Identify and assess likely impacts to flora and fauna arising from the proposal.
- Undertake assessments under Section 5A of the EP&A Act and the EPBC Act with tests of significance for threatened biota where required.
- Identify mitigating measures for managing impacts on threatened biota during design, construction and operation.

2 METHODOLOGY

2.1 Personnel

The biodiversity surveys were undertaken by qualified ecologists within the SMEC Sydney Natural Resources team: Dr. Liz Broese, Dr. Jennifer Anson and Kirsten Velthuis.

2.2 Database searches and literature reviews

Desktop research was undertaken prior to the commencement of field surveys and included database searches and a review of relevant literature to determine if targeted surveys for specific species were required. These searches helped to identify threatened biota known or likely to occur in the study area.

The following databases and resources were interrogated:

- NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database within a 10 kilometre buffer of the proposal area.
- Protected Matters Report that documents all MNES within 10 kilometres of site. MNES include threatened species, communities and migratory species which are listed under the Commonwealth EPBC Act (Department of Sustainability, Environment, Water, Population and Communities).
- NSW Flora Online Search – Rare or Threatened Australian Plants (ROTAP) species (The Royal Botanic Gardens and Domain Trust, 2011).
- Department of Primary Industry – Fishing and Aquaculture: Threatened and Protected Species, Wyong LGA (DPI, 2013a).
- Vegetation Types Database, Vegetation Benchmarks Database Threatened Species Profile Database (OEH, 2012).
- Wyong vegetation mapping (Somerville 2009, Bell 2008).
- NSW Department of Primary Industries Noxious Weeds List (DPI, 2013b).
- Ecological investigation, [former] RTA project, intersection of Sparks Road and the F3 Freeway, Halloran (Lesryk Environmental Consultants, 2010).

2.3 Field survey

Based on desktop and on-ground assessment, a terrestrial flora and fauna habitat assessment of the study area was conducted on 17–8 April, 22 May, 5–6 June 2013 and 7 March 2014, targeting threatened species that occurred, or were likely to occur, within the proposal area.

The survey design applies the theory of ecological sampling units (ESUs) to avoid the need to undertake full coverage surveys in locations that are not comprised of remnant native vegetation, or where access is limited. ESUs are sections of the study area stratified by habitat type and delineated to sample all habitat types. Twelve survey sites within the study area were identified; numbers one to 11 running from north to south, and number 12 being the motorway median (refer Figure 2). Thirty plots were surveyed in the study area in autumn 2013 and 2014.

2.3.1 Flora survey

Each survey site was divided into specific ESUs based on habitat type as outlined in Figure 2 and surveyed using either a rapid assessment or comprehensive plot assessment techniques.

To determine the floristic diversity and vegetation cover throughout the study area rapid assessments were conducted of most sites, especially in cleared, highly disturbed sites. Areas that potentially contain an endangered ecological community, based on interrogation of existing vegetation mapping of the area (Bell, 2008), were subject to a comprehensive plot survey assessment (Table 1).

Rapid assessment

Survey sites 1, 4, 5, 6, 7b, 8, 9 and 11 underwent a rapid assessment survey. For each of these ESUs, the random meander technique was used to target threatened species throughout each site. Rapid assessment surveys were carried out during the random meander of the site, with the cover and abundance of the three most dominant species in each stratum (top, mid and under-storey levels) recorded.

Comprehensive assessment

Plot surveys, of 20 x 20 metres, were conducted at survey sites 2, 3, 7a, 7c, 7d, 7e and 10. A 10 x 40 metre plot survey was undertaken at Site 12, within the motorway central median, due to constraints in the width of the plots. These assessments included a complete survey of all species encountered within the plot. Each species within the plot was given a percentage cover and abundance score. Targeted threatened flora species survey was undertaken across the whole site using the random meander technique.

Table 1 provides a summary of the location and survey methodology for each ESU in the proposal area.

Table 1: Location and survey methodology for each ESU in proposal area

Site	ESU	Flora survey type		Fauna habitat survey
		Rapid assessment survey	Comprehensive plot assessment	
Doyalson Road Interchange East	1a	✓		✓
Doyalson Road Interchange East	1b	✓		✓
Doyalson Road Interchange East	1c	✓		✓
Doyalson Road Interchange West	2a		✓	✓
Doyalson Road Interchange West	2b		✓	✓
Sparks Road	3a		✓	✓
Sparks Road	3b		✓	✓
Warren Road	4a	✓		✓
Warren Road	4b	✓		✓
Warren Road	4c	✓		✓
Warnervale Airport	5	✓		✓
Warnervale Airport	6	✓		✓

Site	ESU	Flora survey type		Fauna habitat survey
		Rapid assessment survey	Comprehensive plot assessment	
Hue Hue Road	7a		✓	✓
Hue Hue Road	7b	✓		✓
Hue Hue Road	7c		✓	✓
Hue Hue Road	7d		✓	✓
Hue Hue Road	7e		✓	✓
Alison Road/Hue Hue Road verge	8a	✓		✓
Alison Road/Hue Hue Road verge	8b	✓		✓
McPherson Road	9	✓		✓
Wyong Road/M1	10		✓	✓
Wyong Road off-ramp	11	✓		✓
M1 central median	12a		✓	✓
M1 central median (Deep Creek)	12b		✓	✓
M1 central median (Wyong River)	12c		✓	✓
M1 central median	12d		✓	✓
M1 central median	12e		✓	✓
M1 central median	12f		✓	✓
M1 central median	12g		✓	✓
M1 central median	12h		✓	✓
M1 central median	12i		✓	✓

2.3.2 Fauna habitat assessment

Habitat characteristics considered include the presence of hollow bearing trees, fallen logs, leaf litter and other ground debris, drainage lines, ponds, the structure of vegetation communities and the presence of fruiting/flowering plant species to assess the habitat suitability for a range of fauna species.

Using the random-meander technique, searches were carried out for signs of fauna activity such as tracks, scats, scratches and notches on trees, as well as any opportunistic sightings, to identify the presence of common and threatened fauna species.

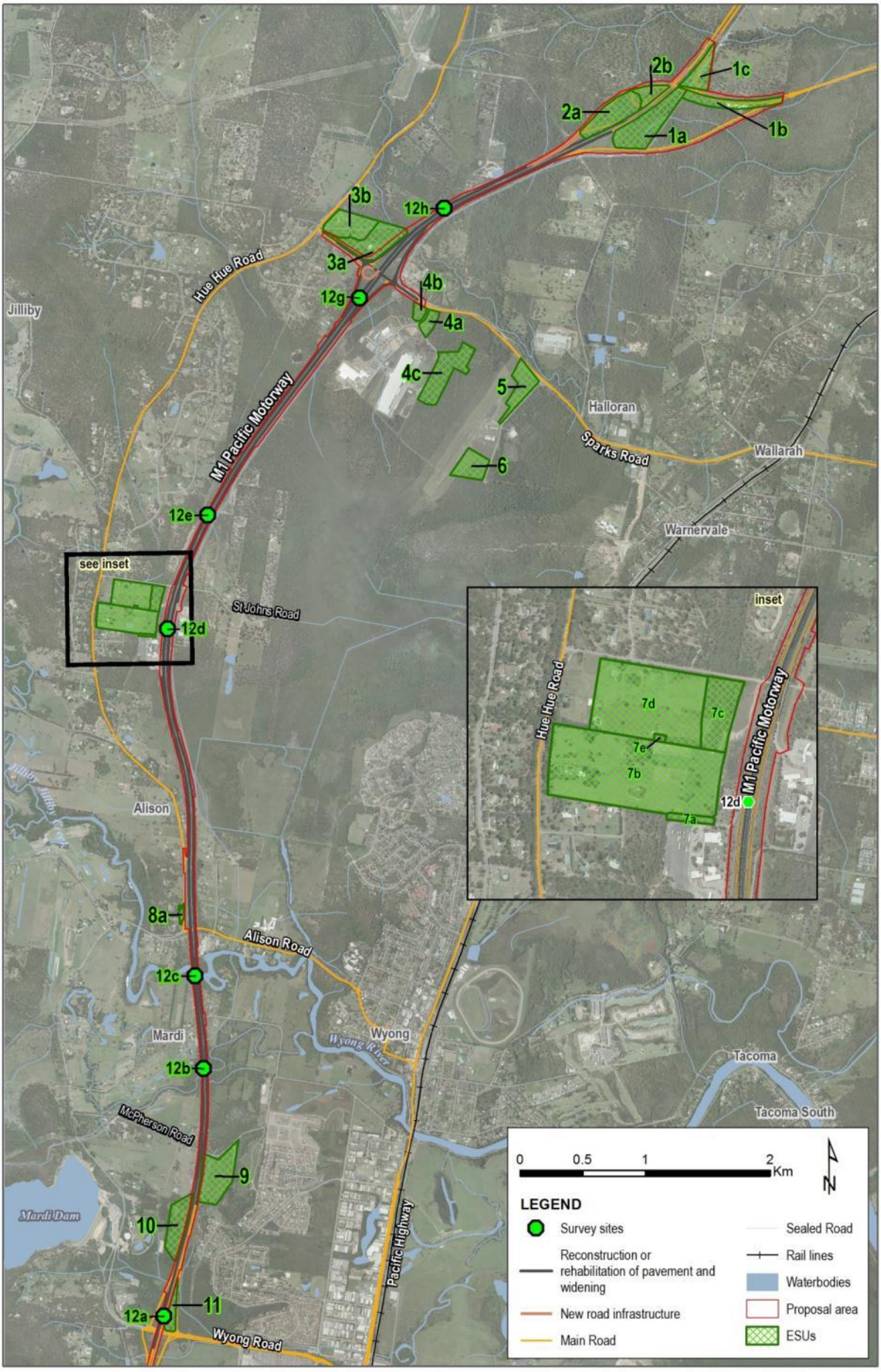


Figure 2 Ecological sampling units (ESUs)

2.4 Limitations

Limitations to the flora and fauna surveys, which may impact on survey results, include:

- While fauna habitat assessments were undertaken, this technique is not an adequate substitute for fauna surveys. Fauna are capable of inhabiting sub-optimal habitat. In addition fragmentation, isolation or species density can all influence the presence and distribution of a particular species. Species likelihood of occurrence was informed by habitat characteristics and opportunistic sightings. No fauna trapping was undertaken.
- No aquatic survey was undertaken of the dams and waterways located within the study area. Several creeks cross the M1 between Tuggerah and Doyalson. Seven threatened amphibians have occurred with 10 kilometres of the study area. Species likelihood of occurrence was informed by habitat characteristics and opportunistic sightings.
- Due to safety constraints and access limitations it was not possible to perform detailed survey within the road corridor of the motorway. However, the flora surveys conducted in May and June 2013 allowed validation of the existing Wyong Shire mapping (Bell, 2008). This provided a high level of confidence in the plant communities identified through the mapping and associated species listed under legislation that may occur in the M1 road reserve. The highly disturbed nature of this area and associated clearing adjacent to the roadside was considered in the assessments of significance concerning potential impacts.

3 RESULTS

3.1 Database searches

The database searches as listed in Section 2.2, identified sixty-two threatened species, 22 flora species and 40 fauna species recorded within 10 kilometres of the proposal area (Figure 3). Of the 22 flora species, 21 are listed under the TSC Act and 19 under the EPBC Act. A full list of species with the potential to occur in the study area is provided in Appendix C.

Using a risk based approach of the likelihood of occurrence (as shown in the matrix in Appendix F), the study area is considered to provide suitable habitat for ten of these species. Species that have a medium or high chance of occurring within the study area include: *Acacia bynoeana* (Bynoe's wattle), *Angophora inopina* (Charmhaven apple), *Cryptostylis hunteriana* (Leafless tongue-orchid), *Eucalyptus parramattensis subsp. parramattensis* (TSC only, population), *Grevillea parviflora subsp. parviflora* (Small-flower Grevillea), *Melaleuca biconvexa* (Biconvexa paperbark), *Prostanthera askania* (Tranquillity mintbush), *Rutidosis heterogama* (Heath wrinklewort), *Tetratheca juncea* (Black-eyed susan) and *Thelymitra sp. adorata* (Wyong sun orchid).

Forty threatened fauna species have been recorded within 10 kilometres of the proposal area, of which 38 are listed under the TSC Act and 18 under the EPBC Act. A full list of species with the potential to occur in the study area is provided in Appendix C. Using a risk based approach the likelihood of occurrence of these species was determined (as shown in the matrix in Appendix F).

The study area provides suitable habitat and availability of resources for 21 of these species. Species that have a medium to high chance of occurring within the study area include: *Crinia tinnula* (Wallum Froglet), *Anthochaera phrygia* (Regent honeyeater), *Calyptorhynchus lathami* (Glossy black-cockatoo), *Daphoenositta chrysoptera* (Varied sittella), *Glossopsitta pusilla* (Little lorikeet), *Grantiella picta* (Painted honeyeater), *Hieraaetus morphnoides* (Little eagle), *Lathamus discolour* (Swift parrot), *Ninox strenua* (Powerful owl), *Tyto novaehollandiae* (Masked owl), *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Miniopterus australis* (Little Bentwing-bat), *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat), *Mormopterus norfolkensis* (Eastern Freetail-bat), *Petaurus norfolcensis* (Squirrel glider), *Phascolarctos cinereus* (koala), *Potorous tridactylus tridactylus* (Long-nosed potoroo), *Pseudomys novaehollandiae* (New Holland mouse), *Pteropus poliocephalus* (Grey-headed flying-fox), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail bat) and *Scoteanax rueppellii* (Greater broad-nosed bat).

There was no record of any fish species occurring in the Wyong LGA that are listed as threatened under the FM Act or the EPBC Act.

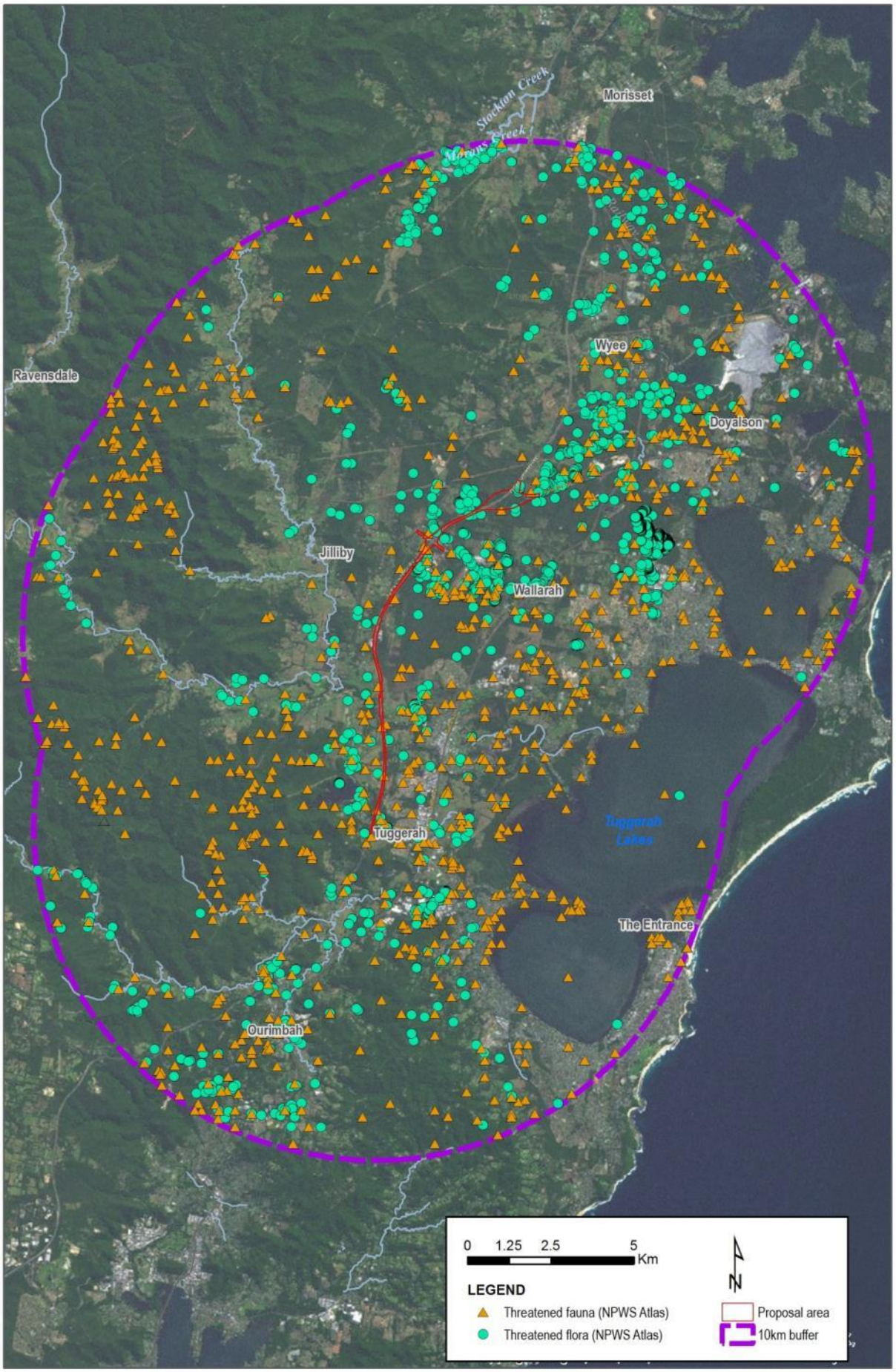


Figure 3 NPWS Wildlife Atlas of threatened flora and fauna within a 10 km radius of the study area

3.2 Existing vegetation mapping

Hunter-Central Rivers Catchment Authority (HCRCMA) and Hunter Councils Environment Division commissioned extensive vegetation survey and mapping of the Hunter, Central and Lower North Coast region of NSW as part of the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) (Somerville, 2009). Systematic survey data was collected from 2,360 sites across the region to compile baseline data, develop a regional vegetation community classification scheme and produce vegetation community mapping. LHCCREMS mapping revealed seven LHCCREMS plant communities within the study area (Figure 4, Figure 5). Roadside vegetation consists mainly of cleared, disturbed vegetation, Wyong Paperbark Swamp Forest, Coastal Plains Smooth-barked Apple Woodland, Coastal Foothills Spotted Gum – Ironbark Forest and some Alluvial Tall Moist Forest.

Wyong City Council undertook mapping and community descriptions of the LGA using stereoscopic aerial photographs, first mapped in 2002 and updated in conjunction with Council GIS staff in 2008 (Bell, 2008). Wyong mapping revealed the study area is comprised primarily of a combination of wet sclerophyll forest, dry sclerophyll forest and forested wetlands. Eight Wyong plant communities exist within the construction footprint, with three potential endangered ecological communities: Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF), River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF) and Lower Hunter Spotted Gum Ironbark Forest (LHSGIF) (Figure 6, Figure 7). The majority of roadside vegetation is comprised of disturbed vegetation, disturbed regrowth or the Wyong plant community Narrabeen Dooralong Spotted Gum-Ironbark Forest. Adjacent to the proposal area are freshwater wetlands of the Wyong community Alluvial Floodplain Swamp Paperbark thicket.

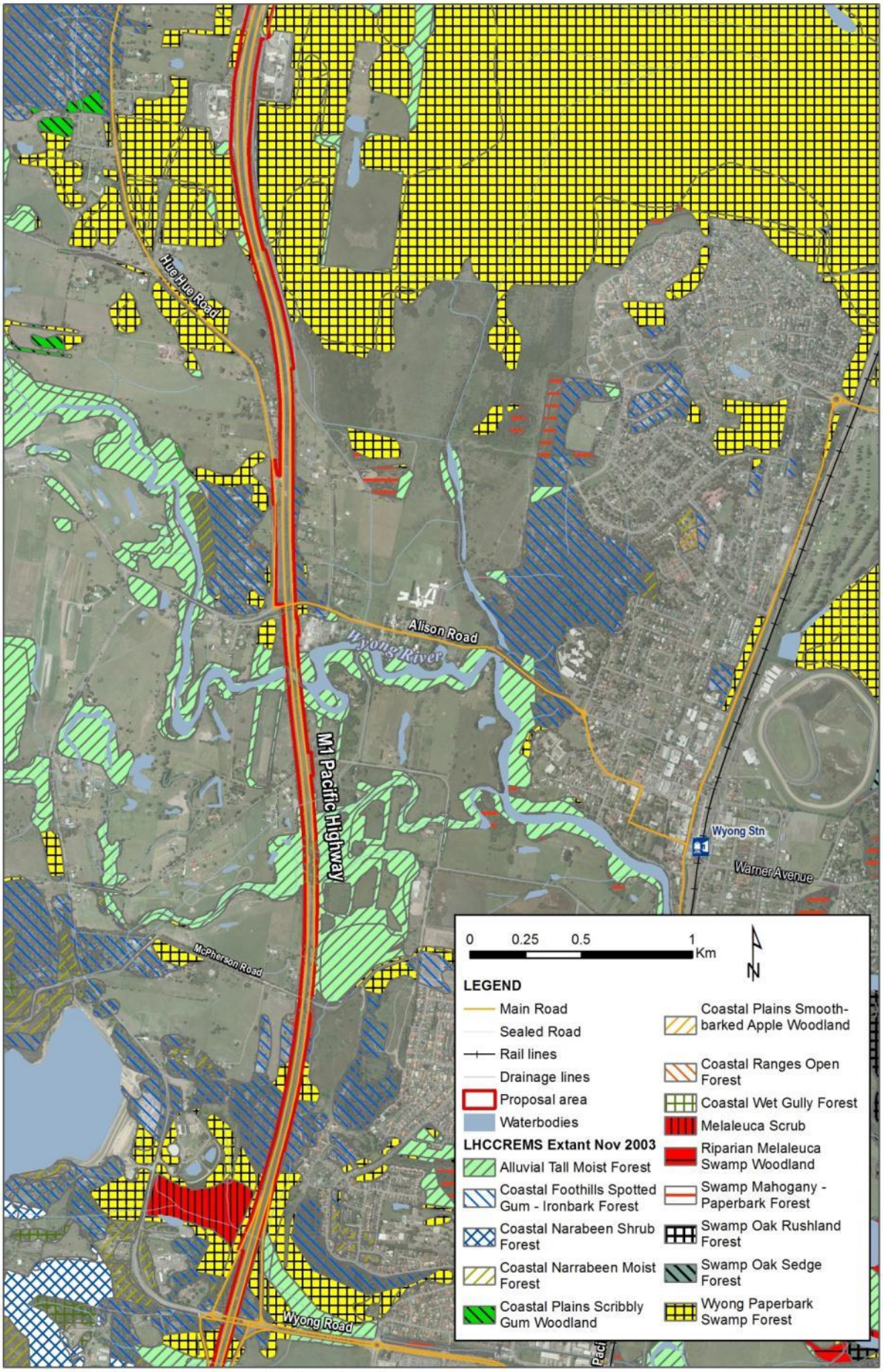


Figure 4 LHCCREMS vegetation mapping – southern (Somerville, 2009)

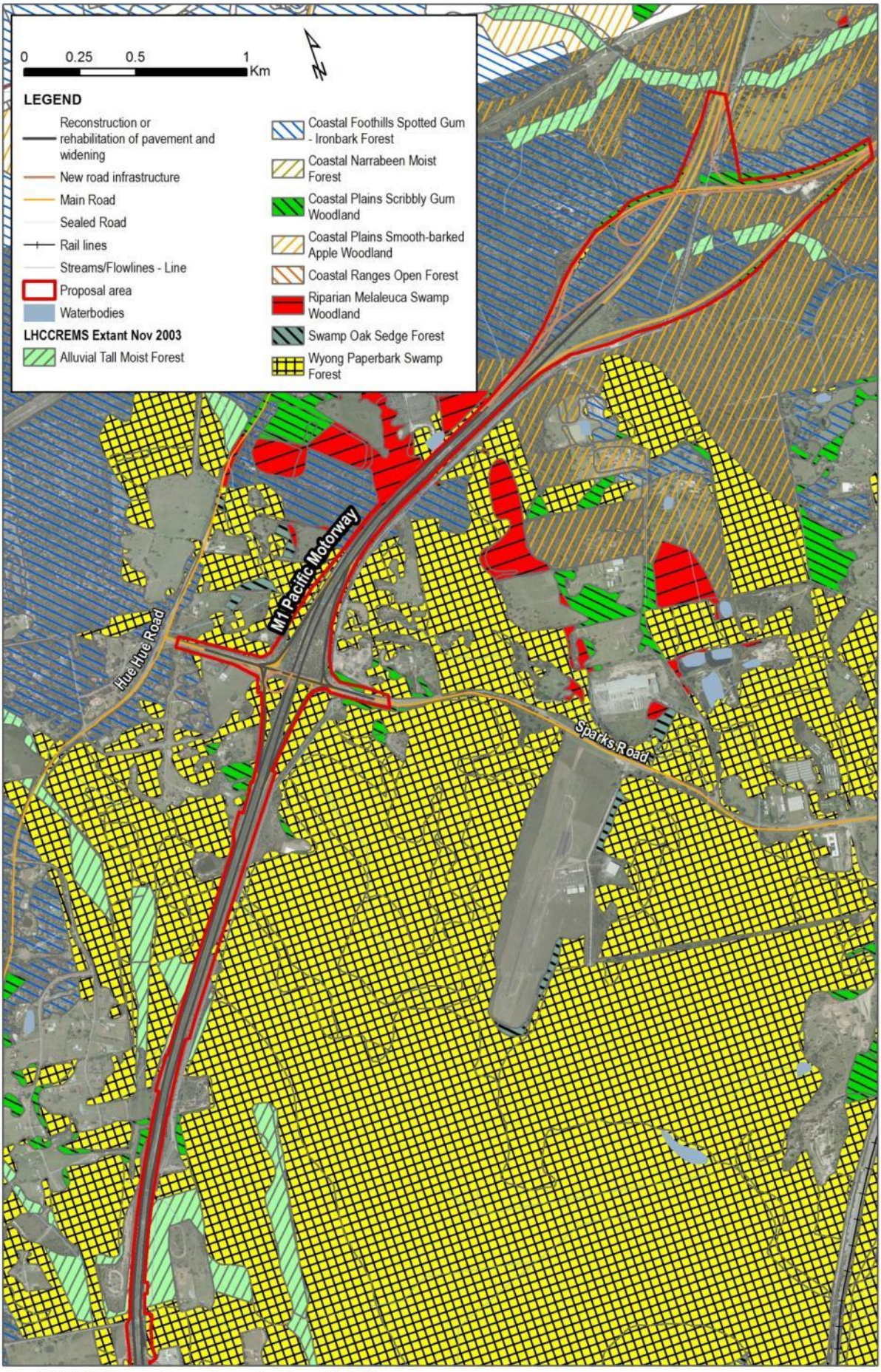


Figure 5 LHCCREMS vegetation mapping - northern (Somerville, 2009)

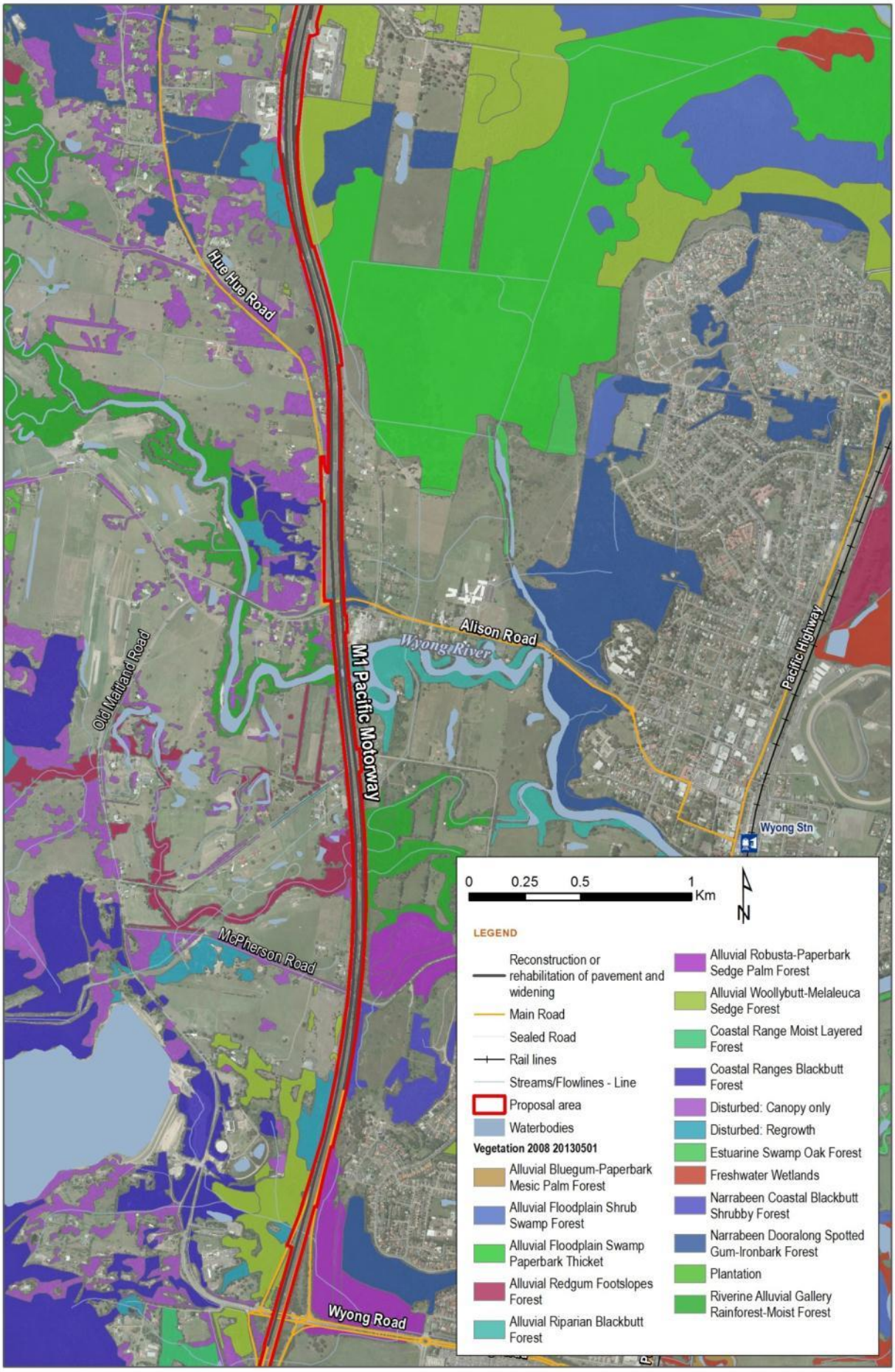


Figure 6 Wyong vegetation mapping – southern (Bell, 2008)

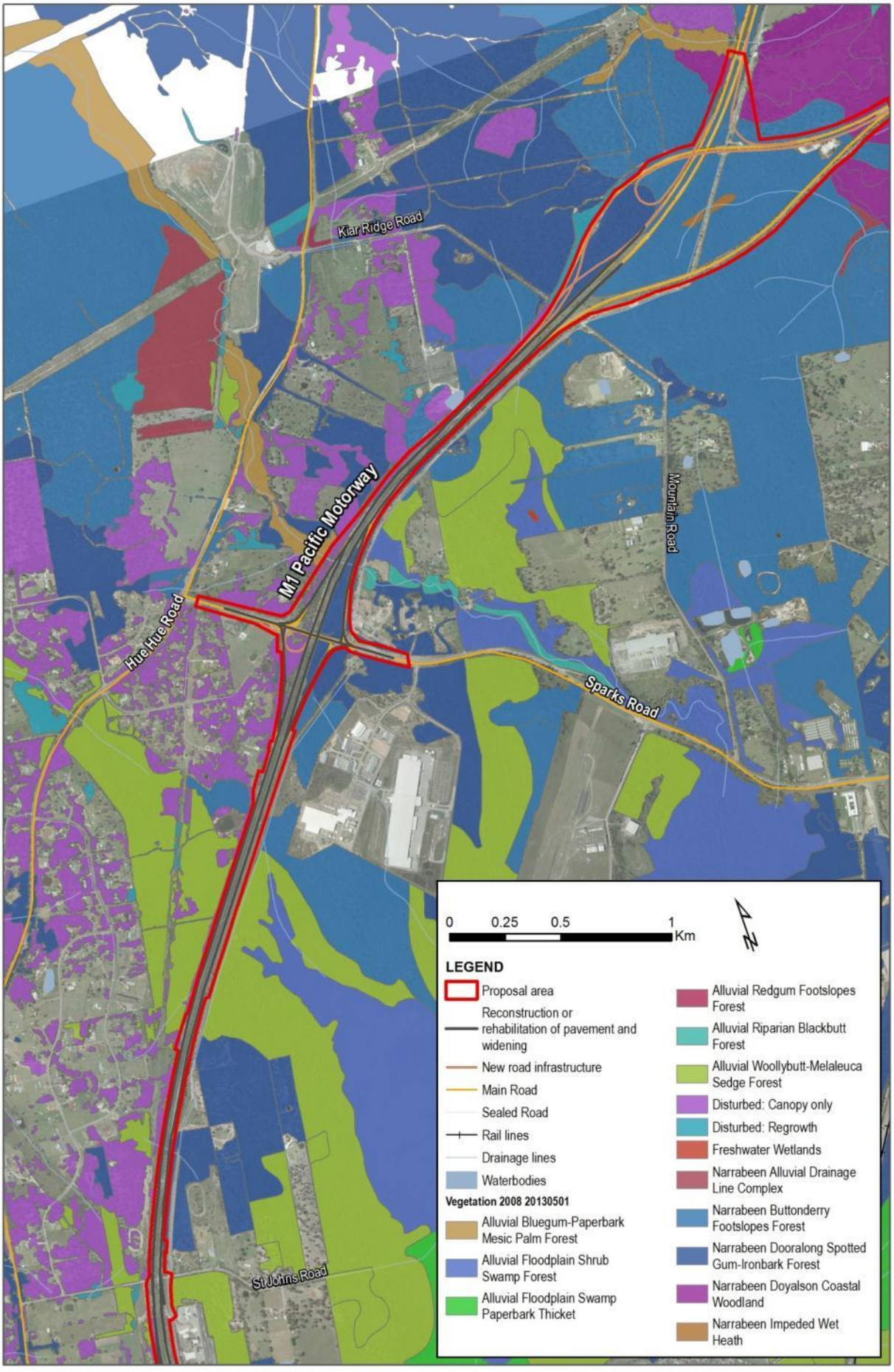


Figure 7 Wyong vegetation mapping – northern (Bell, 2008)

3.3 Flora and fauna habitat assessment

Vegetation communities and endangered ecological communities recorded within the study area, along with plant community types (ESCAVI, 2003) and equivalent Wyong LHCCREMS (Somerville, 2009) and HCCREMS (McCauley, 2006) names are shown in Appendix A, Table 6.

During the autumn 2013 and 2014 surveys, 204 flora species, including 53 exotic species were identified. A comprehensive list of all flora species identified at each site is shown in Appendix B Table 7 and Table 8. Of the exotic species, six are listed as noxious weeds in the Wyong LGA. No threatened flora species were observed within the study area during the autumn surveys. There are records of *Tetratheca juncea* in ESU 1c and potentially to the south of the Doyalson Road interchange within the road corridor, and *Grevillea parviflora subsp. parviflora* in ESU 3a (Figure 10). These records were not confirmed during field survey as the groundcover was long and thick and the plants were not flowering, however it should be assumed that they are present and additional field survey to confirm their location should be undertake pre-construction during flowering season (generally July to December).

Seventeen fauna species were identified within the study area, including six introduced species. All fauna species either encountered or identified from evidence such as scats, tracks and diggings during the fauna habitat assessment are shown in Appendix B Table 9. No threatened fauna species were observed within the study area during the autumn surveys.

3.3.1 Potential ancillary sites

The potential ancillary sites for the proposal are identified in Figure 1. The sites have been numbered and split into ESUs. These are shown in Figure 2. Photos of each proposed ancillary site are shown in Appendix G.

Sparks Road

Sparks Road, or Site 3 covers a total area of 15.7 hectares and is located adjacent to Sparks Road interchange west of the M1 (refer to Figure 2). This potential ancillary site was divided into two ESUs as a portion of the site has previously been cleared.

Site 3a comprises 8.8 hectares of remnant Paperbark – Woollybutt swamp forest on coastal lowlands of the Central Coast and categorised by Wyong LGA as locally significant community Alluvial Woollybutt-Melaleuca Sedge Forest. A small proportion of the site is classified as the EEC 'Swamp Sclerophyll Forest on Coastal Floodplain'. The canopy is dominated by Smooth-barked apple, Black she-oak and Swamp mahogany, many with large hollows. The shrub layer is dominated by *Melaleuca nodosa* (Ball honey myrtle), *Xanthorrhoea fulva* (Grass tree) and *Melaleuca sieberi* (Sieber's paperbark). *Vombatus ursinus* (Common wombat), *Wallabia bicolor* (Swamp wallaby) and Kangaroo scats were present throughout the site. Wiry panic grass, *Microlaena stipoides* (Weeping rice grass), forbs and shrubs covered about 50 per cent of ground, with a light leaf litter and some coarse woody debris (five per cent). Conical digs present suggest Bandicoots or Potoroos are present within the site. This site is classified as potential koala habitat under Schedule 2 of SEPP 44 (NSW Government, 2000). There are several records of the vulnerable *Grevillea parviflora subsp. parviflora* in close proximity to the M1 in this ESU.

Site 3b is a 6.9 hectare section of cleared weedy pasture in the centre of site 3. The site is very open with sparse ground layer and no mid storey. The site is dominated by exotic

grasses *Pennisetum macrourum* (African Feather Grass), *Axonopus fissifolius* (Carpet grass), *Andropogon virginicus* (Whiskey grass) and *Paspalum dilatatum* (Paspalum). Mature remnant Smooth-barked apple trees are scattered throughout the site and contain multiple, large hollows. Fauna scratching were present on the base and trunk of some remnant trees. While the marking cannot be attributed to a single species, they are likely to have been made by either possum or glider species and indicate that trees and/or hollows are being utilised by mammals as food or shelter trees despite the open clearing between trees and the rest of the vegetation.

Warren Road

Warren Road, or Site 4, was divided into three ESUs. Site 4a and 4b are (2.9 hectares) remnant vegetation transected by Warren Road. As Site 4a and 4b are to be affected by potential road upgrades to the Warren Road and Sparks Road intersection, a detailed vegetation description of these sites is included in Section 3.3.4. Site 4c is a cleared area on the east side of Warren Road (9 hectares).

Site 4c is highly modified and open. The whole site has been cleared and is dominated by exotic grasses, with over 65 per cent coverage. The most dominant species is paspalum, with 45 per cent coverage of the site. There was no evidence of fauna present on the site.

Warnervale Airport

Warnervale Airport (Site 5) consists of 5.2 hectares of cleared grassland and forms part of Warnervale Airport at the northern end of Jack Grant Drive. The site is highly modified, with no mid-storey or canopy. Three trees (Swamp mahogany and Spotted gum) in the north-east corner show no signs of nests or hollow formations. The ground is swampy and dominated by exotic grass species. Together Paspalum and Carpet grass cover 95 per cent of ground layer.

The site is adjacent to the plant community type Cabbage Gum-Rough-barked Apple Grassy Woodland on Alluvial Floodplains of the Lower Hunter.

Warnervale Airport (Site 6) consists of cleared 4.7 hectares of grassland and forms part of Warnervale Airport at the southern end of Jack Grant Drive. The site is highly modified, with no mid-storey or canopy. The ground is swampy and completely comprised of exotic grass and forb species. Together Paspalum and Carpet grass cover 95 per cent of ground surface. The site is adjacent to the plant community type Cabbage Gum-Rough-barked Apple Grassy Woodland on Alluvial Floodplains of the Lower Hunter.

Hue Hue Road

Hue Hue Road (Site 7) was divided into 5 ESUs. Site 7a is a remnant strip of vegetation, 7b and 7d are cleared pasture lands, 7c and 7e are areas of remnant vegetation.

Site 7a is a 3 m wide strip of vegetation along the fence line between cleared pasture land and the service centre car park at the southern end of the site (0.2 ha). This disturbed remnant is Broad-leaved Paperbark – Swamp Oak – Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast. Wyong Council Shire categorises this plant community as the locally significant Coastal Sand Bangalay-Paperbark Forest. This habitat forms part of the SSFCF EEC.

The canopy of site 7a is dominated by *Melaleuca linariifolia* (Flax-leaved paperbark) with 50 per cent coverage. There one nest was visible approximately seven metres high and there were no signs of hollow formations. The shrub layer was comprised of *Glochidion ferdinandi* (Cheese tree), Ball honey myrtle and *Commelina cyanea* (Scurvy weed). The

ground layer was dominated by forbs and grasses, including the exotic *Paspalum urvillei* (Vassey grass) and was adjacent to a drainage line.

Site 7b is open, cleared pasture at the southern end of the site with a small number of remnant trees and cattle present (9.6 hectares). Mature Blackbutt, Red bloodwood and Broad-leaved white mahogany trees are scattered throughout the site. No large hollows were visible, however smaller hollows appear to be forming where limbs have fallen off. The site has two dams with aquatic vegetation providing suitable potential frog and turtle habitat. No mid-storey was present and the ground cover was dominated by exotic grasses and forbs. *Pennisetum clandestinum* (Kikuyu) and paspalum accounted for 85 per cent of ground coverage. Wallaby scats were identified on site.

Site 7c is comprised of remnant vegetation at the northern end of the site (1.8 hectares). The plant community is classified Paperbarks – Woollybutt swamp forest on coastal lowlands of the Central Coast. Wyong Council Shire categorises this locally significant community as Alluvial Woollybutt-Melaleuca Sedge Forest. This habitat forms part of the SSFCF EEC. This site has high floristic diversity and is in relatively good condition. The canopy is comprised of at least eight different *Angophora*, *Eucalyptus*, *Allocasuarina* and *Corymbi*a species that provide good quality habitat for a range of mammal and bird species. This site is classified as potential koala habitat under Schedule 2 of SEPP 44 (NSW Government, 2000). No hollow bearing trees are present. The mid-storey is dominated by ball honey myrtle, with several other shrub species scattered throughout the site, including *Daviesia ulicifolia* (Gorse bitter pea), *Epacris pulchella* (Coral heath), *Polyscias sambucifolia* (Elderberry Panax) and *Leptospermum polygalifolium* (Tantoon). Approximately 70 per cent of the ground layer is covered in leaf litter, with coarse woody debris and logs scattered through 10 per cent of the site. The ground layer is diverse, with native grasses, forbs and sedges throughout. 55 per cent of the ground layer is covered by *Imperata cylindrical* (Blady grass), Wiry panic grass, *Themeda australis* (Kangaroo grass) and *Mitrasacme polymorpha* (Miterwort).

Site 7d is a disturbed area with open, cleared habitat (six hectares) adjacent to SSFCF. The site has no canopy or mid-storey. The ground layer is dominated by exotic grass and forb species, including Whiskey grass, Kikuyu, Paspalum, Vassey grasses and *Sida rhombifolia* (Paddy's Lucerne). There is no evidence of native fauna, although *Equus ferus* (Horse) scats were detected.

Site 7e is a small, remnant patch of Spotted Gum – Red Ironbark – Grey Gum shrub - grass open forest of the Lower Hunter (0.1 hectares). This is categorised as the locally significant Wyong community of Narrabeen Dooralong Spotted Gum-Ironbark Forest. This habitat forms part of the Lower Hunter Spotted Gum Ironbark Forest (LHSGIF) EEC. The canopy is relatively open and comprised of spotted gum and red ironbark, with combined coverage of 40 per cent. No hollow bearing trees were identified. Ball honey myrtle is the main shrub species. The ground layer is a mixture of native grasses and forbs. Wiry panic grass, Kangaroo grass, Blady grass and Weeping rice grass are relatively evenly disturbed throughout the site.

McPherson Road

McPherson Road (Site 9) is comprised of disturbed 9.4 hectares of open grassland with remnant vegetation adjacent to the roadside. The vegetation is dominated by exotic grasses; Whiskey grass, Tussock paspalum and *Briza subaristata*. The area receives drainage from the adjoining landfill to the east of the low-lying swampy patches dominated by sedges and rushes. The remnant patch of vegetation adjacent to the motorway is

remnant Paperbarks - Woollybutt swamp forest on coastal lowlands of the Central Coast, categorised by Wyong Shire as a locally significant community, Alluvial Woollybutt-Melaleuca Sedge Forest. The site does not contain, but is adjacent to the SSFCF EEC.

The site has limited canopy cover, with a small number of the exotic *Cinnamomum camphora* (Camphor laurel) and native *Acacia* spp. and Rough-barked apple. The site has some clumps of regenerating shrubs: *Acacia longifolia* (Sydney golden wattle) and *Melaleuca ericifolia* (Swamp paperbark). The exotic Blackberry is present within the site.

The open grassland provides suitable foraging habitat for some mammal and bird species, with evidence of small-medium marsupials in the area. *Wallabia bicolor* (Swamp wallaby) scats were located throughout the area. Small burrows, with entrances less than 10 centimetres, characteristics of *Rattus* and *Antechinus* species were present in cleared areas. Conical digs, characteristics of Bandicoots (either *Isoodon macrourus* or *Perameles nasuta*) and *Potorous tridactylus* (Long-nosed potoroo), were scattered throughout in areas not dominated by high exotic grasses. Scats of two introduced mammals were detected: *Canis lupus familiaris* (Dog) and *Vulpes vulpes* (Fox).

The area contains very limited nesting or shelter habitat due to a lack of trees, coarse woody debris, logs and hollows. The low cover of high grasses and tussock skirts provide some shelter habitat for bandicoots, with evidence of animal runs underneath.

3.3.2 Roadside verge – road widening

Alison Road/Hue Hue Road verge

Alison Road/Hue Hue Road verge, or Site 8, is divided into two ESUs, Site 8a is (0.4 hectares) completely cleared while site 8b is a small patch (0.1 hectares) of remnant vegetation.

Site 8a is cleared, open roadside vegetation. No canopy or mid-storey is present. The ground layer is dominated by exotic grasses and forbs, including *Chloris gayana* (Rhode's grass), Whiskey grass, Paspalum and Carpet grass. The only native grass species present is Couch grass, with 25 per cent coverage. No leaf litter or coarse woody debris is present and there is no evidence of fauna utilising the site.

Site 8b is comprised of the plant community Smooth-barked Apple open forest on coastal lowlands of the Central Coast. Wyong Council categorise this community as Narrabeen Coastal Sheltered Peppermint-Apple Forest, a locally significant vegetation community. The remnant patch contains overstorey vegetation, including smooth-barked apple, brown stringybark and spotted gum. While most trees in this patch are not mature, one spotted gum is over 20 metres high and contains small hollows (<10 centimetres entrance diameter). The mid-storey contains several shrub species in low density, including *Pittosporum undulatum* (Sweet pittosporum), *Glochidion ferdinandi* (Cheese tree) and *Breynia oblongifolia* (Coffee bush). The ground layer is sparse, with a very low density of grasses and forbs covering less than 10 per cent of the ground. Fauna habitat is very limited with limited leaf litter (<10 per cent ground coverage), no coarse woody debris and very limited structural diversity in the vegetation.

Wyong Road/M1

Wyong Road/M1 (Site 10) is a 6.3 hectare patch of disturbed remnant open, alluvial tall moist forest. The vegetation on site is consistent with Smooth-barked Apple - Turpentine - Blackbutt open forest on ranges of the Central Coast plant community type. This community is categorised by Wyong Council as Narrabeen Coastal Blackbutt Shrubby

Forest, a locally significant vegetation type. High plant species diversity was recorded. The canopy was dominated by immature blackbutt, with 50 per cent coverage. Trees were too young to have formed hollows. The mid-storey was open, with scattered shrubs and sub-shrubs. Daviesia, *Acacia irrorata* (Green wattle), *Pimelea linifolia* (Slender rice flower) and *Pultenaea blakelyi* (Blakely's bush pea) each had approximately one per cent vegetation coverage in the mid-storey.

The ground layer was patchily distributed with forbs, grasses and some scramblers, with a thin layer of leaf litter and small branches covering approximately 70 per cent of the ground. *Centella asiatica* (Centella), *Pratia purpurascens* (Whiteroot), *Hardenbergia violacea* (False sarsaparilla) *and Lantana camara* (Lantana) each had less than two per cent coverage, with other species at one per cent coverage. Lantana is classified as a noxious weed (DPI, 2013b) and a weed of national significance (AWC, 2012).

Scats of two mammals were detected: the introduced Fox and the native Wombat. The area contains limited nesting or shelter habitat due to a lack of mature trees, coarse woody debris, logs and hollows, but had bird and small reptile species utilising the site. Several species of fungi were visible, which may provide nutritional resources for a range of mammals such as Swamp wallaby and Potoroo species. A small creek line with drainage lines runs through the SSW corner of the site, draining away from the site.

Wyong Road off ramp

Wyong Road off ramp (Site 11) is a remnant 2.1 hectare isolated patch of vegetation between the M1, the Wyong Road overpass and the south-bound off ramp at Wyong Road. This Smooth-barked Apple - Turpentine – Blackbutt open forest on ranges of the Central Coast is weedy and highly modified along the roadside. It forms the locally significant community Narrabeen Coastal Blackbutt Shrubby Forest. The majority of the site is dominated by a relatively dense canopy of immature blackbutt and some black she-oak and smooth-barked apple. No large hollows were visible, but some trees may contain small hollows (diameter <10 centimetres). Mid-storey vegetation was also dense, with several shrub species distributed across the site; Cheese tree, Coffee bush, Sydney golden wattle, Elderberry Panax, Daviesia, Green wattle and *Persoonia linearis* (narrow-leaved geebung). Several bird species were heard, but not observed due to the dense vegetation.

The site had a large covering of leaf litter and small branches across 90 per cent of the ground. This may provide good quality habitat for a range of small reptiles. Ground layer vegetation was patchy with several grass, forb and fern species each with a low level of coverage. Lantana has over 15 per cent coverage at the site and is classified as a noxious weed (DPI, 2013b) and a weed of national significance (AWC, 2012). Drainage channels run into the site from the surrounding roads and were dry during the survey.

M1 corridor

Due to safety regulations and access limitations it was not possible to perform detailed survey within the M1 corridor. However, the flora surveys conducted in May and June 2013 allowed validation of the existing Wyong Council mapping (Bell, 2008). This provided a high level of confidence in the plant communities identified through the mapping and associated threatened species that may occur in the motorway corridor.

Roadside vegetation consists mainly of cleared or disturbed vegetation with limited regrowth. The majority of road side verge is cleared within 5-10 metres of the motorway, but does change continuously throughout the study area. Mapping shows eight Wyong

plant communities along the roadside verge. Narrabeen Dooralong Spotted Gum-Ironbark Forest and Narrabeen Buttonderry Footslopes Forest are located adjacent to road along the northern section of the study area. The equivalent plant community type for Narrabeen Dooralong Spotted Gum-Ironbark forest in the study area is Spotted Gum - Red Ironbark - Grey Gum –shrub - grass open forest of the Lower Hunter.

The canopy is dominated by *C. maculata*, *E. fibrosa*, *E. globoidea* and *A. costata*. This habitat may form part of the Lower Hunter Spotted Gum Ironbark Forest (LHSGIF) EEC. The equivalent plant community for Narrabeen Buttonderry Footslopes Forest is Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia healthy open forest of coastal lowlands that is also found throughout the ancillary sites.

The central and southern regions of the study area the roadside corridor have sections of dry sclerophyll forest (Narrabeen Coastal Blackbutt Shrubby Forest), wet sclerophyll forest (Alluvial Robusta-Paperbark Sedge Palm Forest) and forested wetlands (Alluvial Woollybutt-Melaleuca Sedge Forest). The SSFCF EEC is potentially present in small sections of the forest wetlands and wet sclerophyll forest in the southern section.

Alluvial Riparian Blackbutt Forest, Riverine Alluvial Gallery Rainforest-Moist Forest and Alluvial Redgum Footslopes Forest are present around creek line crossings with the motorway. These communities are dominated by large canopy trees. Alluvial Riparian Blackbutt Forest equates to the plant community Alluvial Tall Moist Forest of NPWS (2000) and this community is included within the RFEFCF EEC. Roadside vegetation connects with ecological corridors of the region, in particular at river crossings, where riparian vegetation consists of good quality habitat connected on either side of the motorway by the vegetation beneath and between the bridge structures.

3.3.3 Central median – road widening

The median strip is primarily comprised of disturbed vegetation. The median was cleared in the 1980's for the initial road construction, and has since naturally regenerated through seed propagation from the surrounding landscape. The vegetation structures changes continuously along the 12 kilometres linear median, from cleared open areas to sections of dense vegetation. Surveys found three distinct vegetation types; cleared open vegetation, riparian vegetation and native vegetation regrowth. Due to the level of disturbance and flora species variety, sections of the median do not fit into plant community types

Cleared areas

Sections along the median consist of disturbed areas with open, cleared habitat. These areas typically have a dense coverage of tall exotic grasses. These areas have no canopy and scattered mid storey shrubs or emerging eucalypts. The ground layer is dominated by exotic grass and forbs species, including *Andropogon virginicus* (Whiskey grass), *Bidens pilosa* (Cobblers peg), *B. subalternans*, *Chloris gayana* (Rhodes grass) and Lantana. There is no evidence of native fauna, however due to the dense grass coverage, scats and tracks are difficult to detect. This habitat provides very limited nesting and foraging opportunities for fauna due to a lack of structure.

Riparian vegetation

The M1 crosses Deep Creek (Site 12b) and Wyong River (Site 12c). Good quality riparian vegetation was present on either side of the motorway, with large canopy trees and high floristic diversity. Riparian vegetation in the centre of the motorway was dominated by exotic weeds including *Lantana camara* (lantana) and *Cinnamomum camphora* (camphor

laurel). However these areas provide potential opportunity for cross highway fauna movements, with a large variety of animal tracks underneath the bridge structure. Unidentified bird calls were heard during the survey. Lantana, despite being a noxious weed, also provides some nesting habitat in its dense cover for ground dwelling mammals. Riparian vegetation in the median adjacent to Deep Creek contained several canopy trees including *Eucalyptus saligna* (Sydney blue gum), *Alphitonia excelsa* (Red ash) and *Stenocarpus sinuatus* (Firewheel tree). The mid storey is dominated by *Melaleuca hypericifolia*, *Glochidion ferdinandi* (Cheese tree) and *Bursaria spinosa* (Blackthorn). The mid and under storey are both densely vegetated. The understorey is diverse and comprised of a mixture of 17 weed species as well as native grasses, ferns and herbs. Riparian vegetation in the median adjacent to Wyong River was dominated by canopy trees including red ash, *Casuarina glauca* (Swamp she-oak), Sydney blue gum, *Pittosporum undulatum* (Sweet pittosporum) and *Tristaniopsis laurina* (Water gum) with some potential small hollows. The shrub layer is diverse with a dense coverage of *Acacia falcata* (Sickle wattle), *Acacia longifolia* (Sydney golden wattle), Cheese tree and *Kunzea ambigua* (Tick bush). The ground had up to 60 per cent leaf litter coverage and 10 per cent coarse woody debris. Ground coverage was dominated by native ferns and rush and a high coverage of nine exotic weed species.

Native vegetation regrowth

Sections along the motorway median consist of disturbed areas with native vegetation regrowth. These areas have been naturally propagated from the surrounding landscape since the median was cleared for road construction in the 1980s. There are no canopy trees present. The mid storey is dense and dominated by a range of native trees and shrubs including *Acacia falcata* (Sickle wattle), *A. linifolia* (Flax-leaved wattle), *A. longifolia* (Sydney golden wattle), *Allocasuarina littoralis* (Black she-oak), *Hakea sericea* (Bushy needlebush) and *Kunzea ambigua* (Tick bush). The native climber *Parsonsia straminea* (Common silkpod) is common to all areas and attached to mid storey vegetation. No nests were visible. The ground layer underneath the native vegetation was fairly open, with some coverage by *Dichondra repens* (Kidney weed), a high level of leaf litter and 5-10 per cent coarse woody debris comprised mainly of fallen tree limbs with fungi species present. Conical diggings were visible in some cleared understorey sections, suggesting bandicoot or potoroo species are present. The sections of the median adjacent to the motorway (1-2 metres) were dominated by widespread exotic grasses and forbs, including *Bidens pilosa* (Cobblers peg), *Chloris gayana* (Rhodes grass), *Paspalum dilatatum* (Paspalum), *Plantago lanceolata* (Lambs tongue) and *Senecio madagascariensis* (Fireweed). Small burrows and animal runs in the grass indicate the presence of rodent species.

3.3.4 Motorway interchange and intersection works

Doyalson Road Interchange East

Doyalson Road Interchange East (Site 1) is located in the north-east of the study area and is divided into three ESUs. Site 1a is located between the M1 and the on-ramp from Doyalson Link Road (11 ha). It is comprised of undisturbed remnant vegetation of the plant community type (PCT) Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia healthy open forest of coastal lowlands. This is a locally significant vegetation community, categorised by Wyong Council as Narrabeen Buttonderry Footslopes Forest. Dominant tree species include *Angophora costata* (Smooth-barked apple), *Allocasuarina littoralis* (Black she-oak) and *Melaleuca linariifolia* (Flax-leaved paperbark). Several hollow-bearing trees are located in this site, as well as a large dead

burnt out stag, providing potential nesting, roosting and shelter habitat. The shrub layer is moderately dense and comprised mainly of *Banksia spinulosa* (Hairpin banksia). A thick layer of leaf litter is interspersed with a moderate distribution of grasses and *Gahnia clarkei* (Saw sedge). Diggings in leaf litter suggest the presence of either bandicoot or potoroo species and wallaby scats are located throughout the site.

Site 1b is located on the southern road embankment along the Doyalson Link Road off ramp, to the east of the M1 (5.2 hectares). The site has been previously disturbed for construction and is located adjacent to a waste stockpile and access road. It is comprised of moderately disturbed vegetation of the PCT)Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia healthy open forest of coastal lowlands. This is a locally significant vegetation community, categorised by Wyong Council as Narrabeen Buttonderry Footslopes Forest, grading into Narrabeen Doyalson Coastal Woodland in the eastern part of the site with some *Eucalyptus haemastoma* present. Dominant tree species include *Angophora costata* (Smooth-barked apple), *Corymbia gummifera* (Red bloodwood) and *Eucalyptus capitellata* (Brown stringybark). A moderate layer of leaf litter is present amongst scattered low shrubs and a mix of native and exotic grasses. The mid-story is generally absent and the canopy layer consists of immature trees. Several large hollow-bearing trees were identified outside the proposed construction boundary. Tracks and scats indicate the presence of rabbits and wallabies.

Site 1c is located east of the M1 and north of the Doyalson Link Road off ramp (4.4 hectares). The site is dissected by a cleared access track approximately 20 metres wide in some locations. A concrete drainage line runs parallel to the M1 near the western boundary of the site. It is comprised of mostly undisturbed native vegetation of the PCT Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia healthy open forest of coastal lowlands. This is categorised by Wyong Council as Narrabeen Buttonderry Footslopes Forest nearest the existing motorway grading into Narrabeen Doyalson Coastal Woodland in the eastern part of the ESU. Canopy species include *Eucalyptus haemastoma (*Scribbly gum*), Angophora costata* (Smooth-barked apple), *Corymbia gummifera* (Red bloodwood) and *Eucalyptus capitellata* (Brown stringybark). Midstorey species include *Allocasuarina littoralis* (Black she-oak), *Banksia spinulosa* (Hairpin banksia), *Leptospermum trinervium* (Slender tea-tree) and *Hakea sp*. Groundcover varies from dense grasses and graminoids such as *Entolasia stricta* (Wiry panic) and *Cyathochaeta diandra* to thick leaf litter or bare ground. Numerous fallen logs and rocks are present. A number of large mature canopy trees were observed with the potential to have small hollows suitable for birds and small mammals. There are several records of the vulnerable *Tetratheca juncea* in this ESU.

Doyalson Road Interchange West

Doyalson Road Interchange (Site 2) is located in the north-east of the study area, between the M1 and the Doyalson Link Road off ramp. This site is divided into two ESUs, as part of the site was cleared in 1983.

Site 2a is 8 hectares of undisturbed remnant Spotted Gum - Red Ironbark - Grey Gum – shrub - grass open forest of the Lower Hunter. This is a locally significant vegetation community, categorised by Wyong Council as Narrabeen Dooralong Spotted Gum-Ironbark Forest. This habitat forms part of the Lower Hunter Spotted Gum Ironbark Forest (LHSGIF) EEC. The canopy is comprised of *Corymbia maculata* (Spotted gum), *Eucalyptus fibrosa* (Red ironbark), *Eucalyptus globoidea* (White stringybark) and *Eucalyptus punctata* (Grey gum). Mature hollow bearing trees over 25 metres high, and

several dead stage were present on the site. In addition, limbs were missing from several trees and shrubs, creating smaller hollows. Two leaf nests were visible in tree limbs, approximately eight metres high. This habitat potentially provides nesting, roosting and breeding resources. The shrub layer is fairly sparse and contains *Daviesia ulicifolia* (Gorse bitter-pea), *Bursaria spinosa* (Blackthorn) and *Dodonaea triquetra* (Large-leaf hopbush). Grasses dominate the understorey, in particular *Entolasia stricta* (Wiry panic) and *Themeda australis* (Kangaroo grass). Coarse woody debris and logs was scattered throughout approximately 10 per cent of the site. This ground coverage can be utilised by a range of small mammals and reptiles.

Site 2b is comprised of 2.6 hectares of disturbed remnant Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia healthy open forest of coastal lowlands that was cleared in 1983. This is a locally significant vegetation community, categorised by Wyong Council as Narrabeen Buttonderry Footslopes Forest. Site 2b is dominated by Smooth-barked apple, Black she-oak and Saw sedge. However Site 2b is modified and sparser, with less mature trees. Two exotic species, *Cortaderia selloana* (Pampas grass) and *Ageratina adenophora* (Crofton weed), were widespread. The understorey is less dense than Site 2a and conical diggings were visible in some cleared understorey sections, suggesting Bandicoot or Potoroo species are present.

Warren Road

Warren Road (Site 4) was divided into three ESUs. Site 4a and 4b (2.9 hectares) are remnant vegetation transacted by Warren Road. Site 4c is a cleared area on the east side of Warren Road (9 hectares).

Site 4a and 4b are disturbed remnant Spotted Gum - Red Ironbark - Grey Gum –shrub - grass open forest of the Lower Hunter. This is a locally significant vegetation community, categorised by Wyong Council as Narrabeen Dooralong Spotted Gum-Ironbark Forest. This habitat potentially forms part of the Lower Hunter Spotted Gum Ironbark Forest (LHSGIF) EEC.

Sites 4a and 4b have a relatively open forest structure. The canopy stratum has approximately 40 per cent cover in Site 4a and 30 per cent cover in Site 4b. Both are dominated by spotted gum and smooth-barked apple, with some red ironbark also present. The site contains approximately 10 potential hollow bearing trees. Several trees have fauna scratchings on the base and trunk that cannot be attributed to a single species, but likely come from either possums or gliders. There are several nest boxes attached to trees, all in poor condition with lids missing and are unlikely to provide adequate shelter for fauna. The shrub stratum is fairly open, with between 5-10 per cent coverage and consists of *Daviesia ulicifolia* (Daviesia), Ball honey myrtle, *Hakea sericea* (Bushy needlebush) and *Epacris pulchella* (Coral heath). Ground cover is low and dominated by grasses; *Themeda australis* (Kangaroo grass) and Weeping rice grass in Site 4a and Wiry panic in Site 4b. Wallaby scats were identified at both sites.

3.4 General findings

Seven vegetation communities were identified within the study area and all are listed as locally significant in Wyong Shire (Figure 8, Figure 9). Three ecological communities listed as endangered under the TSC Act was present within the study area. No threatened flora or fauna species were identified during the survey, however Sites 1c and 3a should be re-surveyed when *Tetratheca juncea* and *Grevillea parviflora subsp. parviflora* are flowering as there are reliable records of these species in the ESUs (OEH 2013). This biodiversity

assessment assumes these species are present at these locations. Six of the 53 weed species identified are listed in Wyong Shire under *Noxious Weeds Act 1993*. Four of these weed species are listed as weeds of national significance (WoNS).

3.4.1 Vegetation communities

Seven vegetation communities were identified within the study area. Table 6, Appendix A lists the PCT ID and equivalence with Wyong, HCCREMS and LHCCREMS identification.

- *Smooth-barked Apple - Turpentine - Blackbutt open forest on ranges of the Central Coast*

Open forest in the sandstone ranges of the Central coast hinterland at lower elevations. Mixed canopy include *Angophora floribunda*, *Syncarpia glomulifera*, *Eucalyptus pilularis* and *Allocasuarina torulosa*. The shrubby understorey is usually comprised of a range of species including *Persoonia linearis*, *P. levis*, *Gompholobium latifolium* and *Cissus hypoglauca*. Grasses, ferns and graminoids dominate the ground layer, including *Entolasia stricta*, *Imperata cylindrical*, *Themeda australis* and *Dianella caerulea*. Forbs including *Pomax umbellata* and *Pratia purpurascens* can be sparsely located.

- *Spotted Gum-Red Ironbark-Grey Gum-shrub-grass open forest of the Lower Hunter.*

Open forests with a canopy dominated by *Corymbia maculata* in association with *E. fibrosa* and *E. punctata*. An open shrub layer may be present and include *Daviesia ulicifolia* and *Bursaria spinosa* along with sparse climbers including *Glycine clandestina* and *Hardenbergia violacea*. The ground layer in characteristically grassy and may include a diverse range of grasses, in particular *Entolasia stricta*, *Themeda australis*, *Microlaena stipoides* and *Rhytidosperma pallidum*. Various herbs such as *Pratia purpurascens* and *Pomax umbellata* along with ground ferns, predominately *Cheilanthes sieberi*, are also typically present. Commonly recorded weeds in this community included *Senecio madagascariensis* (Fireweed). This community occurs within the study area and its main occurrence is in the lower Hunter Valley. This community is potentially included within the LHSGIF EEC.

- *Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands*

Open forests characterised by *Angophora costata* and *Corymbia gummifera* often in association with *Eucalyptus capitellata*. A mid storey of taller shrubs or small trees is often present and includes *Allocasuarina littoralis*, *Banksia spinulosa* and *Leptospermum polygalifolium*. The understorey is typically shrubby and commonly includes smaller shrubs such as *Phyllanthus hirtellus*, *Persoonia levis*, *Persoonia linearis* and *Epacris pulchella*, the grass tree *Xanthorrhoea latifolia* and scrambling climbers such as *Billardiera scandens* and *Hardenbergia violacea*. The ground layer is typically dominated by grasses, mainly *Entolasia stricta* and *Themeda australis* as well as *Aristida vagans*, *Panicum simile* and *Imperata cylindrica*. Grass like plants such as *Lomandra obliqua*, *Lepidosperma laterale* and *Dianella caerulea* may also be common and abundant along with sparse herbs such as *Gonocarpus tetragynus*, *Pratia purpurascens* and *Goodenia heterophylla*. No commonly recorded weed species were recorded in more than 25 per cent of sites in this community. Within the study area this community occurs on the coastal lowlands and low ranges of the lower North Coast and Central Coast on a range of substrates including sandstones conglomerates and siltstones. This community may be of particular conservation significance regionally due to the recorded presence of the rare orchid *Acianthus amplexicaulis* which is not recorded in any other community in this study.

- *Smooth-barked Apple open forest on coastal lowlands of the Central Coast*

Open forests characterised by *Angophora costata* often co-dominant with *Eucalyptus pilularis* and less commonly with other eucalypts including *E. piperita* and *E. globoidea*. An open mid storey characterised by *Allocasuarina torulosa* and often including *Clerodendrum tomentosum* is typically present. The understorey is typically shrubby and commonly includes *Polyscias sambucifolia*, *Breynia oblongifolia*, *Notelaea longifolia*, *Acacia longifolia* and *Dodonaea triquetra* along with scrambling climbers such as *Eustrephus latifolius*, *Clematis aristata* and *Hibbertia dentata*. The ground layer typically consists a mixture of grasses, predominately *Oplismenus aemulus*, *Entolasia marginata*, *Imperata cylindrica*, *Poa affinis* and *Echinopogon ovatus*, grass like plants including *Lomandra longifolia* and *Lepidosperma neesii* and ground ferns, mainly including *Adiantum aethiopicum* and *Pteridium esculentum*. Various small herbs may also be commonly present including *Pratia purpurascens* and *Dichondra repens*. Commonly recorded weed species in this community included *Lantana camara* and *Chrysanthemoides monilifera subsp. rotundata*. Within the study area this community occurs on coastal lowlands of the Central Coast in the Macquarie/ Tuggerah Lakes area.

- *Paperbarks - Woollybutt swamp forest on coastal lowlands of the Central Coast*

Open swamp forests with an overstorey characterised by *Eucalyptus longifolia* and with a dense mid storey of tall shrubs dominated by paperbarks, including *Melaleuca linariifolia*, *M. sieberi*, *M. ericifolia* and *M. nodosa*. A range of smaller shrubs is also common in the understorey including *Pultenaea villosa*, *Leptospermum juniperinum*, *Acacia longifolia*, *Melaleuca thymifolia* and the grass tree *Xanthorrhoea fulva*. The climber *Parsonsia straminea* is also a common component. The ground layer is typically dominated by sedges and other graminoids and grasses, commonly including *Schoenus brevifolius*, *Chorizandra cymbaria*, *Gahnia clarkei*, *Lomandra longifolia*, *Entolasia stricta*, *Hemarthria uncinata* and *Pseudoraphis paradoxa*. Common forbs include *Gonocarpus tetragynus* and *Centella asiatica*. No commonly recorded weed species were recorded at more than 25 per cent of sites in this community. Within the study area this community occurs on sands and sandstones on poorly drained sites on coastal lowlands of the Central Coast.

- *Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast*

Open swamp forest with a canopy dominated by *Melaleuca quinquenervia* and can include *Casuarina glauca* and *Eucalyptus robusta*. The shrub layer is open and includes *Acacia longifolia*, *Glochidion ferdinandi* and the climber *Parsonsia straminea*. The ground layer is wet and dominated by sedges, other graminoides and ground ferns. This community can contain threatened flora including *Clematis fawcettii*, *Maundia triglochinoides* and *Melaleuca biconvexa*. Within the study area this community occurs on alluvial sands and mud on floodplains and barrier sands of the Central Coast.

- *Alluvial Tall Moist Forest*

This forest has a well-developed canopy dominated by *Eucalyptus pilularis*, *Corymbia maculata* and *Eucalyptus saligna*, and sub-canopy dominated by *Melaleuca biconvexa* and *Melaleuca linariifolia. Gahnia clarkei* is often prominent in the understorey, along with a variety of sedges and herbs. This vegetation type is closely associated with major creek lines on the Wyong sub-coastal plain. This community is included within the RFEFCF EEC.

3.4.2 Locally significant vegetation communities – Wyong Shire

Nine vegetation communities of local significance for Wyong Shire were identified within the study area.

- **Narrabeen Coastal Blackbutt Shrubby Forest**

Equivalent Plant Community Type Identification (PCT ID): Smooth-barked Apple - Turpentine - Blackbutt open forest on ranges of the Central Coast.

Reason for local conservation significance: Highly restricted occurrence.

- **Narrabeen Dooralong Spotted Gum-Ironbark Forest**

Equivalent PCT ID: Spotted Gum - Red Ironbark - Grey Gum –shrub - grass open forest of the Lower Hunter.

Reason for local conservation significance: Poorly conserved in the region.

- **Narrabeen Buttonderry Footslopes Forest**

Equivalent PCT ID: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia healthy open forest of coastal lowlands.

Reason for local conservation significance: Restricted occurrence in the region and habitat for *Grevillea parviflora subsp parviflora.*

- **Narrabeen Coastal Sheltered Peppermint-Apple Forest**

Equivalent PCT ID: Smooth-barked Apple open forest on coastal lowlands of the Central Coast.

Reason for local conservation significance: Highly restricted occurrence.

- **Alluvial Woollybutt-Melaleuca Sedge Forest**

Equivalent PCT ID: Paperbarks - Woollybutt swamp forest on coastal lowlands of the Central Coast.

Reason for local conservation significance: Naturally restricted in the region and prone to agricultural development.

- **Coastal Sand Bangalay Paperbark Forest**

Equivalent PCT ID: Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast.

Reason for local conservation significance: Naturally restricted occurrence and highly modified.

- **Alluvial Redgum Footslopes Forest**

Reason for local conservation significance: Highly restricted and few undisturbed fragments remain.

- **Riverine Alluvial Gallery Rainforest-Moist Forest**

Reason for local conservation significance: Highly restricted and prone to weed invasion and agricultural development.

- **Alluvial Riparian Blackbutt Forest**

Reason for local conservation significance: Highly restricted and prone to edge effects and development.

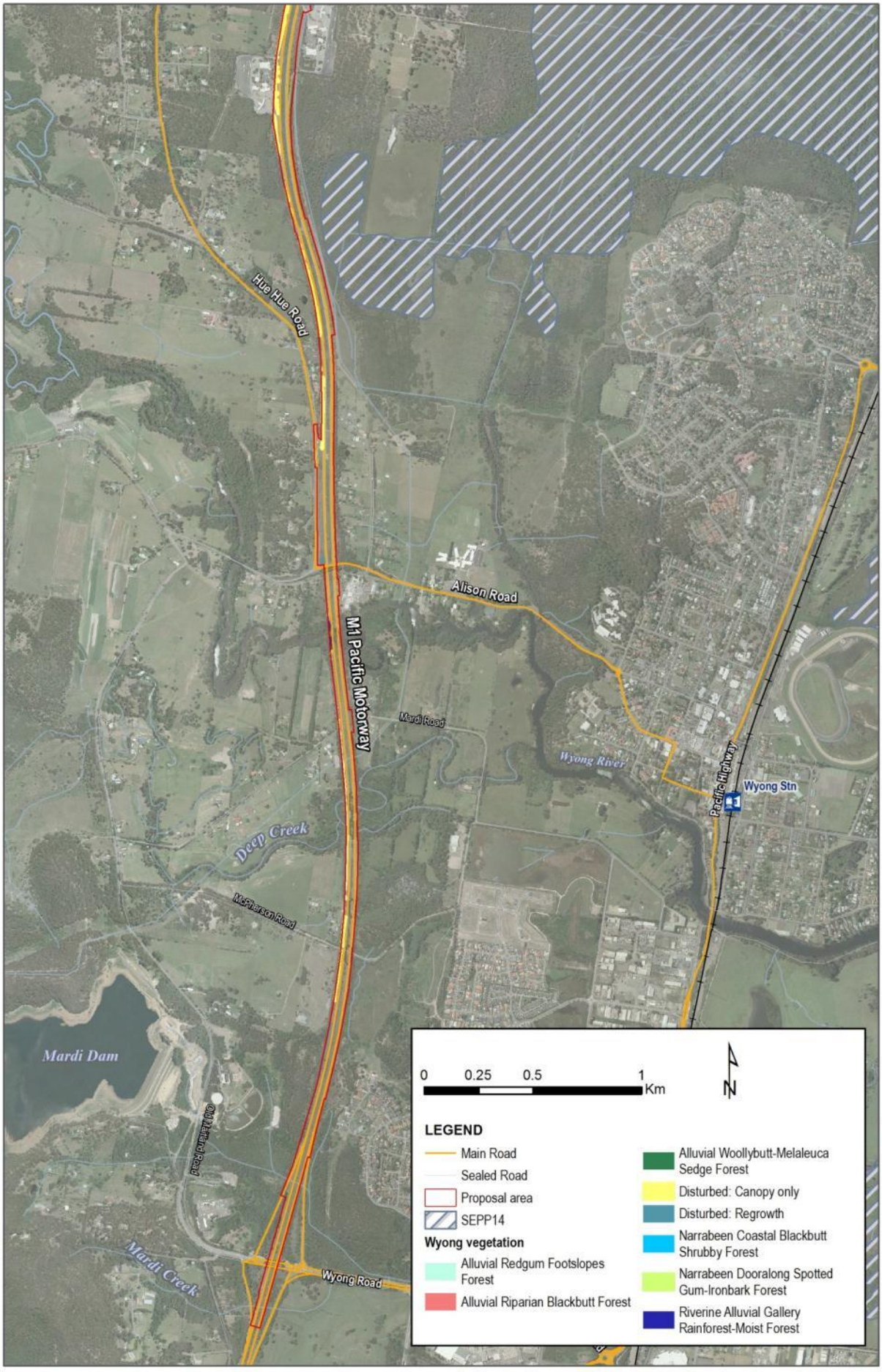


Figure 8 Aerial photograph with vegetation communities - southern

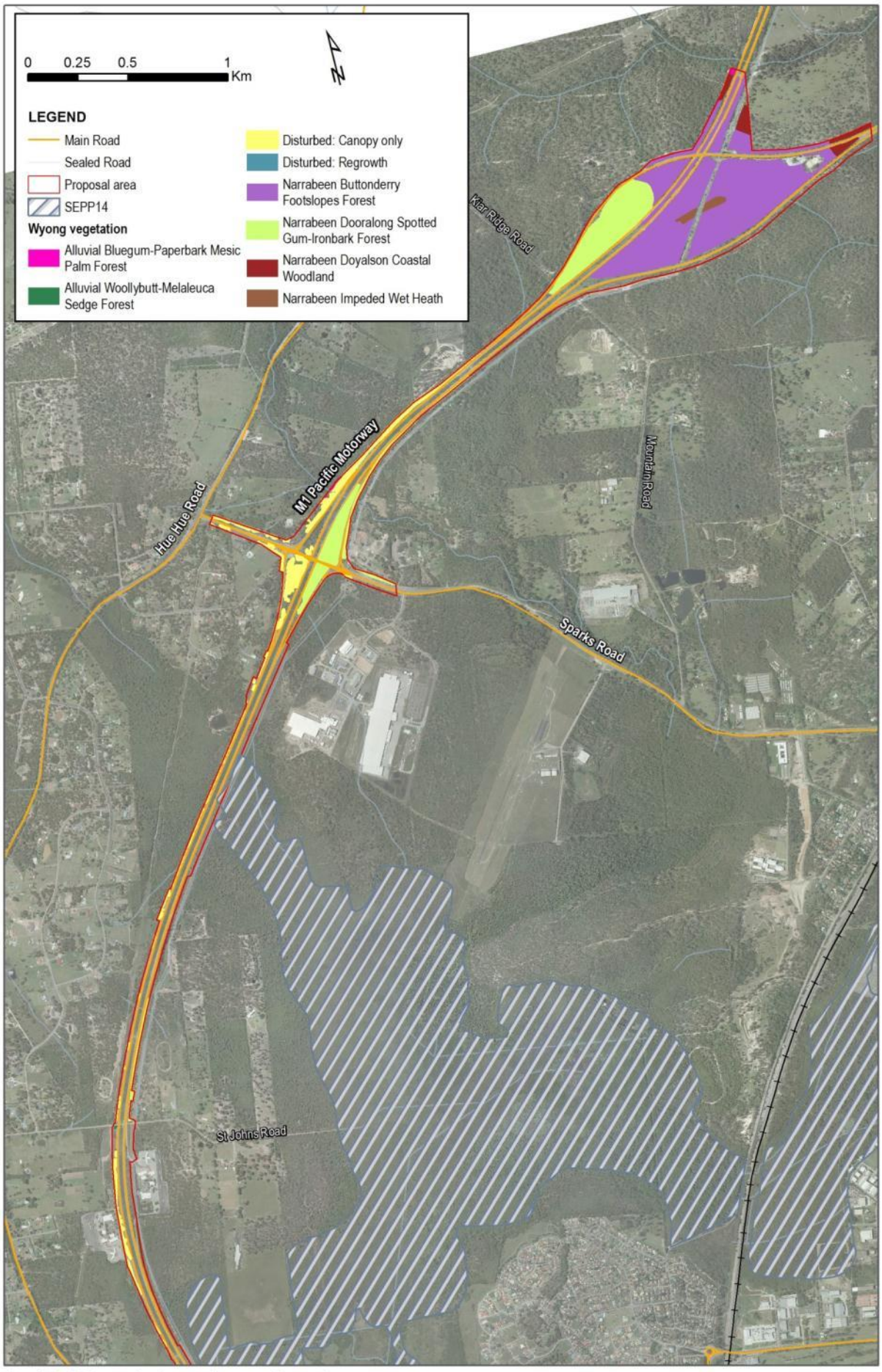


Figure 9 Aerial photograph with vegetation communities - northern

3.4.3 Threatened species

No threatened flora or fauna species were detected during the field surveys. However, reliable records of *Tetratheca juncea* are present within ESU 1c and *Grevillea parviflora subsp. parviflora* in ESU 3a, and habitat for a number of other flora and fauna species is present within the study area (OEH 2013). Potential Wallum Froglet habitat is present within site 3a, though is restricted to in and around water bodies on this site. The likelihood of occurrence of threatened flora and fauna species is further assessed in Appendix C and further discussed in Sections 5.1 and Section 3.4.4 below.

3.4.4 Threatened ecological communities

Three EECs listed under the TSC Act were identified within the study area (Figure 10):

- Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (SSFCF)

The SSFCF community has an open to dense tree layer of eucalypts and paperbarks, dominated in particular by *Eucalyptus robusta* (Swamp mahogany) and *Melaleuca quinquenervia* (Paperbark). Some remnants only have scattered trees as a result of partial clearing. There are less than 7,000 hectares of this community remaining in the Lower Hunter – Central Coast district. Although it is proposed that EECs are retained within the study area wherever possible, the proposal is likely to result in the clearing of approximately 1.12 hectares of SSFCF.

- River Flat Eucalypt Forest on Coastal Floodplains in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (RFEFCF)

The RFEFCF community is found on the river flats of coastal floodplains, with a tall open layer of eucalypts that can exceed 40 metres in height. There is less than 2,000 hectares remaining in the Lower Hunter region and its total distribution across the state represents less than 30 per cent of its original range. It is proposed that approximately 1.0 hectares of RFEFCF will be cleared within the study area.

- Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin Bioregion (LHSGIF).

This community is an open forest dominated by *Corymbia maculata* (Spotted gum) and *Eucalyptus fibrosa* (Red ironbark) found on Permian or Triassic Narrabeen group geology. It occurs mainly between Cessnock and Beresfield, but remnants may also occur elsewhere within the bioregion. The remaining distribution in the region represents less than 40 per cent of its original range. There has been some conjecture in recent years over the delineation of vegetation communities in the Lower Hunter and Central Coast regions that have canopy dominated by spotted gum and ironbark and their association with the NSW Scientific Committee determination for the EEC. However, a review of plot data for sites within the study area in relation to the determination and recent research in the locality (Bell, 2013) indicates strong similarities with the EEC. It is proposed that approximately 3.4 hectares of LHSGIF will be cleared within the study area.

3.4.5 Cleared or disturbed vegetation

Several sections of the study area have been cleared with almost all vegetation removed. Cleared areas usually have remnant trees, no mid storey and dominated by exotic grasses in the ground layer. Disturbed vegetation can be comprised of partially cleared remnants or areas with regrowth of native vegetation. Disturbed vegetation is often lower quality habitat than intact vegetation, with a more simplistic structure and less floristic diversity.

3.4.6 Weeds

Six exotic species within the study area are listed in NSW under the *Noxious Weeds Act 1993* as Schedule 4 and 5 noxious weeds in Wyong LGA (DPI, 2013b); *Pennisetum macrourum* (African feather grass), *Ageratina adenophora* (Crofton weed), *Asparagus asparagoides* (Bridal creeper) *Lantana camara* (Lantana), *Rubus fruticosus* (Blackberry) and *Cortaderia selloana* (Pampas grass). Lantana, Bridal creeper, Blackberry and *Senecio madagascariensis* (Fireweed) are also listed as WoNS (Australian Weeds Committee, 2012). Sites 2b, 3b, 10, 11 and 12 had noxious weeds present.

3.4.7 State Environmental Planning Policy 44 (SEPP 44) - Potential koala habitat

Potential koala habitat is defined by the SEPP as 'areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15 per cent of the total number of trees in the upper and lower strata of the tree component'.

In Wyong LGA koala habitat is defined as any area that has at least 15 per cent of trees in the upper and lower strata comprised of *Eucalyptus tereticornis* (Forest red gum), *Eucalyptus microcorys* (Tallowwood), *Eucalyptus punctata* (Grey gum), *Eucalyptus haemastoma* (Broad leaved scribbly gum) and *Eucalyptus robusta* (Swamp mahogany). Most koala habitat on the Central Coast has been cleared, and the remaining habitat is highly fragmented and disjunct (DECC, 2008a).

Potential koala habitat was recorded within the study area. Two eucalypt species listed as a koala feed tree under Schedule 2 of SEPP 44 were recorded within the study area, *Eucalyptus robusta* (Swamp Mahogany) and *E. punctata* (Grey Gum). *E. robusta* comprised 15 per cent of vegetation at Sparks Road (Site 3a) and Hue Hue Road (Site 7c) (Figure 11). Mitigation measures have been recommended to retain the potential koala habitat on these potential ancillary sites. *E. punctata* was present at Doyalson Road Interchange West, but it did not comprise 15 per cent of the canopy, so is not considered potential koala habitat according to SEPP 44.

3.4.8 State Environmental Planning Policy 14 (SEPP 14) – Coastal Wetlands

SEPP 14 aims to ensure that coastal wetlands are protected and preserved in the environmental and economic interests of the State. There is a SEPP 14 designated wetland (Porter's Wetland) located immediately east of the motorway, south of the Warnervale interchange. P&E mapping shows an area of mapped SEPP 14 wetland extending onto a section of the southbound motorway carriage at around Ch. 92000. It has been concluded that this is an inconsistency in the mapping, due to the timing and scale at which the SEPP 14 mapping was conducted. The Paperbark Swamp vegetation adjacent to the roadside is within two to three metres from the road shoulder of the northbound lanes and at least 10 metres from the road shoulder of the southbound lanes, outside the proposal area. The proposed work in the vicinity of the SEPP 14 wetland would comprise replacement of the existing pavement, an activity which is an activity permissible without consent, therefore permission from local council or the Director-General of P&E is not required.

Further detail on the statutory requirements relating to SEPP 14 is provided in the REF.

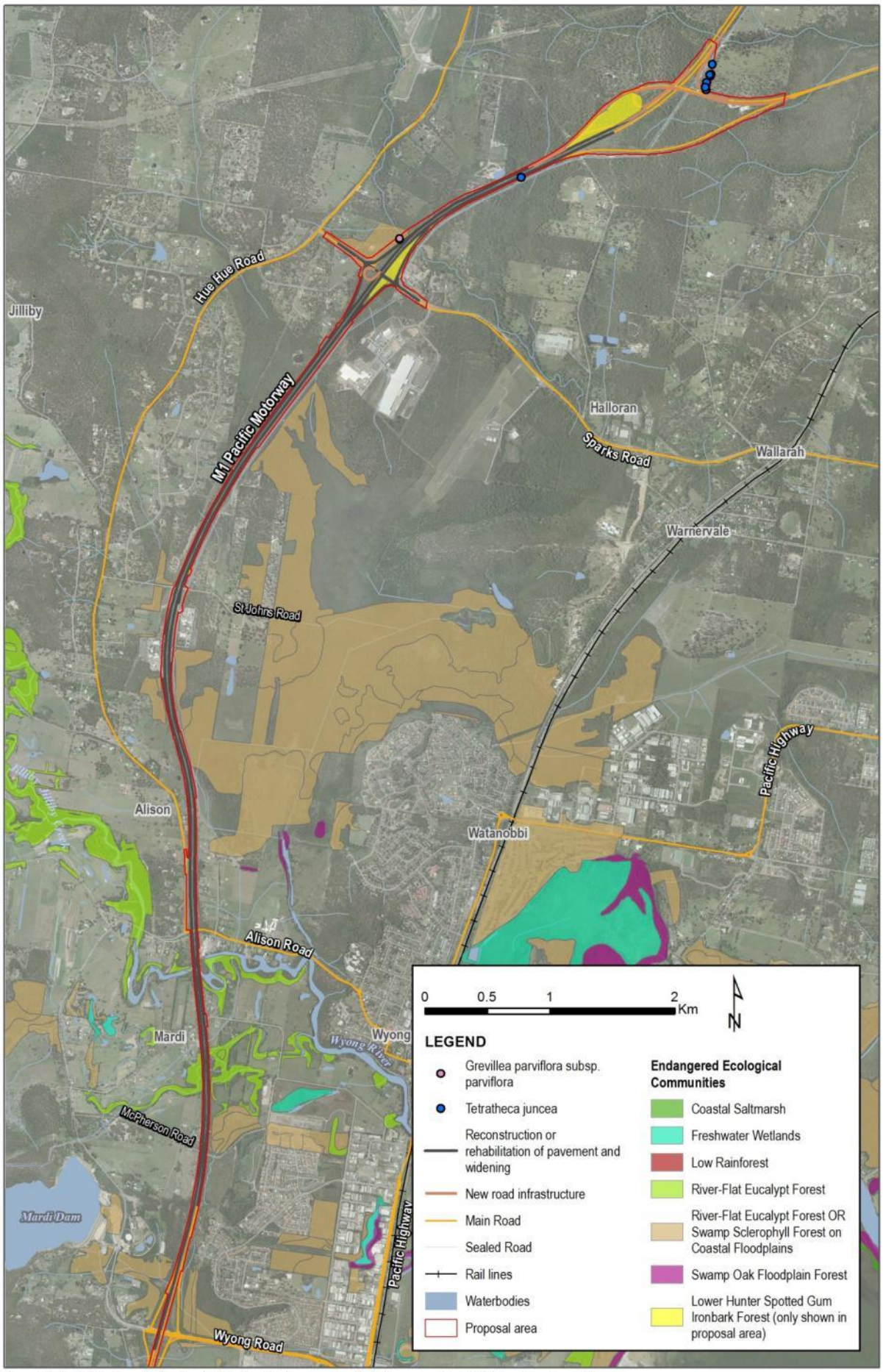


Figure 10 Aerial photograph showing distribution of endangered ecological communities (EECs) and threatened flora

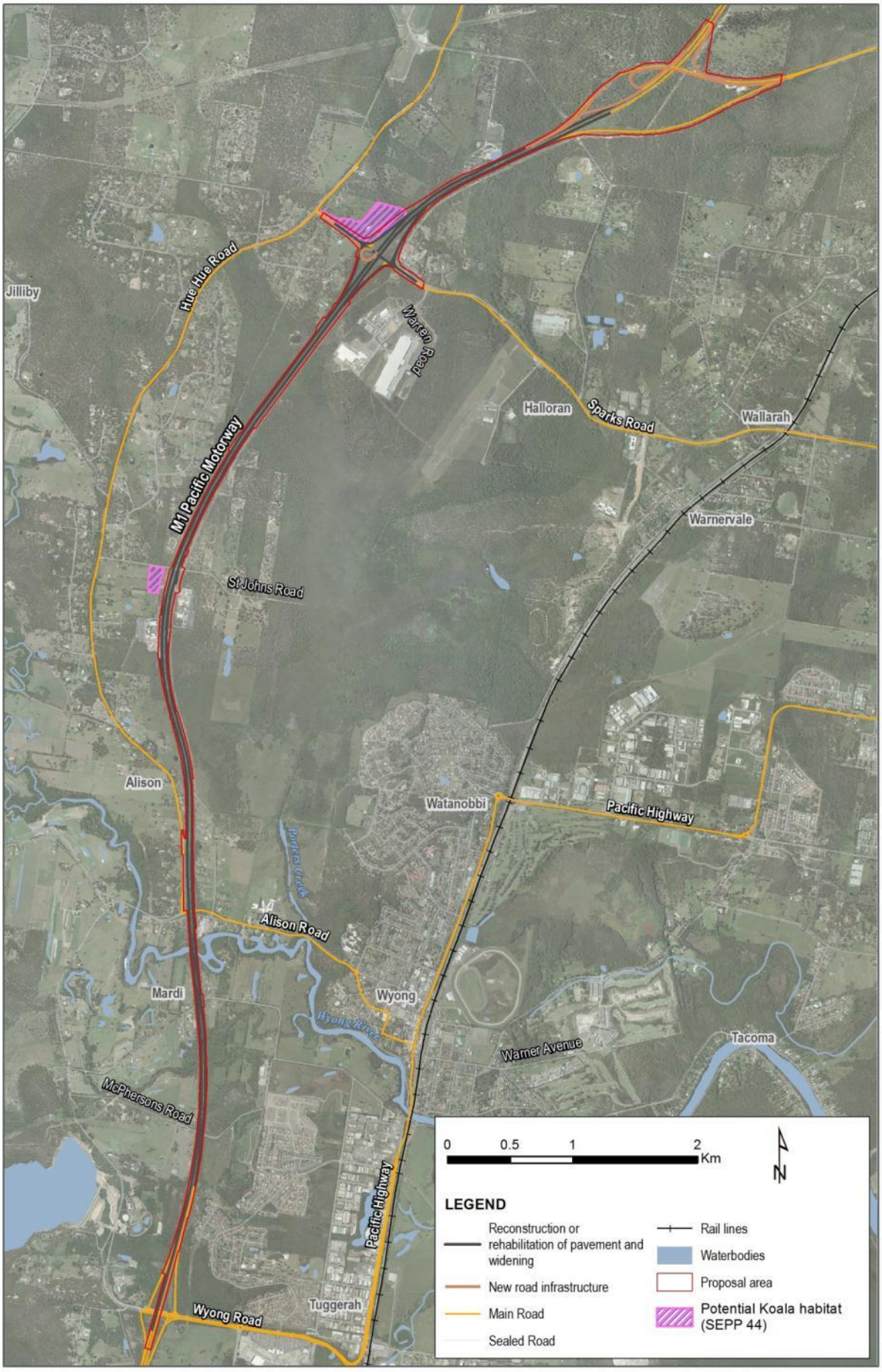


Figure 11 Potential Koala habitat

4 IMPACT ASSESSMENT

This section of the biodiversity specialist report outlines the potential impacts of the road widening on the ecological value of the study area. A large proportion of potential impacts can be mitigated to reduce the adverse effects the proposal would have on species and ecological communities within the study area.

4.1 Key threatening processes

The following ten key threatening processes (KTPs) which are listed on the schedule of the TSC Act are considered relevant to all proposal elements of the M1 replacement and widening are:

- Clearing of native vegetation.
- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis.
- Invasion and establishment of exotic vines and scramblers.
- Invasion by native plant communities by exotic perennial grasses.
- Invasion, establishment and spread on Lantana (*Lantana camara* L. *sens. lat*).
- Loss of hollow-bearing trees.
- Predation by the European Red Fox *Vulpes vulpes* (Linnaeus 1758).
- Removal of dead wood and dead trees.
- Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae.

Mitigation measures have been proposed in Section 4.4 to reduce the likelihood of exacerbating these KTPs.

4.2 Potential impacts

4.2.1 Loss of vegetation/habitat

The proposed road widening would potentially result in the clearing of approximately 18 hectares of native vegetation, including 5.5 hectares of EEC, ranging in quality from highly disturbed to good condition both within the motorway central median, the motorway shoulders and the around the interchanges. Clearing of mature remnant trees is not proposed to occur on ancillary sites. Within these sites previously cleared areas would be utilised as a first priority.

Table 2: Summary of vegetation affected by the proposal

Vegetation community (Bell 2008)	TSC Act	EPBC Act	Area to be cleared[1]	Locality (10km)[2]
Alluvial Bluegum-Paperbark Mesic Palm Forest	Yes (RFEFCF)	No	0.02 ha	1751 ha
Alluvial Redgum Footslopes	Yes (RFEFCF)	No	0.66 ha	2642 ha

Vegetation community (Bell 2008)	TSC Act	EPBC Act	Area to be cleared[1]	Locality (10km)[2]
Forest				
Alluvial Woollybutt-Melaleuca Sedge Forest	Yes (1.12ha SSFCF, 0.33ha RFEFCF)	No	1.45 ha	2642 ha
Narrabeen Buttonderry Footslopes Forest	No	No	4.43 ha	6487 ha
Narrabeen Coastal Blackbutt Shrubby Forest	No	No	0.34 ha	897 ha
Narrabeen Dooralong Spotted Gum Ironbark Forest	Yes (3.4ha LHSGIF)	No	4.6 ha	507
Narrabeen Doyalson Coastal Woodland	No	No	0.41 ha	1722 ha
Disturbed (canopy only)	-	-	5.64 ha	-
Disturbed (regrowth)	-	-	0.25 ha	-

1 Area to be cleared based on design footprint within the study area.

2 Based on mapped extent within 10km radius (NPWS 2000).

The proposed clearing of vegetation will result in the loss or degradation of habitat including:

- Loss of structural diversity suitable to provide nesting, breeding and nutritional resources to a range of fauna species known to occur, or could potentially occur within the study area.
- Loss of mature trees (i.e. hollow bearing trees) important for a number of hollow-dependent fauna species with potential to occur within the study area including; *Calyptorhynchus lathami* (Glossy black-cockatoo), *Ninox strenuus* (Powerful owl), *Tyto novaehollandiae* (Masked owl), *Falsistrellus tasmaniensis* (Eastern false pipistrelle), *Miniopterus australis* (Little Bentwing-bat), *Petaurus norfolcensis* (Squirrel glider).
- Loss of mature trees with small hollows suitable for nesting or breeding by threatened species with potential to occur in the study area including *Glossopsitta pusilla* (Little lorikeet).
- Clearing of plant communities with local, regional and state conservation significance (including three EECs) that either have restricted ranges or contain threatened species.
- Loss of potential koala habitat.

4.2.2 Hollow-bearing trees

The proposal would result in the removal of hollow-bearing trees from several ESUs. Estimates of the number of hollows removed for each ESU is included in Table 3.

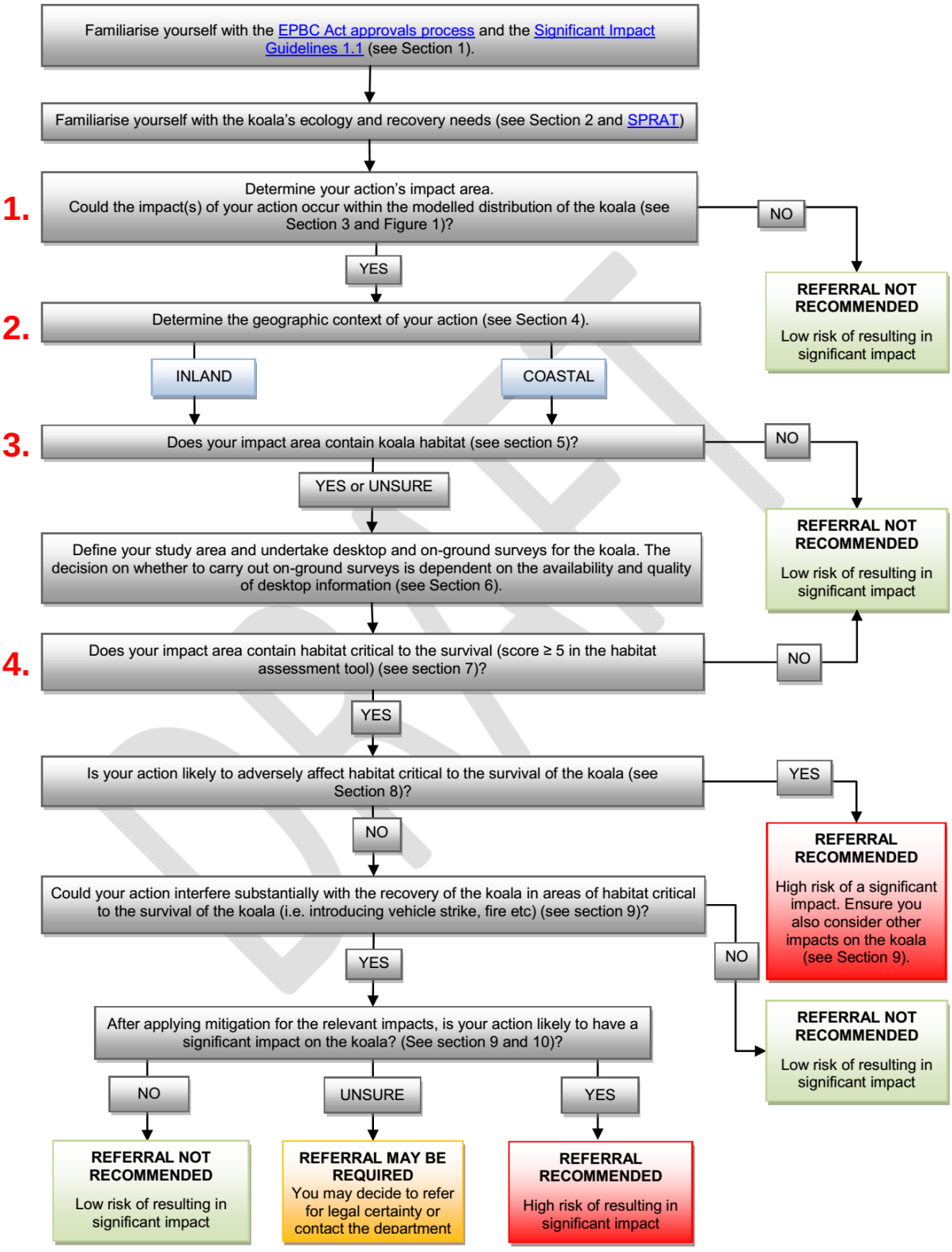
Table 3: Hollow bearing trees present within the proposal

Site	Size	Estimated number of hollows
Doyalson Road Interchange East (Site 1)	11 ha	Several small and large hollows present
Doyalson Road Interchange (Site 2a)	8 ha	Several small and large hollows present
Doyalson Road Interchange (Site 2a)	2.6 ha	None
Sparks Road (Site 3a)	8.8 ha	Multiple large hollows
Sparks Road (Site 3b)	6.9 ha	Mature remnant trees scattered throughout the site with multiple large hollows
Warren Road (Site 4a and 4b)	2.9 ha	Approximately 10 hollows
Warnervale Airport (Site 5)	5.2 ha	None
Warnervale Airport (Site 6)	4.7 ha	None
Hue Hue Road (Site 7a)	0.2 ha	None
Hue Hue Road (Site 7b)	9.6 ha	Few small hollows (<10 cm diameter)
Hue Hue Road (Site 7c)	1.8 ha	None
Hue Hue Road (Site 7d)	6.0 ha	None
Hue Hue Road (Site 7e)	0.1 ha	None
Alison Road/Hue Hue Road verge (Site 8a)	0.4 ha	None
Alison Road/Hue Hue Road verge (Site 8b)	0.1 ha	Few small hollows (<10 cm diameter) in one tree
McPherson Road (Site 9)	9.4 ha	None
Wyong Road/M1 (Site 10)	6.3 ha	None
Wyong Road off ramp (Site 11)	2.1 ha	No large hollows visible, though some small hollows possible
Deep Creek (Site 12b)	n/a	Potential for few small hollows
Wyong River (Site 12c)	n/a	Potential for few small hollows

The nature of the ESUs likely to be affected by the proposal means that the number of hollows to be affected differs throughout. As can be seen however, most sites contain either no hollows, or very few small hollows. On this basis and within the context of nearby available habitat the overall number and nature of hollows to be removed is not considered to be significant.

4.2.3 Draft EPBC Act referral guidelines for the vulnerable koala

In December 2013 the Commonwealth Department of Environment replaced the Interim koala referral advice for proponents (DoE 2012) with the Draft EPBC Act referral guidelines for the vulnerable koala (Doe 2013). These guidelines provide specific advice to proponents in view of providing additional protection for the koala over and above that granted by the EPBC Act generally. These guidelines set out a process in which the need for referral of the project to the Commonwealth is specified according to the location and habitat attributes of the development site. This process is illustrated in below.



The flowchart process was undertaken in order to assess the potential for a significant impact upon the koala or its habitat. The following processes reflect the steps numbered in the figure above.

1. Could the impact(s) of your action occur within the modelled distribution of the koala?

   The study area is within the area mapped as 'Known/Likely to occur'.

2. Determine the geographic context of your action

The study area is within the coastal area.

3. Does your impact area contain koala habitat?

   The draft EPBC Act referral guidelines for the vulnerable koala (DoE 2013) state that: "*For the purposes of these guidelines, koala habitat is defined as any forest or woodland containing species that are known koala food trees or shrubland with emergent food trees. This can include remnant or non-remnant vegetation in natural, agricultural and urban environments. koala habitat is defined based on the plant community present and the vegetation structure; the koala does not necessarily have to be present.*"

   Based on the above definition and the plant species detected during surveys (*Eucalyptus robusta* and *E. resinifera*, listed as primary and secondary food trees respectively in the Hunter–Central Rivers CMA) the study area may be considered to contain koala habitat.

4. Does your impact area contain habitat critical to the survival of the koala (score ≥ 5 in the habitat assessment tool)?

   The draft EPBC Act referral guidelines for the vulnerable koala (DoE 2013) provide a tool whereby a site may be assessed for it's potential to be considered habitat critical to the koala. This tool is provided in Table 4 below, with the relevant answers highlighted in blue.

Table 4: EPBC koala guidelines habitat assessment scoring

Attribute	Score	Inland	Coastal
koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	Evidence of one or more koalas within the last 2 years.
	+1 (medium)	Evidence of one or more koalas within 5 km of the edge of the impact area within the last 10 years.	Evidence of one or more koalas within 5 km of the edge of the impact area within the last 5 years.
	0 (low)	None of the above.	None of the above.
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species in the canopy.	Has forest or woodland with 2 or more known koala food tree species in the canopy.
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present in the canopy.	Has forest or woodland with only 1 species of known koala food tree present in the canopy.
	0 (low)	None of the above.	None of the above.
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	Area is part of a contiguous landscape ≥ 500 ha.
	+1 (medium)	Area is part of a contiguous landscape < 1000 ha, but ≥ 500 ha.	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha.
	0 (low)	None of the above	None of the above.

Attribute	Score	Inland	Coastal
Key existing threats	+2 (low)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence.	
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence.	
	0 (high)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, or Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context.	
	+1 (medium)	Uncertainty exists as to whether the habitat is important for achieving the interim recovery objectives for the relevant context.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context.	

As indicated in the table above, the overall score for critical koala habitat was four. As such a referral to the DoE is not recommended.

4.2.4 State Environmental Planning Policy 44 (SEPP 44) – koala habitat protection

SEPP 44 concerns the protection of koala habitat through proper conservation and management of areas of natural vegetation that provide habitat for the species. The policy seeks to define areas according to their habitat value, dividing koala habitat into 'potential' and 'core' habitat.

Potential kola habitat is defined by areas of native vegetation where the trees of the types listed in Schedule 2 of the policy constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. Core koala habitat is defined by the SEPP as 'an area of land with a resident population of koalas, evidenced by attributes such as breeding females'. The likelihood of the presence of potential or core koala habitat is determined by an assessment of the presence of koala food trees present on the site by an appropriately qualified professional.

A desktop assessment of Wildlife Atlas records showed that koalas had been recorded only seven times within a 10 km area containing the study since 1916, with the most recent of these records being 2003 and 2007. As there have been no recent records in the area it was determined that the study area was not likely to support a resident population and detailed koala searches were therefore not required. A habitat survey for the koala was however undertaken as part of the flora and fauna assessment.

During the koala habitat survey no individuals, or characteristic scratching or scats, were identified. Despite having potential to occur, there is no evidence to suggest a resident koala population exists within the study area.

It has been concluded that there is no core koala habitat located within the study area and the proposal is unlikely to have an impact on core koala habitat.

One eucalypt species listed as a koala feed tree under Schedule 2 of SEPP 44, *Eucalyptus robusta* (Swamp Mahogany), was recorded as comprising 15 per cent of vegetation at Sparks Road (Site 3a) and Hue Hue Road (Site 7c). Therefore, in accordance with SEPP 44, these sections of the study area are considered to contain

potential koala habitat. As such, it is recommended that no remnant eucalyptus species are disturbed within these ESUs.

4.2.5 State Environmental Planning Policy 14 (SEPP 14) – Coastal wetlands

As stated in Section 0 the area of the motorway corridor around Ch. 92000 has been groundtruthed and the SEPP 14 wetlands are located adjacent to, not within the road corridor. The construction activities in this location would comprise replacement of the existing asset and no additional ground disturbance is proposed. Nevertheless, construction activities adjacent to the SEPP 14 wetlands, through the section between Ch. 93160 and 92700, have the potential to affect the wetlands if not managed properly through activities such as inappropriate vehicle access, sedimentation and water run-off. The replacement works would include four existing drainage outlets which are in place for road drainage only and are not connected to any existing natural drainage channels. The drainage outlets dissipate into the roadside verge.

4.2.6 Wildlife connectivity and habitat fragmentation

Within the study area, there are valuable areas of vegetation including EECs, remnant vegetation and riparian vegetation which form part of ecological corridors in the region (Figure 12). The majority of this habitat runs parallel with the motorway and will be largely unaffected by the road widening if indirect impacts are managed, including water quality and erosion.

The existing M1 is a permanent barrier for connectivity and dispersion for a number of ground dwelling and arboreal species. However connectivity still exists in some areas, as vegetation in the median may act as a refuge for fauna dispersing or moving across the motorway and existing box culverts running underneath the motorway may support some cross highway movement. In addition the motorway crosses ecological corridors of riparian vegetation via a series of elevated bridges which allows for vegetation connectivity and for east-west movement of fauna across the study area.

The proposal would remove vegetation in the median which may be a further barrier to movement for some species that may occasionally use the median as a refuge for movement across the motorway. However, as the proposal does not require major alterations to the bridge structures, works within waterways, or alteration to waterway crossings, the proposal is unlikely to impact the existing riparian corridors.

4.2.7 Injury and mortality of wildlife

Habitat clearing in close proximity to the motorway and associated roads may lead to incidences of fauna injury or mortality through interactions with vehicles. Removal of fauna habitat trees and reduction in habitat quality may also result in injury or mortality to wildlife.

4.2.8 Weeds

Weed species identified within the study area, particularly noxious weed species and weeds of national significance may spread throughout the study area and adjacent sites as a result of vegetation disturbance through habitat removal or increased human activity.

4.2.9 Pests and pathogens

Two invasive mammals were detected within the study area; European fox and Rabbit. Habitat disturbance, land clearing and a reduction in structural diversity of vegetation aid the spread of these pest species.

Development activities associated with this proposal potentially risk introducing or spreading diseases such as amphibian chytrid fungus to the study area. As such a precautionary approach to manage disease (and weeds) should be taken.

Although vegetation in the study area did not appear to be obviously affected by Myrtle rust, the proposal area is potentially contaminated. DPI has mapped Wyong Shire as a 'red' management zone, where the fungus is considered to be widely distributed. Myrtle rusts are serious pathogens which affect plants belonging to the family Myrtaceae including Australian natives like bottle brush (*Callistemon* spp.), tea tree (*Melaleuca* spp.) and eucalypts (*Eucalyptus* spp.). These occur in the proposal area. Infection of native plants by Myrtle rust can indirectly affect threatened fauna species through the loss of cover, food resources and nesting habitat.

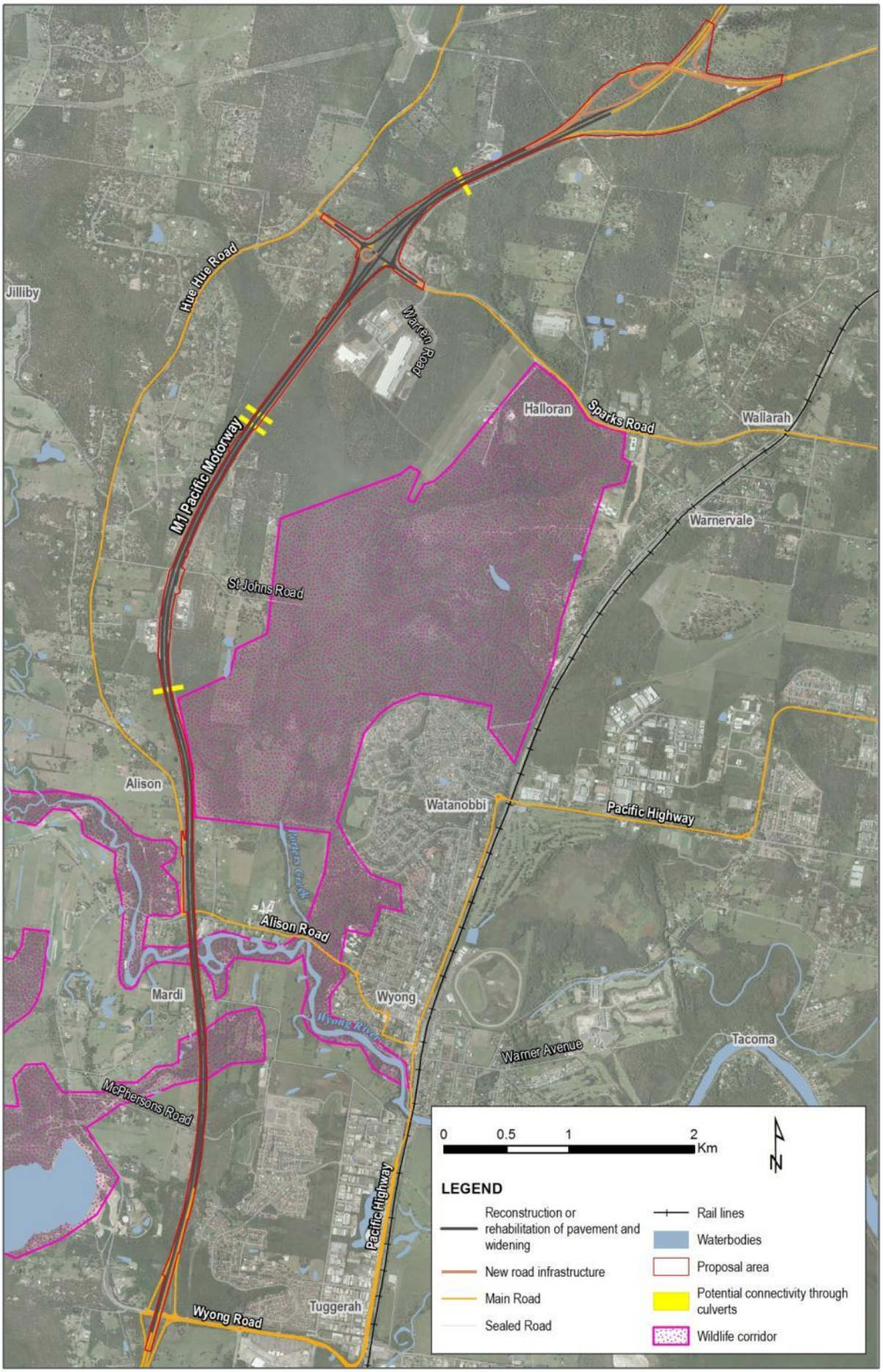


Figure 12 Aerial photograph showing the wildlife connectivity and corridors

4.3 Proposal elements

4.3.1 Ancillary sites

Clearing of mature remnant trees is not proposed to occur on ancillary sites. Within these sites previously cleared areas would be utilised as a first priority. On some sites some native vegetation remains such as an area of SSFCF EEC within the Hue Hue Road site (Site 7a). Vegetation at such sites would be protected from disturbance during construction.

Sites with low quality habitat and disturbed vegetation are suitable for use as potential ancillary and stockpile sites if the proposed mitigation measures are adopted. These sites are: Site 3b (Sparks Road), Site 4c (Warren Road), Site 5 and 6 (Warnervale Airport), Site 7b and 7d (Hue Hue Road,) and Site 9 (McPherson Road).

This study has demonstrated that high quality habitat and remnant vegetation exist within areas that were investigated as potential ancillary sites. In particular, areas containing EECs, locally significant vegetation communities and potential koala habitat were identified within the potential ancillary sites. The nominated sites are quite large, and it would be possible to accommodate the proposed ancillary activities on a portion of the site in each location, excluding the sensitive areas from any activity. It is recommended that these sites are to remain intact: Site 3a (Sparks Road), Site 7a, Site 7c and Site 7e (Hue Hue Road).

Potential impacts to the proposed ancillary sites include; the loss of vegetation/habitat, the loss of potential koala habitat and the spread of weeds, pests and pathogens as a result of mechanical clearing, vehicle movements between sites and disposal of debris.

4.3.2 Road side verge - road widening

Due to safety constraints and access limitations it was not possible to perform detailed survey of the motorway corridor. However, the flora surveys conducted in May and June 2013 allowed existing Wyong Shire mapping (Bell, 2008) to be validated. This provided a high level of confidence in the plant communities identified through the mapping.

The majority of the motorway corridor is cleared within 5-10 metres of the motorway, but does change continuously throughout the study area. Roadside vegetation connects with ecological corridors of the region, in particular at river crossings, where riparian vegetation consists of good quality habitat connected on either side of the motorway by the vegetation beneath and between the bridge structures.

The proposed motorway widening would result in loss of a limited amount of vegetation located within the road corridor. However riparian vegetation would not be disturbed due to the retention of bridge structures in the proposal design. This riparian vegetation contains good quality habitat that may act as a wildlife corridor for Squirrel gliders and other fauna species.

Potential impacts due to the proposed motorway widening include; the loss of vegetation/habitat, fauna injury or mortality and the spread of weeds, pests and pathogens as a result of mechanical clearing, vehicle movements between sites and disposal of debris.

4.3.3 Central median - road widening

The existing motorway is a barrier to most fauna movement. The vegetation in the median potentially facilitates the movement of gliders and some bird and bat species. The M1

widening would result in loss of all vegetation within the existing median strip of the motorway. However bird and bat species are mobile and unlikely to be impeded by the extended road width. There is a lack of canopy trees in the median, with the majority of trees immature, and therefore not high enough, to provide suitable gliding opportunities to safely facilitate movement of gliders. The notable exception is the riparian vegetation, between and underneath bridges that contain good quality habitat that may act as a wildlife corridor for squirrel gliders and other fauna moving across the motorway. These sections of habitat would be retained and the bridge structures to be kept intact. Most of the vegetation to be removed is highly disturbed and weed infested and is comprised of low quality habitat.

Potential impacts due to clearing of the median strip include; the loss of vegetation/habitat, loss of refuge for fauna moving across the roadway, increased fauna injury or mortality, and the spread of weeds, pests and pathogens resulting from removal, transportation and disposal of vegetation and soil.

4.3.4 Motorway interchange and intersection works

Potential impacts due to clearing to facilitate motorway interchange and intersection works include; the loss of vegetation/habitat, restricted wildlife movements and loss of wildlife corridor connectivity, fauna injury or mortality, and the spread of weeds, pests and pathogens as a result of mechanical clearing, vehicle movements between sites and disposal of debris.

A number of new ramps are proposed within areas of remnant vegetation, including locally significant communities. Mitigation measures have been recommended to minimise impacts to native flora and fauna and offset the loss of vegetation.

Dry Sclerophyll Forest Vegetation at Doyalson Road Interchange West (Site 2) would be partially cleared for an interchange upgrade. This would result in the loss of approximately 2.7 hectares of moderate to good quality Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the Lower Hunter. This vegetation community is considered to meet the definition of Lower Hunter Spotted Gum Ironbark Forest EEC. No threatened flora or fauna were identified within this area, however at Doyalson Road Interchange East (Site 1c) there are thought to be reliable records of the vulnerable *Tetratheca juncea* that should be confirmed during flowering season prior to construction (OEH 2013). The vegetation at Doyalson Road Interchange East (Site 1) is Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia healthy open forest of coastal lowlands.

The upgrade of the Sparks Road Interchange would result in the loss of about one hectare of previously disturbed dry sclerophyll forest vegetation including about 0.7 hectares of potential LHSGIF. There are thought to be reliable records of the vulnerable *Grevillea parviflora subsp. parviflora* (northbound) that should be confirmed during flowering season prior to construction (OEH 2013). Several mature potential hollow bearing trees are present within this area and should be retained where possible.

4.3.5 Drainage upgrades

Drainage for the current motorway occurs through several mechanisms. This includes natural creeks and rivers flowing beneath motorway bridges, transverse drainage lines crossing the motorway through box culverts or pipe culverts, longitudinal table drains within the median, longitudinal drains on the motorway verges and pavement drainage that collect and distribute stormwater in a network of pits and pipes.

No bridges will be affected by the proposal and as such no impacts would be predicted on the waterways beneath them. The aquatic environments of the waterways in the study area will therefore not be affected.

Transverse pipe culverts and box culverts allow flows from upstream catchments to be passed beneath the motorway. Three box culverts are to be replaced as part of the proposal however these three culverts are not situated within waterways or ephemeral creeks.

Pavement drainage and longitudinal drainage can cause impacts to habitat and to flora and fauna from the effects of scour, erosion or pollution. As part of the proposal the longitudinal drainage and pavement drainage will be extended and modified as part of the proposal. These modifications will occur nearby to sensitive areas including EECs and SEPP 14 wetlands. These modifications may temporarily generate additional sediment loads due to the disturbances of construction.

The additional pavement surface would generate negligible increases in discharge at each culvert. Therefore the existing flow regimes would remain unchanged at each culvert and there would be no increased risk of flooding, very low risk of increased erosion damage and very minor increases to the hydraulic flows experienced at downstream sensitive environments such as the SEPP 14 Porters Creek Wetland. No impacts on fish passage would result from the proposal.

The operation of the proposal would not affect any aquatic flora, fauna or their habitats. SEPP 14 wetlands and other areas of sensitive vegetation would not be adversely affected by the proposal.

4.4 Mitigation measures

In order to reduce the potential ecological impact of the M1 widening and replacement between Tuggerah and Doyalson the following mitigation measures have been proposed.

4.4.1 Pre-construction

Minimise risk to fauna in remnant vegetation to be removed/modified by the proposal:

- Temporary limit of work fencing is to be established.
- Exclusion zones (20 metres) are to be established around water bodies (including creeks and dams).
- Pre-clearing surveys are to be undertaken by a qualified ecologist in accordance with the Roads and Maritime *Biodiversity Guidelines* (RTA, 2011) for all areas outside of the central median. The surveys are to include checking for the presence of threatened flora and fauna species and habitat before clearing begins.
- A fauna relocation site would be identified prior to construction to release any uninjured fauna encountered on site.

Minimise loss of EECs to the proposed development activities:

- Where possible, vegetation that contains EECs present in the study area and adjacent sites is to be retained.
- Exclusion zones are to be established around EECs and the SEPP 14 wetlands, that are located either within or bordering the study area prior to commencement of construction.

Retention of threatened flora species:

- Surveys are to be undertaken in appropriate flowering season to confirm threatened plant records around the Doyalson Link Road Interchange, the Sparks Road Interchange and the road corridor between these two interchanges.
- Threatened flora present in the proposal area would be protected and retained where possible.
- If the proposal will have unavoidable impacts on individuals of *Tetratheca juncea,* translocation options should be considered in consultation with Roads and Maritime.

Maintenance of habitat corridor and wildlife connectivity:

- Maintain culverts as road crossing structures (Figure 12).
- Culverts would be designed to facilitate opportunistic fauna crossing under the M1 Motorway

Retention of native vegetation, habitat trees (including hollow bearing trees) and potential koala habitat during pre-construction:

- During detailed design consideration should be given to minimising, where possible, any vegetation clearance required as a result of the design. In particular, potential koala habitat should be avoided or the construction footprint locally minimised where avoidance cannot be achieved.
- During detailed design, construction access tracks, ancillary facilities and construction areas along the road verge should be sited to avoid or minimise disturbance of native vegetation where possible.
- Use existing tracks and previously cleared/disturbed land for ancillary facilities and temporary access tracks where possible.

Site specific environmental induction:

All staff working on site should undertake a site-specific environmental induction. The induction should include items such as:

- Sensitivity of surrounding vegetation (particularly EECs, remnant and riparian vegetation).
- Site environmental procedures (vegetation management, sediment and erosion control temporary protective fencing, threatened flora species, risk of myrtle rust and noxious weeds).
- What to do in case of emergency (chemical spills, fire or fauna encountered).
- Key contact in case of environmental incident.

Replace nest boxes removed during construction:

- Count the number of nest boxes to be affected by the proposal (Site 4a and 4b).
- Nest boxes located throughout Site 4a and 4b should be replaced in suitable adjacent remnant vegetation.

Biodiversity offsets

- Offsetting for impacts on EEC vegetation should be investigated in accordance with the Roads and Maritime *Guideline for Biodiversity Offsets* (RMS, 2011).

4.4.2 During construction

Staged habitat removal:

- Where possible, retain habitat trees and hollow bearing trees throughout the proposal area.
- If hollow bearing trees are unable to be retained (as in Site 2), an ecologist should be present on-site for staged habitat removal and hollow clearing and follow the Roads and Maritime *Biodiversity Guidelines – Guide 4 (Clearing of vegetation and removal of bush rock)* (RTA, 2011).

Minimise risk of establishment and spread of invasive species and disease due to the proposed development activities:

- Exclude the movement of vehicles, and human traffic into endangered ecological communities and SEPP 14 wetlands.
- The use of pesticides in weed control should be discouraged/minimised to reduce threat to fauna species.
- Implement inspection/maintenance procedures to reduce the carriage of weed material on machinery.
- Pathogens (e.g. Chytrid, Myrtle Rust and Phytophthora) are to be managed in accordance with the Roads and Maritime *Biodiversity Guidelines - Guide 7 (Pathogen Management)* (RTA, 2011), the DPI handout prepared for Myrtle rust response 2010–11: *Preventing spread of Myrtle Rust in bushland* or the OEH Interim management plan for Myrtle rust in bushland (2011) and *DECC Statement of Intent 1: Infection of native plants by Phytophthora cinnamomi* (for Phytophthora).
- Declared noxious weeds are to be managed according to requirements under the *Noxious Weeds Act 1993* and the Roads and Maritime *Biodiversity Guidelines - Guide 6 (Weed Management)* (RTA, 2011).

Flora and fauna encountered:

- If unexpected threatened fauna or flora species are discovered, stop works immediately and follow the Roads and Maritime Unexpected Threatened Species Finds Procedure in the Roads and Maritime *Biodiversity Guidelines – Guide 1 (Pre-clearing process)* (RTA, 2011).
- WIRES should be consulted if any injured fauna are encountered as outlined in site specific environmental inductions.
- Fauna handling must be carried out in accordance with the requirements the Roads and Maritime *Biodiversity Guidelines - Guide 9 (Fauna Handling)* (RTA, 2011).

Management of erosion and sediment control:

- A progressive erosion and sediment control plan is to be prepared for the works in accordance with plan outlined in the current *Managing Urban Storm Water: Soils and Construction* (Volume 1- Blue Book) (Landcom, 2004), Volume 2A (DECC, 2008b) and Volume 2D (DECC, 2008c) and Roads and Maritime specification “G38 Soil and Water Management”.

- Erosion and sediment control measures are to be implemented to prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, drain inlets or fauna habitat.
- Specific consideration of erosion and sediment controls should be made during construction to prevent any indirect impacts on adjacent SEPP 14 wetlands.
- Erosion and sedimentation controls are to be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.
- Erosion and sediment control measures are not to be removed until the works are complete and areas are stabilised.
- Rehabilitate disturbed areas as soon as practical, through progressive landscaping to stabilise bare areas and to take advantage of optimal growing conditions.

Retention of native vegetation, threatened flora, habitat trees (including hollow bearing trees) and potential koala habitat during construction:

- Temporary exclusion fencing should be installed at the site boundary for Site 6 to ensure adequate protection of the adjacent locally significant vegetation community.
- The dam on Site 7b, which may potentially contain frog or turtles, should be fenced off and excluded from the site to ensure fauna is not affected.
- Retain native vegetation, habitat trees and potential koala habitat where possible.
- Establish exclusion zones around remnant vegetation, threatened flora, habitat trees, water bodies and potential koala habitat prior to commencement of construction (Figure 13 and Figure 14).
- Vegetation that has been protected is not to be removed.
- If native vegetation must be removed, wood debris and any bush rock encountered should be stockpiled for later re-use or relocation in appropriate environments following the Roads and Maritime *Biodiversity Guidelines – Guide 4 (Clearing of vegetation and removal of bush rock)* (RTA, 2011).
- Avoid disturbance of native vegetation for construction of temporary access tracks to stockpile sites or for the establishment of temporary facilities.
- Use existing tracks and previously cleared/disturbed land for stockpile areas and temporary access tracks.

4.4.3 Post-construction

Re-establishment of any native vegetation disturbed or removed by the proposal:

- Revegetate or replant disturbed areas with native vegetation following construction.
- Plant vegetation from the existing plant community on cleared roadside adjacent to Site 4a and 4b to reduce the impact of clearing associated with the road upgrade at this location.
- Revegetation/replanting to follow the Roads and Maritime *Biodiversity Guidelines* (RTA, 2011).

5 SIGNIFICANCE ASSESSMENTS

5.1 Summary of assessments

A summary of the findings of significance assessments for all species listed under the TSC and EPBC Acts which were found to occur, or have potential to occur, in the study area is shown in Table 5 below. in accordance with the requirements of Section 5A of the EP&A Act for each threatened species or community is shown in Appendix D. Details associated with impacts of the proposed proposal on threatened species and communities of National Environmental Significance (NES) are provided in Appendix E.

These assessments were undertaken with the following provisions in mind; the road widening and associated ancillary works would result in the loss of approximately 18 ha of native vegetation, areas of ancillary sites of high ecological value are to be retained and mitigation measures are to be followed.

There is likely to be no species significantly affected by the proposal under the TSC Act or EPBC Act if the mitigation measures (Section 4.7) and recommendations (Section 6) are adopted.

Table 5: Summary of the findings of significance assessments

TSC Act significance assessments Threatened species or communities	Significance assessment question[1] a	b	c	d	e	f	g	Likely significant impact?
Falsistrellus tasmaniensis (Eastern False Pipistrelle)	N	X	X	N	X	X	N	No
Miniopterus australis (Little Bentwing-bat)	N	X	X	N	X	X	N	No
Miniopterus schreibersii oceanensis (Eastern Bentwing-bat)	N	X	X	N	X	X	N	No
Mormopterus norfolkensis (Eastern Freetail-bat)	N	X	X	N	X	X	N	No
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat)	N	X	X	N	X	X	N	No
Scoteanax rueppellii (Greater Broad-nosed Bat)	N	X	X	N	X	X	N	No
Anthochaera phrygia (Regent Honeyeater)	N	X	X	N	X	N	N	No
Calyptorhynchus lathami (Glossy Black-Cockatoo)	N	X	X	N	X	X	N	No
Daphoenositta chrysoptera (Varied Sittella)	N	X	X	N	X	X	N	No
Glossopsitta pusilla (Little Lorikeet)	N	X	X	N	X	X	N	No
Grantiella picta (Painted Honeyeater)	N	X	X	N	X	X	N	No
Hieraaetus morphnoides (Little Eagle)	N	X	X	N	X	X	N	No
Lathamus discolor (Swift Parrot)	N	X	X	N	X	N	N	No
Ninox strenua (Powerful Owl)	N	X	X	N	X	N	N	No
Tyto novaehollandiae (Masked Owl)	N	X	X	N	X	N	N	No
Petaurus norfolcensis (Squirrel Glider)	N	X	X	N	X	N	N	No
Phascolarctos cinereus (Koala)	N	X	X	N	X	N	N	No

TSC Act significance assessments Threatened species or communities	Significance assessment question[1] a	b	c	d	e	f	g	Likely significant impact?
Pteropus poliocephalus (Grey-headed Flying-fox)	N	X	X	N	X	N	N	No
Crinia tinnula (Wallum Froglet)	N	X	X	N	X	N	N	No
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner bioregions	X	X	N	N	X	X	N	No
River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner bioregions	X	X	N	N	X	X	N	No
Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin Bioregion	X	X	N	N	X	X	N	No
Rutidosis heterogama (Heath Wrinklewort)	N	X	X	N	X	X	N	No
Pimelea curviflora var. *curviflora*	N	X	X	N	X	X	N	No
Grevillea parviflora subsp. *parviflora* (Small-flower Grevillea)	N	X	X	N	X	X	N	No
Thelymitra sp. *adorata* (Wyong Sun Orchid)	N	X	X	N	X	X	N	No
Eucalyptus parramattensis subsp. *parramattensis* (*Eucalyptus parramattensis* C. Hall. subsp. *parramattensis* In Wyong and Lake Macquarie LGAs)	N	X	X	N	X	X	N	No
Melaleuca biconvexa (Biconvex Paperbark)	N	X	X	N	X	X	N	No
Angophora inopina (Charmhaven Apple)	N	X	X	N	X	X	N	No
Tetratheca juncea (Black-eyed Susan)	N	X	X	N	X	X	N	No
Cryptostylis hunteriana (Leafless Tongue-orchid)	N	X	X	N	X	X	N	No
Acacia bynoeana (Bynoes Wattle)	N	X	X	N	X	X	N	No

EPBC Act Assessments Threatened species, or communities	Important population[2]	Likely significant impact?
Anthochaera phrygia (Regent Honeyeater)	No	No
Lathamus discolor (Swift Parrot)	No	No
Pseudomys novaehollandiae (New Holland Mouse)	No	No
Pteropus poliocephalus (Grey-headed Flying-fox)	No	No
Melaleuca biconvexa (Biconvex Paperbark)	No	No
Angophora inopina (Charmhaven Apple)	No	No
Rutidosis heterogama (Heath Wrinklewort)	No	No
Pimelea curviflora var. *curviflora*	No	No
Grevillea parviflora subsp. *parviflora* (Small-flower	No	No

EPBC Act Assessments Threatened species, or communities	Important population[2]	Likely significant impact?
Grevillea)		
Tetratheca juncea (Black-eyed Susan)	No	No
Acacia bynoeana (Bynoe's Wattle)	No	No
Cryptostylis hunteriana (Leafless Tongue-orchid)	No	No

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

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:
    - 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
    - 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:
    - the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
    - 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
    - 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.

Important Population as determined by the *Environment Protection and Biodiversity Conservation Act 1999*, is one that for a vulnerable species:

i. is likely to be key source populations either for breeding or dispersal
ii. is likely to be necessary for maintaining genetic diversity
iii. is at or near the limit of the species range.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Biodiversity values

A range of biodiversity values have been identified within and adjoining the M1 Pacific Motorway corridor. These values are related to the extent and distribution of threatened species, populations and endangered ecological communities and are summarised as follows:

- Potential foraging, roosting and breeding habitat for a range of threatened fauna.
- Hollow bearing trees that provide roosting and breeding habitat for a range of threatened birds and mammals.
- Ecological corridors for fauna movements within and adjoining the study area.
- EECs within and adjoining the study area.
- A range of locally significant vegetation communities within the study area.
- Threatened flora records within and adjoining the study area.
- Ecological corridors for fauna movements within and adjoining the study area.
- SEPP 14 wetlands adjoining the study area.

The proposal would result in vegetation clearing, with a 'worst case assessment' of:

- A loss of approximately 18 hectares of vegetation (of varying quality) for road widening and construction.
- A loss of approximately 5.5 hectares of EEC.

6.2 Recommendations

The proposed replacement and widening of the M1 and construction of associated temporary ancillary sites has the potential to cause impacts to the EECs – *Swamp Sclerophyll Forest on Coastal Floodplain*, *River Flat Eucalypt Forest on Coastal floodplain and Lower Hunter Spotted Gum Ironbark Forest* as well as a range of threatened flora and fauna species and an adjoining area of SEPP 14 wetland if the range of mitigation measures outlined in Section 4.7 is not adopted. These measures have been developed to limit the risks associated with the proposed road widening and related ancillary/stockpile sites.

Impacts can be mitigated through the retention of EECs, threatened flora and remnant vegetation where possible, retention of potential koala habitat and hollow bearing trees as shown in Figure 13 and Figure 14. Risks that need to be managed include:

- Accidental construction incursions into areas of high ecological significance.
- Additional impacts to areas not identified in the concept design.
- Degradation of vegetation, local waterways and riparian areas.

The implementation of mitigation measures would help reduce the risk of further impacts occurring during the construction and operational phases of this proposal. As such, the overall impact of the proposal on threatened biodiversity is considered low.

Although the Assessments of Significance for the three EECs concluded that there would not be a significant impact on these EECS and a Species Impact Statement is not required, it is recommended that Roads and Maritime consider offsetting impacts on these EECs in accordance with the *Guidelines for Biodiversity Offsets* (RMS, 2011) as greater than one hectare of each EEC is potentially affected by the proposal.

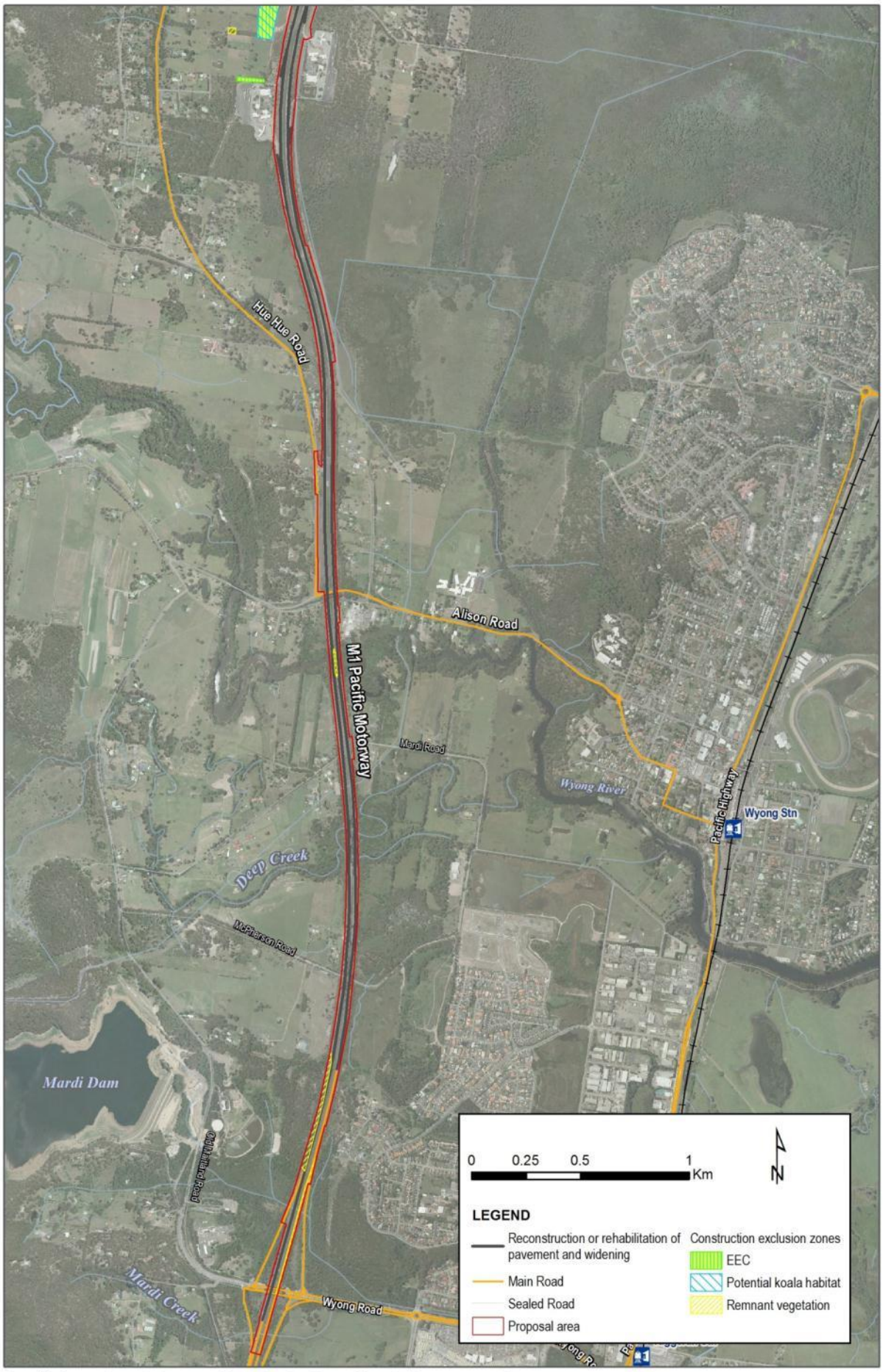


Figure 13 Construction exclusion areas within are based on flora and fauna habitat surveys - southern

Figure 14 Construction exclusion areas within are based on flora and fauna habitat surveys - northern

7 REFERENCES

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APPENDICES

Appendix A: Vegetation communities

Table 6: Vegetation communities recorded in M1 widening proposal with PCT ID and equivalence with Wyong, HCCREMS and LHCCREMS identification

M1 site (plot)	PCT ID	PCT common name	Wyong map unit ID	Wyong equivalent common name	LHCCREMS equivalent common name	LHCCREMS map unit ID	Hunter map unit ID	HCCREMS equivalent common name	Potential EEC
10, 11	1579	Smooth-barked Apple – Turpentine – Blackbutt open forest on ranges of the Central Coast	MU 27	Narrabeen Coastal Blackbutt Shrubby Forest*	Coastal Narrabeen Shrub Forest	MU 55	HU793	Forest Oak/ Smooth-barked Apple/ Blackbutt open forest	
2a, 4a, 4b, 7e	1592	Spotted Gum – Red Ironbark – Grey Gum –shrub - grass open forest of the Lower Hunter	MU 30	Narrabeen Dooralong Spotted Gum-Ironbark Forest*	Lower Hunter Spotted Gum Ironbark Forest	MU 67	HU629	Spotted Gum/Red Ironbark/ Large-fruited Grey Gum shrub/grass open forest	LHSGIF (part)
1, 2b	1619	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands	MU 28	Narrabeen Buttonderry Footslopes Forest*	Coastal Plains Smooth-barked Apple Woodland	MU 89	HU833, HU621	Smooth-barked Apple/ Red Bloodwood/ Brown Stringybark/ Wiry Panic heathy open forest	
8b	1621	Smooth-barked Apple open forest on coastal lowlands of the Central Coast	MU 29	Narrabeen Coastal Sheltered Peppermint-Apple Forest*	Coastal Sheltered Apple – Peppermint Forest	MU 90	HU835	Smooth-barked Apple open forest of coastal lowlands	

M1 site (plot)	PCT ID	PCT common name	Wyong map unit ID	Wyong equivalent common name	LHCCREMS equivalent common name	LHCCREMS map unit ID	Hunter map unit ID	HCCREMS equivalent common name	Potential EEC
3a, 4c ,7c, 9	1719	Paperbarks – Woollybutt swamp forest on coastal lowlands of the Central Coast	MU 19	Alluvial Woollybutt-Melaleuca Sedge Forest*	Wyong Paperbark Swamp Forest	MU 183	HU933	Paperbarks/ Woollybutt swamp forest on the Central Coast	SSFCF (part)
7a	1724	Broad-leaved Paperbark – Swamp Oak – Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast	MU 09	Coastal Sand Bangalay-Paperbark Forest*	Swamp Mahogany – Paperbark Forest	MU 206	HU938	Broad-leaved Paperbark/ Saw Sedge swamp forest of coastal lowlands	SSFCF (part)
-	836	Forest Red Gum - Rough-barked Apple open forest on poorly drained lowlands of the Central Coast, Sydney Basin	MU 15	Alluvial Redgum Footslopes Forest	Wyong Paperbark Swamp Forest	Included in MU 43	-	-	RFEFCF (part)
-	-	Not described	MU 16	Alluvial Bluegum-Paperbark Mesic Palm Forest	Alluvial Tall Moist Forest	Included in MU 5	-	-	RFEFCF (part)
-	1719	Woollybutt - Paperbark sedge forest on alluvial plains of the Central Coast, Sydney Basin	MU 19	Alluvial Woollybutt-Melaleuca Sedge Forest	Wyong Paperbark Swamp Forest	Included in MU 43	HU656	Paperbarks/ Woollybutt swamp forest on the Central Coast	SSFCF or RFEFCF (part)
1	1137	Scribbly Gum - Red Bloodwood heathy woodland on the coastal plains of the Central Coast, Sydney Basin	MU 31	Narrabeen Doyalson Coastal Woodland	Coastal Plains Scribbly Gum Woodland	MU 31	HU610	Scribbly Gum/ Red Bloodwood heath woodland of coastal lowlands	No

M1 site (plot)	PCT ID	PCT common name	Wyong map unit ID	Wyong equivalent common name	LHCCREMS equivalent common name	LHCCREMS map unit ID	Hunter map unit ID	HCCREMS equivalent common name	Potential EEC
3b, 4c, 5, 6, 7b, 7d, 8a		cleared exotic dominated grassland							No
12		Disturbed regrowth							No

* Locally significant vegetation community (Wyong Shire)

Appendix B: Flora and fauna species recorded onsite during the field survey

Table 7: Flora species recorded during survey of sites 1-11 with percentage cover of each species

Species Name	Common Name	Growth Form	Percentage cover (%)																			
			1	2a	2b	2b	3a	3b	4a	4b	4c	5	6	7a	7b	7c	7d	7e	8a	8b	10	11
NATIVE																						
Acacia irrorata	Green Wattle	shrub																			1	1
Acacia longifolia	Sydney Golden Wattle	shrub				2																5
Acacia ulicifolia	Prickly Moses	shrub			1					1												
Acianthus sp.	Orchid	forb				1																
Adiantum aethiopicum	Maidenhair Fern	fern				1										1						
Allocasuarina littoralis	Black She-oak	tree	10		10	25	15									10						15
Allocasuarina torulosa	Forest Oak	tree																			1	
Alphitonia excelsa	Red Ash	tree														1						
Angophora costata	Smooth-barked Apple	tree	35		15	45	25	5	5	15						25				15	1	5
Aristida vagans	Three-awn Speargrass	grass			1	1				5											1	
Alternanthera denticulata	Lesser Joy weed	forb												5								
Austrodanthonia tenuior	Wallaby Grass	grass					1														1	
Banksia spinulosa	Hairpin Banksia	shrub	20		5																	
Billardiera scandens	Apple Berry	climber			1	1										2					2	
Boronia polygalifolia	Milkwort Boronia	subshrub	1																			
Bossiaea obcordata	Spiny Bossiaea	subshrub				5										1						

Species Name	Common Name	Growth Form	Percentage cover (%)																			
			1	2a	2b	2b	3a	3b	4a	4b	4c	5	6	7a	7b	7c	7d	7e	8a	8b	10	11
Breynia oblongifolia	Coffee Bush	shrub																		5		5
Brunoniella pumilio	Dwarf Trumpet	subshrub																			1	
Bursaria spinosa	Blackthorn	shrub		5																		
Carex inversa	Knob Sedge	sedge									1											
Carex longebrachiata	Carex	sedge													1							
Cassytha glabella	Slender Devil's Twine	climber	1		1																1	
Centella asiatica	Centella	forb				1	5	5			1			20		5			1		2	5
Cheilanthes sieberi	Mulga Fern	fern		2					1	1												
Clematis aristata	Old Man's Beard	climber																				1
Clematis glycinoides	Old Man's Beard	climber				1																
Convolvulus cyanea	Scurvy Weed	scrambler												10								
Corymbia gummifera	Red Bloodwood	tree			5										5	2						
Corymbia maculata	Spotted Gum	tree		15					35	10		1				5		25		5	1	
Cryptostylis subulata	Large Tongue Orchid	orchid			1																	
Cyathochaeta diandra		sedge	3																			
Cynodon dactylon	Couch Grass	grass																	25			2
Cyperus brevifolius	Mullumbimby Couch	sedge						2			1				5							
Daviesia squarrosa		shrub		2																		
Daviesia ulicifolia	Daviesia	shrub		20					3	1						5		1			1	1

Species Name	Common Name	Growth Form	Percentage cover (%)																			
			1	2a	2b	2b	3a	3b	4a	4b	4c	5	6	7a	7b	7c	7d	7e	8a	8b	10	11
Desmodium rhytidophyllum	Desmodium	scrambler														1				1	1	
Dianella caerulea	Blue Flax Lily	forb		3			5		5	1						5		2		2	1	5
Dianella revoluta	Mauve Flax Lily	forb		2																		
Dichondra repens	Kidney Weed	forb								1										2	1	
Dillwynia retorta	Heathy Parrot Pea	shrub			1																	
Dodonaea triquetra	Common Hop Bush	shrub		2	1																	
Doodia aspera	Rasp Fern	fern																		1		1
Echinopogon caespitosus	Tufted Hedgehog Grass	grass		1																		
Echinopogon ovatus	Forest Hedgehog Grass	grass																1				
Entolasia stricta	Wiry Panic	grass		15	35		15		5	15						15		10			1	5
Epacris pulchella	Coral Heath	shrub		2	1					2						2						
Epaltes australis	Epaltes	forb												1								
Eragrostis brownii	Brown's Lovegrass	grass					1			5								1			1	
Eucalyptus capitellata	Brown Stringybark	tree	15		10	5														10		
Eucalyptus fibrosa	Red Ironbark	tree		5					5	5								15				
Eucalyptus globoidea	White Stringybark	tree		10																		
Eucalyptus haemastoma	Scribbly Gum	tree	5																			
Eucalyptus pilularis	Blackbutt	tree													30						50	35
Eucalyptus punctata	Grey Gum	tree		5																		

Species Name	Common Name	Growth Form	Percentage cover (%)																		
			1	2a	2b	2b	3a	3b	4a	4b	4c	5	6	7a	7b	7c	7d	7e	8a	8b	10	11
Eucalyptus resinifera	Red Mahogany	tree												5		10						
Eucalyptus robusta	Swamp Mahogany	tree					**15**					1		10		**15**						
Eucalyptus saligna	Sydney Blue Gum	tree																			2	
Eucalyptus umbra	Broad-leaved White Mahogany	tree													5	5						
Euchiton sphaericus	Cudweed	forb				1					1						1				1	
Gahnia clarkei	Saw Sedge	sedge	15		40	20																
Gahnia radula	Saw Sedge	sedge			5					1												
Geitonoplesium cymosum	Scrambling Lily	scrambler																		1		
Glochidion ferdinandi	Cheese Tree	shrub				5								15						5		10
Glycine clandestina	Love Creeper	twiner			1	1			1											1		1
Glycine microphylla	Love Creeper	twiner																				1
Gomphocarpus latifolia	Broad-leaf Wedge Pea	shrub			1																	
Gonocarpus micranthus	Raspwort	forb							1													
Gonocarpus tetragynus	Raspwort	forb		1	2				1													
Goodenia heterophylla	Variable-leaved Goodenia	subshrub		3	1											5		1				
Hakea sericea	Bushy Needlebush	shrub	2			1			2													
Hardenbergia violacea	False Sarsaparilla	scrambler		2	1	1			1											1	2	
Hibbertia dentata	Twining Guinea Flower	scrambler			1																	
Hydrocotyle laxiflora	Stinking Pennywort	forb								1	1	1										

Species Name	Common Name	Growth Form	Percentage cover (%)																			
			1	2a	2b	2b	3a	3b	4a	4b	4c	5	6	7a	7b	7c	7d	7e	8a	8b	10	11
Hydrocotyle tripartita	Pennywort	forb					1															
Imperata cylindrica	Blady Grass	grass		4	1	1					1					20		10			1	
Isopogon anemonifolius	Drumsticks	shrub							1													
Juncus usitatus	Common Rush	rush									1											
Lepidosperma laterale	Sword Sedge	sedge				1										5						1
Lepidosperma neesii	Sword Sedge	sedge			10																	
Leptospermum polygalifolium	Tantoon	shrub				1										1						
Leptospermum trinervium	Paperbark Tea-tree	shrub	3		10																	
Leucopogon juniperinus	Bearded Heath	subshrub																				2
Leucopogon lanceolatus	Lance Beard Heath	subshrub														1						
Lindsaea microphylla	Lacy Wedge Fern	fern			1																	
Lomandra filiformis	Lomandra	rush								1												
Lomandra longifolia	Wattle Matt-Rush	rush			1	1														5	1	
Lomandra multiflora	Matt-Rush	rush		3		1																
Lomandra obliqua	Fish Bones	rush			5				1	5												
Marsdenia suaveolens	Sweet Scented Doubah	twiner				1										1						
Melaleuca linariifolia	Flax-leaved Paperbark	tree	10	1			5							50								
Melaleuca nodosa	Ball Honey Myrtle	shrub					35		2					10		40		30				
Melaleuca quinquenervia	Broad-leaved Paperbark	tree												5								

Species Name	Common Name	Growth Form	Percentage cover (%)																			
			1	2a	2b	2b	3a	3b	4a	4b	4c	5	6	7a	7b	7c	7d	7e	8a	8b	10	11
Melaleuca sieberi	Sieber's Paperbark	shrub					5	5														
Microlaena stipoides	Weeping Rice Grass	grass				2	10		10						1	5		5		2		
Mitrasacme polymorpha	Miterwort	forb														10						
Opercularia aspera	Thin Stink Weed	shrub																			1	
Oxalis exilis	Oxalis	forb								1						2					1	
Ozothamnus diosmifolius	Everlasting	shrub		2					2													
Panicum simile	Two Colour Panic	grass		1	1	1				1												
Parsonsia straminea	Common Silkpod	climber		2		5	1									1						
Pellaea falcata	Sickle Fern	fern		1																		
Persicaria lapathifolium	Knotweed	forb												10								
Persoonia linearis	Narrow-leaved Geebung	shrub		1	1	1	1															1
Phyllanthus hirtellus	Thyme Spurge	subshrub			1	1																
Pimelea linifolia	Slender Rice Flower	subshrub				1										1					1	
Pittosporum undulatum	Sweet Pittosporum	shrub																		10		
Polyscias sambucifolia	Elderberry Panax	shrub			1	1										2				1		2
Pratia purpurascens	Whiteroot	forb		1			2								1			1			2	
Pseuderanthemum variabile	Pastel Flower	subshrub			1																	
Pteridium esculentum	Bracken	fern			1	1															1	5
Ptilothrix deusta	Ptilothrix	sedge			40																	

Species Name	Common Name	Growth Form	Percentage cover (%)																			
			1	2a	2b	2b	3a	3b	4a	4b	4c	5	6	7a	7b	7c	7d	7e	8a	8b	10	11
Pultenaea blakelyi	Blakely's Bush Pea	shrub																			1	
Pultenaea paleacea		shrub		2																		
Ranunculus inundatus	River Buttercup	forb						1														
Rumex brownii	Dock	forb						1							1							
Syncarpia glomulifera	Turpentine	tree																			1	
Themeda australis	Kangaroo Grass	grass		10	1	10			30							10		10			1	
Vernonia cinerea		forb		1																		
Wahlenbergia gracilis	Native Bluebell	forb																	1			
Xanthorrhoea fulva	Grass Tree	shrub					20															
Xanthorrhoea sp	Grass Tree	shrub				1																
Count Native			**8**		**36**	**33**	**17**	**6**	**18**	**18**	**7**	**3**	**0**	**11**	**8**	**31**	**1**	**13**	**3**	**16**	**30**	**21**
	EXOTIC																					
*Ageratina adenophora**	Crofton Weed	forb				2																
Andropogon virginicus	Whiskey Grass	grass						10			1						50		25		1	
Axonopus fissifolius	Carpet Grass	grass						20			5	30	25		5				15			
Bidens subalternans	Cobbler's Peg	forb		1							2				1				1			
Briza maxima	Quaking Grass	grass									1											
Chloris gayana	Rhode's Grass	grass																	45			
Conyza sumatrensis	Tall Fleabane	forb									5				1		1				1	

Species Name	Common Name	Growth Form	Percentage cover (%)																			
			1	2a	2b	2b	3a	3b	4a	4b	4c	5	6	7a	7b	7c	7d	7e	8a	8b	10	11
*Cortaderia selloana**	Pampas Grass	grass				10																
Cyperus eragrostis	Cyperus sedge	sedge															1					
Gamochaeta purpurea	Gamochaeta	forb									2						1					
Gomphrena celosioides	Gomphrena	forb										1					1					
Hypochaeris radicata	Flat Weed	forb									2	1	2		1		1		1			
*Lantana camara**‡	Lantana	shrub																			2	15
Paspalum dilatatum	Paspalum	grass		4				10			45	65	70		20		10		20			
Paspalum urvillei	Vassey Grass	grass				10		2			5			15			5		5			
Pennisetum clandestinum	Kikuyu	grass		2											65		25					
*Pennisetum macrourum**	African Feather Grass	grass						30														
Plantago lanceolata	Lamb's Tongues	forb									1	1	1		1				2		1	
Senecio madagascariensis	Fireweed	forb		1				2									1					
Setaria parviflora	Small-flowered Pigeon Grass	grass															2					
Sida rhombifolia	Paddy's Lucerne	forb															5		1			
Trifolium repens	White Clover	forb						5				2	1		2				5			
Verbena rigida	Veined Verbena	forb															2		1			
Count Exotic			0		0	3	0	7	0	0	10	6	5	1	8	0	13	0	11	0	4	1
Total Species			8		36	36	17	13	18	18	17	9	5	12	16	31	14	13	14	16	34	22

* Noxious weed listed in Wyong Shire Council

‡ A Weed of National Significance

Table 8: Flora species recorded during survey of road median (Site 12) with percentage cover of each species

Species Name	Common Name	Growth Form	Percentage cover (%)								
			12a	12b	12c	12d	12e	12f	12g	12h	12i
NATIVE											
Acacia decurrens	Sydney Green Wattle	shrub					35				
Acacia falcata	Sickle Wattle	shrub	20		20	15	25	25	25	30	25
Acacia floribunda	White Sallow Wattle	shrub		25							
Acacia linifolia	Flax-leaved Wattle	shrub		30		25	15	20	35		
Acacia longifolia	Sydney Golden Wattle	shrub			25		20	40		15	25
Acacia mearnsii	Black Wattle	shrub	20				20				20
Acacia parramattensis	Parramatta Green Wattle	shrub					25				
Adianthum hispidulum	Rough Maidenhair Fern	fern		15							
Allocasuarina distyla	-	shrub	20								
Allocasuarina littoralis	Black She-oak	tree	15			20	20	20	20	15	
Alphitonia excelsa	Red Ash	tree		25	20	15					
Angophora costata	Smooth-barked Apple	tree									25
Aristida sp.	Awn Speargrass	grass							10		
Blechnum cartilagineum	Gristle Fern	fern		15							
Breynia oblongifolia	Coffee Bush	shrub	20						15		
Bursaria spinosa	Blackthorn	shrub		10							

Species Name	Common Name	Growth Form	Percentage cover (%)								
			12a	12b	12c	12d	12e	12f	12g	12h	12i
Calochlaena dubia	False Bracken	fern							20		
Cassytha pubescens	Common Devil's Twine	creeper				5					
Casuarina glauca	Swamp She-oak	tree			25						
Ceratopetalum gummiferum	Christmas Bush	shrub									30
Christella dentata	-	fern		20							
Clematis aristata	Traveller's Joy	climber							10	10	
Commelina cyanea	Scurvy Weed	scrambler		20							
Cyperus brevifolius	Mullumbimby Couch	sedge								5	
Cyperus polystachyos	-	sedge						15		5	
Dianella sp.	Flax Lilly	herb				5					
Dichondra repens	Kidney Weed	forb	15			10	10	10	10	5	
Eleocharis gracilis	Spike Rush	rush								5	
Eucalyptus robusta	Swamp Mahogany	tree	25								
Eucalyptus saligna	Sydney Blue Gum	tree		20	20					30	20
Glochidion ferdinandi	Cheese Tree	shrub	30	35	30						
Glycine clandestina	-	creeper							5		
Gonocarpus micranthus	-	forb					2	5	15		
Hakea sericea	Bushy Needlebush	shrub				25	25	25		20	50

Species Name	Common Name	Growth Form	Percentage cover (%)								
			12a	12b	12c	12d	12e	12f	12g	12h	12i
Hypolepis muelleri	Harsh Ground Fern	fern						30			
Juncus sp.	Rush	rush							20		
Kunzea ambigua	Tick bush	shrub	30		25	30	25	25	25	30	20
Leptospermum polygalifolium	Lemon-scented Tea-tree	shrub					20				
Lomandra longifolia	Matt-Rush	rush		20	20						30
Lomandra sp.	-	herb				5					
Melaleuca hypericifolia	-	shrub		30							
Oplismenus aemulus	Basket Grass	grass		5							
Parsonsia straminea	Common Silkpod	climber	5			10	10	10	15	15	
Persicaria decipiens	Spotted Knotweed	herb		15							
Pittosporum undulatum	Sweet Pittosporum	tree			30				5		
Pteridium esculentum	Bracken	fern			25						
Stenocarpus sinuatus	Firewheel Tree	tree		25							
Stephania japonica	Snake Vine	climber	10	20							
Tristaniopsis laurina	Water Gum	tree			25						
Count Native			**11**	**16**	**11**	**11**	**13**	**11**	**14**	**12**	**9**
EXOTIC											
*Ageratina adenophora**	Crofton Weed	forb		15		25	25				

Species Name	Common Name	Growth Form	Percentage cover (%)								
			12a	12b	12c	12d	12e	12f	12g	12h	12i
Andropogon virginicus	Whisky Grass	grass	15	15		10			10	2	10
Araujia sericifera	Moth plant	climber	20		20						25
*Asparagus asparagoides** ‡	Bridal Creeper	climber		25							
Bidens pilosa	Cobbler's Peg	forb		10		15	10		10	5	10
Bidens subalternans	Cobbler's Peg	forb	25		15						
Briza subaristata	Landern Grass	grass								10	
Chloris gayana	Rhodes Grass	grass	15	15	10	15	20	5		10	15
Cinnamomum camphora	Camphor Laurel	shrub	30	30	35						
Cynodon dactylon	Couch Grass	grass						20	10		
Cyperus eragrostis	-	sedge	10								
Digitaria didactyla	Blue Couch	grass	15			10			15		
Eragrostis sp.	Lovegrass	grass							10		
Erythrina x sykesii	Coral Tree	tree			30						
Gomphocarpus fruticosus	Narrow-leaved Cottonbush	shrub			20						
Hyparrhenia hirta	Coolatai Grass	grass									15
Ipomoea cairica	Coastal Morning Glory	climber	10								
*Lantana camara** ‡	Lantana	scrambler	25	30	30		20		30		
Ligustrum lucidum	Broad-leaf Privet	shrub		30							

Species Name	Common Name	Growth Form	Percentage cover (%)								
			12a	12b	12c	12d	12e	12f	12g	12h	12i
Ligustrum sinense	Privet	shrub		35							
Lonicera japonica	Japanese Honeysuckle	climber		15							
Melinis repens	Red Natal Grass	grass		10							
Olea cuspidata	African Olive	tree									50
Paspalum dilatatum	Paspalum	grass	10		10	15		20		10	10
Pellaea viridis	-	fern				20			20	20	20
Plantago lanceolata	Lamb's Tongues	forb	20			5		10	15	10	10
Ricinus communis	Castor Oil Plant	shrub		40							
*Rubus fruticosus** ‡	Blackberry	climber	25	30							
Senecio madagascariensis ‡	Fireweed	forb	15		15	20	15	10			5
Senna pendula var glabrata	Cassia	shrub		25							
Setaria gracilis	Slender Pigeon Grass	grass						5	5	5	
Setaria pumila	Pale Pigeon Grass	grass	10	5					5		
Sida rhombifolia	Paddy's Lucerne	forb	10								
Solanum mauritianum	Tobacco Bush	shrub		30							25
Solanum nigrum	Blackberry Nightshade	forb					10			10	
Sporobolus africanus	Parramatta Grass	grass	10						5	10	10
Stenotaphrum secundatum	Buffalo Grass	grass							20		

Species Name	Common Name	Growth Form	Percentage cover (%)								
			12a	12b	12c	12d	12e	12f	12g	12h	12i
Tradescantia fluminensis	Wondering Jew	scrambler		30							
Trifolium pratense	Red Clover	forb	10								
Verbena bonariensis	Purpletop	forb	15				5	10			10
Count Exotic			**18**	**17**	**9**	**9**	**7**	**7**	**12**	**10**	**13**
Total Species			**29**	**33**	**20**	**20**	**20**	**18**	**26**	**22**	**22**

* Noxious weed listed in Wyong Shire Council

‡ A Weed of National Significance

Table 9: Fauna species recorded during survey (sightings or scats)

Scientific Name	Common Name	Site
*Acridotheres tristis**	Indian Myna	11
*Bos primigenius**	Cattle	7
*Canus lupus familiaris**	Dog	8
Cracticus tibicen	Australian Magpie	2
*Equus ferus**	Horse	7
Egernia cunninghami	Cunningham's Skink	10
Isoodon, Perameles or Potorous spp.	Bandicoot or Potoroo tracks	1, 2, 3, 9, 12
Lampropholis delicata	Delicate Skink	2, 11
Lampropholis guichenoti	Garden Skink	2, 11
Manorina melanocephala	Noisy Miner	7
Manorina melanophrys	Bell Miner	10, 11
*Oryctolagus cuniculus**	European Rabbit	6, 9, 12
Pseudocheirus peregrinus	Common Ringtail Possum	12
Trichosurus vulpecula	Common Brushtail Possum	12
Vombatus ursinus	Common Wombat	3, 11
*Vulpes vulpes**	European Fox	11, 9, 12
Wallabia bicolor	Swamp Wallaby	1, 4, 7, 9
-	Unidentified possum or glider species (scratching)	3, 4

* Denotes introduced species

Appendix C: Flora and fauna species with the potential to occur in the study site

To meet requirements to assess the impacts to the fullest extent possible, further assessment is required through an Assessment of Significance under the EP&A Act for species listed as threatened under the TSC Act and an Assessment of Significance under the EPBC Act for species listed as threatened under the EPBC Act if the likelihood of occurrence is of medium or high risk. Assessments of Significance are in Appendix D and Appendix E.

Note: List of threatened species, populations, or ecological communities which may be affected directly or indirectly by the proposal is derived from searches of the following databases as well as on ground survey conducted on 17 and 18 April 2013. Likelihood of occurrence is based on the risk matrix in Appendix F.

1. NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database.
2. Protected Matters Report that documents all Matters of National Environmental Significance (MNES) within 10 km of site (Department of Sustainability, Environment, Water, Population and Communities).
3. Department of Environment and Conservation (now OEH) Endangered Ecological Community and Threatened Species Profiles (DEC 2005-2013).
4. Native vegetation mapping of the study area with Wyong LGA (Bell, 2008; Somerville, 2009).
5. NSW Flora Online Search – Rare or Threatened Australian Plants (ROTAP) species (The Royal Botanic Gardens and Domain Trust, 2011)

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
FAUNA					
Amphibians					
Crinia tinnula	Wallum Froglet	V		Usually associated with acidic swamp on coastal sand plains and occur in a range of habitats, including sedgelands, wet heathland, paperbark swamps and drainage lines. This species can persist in disturbed areas and breed in both permanent and ephemeral water bodies. Shelter under leaf litter, debris or in burrows.	Habitat resources available in the study area. Risk Medium: could possibly occur. **Further assessment required**
Heleioporus australiacus	Giant Burrowing Frog	V	V	Distributed through the Sydney Basin sandstone country in woodland, open woodland and heath vegetation, breeding habitat is generally soaks or pools within first or second order streams, but also 'hanging swamp' seepage lines and where small pools form from the collected water. Spend the majority of time in non-breeding habitat up to 300 m away and burrows in soil surface or leaf litter.	Suitable habitat is not located within the study area. Risk Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Litoria aurea	Green and Golden Bell Frog	E	V	Large populations in NSW are located around coastal and near coastal areas of the metropolitan areas of Sydney, Shoalhaven and mid north coast. It Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.)	Suitable habitat is not located within the study area. Risk Low: unlikely to occur
Litoria brevipalmata	Green-thighed Frog	V		Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. The species is thought to forage in leaf-litter. The species inhabits the leaf-litter and low vegetation of forests. It breeds after heavy rains anywhere from September to May, preferring larger temporary pools, and flooded areas for breeding.	Suitable habitat is not located within the study area. Risk Low: unlikely to occur
Litoria littlejohni	Littlejohn's Tree Frog	V	V	Restricted to sandstone woodland and heath communities at mid to high altitude. It forages both in the tree canopy and on the ground, and it has been observed sheltering under rocks, leaf litter and low vegetation in heath based forests and woodland. It is not known from coastal habitats.	Suitable habitat is not located within the study area. Risk Low: unlikely to occur
Mixophyes balbus	Stuttering Frog	E	V	Inhabits rainforest and wet, tall open forest. Breeds in streams after summer rains and deposits eggs on rock shelves or in shallow riffles. Non-breeding habitat includes thick understorey vegetation and deep leaf litter on forest floors.	Suitable habitat is not located within the study area. Risk Low: unlikely to occur
Mixophyes iteratus	Giant Barred Frog	E	E	Occurs in damp rainforest, and both moist and dry eucalypt forest below 1000m. Inhabit deep leaf litter and breed in shallow, flowing rocky streams. Are capable of dispersing hundreds of metres from streams.	Suitable habitat is not located within the study area. Risk Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Pseudophryne australis	Red-crowned Toadlet	V		Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Red-crowned Toadlets have not been recorded breeding in waters that are even mildly polluted or with a pH outside the range 5.5 to 6.5.	Suitable habitat is not located within the study area. Risk Low: unlikely to occur
Aves					
Anthochaera phrygia	Regent Honeyeater	CE	E	Inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. NSW the distribution is very patchy and mainly confined to the two main breeding areas at Capertee Valley and the Bundarra-Barraba region and surrounding fragmented woodlands. Birds are also found in drier coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak. These habitats have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Nectar and fruit from the mistletoes are also eaten during the breeding season.	Non-breeding foraging habitat available (Swamp Mahogany and Spotted Gum). Risk High: highly likely to occur **Further assessment required**

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Botaurus poiciloptilus	Australasian Bittern	E	E	Inhabits temperate freshwater wetlands and occasionally estuarine reed beds, with a preference for permanent water bodies with tall dense vegetation. The species prefers wetlands with dense vegetation, including sedges, rushes and reeds. Freshwater is generally preferred, although dense saltmarsh vegetation in estuaries and flooded grasslands are also used by the species	Suitable habitat is not located within the study area. Risk Low: unlikely to occur
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		Occupy coastal woodlands and drier forest areas, open inland woodlands or timbered watercourses where *Casuarina* and *Allocasuarina* species are present. This species is dependent on large hollow-bearing eucalypts for nesting.	Nesting and foraging habitat available Risk High: highly likely to occur **Further assessment required**
Daphoenositta chrysoptera	Varied Sittella	V		Inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Suitable habitat resources available Risk High: highly likely to occur **Further assessment required**
Ephippiorhynchus asiaticus	Black-necked Stork	E		Restricted to coastal and near-coastal habitat. Inhabits wetlands, floodplains and deeper permanent water bodies. Occurs in shallow, permanent freshwater terrestrial wetlands and surrounding marginal vegetation. Nest in tall, live isolated paddock trees near freshwater swamps and construct large nesting platform.	Suitable water bodies are not located within the study area. Risk Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Glossopsitta pusilla	Little Lorikeet	V		Mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. Nest in small hollows (entrance approx. 3 cm) of *Eucalyptus* spp. between 2 - 15 m above the ground.	Suitable habitat resources available Risk High: highly likely to occur **Further assessment required**
Grantiella picta	Painted Honeyeater	V		Occurs in Eucalyptus woodland and forests, with a preference for mistletoe (*Amyema spp.*). Can also occur along watercourses and in farmland. Nests from spring to autumn in outer canopy of eucalypts, she-oak, paperbark and mistletoe branches.	Suitable habitat resources available. Risk Medium: could possibly occur **Further assessment required**
Hieraaetus morphnoides	Little Eagle	V		Occupies habitats rich in prey (birds, reptiles and mammals) within open eucalypt forest, woodland or open woodland. Requires tall living trees for building a large stick nest and preys on birds, reptiles and mammals and occasionally carrion.	Suitable habitat resources available Risk High: highly likely to occur **Further assessment required**
Ixobrychus flavicollis	Black Bittern	V		Occurs below 200 m above sea level and inhabit both terrestrial and estuarine wetlands, with a preference for permanent water bodies and dense vegetation. Roosts in trees or amongst dense reeds.	Suitable water bodies are not located within the study area. Risk Low: unlikely to occur
Lathamus discolor	Swift Parrot	E	E	In NSW mostly occurs on the coast and south west slopes, occurring in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*).	Suitable habitat resources available. Risk Medium: could possibly occur **Further assessment required**

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Ninox strenua	Powerful Owl	V		Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. They require large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Powerful Owls nest in large tree hollows (at least 0.5m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	Suitable habitat resources available Risk Medium: could possibly occur **Further assessment required**
Rostratula australis	Australian Painted Snipe	E	V	Inhabits shallow inland wetlands, either freshwater or brackish water bodies. Nests on the ground amongst tall reed-like vegetation near water, and feeds near the water's edge and on mudflats.	Suitable water bodies are not located within the study area. Risk Low: unlikely to occur
Sternula nereis nereis	Australian Fairy Tern		V	It breeds on sheltered mainland coastlines and close islands, usually on sandy beaches above the high tide line but below where vegetation occurs. It feeds almost entirely on fish mainly by following shoals of feeding predatory fish, and is rarely found out of sight of land.	The study area does not contain any marine habitat or coastline. Risk Low: unlikely to occur
Tyto novaehollandiae	Masked Owl	V		Occurs throughout NSW, roosting and nesting in heavy forest. Hunts over open woodland and farmland, with a home range of 500 - 1000 ha. The main requirements are tall trees with suitable large hollows for nesting and roosting and adjacent areas for foraging. Feeds on small mammals.	Suitable habitat resources available Risk Medium: could possibly occur **Further assessment required**
Tyto tenebricosa	Sooty Owl	V		Inhabits subtropical and warm temperate rainforest, and moist or dry eucalypt forest with a well-developed mid-storey of trees or shrubs. Roost and nest sites for the species occur in gullies. Utilise large hollows for nesting and prey on other hollow dependent species. Roost in hollows or dense vegetation.	The vegetation within the study area is not dense enough to provide suitable habitat. Risk Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Mammals					
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Roosts in disused mine shafts, caves, overhangs and disused Fairy Martin nests for shelter and to raise young. Also potentially roost in tree hollows. Occurs in low to mid-elevation dry open forest and woodlands, preferably with extensive cliffs, caves or gullies. Pied Bat is largely restricted to the interface of sandstone escarpment (for roost habitat) and relatively fertile valleys (for foraging habitat).	Suitable habitat is not available within the study area. Risk Low: unlikely to occur
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Utilises 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.	The study area does not provide suitable habitat. Risk Low: unlikely to occur
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		This species occupies tall, mature, wet forest and the species have been recorded roosting in stem holes in Eucalyptus and in buildings. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	Suitable habitat resources available Risk Medium: could possibly occur **Further assessment required**
Miniopterus australis	Little Bentwing-bat	V		This species occurs in moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bent-wing Bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Suitable habitat resources available and has been identified in previous surveys adjacent to Site 9 (McPherson Road) Risk High: highly likely to occur **Further assessment required**

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. They form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. This species tends to hunt in forested areas.	Suitable foraging resources available Risk Medium: could possibly occur **Further assessment required**
Mormopterus norfolkensis	Eastern Freetail-bat	V		Habitats preference includes dry eucalypt forest and coastal woodlands but also include riparian zones in rainforest and wet sclerophyll forest. Forages above forest canopy or forest edge and requires roosts including tree hollows.	Suitable foraging and roosting resources available Risk Medium: could possibly occur **Further assessment required**
Myotis macropus	Southern Myotis	V		This species generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish by raking their feet across the water surface.	The study area does not provide suitable habitat. Risk Low: unlikely to occur
Petaurus australis	Yellow-bellied Glider	V		Typically occurs in tall, mature eucalypt forest in regions of high rainfall, but is also known to occur in drier areas. Preference for resource rich forests where mature trees provide nesting hollows and tree species composition with adequate food resources, including winter-flowering Eucalypts and sap-rich trees.	The study area does not provide suitable habitat. Risk Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Petaurus norfolcensis	Squirrel Glider	V		The Squirrel Glider inhabits dry sclerophyll forest and woodland. In NSW, potential habitat includes Box-Ironbark forests and woodlands in the west, the River Red Gum forests of the Murray Valley and the eucalypt forests of the northeast. Individuals have also been recorded in a diverse range of vegetation communities, including Blackbutt, Forest Red Gum and Red Bloodwood forests, Coastal Banksia heathland and Grey Gum/Spotted Gum/Grey Ironbark dry hardwood forests of the Central NSW Coast. The Squirrel Glider is nocturnal and shelters in tree hollows. This species is capable of gliding up to 50m.	Suitable habitat resources available Risk Medium: could possibly occur **Further assessment required**
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	This species prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges, isolated rock stacks and tree limbs. Preference for north-facing slopes and cliff lines. A range of vegetation types are associated with Brush-tailed Rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest.	The study area does not provide suitable habitat. Risk Low: unlikely to occur
Phascolarctos cinereus	koala	V	V	Inhabits a range of eucalypt forest and woodland communities. Adequate floristic diversity, availability of feed trees (primarily *Eucalyptus tereticornis* and *E. viminalis*) and presence of mature trees very important. Preferred food tree species vary with locality and there are quite distinct regional preferences. They are able to persist in fragmented habitats, and even survive in isolated trees across a predominantly agricultural landscape.	Suitable habitat resources available Risk Medium: could possibly occur **Further assessment required**

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Potorous tridactylus tridactylus	Long-nosed Potoroo	V	V	Inhabits coastal heaths and dry and wet sclerophyll forests, with sandy loam soils. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. Require dense vegetation for shelter and access to fungi. It is mainly nocturnal, hiding by day in dense vegetation - however, during the winter months animals may forage during daylight hours.	Suitable habitat resources available Risk Medium: could possibly occur **Further assessment required**
Pseudomys novaehollandiae	New Holland Mouse		V	Inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. Nest in burrows and have a preference for deeper top soils and softer substrates to aid digging. Spends considerable time foraging above-ground for food in areas of high floristic diversity.	Suitable habitat resources available Risk Medium: could possibly occur **Further assessment required**
Pteropus poliocephalus	Grey-headed Flying-fox	V	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 commonly found in gullies, close to water, in vegetation with a dense canopy. They travel up to 50 km to forage, on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.	Suitable habitat resources available Risk Medium: could possibly occur **Further assessment required**
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		Inhabits eucalypt rainforest, sclerophyll forest and open woodland vegetation. Availability of tree hollows is important for access to roosting sites.	Suitable habitat resources available Risk Medium: could possibly occur **Further assessment required**

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Scoteanax rueppellii	Greater Broad-nosed Bat	V		Occur in a variety of habitats including rainforest, dry and wet sclerophyll forest and eucalypt woodland. Large hollow bearing trees required for roosting.	Suitable habitat resources available Risk Medium: could possibly occur **Further assessment required**
Reptiles					
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Confined to the Sydney basin within a radius of approximately 200 km of Sydney. Preferred habitat of sandstone outcrops with woodland, open woodland and/or heath vegetation. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges and tree hollows.	The study area does not provide suitable habitat. Risk Low: unlikely to occur
Migratory Species					
Apus pacificus	Fork-tailed Swift		M	The Fork-tailed Swift leaves its breeding grounds in Siberia from August–September. They usually arrive in Australia around October. In NSW, the Fork-tailed Swift is recorded in all regions. They mostly occur over inland plains but sometimes above foothills or in coastal areas. They prefer dry, open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sand plains covered with spinifex, open farmland and inland and coastal sand-dunes. They sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines. The Fork-tailed Swift is an aerial eater, flying anywhere from 1 m to 300 m above the ground to forage.	Suitable habitat available within study area Risk Medium: could possibly occur **Further assessment is required**

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Diomedea exulans antipodensis	Antipodean Albatross		V, M	Breeds on New Zealand islands. Occurs in Australia to forage in NSW waters. Foraging can occur over large distances and is temporally and spatially patchy.	Low: unlikely to occur
Diomedea exulans exulans	Tristan Albatross		E, M	The Tristan Albatross is a marine, pelagic seabird. It forages in open water in the Atlantic Ocean near the Cape of Good Hope, South Africa. The 'at sea' distribution of this newly described species is yet to be defined. There is currently only one definitive record of the Tristan Albatross from Australian waters.	Low: unlikely to occur
Diomedea epomophora epomophora	Southern Royal Albatross		V, M	The Southern Royal Albatross is marine and pelagic. It occurs in subantarctic, subtropical and occasionally Antarctic waters.	Low: unlikely to occur
Diomedea exulans gibsoni	Gibson's Albatross		V, M	Breeds in New Zealand and disperses across the southern Pacific. Occurs off the NSW coast.	Low: unlikely to occur
Diomedea exulans	Wandering Albatross	E1	V, M	Wandering albatross spend the majority of their time in flight, soaring over the southern oceans.	Low: unlikely to occur
Diomedea epomophora sanfordi	Northern Royal Albatross		E, M	The Northern Royal Albatross is marine, pelagic and aerial. Its habitat includes subantarctic, subtropical, and occasionally Antarctic waters.	Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Macronectes giganteus	Southern Giant-Petrel		E, M	Over summer, the species nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory. It is an opportunistic scavenger and predator, and scavenges from fishing vessels and animal carcasses on land.	Low: unlikely to occur
Macronectes halli	Northern Giant-Petrel		V, M	The Northern Giant-Petrel is marine and oceanic. It mainly occurs in sub-Antarctic waters, but regularly occurs in Antarctic waters of the south-western Indian Ocean, the Drake Passage and west of the Antarctic Peninsula.	Low: unlikely to occur
Puffinus carneipes	Flesh-footed Shearwater, Fleshy-footed Shearwater		M	Mainly occurs in the subtropics over continental shelves and slopes and occasionally inshore waters.	Low: unlikely to occur
Thalassarche bulleri	Buller's Albatross, Pacific Albatross		V, M	Buller's Albatross are marine and pelagic, inhabiting subtropical and subantarctic waters of the southern Pacific Ocean.	Low: unlikely to occur
Thalassarche cauta cauta	Shy Albatross, Tasmanian Shy Albatross		V, M	The Shy Albatross is a marine species occurring in subantarctic and subtropical waters, reaching the tropics in the cool Humboldt Current off South America.	Low: unlikely to occur
Thalassarche eremita	Chatham Albatross		E, M	The Chatham Albatross is a marine species. It occurs in subantarctic and subtropical waters reaching the tropics in the cool Humboldt Current off South America.	Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Thalassarche melanophris impavida	Campbell Albatross		V, M	The Campbell Albatross is a marine sea bird inhabiting sub-Antarctic and subtropical waters from pelagic to shelf-break water habitats.	Low: unlikely to occur
Thalassarche melanophris	Black-browed Albatross	V	V, M	Inhabits Antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. Spends most of its time at sea, breeding on small isolated islands.	Low: unlikely to occur
Thalassarche cauta salvini	Salvin's Albatross		V, M	Salvin's Albatross is a marine species occurring in subantarctic and subtropical waters, reaching the tropics in the cool Humboldt Current, off South America.	Low: unlikely to occur
Thalassarche cauta steadi	White-capped Albatross		V, M	The White-capped Albatross is a marine species and occurs in subantarctic and subtropical waters.	Low: unlikely to occur
Caretta caretta	Loggerhead Turtle	E1	E, M	Marine species; coming on land only to nest on beaches	Low: unlikely to occur
Chelonia mydas	Green Turtle	V	V, M	Marine species; coming on land only to nest on beaches	Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle, Luth	E	E, M	Marine species; coming on land only to nest on beaches	Low: unlikely to occur
Eretmochelys imbricata	Hawksbill Turtle		V, M	Marine species; coming on land only to nest on beaches	Low: unlikely to occur
Lamna nasus	Porbeagle, Mackerel Shark			Marine species. No habitat available in study area.	Low: unlikely to occur
Manta birostris	Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray			Marine species. No habitat available in study area.	Low: unlikely to occur
Natator depressus	Flatback Turtle		V, M	Marine species; coming on land only to nest on beaches	Low: unlikely to occur
Sousa chinensis	Indo-Pacific Humpback Dolphin			Marine species. No habitat available in study area.	Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Haliaeetus leucogaster	White-bellied Sea-Eagle		M	This species inhabits coastal and inland riverine areas with large areas of open water. Breeding habitat is located near water and predominantly within tall open forest and woodland. The nest is a large structure made of sticks. Foraging habitat is large areas of open water as well as open terrestrial habitats such as grasslands. They forage either from a perch or whilst in flight.	Low: unlikely to occur
Hirundapus caudacutus	White-throated Needletail		M	This species is predominantly aerial within Australia, however they have been recorded roosting in trees in both forests and woodlands within dense foliage either in the canopy or within hollows. This species breeds in northern Asia. And migrates south between September-October.	Suitable habitat available within study area Risk Medium: could possibly occur **Further assessment is required**
Merops ornatus	Rainbow Bee-eater		M	Preference for open forests and woodlands, shrub lands, and various cleared or semi-cleared habitats, including farmland, close to permanent water. It also occurs in inland and coastal sand dune systems. Breeding occurs from August to January, nesting in enlarged chambers at the end of long burrow or tunnel excavated in flat or sloping ground.	Suitable habitat available within study area Risk Medium: could possibly occur **Further assessment is required**
Monarcha melanopsis	Black-faced Monarch		M	The Black-faced Monarch is found along the coast of eastern Australia, becoming less common further south. This species of bird usually inhabits dense gullies of rainforest, sclerophyll forests and eucalypt woodlands along the coastal regions from Victoria to Cape York and is migratory over much of its range.	Low: unlikely to occur
Monarcha trivirgatus	Spectacled Monarch		M	Usually in rainforest, mangroves, moist gloomy gullies of dense eucalyptus forest.	Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Myiagra cyanoleuca	Satin Flycatcher		M	Summer breeding range from Qld to Tas, winter migration to NE Qld. Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands often near wetlands or watercourses, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	Low: unlikely to occur
Rhipidura rufifrons	Rufous Fantail		M	This species is a summer breeding migrant to SE Australia. They occur in the undergrowth of rainforests/wetter Eucalypt forests/gullies. Preference for deep shade, and is often seen close to the ground. The Rufous Fantail feeds on insects, in the middle and lower levels of the canopy. Constructs a small compact cup nest, suspended from a tree fork about 5 m from the ground.	Low: unlikely to occur
Actitis hypoleucos	Common Sandpiper		M	The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties.	Low: unlikely to occur
Calidris alba	Sanderling		M	In Australia, the species is almost always found on the coast, mostly on open sandy beaches exposed to open sea-swell, and also on exposed sandbars and spits, and shingle banks, where they forage in the wave-wash zone and amongst rotting seaweed.	Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Calidris canutus	Red Knot		M	In Australasia the Red Knot mainly inhabit intertidal mudflats, sand flats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs.	Low: unlikely to occur
Calidris ferruginea	Curlew Sandpiper	E1	M	It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts.	Low: unlikely to occur
Calidris ruficollis	Red-necked Stint		M	In Australasia, the Red-necked Stint is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores.	Low: unlikely to occur
Calidris tenuirostris	Great Knot	V	M	Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sand flats, including inlets, bays, harbours, estuaries and lagoons.	Low: unlikely to occur
Charadrius bicinctus	Double-banded Plover		M	Found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers.	Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Charadrius mongolus	Lesser Sand-plover	V	M	Almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sand flats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms.	Low: unlikely to occur
Gallinago hardwickii	Latham's Snipe, Japanese Snipe		M	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies).	Low: unlikely to occur
Heteroscelus brevipes	Grey-tailed Tattler		M	The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats.	Low: unlikely to occur
Limosa lapponica	Bar-tailed Godwit		M	Found mainly in coastal habitats such as large intertidal sand flats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh.	Low: unlikely to occur
Limosa limosa	Black-tailed Godwit	V	M	Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sand flats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps.	Low: unlikely to occur
Numenius madagascariensis	Eastern Curlew		M	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sand flats, often with beds of seagrass.	Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Numenius minutus	Little Curlew, Little Whimbrel		M	hen resting during the heat of day, the Little Curlew congregates around pools, river beds and water-filled tidal channels, and shallow water at edges of billabongs. The Little Curlew is most often found feeding in short, dry grassland and sedge land, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated.	Low: unlikely to occur
Numenius phaeopus	Whimbrel		M	The Whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms.	Low: unlikely to occur
Pluvialis fulva	Pacific Golden Plover		M	In non-breeding grounds in Australia this species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands. Pacific Golden Plovers usually occur on beaches, mudflats and sand flats (sometimes in vegetation such as mangroves, low saltmarsh such as Sarcocornia, or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in salt works.	Low: unlikely to occur
Pluvialis squatarola	Grey Plover		M	In non-breeding grounds in Australia, Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sand flats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons.	Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Rostratula australis	Australian Painted Snipe		E, M	Inhabits shallow inland wetlands, either freshwater or brackish water bodies. nests on the ground amongst tall reed-like vegetation near water, and feeds near the water's edge and on mudflats.	Low: unlikely to occur
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank		M	The Marsh Sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and salt works.	Low: unlikely to occur
Xenus cinereus	Terek Sandpiper	V	M	In Australia, has been recorded on coastal mudflats, lagoons, creeks and estuaries. Favours mud banks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools.	Low: unlikely to occur
FLORA					
Threatened Ecological Community					

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	RFEFCF	E		This ecological community is associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). RFEFCF generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level. The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees. Typically these forests and woodlands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water (DEC 2005a).	Risk High: occurs in study area. **Further assessment required**

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Swamp Sclerophyll Forest on Coastal Floodplain	SSFCF	E		This community generally occurs below 20 m elevation and is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. This swamp forest community has many structural forms depending on site conditions. It generally has an open to dense tree layer of eucalypts and paperbarks, although some remnants only have scattered trees as a result of partial clearing. Trees may exceed 25 m in height, but can be considerably shorter in regrowth stands or on lower quality sites where the tree stratum is low and dense. The community also includes some areas of fernland and tall reedland or sedge land, where trees are very sparse or absent (DEC 2005).	Risk High: occurs in study area. **Further assessment required**

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Lower Hunter Spotted Gum Ironbark Forest	LHSGIF	E		This community is dominated by Spotted Gum *Corymbia maculata* and Broad-leaved Ironbark *Eucalyptus fibrosa*, while Grey Gum *E. punctata* and Grey Ironbark *E. crebra* occur occasionally. A fragmented core of the community still occurs between Cessnock and Beresfield. Remnants occur within the Local Government Areas of Cessnock, Maitland, Singleton, Lake Macquarie, Newcastle and Port Stephens but may also occur elsewhere within the bioregion. The Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures, although smaller areas of the community may also occur on the Permian Singleton and Newcastle Coal Measures and the Triassic Narrabeen Group.	Risk High: occurs in study area. **Further assessment required**
Threatened Flora					
Acacia bynoeana	Bynoe's Wattle	E	V	Occurs mainly in heath and dry sclerophyll forest, open woodland with dense to sparse heath understorey; open woodlands with a sparse shrub cover and a grass/sedge ground cover; and heathlands with sparse overstorey. With sand or sandy clay substrate, often with ironstone gravel and usually well drained, infertile soil.	Small area of suitable habitat available within study area. Narrabeen Doyalson Coastal Woodland (Unit 31) occurs north of study area. Risk Medium: could possibly occur. **Further assessment is required**

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Angophora inopina	Charmhaven Apple	V	V	Limited ecological knowledge on the species. Known to occur most frequently in open woodland with a dense shrub understorey. Grows in deep white sandy soils over sandstone.	Limited suitable habitat available within in study area Risk Medium: could possibly occur **Further assessment is required**
Asterolasia elegans		E	E	Occurs in the northern hills of Sydney. Habitat requirements are wet, sheltered sclerophyll forests on the mid to lower slopes of moist gullies and rocky outcrops.	No suitable habitat available within study area. Moist gullies and rocky outcrops not in study area. Risk Low: unlikely to occur
Caladenia tessellata	Thick-lipped Spider-orchid	E	V	Requires low, dry sclerophyll woodland with a heathy or sometimes grassy understorey on clay loams or sandy soils, specifically in dry, low Brittle Gum (*Eucalyptus mannifera*), Inland Scribbly Gum (*E. rossii*) and Allocasuarina spp. woodland with a sparse understorey and stony soil.	No suitable habitat available within study area. No Brittle Gum or Inland Scribbly Gum woodland in study area. Risk Low: unlikely to occur
Clematis fawcettii	Northern Clematis	V	V	A vine growing high into the rainforest canopy, but is usually recognised only as small weak plants in the understorey. The vine climbs by means of the long twining leaf-stalks. Found in widely dispersed areas in southern Queensland and in north-east NSW north from Lismore.	Site is not within this species natural range. Risk Low: unlikely to occur
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	Occurs across a wide variety of habitats including coastal districts, heathlands, heathy woodlands, sedgelands, forests, and Spear Grass-tree (*Xanthorrhoea resinosa*) plains. Soils are generally considered to be moist and sandy, however, this species is also known to grow in dry soils and peaty soils	Some suitable habitat available within study area. Risk Medium: could possibly occur. **Further assessment is required**

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Diuris praecox	Rough Doubletail	V	V	Occurs in a range of habitat types, most of which have a strong shale soil influence. These include ridgetop drainage depressions supporting wet heath within or adjoining shale cap communities.	No suitable coastal habitat available within study area. Risk Low: unlikely to occur
Eucalyptus camfieldii	Camfield's Stringybark	V	V	Occurs mostly in small scattered stands in exposed situations on sandstone plateaus, ridges and slopes near the coast, often on the boundary of tall coastal heaths or low open woodland. Requires shallow sandy soils.	No suitable habitat available within study area. Risk Low: unlikely to occur
Eucalyptus parramattensis subsp. parramattensis	*Eucalyptus parramattensis* C. Hall. *subsp. parramattensis* in Wyong and Lake Macquarie local government areas	EP		This species is associated with low moist areas alongside drainage lines and adjacent to wetlands. Occurs in woodlands on sandy soils. This endangered population is quite separate from other known populations and occurs on sandy alluvium within a floodplain community that also supports *Eucalyptus robusta*, *E. tereticornis*, *E. gummifera* and *Melaleuca* species	Suitable habitat available within study area Risk High: highly likely to occur **Further assessment is required**
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	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. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests Often occurs in open, slightly disturbed sites such as along tracks.	Suitable habitat available within study area Risk High: highly likely to occur **Further assessment is required**
Maundia triglochinoides		V		Grows in swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients. Flowering occurs during warmer months. Associated with wetland species e.g. *Triglochin procerum*.	No suitable freshwater habitat available within study area. Risk Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Melaleuca biconvexa	Biconvex Paperbark	V	V	The species may occur in dense stands forming a narrow strip adjacent to watercourses, in association with other Melaleuca species or as an understorey species in wet forest.	Suitable habitat available within study area Risk High: highly likely to occur **Further assessment is required**
Pelargonium sp.	Omeo Stork's-bill	E	E	Normally located in habitat just above high water mark of ephemeral lakes and can colonise exposed lake beds.	No suitable freshwater habitat available within study area. Risk Low: unlikely to occur
Pimelea curviflora var. curviflora		V	V	Occurs in open forest on sandy soil derived from sandstone and on lateritic soils. Often grows amongst dense grasses and sedges.	Marginal suitable habitat available within study area Risk Medium: could possibly occur **Further assessment is required**
Prostanthera askania	Tranquillity Mint bush	E	E	Occurs adjacent to, but not immediately in, drainage lines on flat to moderately steep slopes formed on Narrabeen sandstone and alluvial soils derived from it. Occurs in moist sclerophyll forest and warm temperate rainforest communities, and the ecotone between them. These communities are generally tall forests with a mesic understorey; Sydney Blue Gum *Eucalyptus saligna* and Turpentine *Syncarpia glomulifera* are usually present, though canopy species present can be highly variable.	No suitable moist sclerophyll forest and warm temperate rainforest habitat available within study area. Risk Low: unlikely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Prostanthera junonis	Somersby Mint bush	E	E	Restricted to Sydney Basin bioregion. Preference for sloping habitat, rock outcropping and/or rocky fragments in open-forest/Low woodland/open scrub habitat.	No suitable habitat available within study area. Vegetation types where this species has been recorded in Wyong LGA do not occur in study area (Bell, 2002). Risk Low: unlikely to occur.
Rhizanthella slateri	Eastern Underground Orchid	V	E	Grows in sclerophyll forests in shallow to deep loam. Flowers in spring (Oct-Nov). This species geographical distribution is poorly understood, with small isolated populations.	Risk Low: unlikely to occur
Rutidosis heterogama	Heath Wrinklewort	V	V	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides. Flowers mostly in autumn (March-May).	Suitable habitat available within study area Risk Medium: could possibly occur **Further assessment is required**
Streblus pendulinus	Siah's Backbone		E	This tree/shrub species occurs in warm rainforest along watercourses. It inhabits a range of between sea level and 800 m altitude.	No suitable warm rainforest habitat available within study area. Risk Low: unlikely to occur
Syzygium paniculatum	Magenta Lilly Pilli	E	V	Grows in subtropical and littoral rainforest on sandy soils or stabilised dunes near the sea.	No suitable rainforest habitat available within study area. Risk Low: unlikely to occur
Tetratheca glandulosa	Glandular Pink-bell	V	V	Strongly associated with areas of shale-sandstone transition habitat and occupies ridgetops, upper-slopes and mid-slope sandstone benches. Preferred vegetation includes heaths, scrub, woodlands/open woodlands and open forest.	No suitable habitat available within study area. Vegetation types where this species has been recorded in Wyong LGA do not occur in study area (Bell, 2002). Risk Low: unlikely to occur.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat requirements	Likelihood of occurrence
Tetratheca juncea	Black-eyed Susan	V	V	Usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. While the species has a preference for cooler southerly aspects, it has been found on slopes with a variety of aspects. It generally prefers well-drained sites and occurs on ridges, although it has also been found on upper slopes, mid-slopes and occasionally in gullies.	Suitable habitat available and reliable records within the study area. Risk High: likely to occur **Further assessment is required**
Thelymitra sp. adorata	Wyong Sun Orchid	CE		Occurs from 10-40 m a.s.l. in grassy woodland or occasionally derived grassland in well-drained clay loam or shale derived soils. The vegetation type in which the majority of populations occur (including the largest colony) is a Spotted Gum - Ironbark Forest with a diverse grassy understorey and occasional scattered shrubs. Typical composition of the community, in areas where the orchid is known to occur, is an overstorey of *Corymbia maculata* and *Eucalyptus paniculata*, with an open to dense shrub layer of *Melaleuca nodosa* over a grass/herb ground layer.	Suitable habitat available within study area Risk Medium: could possibly occur **Further assessment is required**

Note: V = Vulnerable, E = Endangered; CE = Critically Endangered, EP = Endangered Population.

Appendix D: EP&A Act assessment of significance

River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner bioregions (RFEFCF)

Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	River Flat Eucalypt Forest is listed as endangered under the *Threatened Species Conservation Act 1995.* This community occurs in the study area. The proposed actions will require the removal of native vegetation. However, most of this is regrowth vegetation confined to the median strip of the existing motorway. Proposed stockpile areas are in previously disturbed, exotic dominated areas. Minimal clearing and groundcover disturbance of RFEFCF (about 1.0 ha in the study area) may be required in vegetated areas along the roadside verge in the study area. 1.0 hectares represents about 0.05% of the remaining distribution in the Lower Hunter region and about 0.01% state-wide.
Conclusion	The action is not 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.
Criteria	**(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.**
Response	Minimal clearing and groundcover disturbance of RFEFCF (up to 1.0 ha in the study area) would be required in vegetated areas along the roadside verge in the study area.
Conclusion	The action is not likely to adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
Criteria	**(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**
Response	Minimal clearing and groundcover disturbance of RFEFCF (up to 1.0 ha in the study area) would be required in vegetated areas along the roadside verge in the study area.
Conclusion	The actions proposed is likely to result in a limited amount of habitat to be removed or modified.
Criteria	**(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**
Response	Minimal clearing and groundcover disturbance of RFEFCF (up to 1.0 ha in the study area) would be required in vegetated areas along the roadside verge in the study area.
Conclusion	Disturbance of the narrow strips RFEFCF is unlikely to result in this becoming fragmented

	or isolated as a result of the proposed actions.
Criteria	**(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.**
Response	Minimal clearing and groundcover disturbance of RFEFCF (up to 1.0 ha in the study area) would be required in vegetated areas along the roadside verge in the study area.
Conclusion	The habitat to be removed is not likely to be critical to the long-term survival of this vegetation community.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	To date, no critical habitat has been declared under the TSC Act for this vegetation community.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	To date, no recovery plan has been developed under the TSC Act for this vegetation community, however, OEH has identified five priority activities to assist this community including: • Protect habitat by minimising further clearing of the community. This requires recognition of the values of all remnants in the land use planning process. • Ensure that the fire sensitivity of the community is considered when planning hazard reduction and asset management burning. • Undertake restoration including bush regeneration, revegetation and weed control, and promote public involvement in this restoration.
Conclusion	The proposal is not consistent with some of these priority activities, however, mitigation measures will ensure weed control and landscaping works minimise impacts on this EEC.
Criteria	**(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.**
Response	Key threatening processes listed on the *Threatened Species Conservation Act 1995* with relevance to RFEFCF include: • Clearing of native vegetation • High frequency fire • Invasion by exotic perennial grasses The clearing of native vegetation and Invasion by exotic perennial grasses have the potential to adversely affect River Flat Eucalypt Forest in the study area. It is proposed to implement mitigation measures to minimise clearing and disturbance of native vegetation and to reduce the risk of spreading disease and invasive species becoming established in the study area.
Conclusion	The proposed actions are unlikely to have an adverse effect on River Flat Eucalypt Forest or increase the impact of a key threatening process.

Overall Conclusion

While the proposed works are likely to affect about 1.0 ha of RFEFCF, the limited area of disturbance and proposed mitigation strategies suggest any actions are unlikely to significantly affect this endangered ecological community. It is recommended that one hectare of this EEC is likely to be affected, offsets are considered in accordance with the Roads and Maritime Guideline for Biodiversity Offsets.

A Species Impact Statement is not required.

Mitigation Measures

Retain mature trees and shrubs in remnant vegetation in and adjacent to roadside works. This is feasible for all areas and the significance assessment is based on this mitigation measure being implemented.

Avoid disturbance of native vegetation (groundcover, shrubs and trees) in and adjacent to roadside works.

Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established.

Consider offsets in accordance with the Roads and Maritime Guideline for Biodiversity Offsets.

Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner bioregions (SSFCF)

Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	Swamp Sclerophyll Forest is listed as endangered under the *Threatened Species Conservation Act 1995*. This community occurs in the study area. The proposed actions would require the removal of native vegetation. However, most of this is regrowth vegetation confined to the median strip of the existing motorway. SSCFC community does not occur in the median strip. Proposed stockpile areas are in previously disturbed, exotic dominated areas. Clearing or groundcover disturbance of SSFCF (about 1.12 hectares) mainly in sites 7a, 7c and 3a would be required for road widening or access to proposed stockpile areas. 1.12 ha represents about 0.02% of its distribution within the locality and about 0.01% of its remaining distribution in NSW.
Conclusion	The action is not 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.
Criteria	**(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.**
Response	Disturbance of native vegetation will be avoided for construction of temporary access tracks up to 3m wide to stockpile sites. In some cases minimal clearing and groundcover disturbance of SSFCF (up to 1.12 hectares) would be required for access to proposed stockpile areas.
Conclusion	The action is not likely to adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
Criteria	**(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**
Response	Minimal clearing and groundcover disturbance of SSFCF (up to a total of 1.12 ha in the study area) would be required to accommodate the road widening and for access to proposed stockpile areas in previously cleared areas (Sites 9, 7a, 7c and 3a).
Conclusion	The actions proposed are likely to result in a limited amount of habitat to be removed or modified.
Criteria	**(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**

Response	Minimal clearing and groundcover disturbance of SSFCF (up to a total of 1.12 ha in the study area) would be required mainly for temporary access tracks up to 3m wide to proposed stockpile areas in previously cleared areas (Sites 9, 7a, 7c and 3a).
Conclusion	Disturbance of the narrow strips SSCFC is unlikely to result in this becoming fragmented or isolated as a result of the proposed actions.
Criteria	**(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.**
Response	Minimal clearing and groundcover disturbance of SSFCF (up to a total of 1.12 ha in the study area) would be required for access to proposed stockpile areas in previously cleared areas (Sites 9, 7a, 7c and 3a).
Conclusion	The habitat that is likely to be removed is not likely to be critical to the long-term survival of this vegetation community.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	To date, no critical habitat has been declared under the TSC Act for this vegetation community.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	To date, no recovery plan has been developed under the TSC Act for this vegetation community, however, OEH has identified five priority activities to assist this community including: • Protect habitat by minimising further clearing of the community. This requires recognition of the values of all remnants in the land use planning process. • Ensure that the fire sensitivity of the community is considered when planning hazard reduction and asset management burning. • Undertake restoration including bush regeneration, revegetation and weed control, and promote public involvement in this restoration.
Conclusion	The proposal is not consistent with some of these priority activities, however, mitigation measures will ensure weed control and landscaping works minimise impacts on this EEC.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect Swamp Sclerophyll Forest. However, the proposed vegetation clearing is unlikely to impact important habitat for this community, with the minimal clearing for temporary access tracks to adjoining stockpile areas.
Conclusion	The proposed actions are unlikely to have an adverse effect on Swamp Sclerophyll Forest or increase the impact of a key threatening process.

Overall Conclusion

While the proposed works are likely to affect up to 1.12 ha of SSFCF, the limited area of disturbance and proposed mitigation strategies suggest any potential actions are unlikely to negatively affect this threatened ecological community. It is recommended that as greater than one hectare of this EEC is likely to be affected, offsets are considered in accordance with the Roads and Maritime Guideline for Biodiversity Offsets.

A Species Impact Statement is not required.

Mitigation Measures

Retain mature trees and shrubs in remnant vegetation in and adjacent to stock pile areas.
Avoid disturbance of native vegetation (groundcover, shrubs and trees) for construction of temporary

access tracks to stockpile sites. Use existing tracks and previously cleared/disturbed land for stockpile areas and temporary access tracks. Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established. Consider offsets in accordance with the Roads and Maritime Guideline for Biodiversity Offsets.

Lower Hunter Spotted Gum Ironbark Forest of the Sydney Basin bioregion (LHSGIF)

Criteria	**(d) 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**
Response	
Conclusion	Not applicable
Criteria	**(e) 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**
Response	
Conclusion	Not applicable
Criteria	**(f) 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**
Response	Lower Hunter Spotted Gum Ironbark Forest is listed as endangered under the *Threatened Species Conservation Act 1995*. This community occurs in the study area. The proposed actions would require the removal of native vegetation. However, most of this is regrowth vegetation confined to the median strip of the existing motorway. LHSGIF community does not occur in the median strip. Proposed stockpile areas are in previously disturbed, exotic dominated areas. Minimal clearing and groundcover disturbance of LHSGIF (3.4 hectares) mainly in site 2a will be required for interchange upgrade, and may be required access to proposed stockpile areas 4a, 4b and 7e. The vegetation in Site 2a is in moderate to good condition. 3.4 hectares represents about 0.8% of the local occurrence of this community (10km radius) and about 0.01% of its remaining distribution.
Conclusion	The action is not 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.
Criteria	**(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.**
Response	Disturbance of native vegetation will be avoided for construction of temporary access tracks up to 3m wide to stockpile sites. In some cases minimal clearing and groundcover disturbance of LHSGIF (up to 3.4 hectares) would be required for interchange upgrades and access to proposed stockpile areas.
Conclusion	The action is not likely to adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
Criteria	**(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**
Response	Minimal clearing and groundcover disturbance of LHSGIF (up to a total of 3.4 ha in the study area) will be required to accommodate the road widening and for access to proposed stockpile areas in previously cleared areas (Sites 2a, 4a, 4b and 7e).
Conclusion	The actions proposed are likely to result in a limited amount of habitat to be removed or modified.
Criteria	**(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**
Response	Minimal clearing and groundcover disturbance of LHSGIF (up to a total of 3.4 ha in the study area) would be required mainly for upgrades to interchanges and temporary access

	tracks up to 3m wide to proposed stockpile areas in previously cleared areas (Sites 2a, 4a, 4b and 7e).
Conclusion	Disturbance of the narrow strips LHSGIF is unlikely to result in this becoming fragmented or isolated as a result of the proposed actions.
Criteria	**(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.**
Response	Minimal clearing and groundcover disturbance of LHSGIF (up to a total of 3.4 ha in the study area) would be required for interchange upgrades and access to proposed stockpile areas in previously cleared areas (Sites 2a, 4a, 4b and 7e).
Conclusion	The habitat to be removed is not likely to be critical to the long-term survival of this vegetation community.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	To date, no critical habitat has been declared under the TSC Act for this vegetation community.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	To date, no recovery plan has been developed under the TSC Act for this vegetation community, however, OEH has identified five priority activities to assist this community including: • Protect habitat by minimising further clearing of the community. This requires recognition of the values of all remnants in the land use planning process, particularly development consents, rezonings and regional planning. • Weed control. • Undertake restoration including bush regeneration and revegetation.
Conclusion	The proposal is not consistent with some of these priority activities, however, mitigation measures will ensure weed control and landscaping works minimise impacts on this EEC.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect LHSGIF. However, the proposed vegetation clearing is unlikely to impact important habitat for this community, with minimal clearing (3.4ha) for interchange upgrades and temporary access tracks to adjoining stockpile areas.
Conclusion	The proposed actions will result in a minor increase to the impact from this key threatening process.

Overall Conclusion

While the proposed works are likely to affect up to 3.4 ha of LHSGIF the limited area of disturbance and proposed mitigation strategies suggest any potential actions are unlikely to negatively affect this threatened ecological community. It is recommended that as greater than one hectare of this EEC is likely to be affected, offsets are considered in accordance with the Roads and Maritime Guideline for Biodiversity Offsets.

A Species Impact Statement is not required.

Mitigation Measures

Minimise clearing of native vegetation wherever possible.
Retain mature trees and shrubs in remnant vegetation in and adjacent to stock pile areas.
Avoid disturbance of native vegetation (groundcover, shrubs and trees) for construction of temporary

access tracks to stockpile sites. Use existing tracks and previously cleared/disturbed land for stockpile areas and temporary access tracks. Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established. Consider offsets in accordance with the Roads and Maritime Guideline for Biodiversity Offsets.

Rutidosis heterogama (heath Wrinklewort) V; Pimelea curviflora var. curviflora V; Acacia bynoeana (Bynoe's wattle) – V, Cryptostylis hunteriana (leafless tongue orchid) - V.

Grouping: Groundcover and low shrub in heath and shrubby woodland to open forest on sand or sandy clay substrate

Criteria	**(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**
Response	• *Rutidosis heterogama* (Heath Wrinklewort) is listed as vulnerable under the *Threatened Species Conservation Act 1995*. • *Pimelea curviflora* var. *curviflora* is listed as vulnerable under the TSC Act. • *Acacia bynoeana* (Bynoe's wattle) is listed as vulnerable under the TSC Act. • *Cryptostylis hunteriana (*leafless tongue-orchid*)* is listed as vulnerable under the TSC Act. No individuals of these species were identified during the onsite surveys The proposed actions will require the removal of native vegetation. Most of this is regrowth vegetation confined to the median strip of the existing motorway and proposed stockpile areas in previously disturbed, exotic dominated areas. Up to 9 ha of potential habitat for these species occurs in sites 1, 2, and 4. About 5 ha is likely to be cleared as a result of the proposal.
Conclusion	The action is not likely to effect the life cycle of these species such that viable local populations are placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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.**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	No individuals of these species were identified during the onsite surveys. About 5 ha of potential habitat for these species in site 2 is proposed to be cleared for the construction of additional exit lane at the northern end of the study area. 2.25 ha of this area is regrowth that was previously cleared for road construction in the 1980's.
Conclusion	The clearing of up to 5 ha of remnant open forest vegetation in site 2 for the construction of

	additional exit lane at the northern end of the study area is unlikely to impact important habitat for these species.
Criteria	**(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**
Response	No individuals of these species were identified during the onsite surveys.
Conclusion	Clearing is unlikely to fragment or isolate habitat for these species, with the majority of vegetation to be removed being in the existing previously disturbed median strip of the motorway.
Criteria	**(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.**
Response	Up to 5 ha of remnant open forest vegetation in site 2 will be cleared for the construction of additional exit lane at the northern end of the study area.
Conclusion	The habitat to be removed is not likely to fragment or isolate any known populations of these species.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	To date, no critical habitat has been declared under the TSC Act for these threatened species.
Conclusion	Not applicable
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	To date, no recovery plan has been developed under the TSC Act for these threatened species
Conclusion	Not applicable
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect these species. However, vegetation clearing is unlikely to impact important habitat for this species, with the majority of vegetation to be removed exotic or in previously disturbed areas.
Conclusion	The proposed actions are unlikely to have an adverse effect on these species or significantly increase the impact of a key threatening process.

Overall Conclusion

While there is potential for these species to occur within a small area of the site, no species were identified and the proposed works are not likely to impact on their long term survival.

A Species Impact Statement is not required.

Mitigation Measures

Retain mature trees and shrubs in remnant vegetation in and adjacent to stock pile areas.

Avoid disturbance of native vegetation (groundcover, shrubs and trees) for construction of temporary access tracks to stockpile sites.

Use existing tracks and previously cleared/disturbed land for stockpile areas and temporary access tracks.

Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established

Thelymitra sp. *adorata* (Wyong sun orchid) CE

Criteria	**(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**
Response	• This species is listed as critically endangered under the *Threatened Species Conservation Act 1995.* • No individuals were identified during the onsite surveys. The proposed actions will require the removal of native vegetation. However, most of this is regrowth vegetation confined to the median strip of the existing motorway and proposed stockpile areas in previously disturbed, exotic dominated areas.
Conclusion	The proposed actions are unlikely to have an adverse effect on the life cycle of these species such that a viable local population is placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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.**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	No individuals were identified during the onsite surveys. Potential habitat for this species (Spotted Gum-Ironbark forest) occurs in sites 2, 4, Sparks Rd-Burnet Rd T-section and Doyalson Road interchange. About 3.4 ha of habitat for this species is likely to be affected by the proposal.
Conclusion	The actions proposed are likely to remove or modify about 3.4 ha of potential habitat for this species.
Criteria	**(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**
Response	No individuals were identified during the onsite surveys. Potential habitat for this species (Spotted Gum-Ironbark forest) occurs in sites 2, 4, Sparks Rd-Burnet Rd T-section and Doyalson Road interchange. A small area (about 3.4 ha) of potential habitat would be cleared for intersection upgrade works. However, these areas are contiguous with relatively undisturbed larger areas of remnant Spotted Gum-Ironbark forest.
Conclusion	The proposed actions are unlikely to fragment or isolate this species from other areas of habitat.

Criteria	**(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.**
Response	Potential habitat for this species (Spotted Gum-Ironbark forest) occurs in sites 2, 4, Sparks Rd-Burnet Rd T-section. A small area (about 3.4 ha) of potential habitat is likely to be cleared for intersection upgrade works. However, this area is contiguous with relatively undisturbed, larger areas of remnant Spotted Gum-Ironbark forest.
Conclusion	The habitat to be removed is not likely to be critical to the long-term survival of this species.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	To date, no critical habitat has been declared under the TSC Act for this threatened species.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	To date, no recovery plan has been developed under the TSC Act for these threatened species.
Conclusion	Not applicable.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect *Thelymitra* sp*. adorata.* However, vegetation clearing is unlikely to impact important habitat for this species, with the majority of vegetation to be removed exotic or in previously disturbed areas.
Conclusion	The proposed actions are unlikely to have an adverse effect on *Thelymitra* sp*. adorata* or significantly increase the impact of a key threatening process.

Overall Conclusion

While there is potential for these species to occur within a small part of the study area, no *Thelymitra* sp*. adorata* (Wyong sun orchid) was recorded during on-site surveys and the proposed works are not likely to impact on their long term survival

A Species Impact Statement is not required.

Mitigation Measures

Retain mature trees and shrubs in remnant vegetation in and adjacent to stock pile areas.

Avoid disturbance of native vegetation (groundcover, shrubs and trees) for construction of temporary access tracks to stockpile sites.

Use existing tracks and previously cleared/disturbed land for stockpile areas and temporary access tracks.

Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established.

***Eucalyptus parramattensis* subsp. *parramattensis* (*Eucalyptus parramattensis* C. Hall. subsp. *parramattensis* In Wyong and Lake Macquarie Local Government Areas) and *Melaleuca biconvexa* (Biconvex paperbark); *Angophora inopina* (Charmhaven apple)**

Grouping: Grows in damp places, often near streams or low-lying areas. The site is considered to provide suitable habitat for these species.

Criteria	**(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**
Response	• *Eucalyptus parramattensis* subsp. *parramattensis* in the Wyong and Lake Macquarie Local Government Area is listed as an endangered population under the *Threatened Species Conservation Act 1995*. • *Melaleuca biconvexa* and *Angophora inopina* (Charmhaven apple) are listed as a vulnerable species under the TSC Act. *Eucalyptus parramattensis* and *Angophora inopina* were not recorded in the study area. However, there are reliable records of *Melaleuca biconvexa* in Site 3a, but outside of the proposal area (OEH 2013). The proposed actions would require the removal of native vegetation in Site 3a adjoining the existing M1, on/off ramps and Sparks Road, however individuals of the species in Site 3a are at least 50 metres away from the potential impact area and so will not be cleared. Exclusion zones should be established as a precautionary measure to avoid impacts on individuals of this species. No further *Melaleuca biconvexa* were identified within the area to be impacted by the proposal during field surveys. Proposed stockpile areas are in previously disturbed, exotic dominated areas. Minimal clearing and groundcover disturbance of potential habitat (about 1 ha) for these species in sites 9, 7a, 7c and 3a may be required for access to proposed stockpile areas.
Conclusion	The action is not likely to effect the life cycle of these species such that a viable local population is placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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.**
Response	
Conclusion	Not applicable
Criteria	**(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 propose**
Response	The proposed actions will require the removal of mostly previously cleared vegetation. No individuals or stands of these species were identified during the onsite surveys.

	The extent of potential habitat vegetation clearing is restricted to a small area (about 1 ha).
Conclusion	Mitigation measures recommend avoiding disturbance of mature vegetation and use of existing tracks and previously cleared land where possible. These measures will reduce the likelihood of potential habitat for these species being removed or modified.
Criteria	**(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**
Response	Proposed stockpile areas are in previously disturbed, exotic dominated areas. Minimal clearing and groundcover disturbance of potential habitat for these species in sites 9, 7a, 7c and 3a would be required for access up to 3m wide to proposed stockpile areas.
Conclusion	The potential habitat to be removed is not likely to be critical to the long-term survival of these species
Criteria	**(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.**
Response	These species are associated with low moist areas alongside drainage lines. The study area is considered to provide minimal suitable habitat for these species in areas that have been previously cleared/disturbed.
Conclusion	The habitat to be removed is not likely to be critical to the long-term survival of these species
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	To date, no critical habitat has been declared under the TSC Act for these threatened species
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	To date, no recovery plan has been developed under the TSC Act for these threatened species. OEH have identified seven priority activities to assist *Melaleuca biconvexa* including: • Survey thoroughly for the presence of Biconvex Paperbark before the approval of development applications. • Ensure run-off into swamps is controlled. • Assess impact of myrtle rust through monitoring of populations in proximity to known infestations.
Conclusion	Not applicable.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect these species. However, vegetation clearing is unlikely to impact important habitat for this species, with the majority of vegetation to be removed in previously disturbed areas.
Conclusion	The proposed actions are unlikely to have an adverse effect on these species or increase the impact of a key threatening process.

Overall Conclusion

While there is potential for these species to occur within a small area of the site, no *Eucalyptus parramattensis* or *Angophora inopina* were identified and the proposed works are not likely to impact on their long term survival. There are records of *Melaleuca biconvexa* in Site 3a, these will not be affected by the proposal, however, exclusion zones will be established around these individuals as a precautionary

measure. No further *Melaleuca biconvexa* were identified within the area to be impacted by the proposal during field surveys.

A Species Impact Statement is not required.

Mitigation Measures

Retain mature trees and shrubs in remnant vegetation in and adjacent to stock pile areas.
Avoid disturbance of native vegetation (groundcover, shrubs and trees) for construction of temporary access tracks to stockpile sites.
Establish exclusion around individuals of the species adjoining the proposal area.
Use existing tracks and previously cleared/disturbed land for stockpile areas and temporary access tracks.
Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established

Species: *Tetratheca juncea* (Black-eyed susan) - V

Criteria	**(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**
Response	*Tetratheca juncea* is listed as a vulnerable species under the *Threatened Species Conservation Act 1995*. *T. juncea* is known to exist only from the Wyong area to Bulahdelah and inland to the edge of the main ranges with the greatest concentration of records being from the Wyong and Lake Macquarie local government areas (Payne 2000). *Tetratheca juncea is* known found in sandy, occasionally moist heath and in dry sclerophyll vegetation. The total population size of Black-eyed susan is difficult to estimate accurately due to the species' habit of clumping. Plant clumps are commonly counted during survey work and used as a surrogate for individual plants. The total population size of Black-eyed susan has previously been estimated to be between 9,881 and 11,893 plant clumps (approximately 10,000 individuals). It is estimated there are 162 subpopulations in the Wyong LGA. Individual plants are difficult to identify given the plant is clonal and will resprout from rootstock (NSW NPWS 2000a). Little more is known about the life cycle of the species, however, recent research (Driscoll 2009) suggests that the plant is slow growing, with local populations/patches of the plant possibly being a hundred or more years old (Driscoll 2009). Evidence from historical urban development and rural land clearing indicates that the species continues to exist despite large losses from a local population (Driscoll 2009). A local population includes a subpopulation. It is considered that a 500m gap between populations may represent a distinct population (DSEWPAC 2011). This distance is based on the maximum flight distance of pollinators (LMCC 2013). From desktop assessment it is assumed any *Tetratheca juncea* population present within Site 1c is a distinct population with an absence of any further existing records within a 500m radius. This species was not identified in the study area during field survey as it was not the optimal time of year to undertake survey for this species. However there are reliable records (7) (OEH Wildlife Atlas) accurate to 10m in suitable habitat in Site 1c. The proposed actions will not directly impact the known locations of individuals or plant clumps within Site 1c. The proposal does have the potential to indirectly impact any individuals within a 20 metre buffer of the construction footprint where habitat removal will occur (LMCC 2013). Two of the seven records may be within a 20m buffer of the proposed construction impact area. This assessment assumes NSW Wildlife Atlas records from 2005 are still present on site and recommendations are made for pre-clearing surveys to also be undertaken to confirm their presence/location during flowering season. Exclusion zones should then be established to avoid impacts on individuals of this species. Recommendations are also made that the remainder of Site 1c, that although partially disturbed with a gas line easement running through the centre, is to be re-surveyed pre-construction during flowering season to ensure any outlier individuals not detected in the original surveys are considered.
Conclusion	The action is not likely to effect the life cycle of this species such that a viable local population is placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable.

Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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.**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	There is approximately 9 hectares of potential habitat in the study area to be removed including about 0.41 hectares of known habitat in Site 1c. Modelled habitat for the *Tetratheca juncea* Central Coast meta-population is about 25,716 hectares remaining (Driscoll 2012, LMCC 2013). Total potential habitat to be cleared in the study area represents about 0.03% of the remaining potential habitat in the region. It is proposed that the presence of the species is confirmed during flowering season and additional searches of Site 1c are undertaken. Exclusion zones should be established to avoid impacts on individuals of this species. Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible.
Conclusion	Habitat to be removed is a small area considering the extent of habitat remaining in the locality and is not considered significant to the long term survival of this species.
Criteria	**(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**
Response	*Tetratheca juncea* habitat in the study area is already fragmented by the existing M1 and supporting road network. The proposed activity will marginally increase the distance between remaining habitat areas of *Tetratheca juncea*. From desktop assessment it is assumed any *Tetratheca juncea* population present within Site 1c is a distinct, already isolated population with an absence of any further existing records within a 500m radius. Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible.
Conclusion	The potential habitat to be removed is likely to result in a minor increase in fragmentation to areas of habitat for this species.
Criteria	**(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.**
Response	There is approximately 9 hectares of potential habitat in the study area to be removed including about 0.41 hectares of known habitat in Site 1c. Modelled habitat for the *Tetratheca juncea* Central Coast meta-population is about 25,716 hectares remaining (Driscoll 2012, LMCC 2013). Total potential habitat to be cleared in the study area represents about 0.03% of the remaining potential habitat in the region. It is proposed that the presence of the species is confirmed during flowering season and additional searches of Site 1c are undertaken. Exclusion zones should be established to avoid impacts on individuals of this species. Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible.
Conclusion	The habitat to be removed is not likely to be critical to the long-term survival of the species.

Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	To date, no critical habitat has been declared under the TSC Act for this threatened species.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	To date, no recovery plan has been developed under the TSC Act for this threatened species, however, OEH have identified six priority activities to assist this species including: • Undertake targeted searches for the species in known or potential habitat during its flowering period prior to any clearing or development. • Install stormwater control mechanisms to prevent off-site impacts from development upslope of populations. • Undertake weed control as required using removal methods that will not impact on the species (hand pull or cut and paint weeds).
Conclusion	The proposal is consistent with these activities.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect the species. However, vegetation clearing is unlikely to impact important habitat for this species, with the majority of vegetation to be removed in previously disturbed areas.
Conclusion	The proposed actions are likely to lead to a minor increase in the impact of a key threatening process.

Overall Conclusion

This species was not recorded in the study area during field survey, however there are reliable records in Site 1c. The proposed actions will require the removal of native vegetation (about 0.4ha) in Site 1c that could indirectly impact this species.

It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species. As long as these mitigation measures are implemented, the proposal is unlikely to significantly affect this species.

A Species Impact Statement is not required.

Mitigation Measures

Avoid impacts to areas where this species has been recorded and establish exclusion zones around individuals. In the event that unexpected threatened species are detected at the site prior to construction the RMS Unexpected Threatened Species Finds Procedure should be enacted (RTA, 2011)
Where impacts are unavaoidable, investigate translocation options in consultation with Roads and Maritime.
Retain mature trees and shrubs in remnant vegetation in and adjacent to stock pile areas.
Avoid disturbance of native vegetation (groundcover, shrubs and trees) for construction of temporary access tracks to stockpile sites.
Use existing tracks and previously cleared/disturbed land for stockpile areas and temporary access tracks.
Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established

Species: *Grevillea parviflora* subsp. *parviflora* (Small-flower grevillea) V

Criteria	**(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**
Response	*Grevillea parviflora* is listed as a vulnerable species under the *Threatened Species Conservation Act 1995*. The species is distributed sporadically throughout the Sydney Basin with two disjunct, separate regional populations on the Central Coast and in the Lower Hunter. The biology and ecology of Small-flower Grevillea is poorly known, however flowering occurs mainly between July and December, flowers are insect pollinated and there is limited seed dispersal (DSEWPAC 2014). The plant can sucker readily from rhizomes making individuals sometimes difficult to count. All populations should be assumed to be viable (NPWS 2002). Sites of particular significance for the species would include any population with greater than 50 plants, varied age structure and an area of intact habitat away from high disturbance areas (NPWS 2002, DSEWPAC 2014). This species was not recorded in the study area during field survey, however there are reliable records in Site 3a of a small population <20 plants or stems. It is considered that a 500m gap between populations may represent a distinct population, this distance is based on the maximum flight distance of pollinators (LMCC 2013a). From desktop assessment it is assumed any *Grevillea parviflora subsp. parviflora* population present within Site 1c is a distinct population with an absence of any further existing records within a 500m radius. It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species and no vegetation is to be removed within a 20 metre buffer of known *Grevillea parviflora* records in Site 3a.
Conclusion	The action is not likely to effect the life cycle of these species such that a viable local population is placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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.**
Response	
Conclusion	Not applicable

Criteria	**(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**
Response	There is approximately 9 hectares of potential habitat in the study area to be removed however none of the known habitat in Site 3a will be removed. Potential habitat for the *Grevillea parviflora subsp. parviflora* within a 10km radius is about 7000 hectares remaining. Total potential habitat to be cleared in the study area represents about 0.1% of the remaining potential habitat in the region. It is proposed that the presence of the species is confirmed during flowering season and additional searches of Site 3a are undertaken. Exclusion zones should be established to avoid impacts on individuals of this species. Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible.
Conclusion	Habitat to be removed is a small area considering the extent of habitat remaining in the locality and is not considered significant to the long term survival of this species.
Criteria	**(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**
Response	Mitigation measures recommend avoiding impacts to this species where there are known records. About 9 ha of additional potential habitat for this species would be affected. This habitat in Site 2 and around Sparks Road interchange is already fragmented by the existing road network. *Grevillea parviflora subsp. parviflora* habitat in the study area is already fragmented by the existing M1 and supporting road network. The proposed activity will marginally increase the distance between remaining habitat areas of *Grevillea parviflora subsp. parviflora*. From desktop assessment it is assumed any *Grevillea parviflora subsp. parviflora* population present within Site 3a is a distinct, already isolated population with an absence of any further existing records within a 500m radius. Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible
Conclusion	The potential habitat to be removed is likely to result in a minor increase in fragmentation to areas of habitat for this species.
Criteria	**(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.**
Response	There is approximately 9 hectares of potential habitat in the study area to be removed however none of the known habitat in Site 3a will be removed. Potential habitat for the *Grevillea parviflora subsp. parviflora* within a 10km radius is about 7000 hectares remaining. Total potential habitat to be cleared in the study area represents about 0.1% of the remaining potential habitat in the region. It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species and no vegetation is to be removed within a 20 metre buffer of known *Grevillea parviflora* records in Site 3a.
Conclusion	The habitat to be removed is not likely to be critical to the long-term survival of the species.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	To date, no critical habitat has been declared under the TSC Act for this threatened species.
Conclusion	Not applicable.

Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	To date, no recovery plan has been developed under the TSC Act for these threatened species, however OEH has identified eight priority activities to assist this species including: • Ensure that this species is considered in all planning matters on land that contains or may contain populations. • Mark and fence off sites during development/road maintenance activities. • Undertake weed control using methods that will not impact on populations of *G. parviflora* subsp. *parviflora* (avoid spraying in the vicinity of the plants and either hand pull weeds or cut and paint them).
Conclusion	The proposal is consistent with these activities.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect this species. However, vegetation clearing is unlikely to impact important habitat for this species, with the majority of vegetation to be removed in previously disturbed areas.
Conclusion	The proposed actions are likely to lead to a minor increase in the impact of a key threatening process.

Overall Conclusion

This species was not recorded in the study area during field survey, however there are reliable records in Site 3a. The proposed actions will require the removal of native vegetation in the study area that is potential habitat for this species.

It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species. As long as these mitigation measures are implemented, the proposal is unlikely to significantly affect this species.

A Species Impact Statement is not required.

Mitigation Measures

Avoid impacts to areas where this species has been recorded.
In the event that unexpected threatened species are detected at the site prior to construction the RMS Unexpected Threatened Species Finds Procedure should be enacted (RTA, 2011).
Where impacts are unavoidable, investigate translocation options in consultation with Roads and Maritime.
Retain mature trees and shrubs in remnant vegetation in and adjacent to stock pile areas.
Avoid disturbance of native vegetation (groundcover, shrubs and trees) for construction of temporary access tracks to stockpile sites.
Use existing tracks and previously cleared/disturbed land for stockpile areas and temporary access tracks.
Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established

***Falsistrellus tasmaniensis* (Eastern false pipistrelle), *Miniopterus australis* (Little Bentwing-bat), *Mormopterus norfolkensis* (Eastern Freetail-bat), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat) and *Scoteanax rueppellii* (Greater broad-nosed bat)**

Grouping: Primarily forest-dwelling microbats

Criteria	**(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**
Response	These five microbat species are listed as Vulnerable under the TSC Act. No roosting structures or maternity caves have been identified within the study area.
Conclusion	The proposed actions are unlikely to have an adverse impact on the life cycle of these species such that a viable local population will be placed at risk of extinction
Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	
Conclusion	Not applicable
Criteria	**(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.**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	The proposed actions will require the removal of vegetation. However, most of this vegetation is confined to the median strip of the existing motorway. Mitigation measures include the retention of hollow bearing trees throughout the study area. There will be some loss of foraging habitat for these species, but the sections of study area that will be affected are unlikely to currently provide significant foraging or roosting habitat for these bats.
Conclusion	The actions proposed are likely to result in a limited amount of microbat habitat to be removed or modified.
Criteria	**(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**
Response	These microbat species are capable of dispersing large distances and as such have large home ranges.
Conclusion	Given the species are highly mobile and only a small amount of potential habitat is to be removed/modified, it is unlikely the microbat habitat within the study area will become fragmented or isolated as a result of the proposed actions.
Criteria	**(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.
Response	Given the relatively small amount of habitat to be removed as a result of this proposal (less than 0.1% across all vegetation community types) and the currently fragmented nature of much of the study area, it is unlikely that any habitat to be removed is important to the long-term survival of any of these species.
Conclusion	It is unlikely that any habitat to be removed is important to the long-term survival of any of these species.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	To date, no critical habitat has been declared for these species under the TSC Act.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	No recovery plans have been developed for any of the five microbat species.
Conclusion	Not applicable.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This proposal will involve the operation of this key threatening process, though it is expected that the overall impact upon forest-dwelling bats in the area will be minor due to the relatively small amount of clearing required and the variable condition of existing vegetation communities in the area. Additionally a range of mitigation measures have been proposed including the retention of hollow bearing trees.
Conclusion	The proposed actions are likely to result in a minor increase in the operation of a key threatening process.

Overall Conclusion

There is limited suitable foraging and roosting habitat within the study area for these five threatened microbat species. While the proposed works would affect some potential foraging habitat, the limited area of disturbance and proposed mitigation strategies suggest any potential actions are unlikely to have an overall significant impact upon these species.

A Species Impact Statement is not required.

Mitigation Measures

The use of pesticides in weed removal/control should be discouraged or minimised as this is a known threat to the Little Bentwing-bat (that has previously been recorded adjacent to Site 9).

Retention of mature vegetation as potential foraging habitat.

Retention of hollow bearing trees where practical.

Miniopterus schreibersii oceanensis (Eastern Bentwing-bat),

Criteria	**(d) 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**
Response	This microbat species is listed as Vulnerable under the TSC Act. No roosting structures or maternity caves have been identified within the study area, though there is the potential for this species to roost within exiting culverts.
Conclusion	The proposed actions are unlikely to have an adverse impact on the life cycle of these species such that a viable local population will be placed at risk of extinction
Criteria	**(e) 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**
Response	
Conclusion	Not applicable
Criteria	**(f) 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**
Response	
Conclusion	Not applicable
Criteria	**(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.**
Response	
Conclusion	Not applicable
Criteria	**(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**
Response	The proposed actions will require the extension of existing culverts and removal of vegetation. The extension of culverts will increase potential roosting habitat for this species. A maximum of 15.31 hectares of potential habitat will be removed as part of this proposal. This represents less than 0.1% of nearby available habitat.
Conclusion	The actions proposed are likely to result in a limited amount of microbat habitat to be removed or modified.
Criteria	**(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**
Response	This species is capable of dispersing large distances up to 300 km from maternity caves.
Conclusion	Given this species is highly mobile and only a small amount of potential habitat is to be removed/modified, it is unlikely the microbat habitat within the study area will become fragmented or isolated as a result of the proposed actions.
Criteria	**(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.**
Response	Given the relatively small amount of habitat to be removed as a result of this proposal (less than 0.1% across all vegetation community types) and the currently fragmented nature of much of the study area, it is unlikely that any habitat to be removed is important to the long-term survival of any of these species.
Conclusion	It is unlikely that the habitat to be modified or removed is important to the long term

	survival of these species.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	To date, no critical habitat has been declared for these species under the TSC Act.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	This species has been assigned to the site-managed species management stream under the Saving our Species program. As such four management sites have been proposed throughout the species' range in order to encourage its recovery. The nearest of these sites to the proposal area is over 160 km away. Management strategies to protect this species include habitat protection and maintenance, introduced domestic and feral animal control programs and the maintenance and enhancement of floristic and structural diversity of vegetation through the alteration of prescribed burning and grazing regimes.
Conclusion	The proposal does not conflict with the recovery objectives listed for this species.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This proposal has the potential to adversely affect Long-nosed Potoroos through the loss of foraging resources and potential breeding habitat. However, vegetation clearing is unlikely to impact important habitat for these species and a range of mitigation measures have been proposed including the retention of all remnant vegetation where possible and the minimising of off-site indirect impacts e.g. stormwater impacts.
Conclusion	The proposed actions are likely to result in a minor increase in the impact of a key threatening process.

Overall Conclusion

There is limited suitable foraging and roosting habitat within the study area for this species. While the proposed works are likely to affect some potential foraging habitat, the limited area of disturbance and proposed mitigation strategies suggest any potential actions are unlikely to negatively affect these species.

A Species Impact Statement is not required.

Mitigation Measures

Retention of mature vegetation as potential foraging habitat.

Retention of existing road culverts where practical.

Calyptorhynchus lathami (Glossy black-cockatoo), *Glossopsitta pusilla* (Little lorikeet) and *Lathamus discolor* (Swift parrot)

Grouping: Hollow-nesting birds

Criteria	**(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**
Response	Glossy black-cockatoo and Little lorikeet are listed as vulnerable under the TSC Act. The Swift parrot is listed as endangered under the TSC Act. These species are dependent on mature vegetation for nesting and roosting, with particular requirement for hollows for nesting.
Conclusion	Hollow bearing trees are present within the study area but are not abundant. While there will be some removal of vegetation adjacent to the existing alignment of the motorway all large remnant trees will be retained at all ancillary sites. As such the impact upon breeding habitat for these species is likely to be limited to disturbance from site vehicles and activities. It is unlikely that these actions will have an adverse effect on these species such that any potential viable local population will be placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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.**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	The study area only provides limited foraging, roosting and nesting opportunities for these species. The study area contains limited hollow bearing trees, and most of these will be retained as part of the works.
Conclusion	A limited amount of woodland bird habitat will potentially be removed or modified by the proposed actions.
Criteria	**(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**
Response	The clearing of vegetation for the widening of the existing motorway and the establishment of ancillary sites will involve the clearing of vegetation. The limited overall extent of these works however means that habitat for these species is unlikely to be significantly fragmented or isolated.
Conclusion	It is unlikely that woodland bird habitat will become fragmented or isolated as a result of the proposed actions.
Criteria	**(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.
Response	Based upon the generally disturbed nature of the study area and presence of the existing motorway the area is not likely to be habitat important to the long-term survival of these species.
Conclusion	The habitat to be removed in unlikely to be important to the long-term survival of these species.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	No critical habitat has been declared for any of these species.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	A national recovery plan has been developed for the Swift parrot (Birds Australia, 2011). Site management activities have been proposed for both the Glossy Black Cockatoo and the Little Lorikeet under the Saving Our Species program. Recovery objectives these species are primarily concerned with the protection of breeding habitat, identifying non-breeding habitat and ecological research.
Conclusion	The proposal will remove a very small amount of potential breeding habitat for these species in the form of tree hollows.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect threatened woodland bird species through the loss of feeding sites and potential nesting habitat. However, vegetation clearing is unlikely to affect important habitat for these species and a range of mitigation measures have been proposed including the retention of hollow bearing trees and remnant vegetation.
Conclusion	The proposed actions are likely to result in a minor increase in the impact of a key threatening process.

Overall Conclusion

Given these species are highly mobile and the study area only provides limited foraging, roosting and nesting opportunities it is unlikely the proposed actions will have negative impact upon them. As a small amount of habitat would be removed by the proposed actions mitigation strategies have been proposed to retain these habitat features where possible.

A Species Impact Statement is not required.

Mitigation Measures

Retention of remnant vegetation and hollow bearing trees where practical.

***Anthochaera phrygia* (Regent honeyeater), *Daphoenositta chrysoptera* (Varied sittella), *Grantiella picta* (Painted honeyeater) and *Hieraaetus morphnoides* (Little eagle).**

Grouping: Woodland birds

Criteria	**(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**
Response	The Varied sittella, Painted honeyeater and Little eagle are listed as vulnerable under the TSC Act. The Regent honeyeater listed as critically endangered under the TSC Act. These species are dependent on mature vegetation for nesting and roosting. The Regent honeyeater has specific breeding areas that are not located within the study area.
Conclusion	While there will be some removal of vegetation adjacent to the existing alignment of the motorway all large remnant trees will be retained at all ancillary sites. As such the impact upon breeding habitat for these species is likely to be limited to disturbance from site vehicles and activities. It is unlikely that these actions will have an adverse effect on these species such that any potential viable local population will be placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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.**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	The study area only provides limited foraging, roosting and nesting opportunities for these species. The study area contains limited large remanent trees and the majority of these will be retained as part of the works.
Conclusion	A limited amount of woodland bird habitat will potentially be removed or modified by the proposed actions.
Criteria	**(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**
Response	Some of these woodland bird species are nomadic and all are mobile and capable of moving between vegetation patches. The clearing of vegetation for the widening of the existing motorway and the establishment of ancillary sites will involve the clearing of vegetation. The limited overall extent of these works however means that habitat for these species is unlikely to be significantly fragmented or isolated.
Conclusion	It is unlikely that woodland bird habitat will become fragmented or isolated as a result of the proposed actions.
Criteria	**(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.
Response	Based upon the generally disturbed nature of the study area and presence of the existing motorway the area is not likely to be habitat important to the long-term survival of these species.
Conclusion	The habitat to be removed in unlikely to be important to the long-term survival of these species.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	No critical habitat has been declared for any of these woodland bird species.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	A national recovery plan has been developed for the Regent honeyeater (National Heritage Trust, 1999). Recovery objectives for this species are primarily concerned with the protection of breeding habitat, identifying non-breeding habitat and ecological research into the species.
Conclusion	The proposal will remove a very small amount of potential breeding habitat for these species in the form of mature vegetation. Mitigation measures are in place to retain thisall mature vegetation wherever possible.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect threatened woodland bird species through the loss of feeding sites and potential nesting habitat. However, vegetation clearing is unlikely to affect important habitat for these species and a range of mitigation measures have been proposed including the retention of mature remnant vegetation.
Conclusion	The proposed actions are likely to result in a minor increase in the impact of a key threatening process.

Overall Conclusion

Given these species are highly mobile and the study area only provides limited foraging, roosting and nesting opportunities it is unlikely the proposed actions will have negative impact upon them. As a small amount of habitat would be removed by the proposed actions mitigation strategies have been proposed to retain these habitat features where possible.

A Species Impact Statement is not required.

Mitigation Measures

Retention of remnant vegetation and hollow bearing trees where practical.

Ninox strenua (Powerful owl) and *Tyto novaehollandiae* (Masked owl)

Grouping: Large forest owls

Criteria	**(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**
Response	Powerful owl and Masked owl are both listed as vulnerable under the TSC Act. Both species require large tracts of forest for foraging that are suitable to sustain prey populations of small mammals. These owls require hollows in large mature trees for shelter, breeding and nesting.
Conclusion	Given the site does not consist of contiguous forest capable of maintain a large mammal population and has limited mature hollow bearing trees, it is unlikely the proposed actions will have an adverse effect on the life cycle of these four species to the extent that they would be placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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.**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	The study area provides limited roosting, breeding and nesting habitat. The Powerful owl requires large trees between 80-240 cm diameter at breast height, which are only present in restricted sections of the study area. The study area may provide some foraging habitat, with evidence of small mammals within the study area.
Conclusion	The study area is unsuitable to meet the habitat requirement of these two owl species. A very limited amount of owl habitat will be removed or modified as a result of the proposal.
Criteria	**(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**
Response	The habitat to potentially be removed is surrounded by remnant vegetation of varied quality. These species are highly mobile, with home ranges between 400-1450 ha for the Powerful owl and 500-1000 ha for the Masked owl.
Conclusion	Given the mobility of these species, their large home ranges and the limited suitability of the study site, it is highly unlikely that the proposed actions will result in the fragmentation or isolation of owl habitat.
Criteria	**(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.**
Response	There are limited mature trees with hollows large enough to provide nesting habitat for these owl species. Hollow bearing trees and remnant vegetation are to be retained where

	possible.
Conclusion	Vegetation that will be removed is unlikely to include suitable owl habitat and therefore unimportant to the long-term survival of any Powerful owl or Masked owl populations that may occur within the study area.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	No critical habitat has been declared for either powerful or masked owl.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	A NSW Recovery Plan has been developed for the Large Forest Owls (DEC, 2006). Specific recovery objectives and actions that are relevant to the proposed activity include: • minimising further loss and fragmentation of habitat outside conservation reserves and State Forests by protection and management of significant owl habitat (including protection of individual nest sites); and • minimising the impacts of development activities on large forest owls and their habitats outside conservation reserves and State Forests.
Conclusion	The proposed action is consistent with these objectives and actions, as habitat loss and fragmentation associated with the activity will be constrained to areas considered to be of low importance to the long-term survival of the two owl species, and thus does not constitute significant habitat.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect owl species through the loss of foraging resources and potential nesting habitat. However, vegetation clearing is unlikely to impact important habitat for these species and a range of mitigation measures have been proposed including the retention of hollow bearing trees and remnant vegetation.
Conclusion	The proposed actions are likely to result in a minor increase in the impact of a key threatening process.

Overall Conclusion

Given these species high mobility, the retention of hollow bearing trees and remnant vegetation, the proposed actions are unlikely to negatively impact either the Powerful owl or Masked owl.

A Species Impact Statement is not required.

Mitigation Measures

Retention of remnant vegetation and hollow bearing trees where practical.

Potorous tridactylus tridactylus (Long-nosed Potoroo)

Criteria	**(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**
Response	The Long-nosed Potoroo is listed as vulnerable under the TSC Act. This species requires a dense understorey with occasional open patches amongst coastal heaths and dry and wet sclerophyll forests. Underground-fruiting fungi are an important part of their diet and they often dig small holes in a similar manner to bandicoots. A maximum of 15.31 hectares of potential Long-nosed Potoroo habitat will be removed as part of this proposal. This represents less than 0.1% of nearby available habitat. As such it is unlikely that the proposal will 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.
Conclusion	The actions proposed are unlikely to have an adverse effect on the life cycle of the species to the extent that a viable local population will be placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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.**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	15.31 hectares of potential Long-nosed Potoroo habitat will be removed as part of this proposal. This represents less than 0.1% of nearby available habitat.
Conclusion	A minor, non-significant amount of potential Long-nosed Potoroo habitat would be removed or modified as a result of the proposed actions.
Criteria	**(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**
Response	The linear nature of the proposed widening will not isolate or fragment any remaining Long-nosed Potoroo habitat after the clearing has been undertaken.
Conclusion	No habitat is likely to become fragmented or isolated as a result of this proposal.
Criteria	**(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.**
Response	Much of the area proposed for clearing as part of this proposal is of a degraded and sub-optimal state for Long-nosed Potoroos. Of the pockets that may be suitable it is considered highly unlikely that these constitute important habitat to the extent that its removal would threaten the long-term survival of the species.
Conclusion	The habitat to be removed/modified is not likely to be of importance to the long-term

	survival of this species.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	This species has been assigned to the site-managed species management stream under the Saving our Species program. As such five management sites have been set up throughout the species' range in order to encourage its recovery. The nearest of these sites to the proposal area is approximately 70 km away. Management strategies to protect this species include habitat protection and maintenance, introduced domestic and feral animal control programs and the maintenance and enhancement of floristic and structural diversity of vegetation through the alteration of prescribed burning and grazing regimes.
Conclusion	The proposal does not conflict with the recovery objectives listed for this species.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This proposal has the potential to adversely affect Long-nosed Potoroos through the loss of foraging resources and potential breeding habitat. However, vegetation clearing is unlikely to impact important habitat for these species and a range of mitigation measures have been proposed including the retention of all remnant vegetation where possible and the minimising of off-site indirect impacts e.g. stormwater impacts.
Conclusion	The proposed actions are unlikely to significantly increase the impact of a key threatening process.

Overall Conclusion

Given the existing range of this species and the small portion of the proposal area that might affect potentially suitable habitat it is considered unlikely that the proposed actions will have a significantly impact upon the Long-nosed Potoroo.

A Species Impact Statement is not required.

Mitigation Measures

Retention of remnant vegetation and limiting of off-site indirect impacts (e.g. stormwater impacts) where practical.

Petaurus norfolcensis (Squirrel glider)

Criteria	**(d) 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**
Response	The Squirrel glider is listed as vulnerable under the TSC Act. This species requires abundant hollow bearing trees for shelter, nesting and breeding, and a mix of eucalypts, acacias and banksias to meet feeding requirements. Sites 5, 6 and 9 are the only ones to have no Squirrel glider food resources; however the other sites each have only limited resources. Hollow bearing trees are present in some sections of the study area but will not be removed by the proposal.
Conclusion	The actions proposed are unlikely to have an adverse effect on the life cycle of the species to the extent that a viable local population will be placed at risk of extinction.
Criteria	**(e) 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**
Response	
Conclusion	Not applicable.
Criteria	**(f) 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**
Response	
Conclusion	Not applicable.
Criteria	**(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.**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	Squirrel gliders can inhabit a diverse range of vegetation communities, with a preference for dry sclerophyll forests and woodland and generally absent from rainforest and closed forest. A small amount of feeding habitat (about 1 ha) would be removed by the proposal. No nesting habitat is to be removed by the proposal and remnant vegetation is to be retained.
Conclusion	A minor amount of potential Squirrel glider habitat is likely to be removed or modified as a result of the proposed actions.
Criteria	**(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**
Response	The potential habitat to be modified is small and surrounded by remnant vegetation. Squirrel gliders are capable of gliding more than 50 m in one glide and are capable of nightly foraging movements between 300-500 m. Home ranges can vary greatly (between 0.65 and 8.5 ha) and juveniles disperse after approximately 1 year.
Conclusion	Given the mobility of the species and the limited amount of habitat to be modified, it is unlikely that that Squirrel glider habitat will become fragmented or isolated from other areas of habitat as a result of the proposed actions.
Criteria	**(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.**

Response	Vegetation to be removed is disturbed or partially modified and is likely to provide sub-optimal habitat for the squirrel glider. The vegetation to be retained within the study area is much higher quality and more capable of supporting individuals.
Conclusion	The habitat to be removed/modified is likely to be of very little importance to the long-term survival of this species.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	A recovery plan is currently being developed for this species. Management strategies to protect this species include habitat protection and maintenance, introduced animal control programs and the maintenance and enhancement of floristic and structural diversity of squirrel glider vegetation through the alteration of prescribed burning and grazing regimes.
Conclusion	The proposed actions are consistent with these objectives through the retention of good quality habitat in remnant vegetation patches and hollow bearing trees.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect Squirrel gliders through the loss of foraging resources and potential nesting habitat. However, vegetation clearing is unlikely to impact important habitat for these species and a range of mitigation measures have been proposed including the retention of hollow bearing trees and remnant vegetation.
Conclusion	The proposed actions are unlikely to significantly increase the impact of a key threatening process.

Overall Conclusion

Given these species high mobility, the retention of hollow bearing trees and remnant vegetation, the proposed actions are unlikely to negatively impact the Squirrel glider.

A Species Impact Statement is not required.

Mitigation Measures

Retention of remnant vegetation and hollow bearing trees where practical.

Phascolarctos cinereus (koala)

Criteria	**(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**
Response	A desktop assessment of Wildlife Atlas records showed that koalas had been recorded only seven times within a 10 km area containing the study since 1916, with the most recent of these records being 2003 and 2007. As there have been no recent records in the area it was determined that the study area was not likely to support a viable resident population. During the koala habitat survey no individuals, or characteristic scratching or scats, were identified. Despite having potential to occur, there is no evidence to suggest a viable resident koala population exists within the study area.
Conclusion	The actions planned are unlikely to have a negative impact on the life cycle of any viable local population potentially occurring within the study area to the extent that it will be placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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.**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	There are two sites within the proposal that have enough cover of relevant eucalyptus species to potentially constitute koala habitat: Sparks Road (Site 3a) and Hue Hue Road (Site 7c). It has been recommended that both of these sites are avoided in terms of construction impacts to remnant eucalyptus species.
Conclusion	Mitigation measures have been proposed to retain all potential koala habitat within the study area. Therefore potential koala habitat will not be disturbed.
Criteria	**(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**
Response	The majority of clearing proposed will occur within the median strip of the motorway and adjacent to the roadside. This area is already fragmented by the existing road. Koalas are capable of moving large distances in search of food, with home ranges between two and several hundred hectares.
Conclusion	It is unlikely that koala habitat will become further fragmented or isolated as a result of the proposed action.
Criteria	**(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.**
Response	The habitat to be removed is primarily in the median strip and adjacent to the roadside.

	The assessment indicated that only two sites (3a and 7c) had the potential to provide koala habitat due to the presence of greater than 15% cover of recognised food tree species. Given that remnant eucalyptus species are recommended to be retained at these sites it is not expected that any habitat important to the long term survival of the species will be affected.
Conclusion	Remnant eucalyptus species in the only relevant areas of potential koala habitat will be retained, hence avoiding impacts upon the long term survival of the species.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	No critical habitat has been declared for this species.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	A recovery plan has been developed for the koala (DECC, 2008a) and includes an overall objectives to 'reverse the decline of the koala in New South Wales, to ensure adequate protection, management and restoration of koala habitat, and to maintain healthy breeding populations of koalas throughout their current range'.
Conclusion	As there is no breeding population of koalas on site and core habitat will not be disturbed (see section 4.2.3 above) the actions proposed will not interfere with the objectives of the recovery plan.
Criteria	**(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.**
Response	The proposed works constitutes part of the key threatening process of 'clearing native vegetation', due to some vegetation occurring within the area of direct impact. However, potential koala habitat and important remnant vegetation is to be retained.
Conclusion	While a small amount of potential habitat will be cleared, mitigation measures recommend the retention of remnant eucalyptus species in areas of potential koala habitat. Therefore It is unlikely that the actions proposed will significantly increase the impact of a key threatening process.

Overall Conclusion

The proposed development is not considered to have a negative impact upon the koala. This is due to the low value of the potential habitat to be cleared generally and the commitment to retain remnant eucalyptus species within areas of potential koala habitat.

A Species Impact Statement is not required.

Mitigation Measures

Retention of mature trees and remnant vegetation where practical.

Retention of potential koala habitat.

Pteropus poliocephalus (Grey-headed flying-fox)

Criteria	**(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**
Response	The Grey-headed flying-fox is listed as vulnerable under the TSC Act. Roosting sites are located in the branches of large trees in rainforest patches, *Melaleuca* stands, mangroves, riparian woodland or modified vegetation in urban areas. No camps are present on site or in the immediate surrounds
Conclusion	The proposed actions are unlikely to have an adverse effect on the life cycle of the species such that any potential viable population will be placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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.**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	Some forging habitat will be removed by the proposed works, but will mainly be limited to disjunct areas of disturbed habitat.
Conclusion	As there are no roosts within the study area and only minimal impacts on foraging habitat, only a small amount of Grey-headed flying-fox habitat will be removed or modified as a result of the proposed actions.
Criteria	**(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**
Response	The Grey-headed flying-fox is highly mobile, capable of foraging movements of up to 70 km from permanent camps.
Conclusion	It is highly unlikely that any potential flying fox habitat will become fragmented or isolated as a result of the proposed actions.
Criteria	**(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.**
Response	The vegetation to be removed is of low quality habitat for the Grey-headed flying-fox, with most of the areas to be modified dominated by invasive grass species previous land clearing.
Conclusion	The habitat to be removed/modified as a result of the proposed areas is likely to have little importance to the long-term survival of this species.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat**

	(either directly or indirectly).
Response	To date, no critical habitat has been declared for this species.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	A draft recovery plan for the Grey-headed flying-fox has been prepared (DECCW, 2009). Its overall objectives are to reduce the impact of threatening processes and conserve the functional role of the Grey-headed flying-fox in seed dispersal and pollination, by protecting foraging and roosting habitat.
Conclusion	As the proposed actions include mitigation measures to retain remnant habitat, the actions are unlikely to adversely affect recovery strategies.
Criteria	**(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.**
Response	The proposed works constitutes part of the key threatening process of 'clearing native vegetation', due to some vegetation occurring within the area of direct impact. However, remnant vegetation is to be retained.
Conclusion	While a small amount of potential habitat will be cleared, mitigation measures recommend the retention of mature vegetation where possible. Therefore It is unlikely that the actions proposed will significantly increase the impact of a key threatening process.

Overall Conclusion

Within the areas of impact there is very little suitable foraging or roosting habitat for the Grey-headed flying-fox. While the proposed work is likely to affect some potential foraging habitat, the small area of disturbance and high mobility of this species means it is unlikely that there will be a significant impact to the Grey-headed flying fox.

No Species Impact Statement is required.

Mitigation Measures

Retain remnant vegetation where practical.

Crinia tinnula (Wallum Froglet)

Criteria	**(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**
Response	Wallum Froglet is listed as vulnerable under the TSC Act. It breeds in permanent acidic swamps, ephemeral pools and drainage ditches. Breeding normally occurs in colder months, but this species is capable of reproducing all year round following rain. Based upon the incidence of suitable habitat within the study area only 0.07 ha of potential Wallum Froglet habitat would be affected by this proposal. This is wholly contained with ancillary site 3a. The employment of mitigation measures such as no entry zones around water bodies and appropriate sediment management will reduce the likelihood of having any effect upon any resident population. As such it is not expected that the proposal will have an adverse effect on the life cycle of this species such that a viable local population is likely to be placed at risk of extinction.
Conclusion	Based upon the amount of potential habitat to be removes it is unlikely that the proposed actions will have an adverse effect on the life cycle of Wallum Froglet to the extent that a viable local population would be placed at risk of extinction.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	
Conclusion	Not applicable.
Criteria	**(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.**
Response	
Conclusion	Not applicable.
Criteria	**(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**
Response	This species is found in a range of habitats, usually associated with acidic swamps on coastal sand plains. During the day they shelter under leaf litter, debris or burrows of other species. Based upon the incidence of suitable habitat within the study area only 0.07 ha of potential Wallum Froglet habitat would be affected by this proposal. This is wholly contained with ancillary site 3a. The employment of mitigation measures such as no entry zones around water bodies and appropriate sediment management will reduce the likelihood of having any effect upon this area.
Conclusion	A negligible amount of potential habitat for this species will be potentially removed or modified as part of this proposal.
Criteria	**(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**
Response	As the proposal will not directly interfere with water bodies within ancillary site 3a (the only suitable habitat within the proposal area), habitat for this species will not become significantly fragmented or isolated.
Conclusion	Potential habitat for this species is not expected become significantly fragmented or

	isolated.
Criteria	**(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.**
Response	The majority of the study area to be modified is cleared, open grassland away from water bodies and with limited leaf litter. The potential Wallum Froglet habitat present within ancillary site 3a within an area of otherwise disturbed vegetation and is therefore not through to be of high quality. As such this habitat is not thought to be important to the long-term survival of the species.
Conclusion	The potential habitat to be affected is unlikely to be important to the long-term survival of this species in the locality.
Criteria	**(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).**
Response	To date, no critical habitat has been declared for this species under the TSC Act.
Conclusion	Not applicable.
Criteria	**(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**
Response	A recovery plan was developed for the Wallum sedge frog and other Wallum dependent species, including the Wallum Froglet (Meyer et al. 2006). Recovery objectives surround the identification and protection of Wallum Frog habitat.
Conclusion	As there is only very limited Wallum Froglet habitat in the study area, and mitigation measures are in place retain the nature of this habitat, the actions proposed are in line with the recovery plan objectives.
Criteria	**(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.**
Response	The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect Wallum Froglet through the loss of breeding sites and potential shelter habitat. However, vegetation clearing is unlikely to affect important habitat for these species and mitigation measures have been proposed, including the retention of remnant vegetation and a buffer around water bodies.Key threatening processes relevant to this species are: Infection of frogs by amphibian chytrid causing the disease chytridiomycosis Predation by Gambusia holbrooki (plague minnow or mosquito fish) The water bodies present within ancillary site 3a will be protected through the employment of no entry zones and appropriate sediment management. This will ensure that the risk of the project resulting in the operation of, or increase the impact of, a key threatening process will be minimised.
Conclusion	The proposed actions are unlikely to increase the impact of a key threatening process.

Overall Conclusion

There is very limited suitable potential habitat for this species within the study area. Mitigation measures such as the implementation of no entry zones and appropriate sediment management are likely to reduce the overall risk to this species. As such it is considered unlikely that the proposed action will have a significant impact upon any potential population of Wallum Froglet within the study area.

A Species Impact Statement is not required.

Mitigation Measures

20 metre no entry zone to be established around water bodies.

Appropriate sediment management.

Appendix E: EPBC Act assessment of significance

Anthochaera phrygia (Regent honeyeater) and *Lathamus discolor* (Swift parrot)

Criteria	**An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:** • **lead to a long-term decrease in the size of a population**
Response	The Regent honeyeater and Swift parrot are listed as Endangered under the EPBC Act. Regent honeyeaters occur mainly in dry box ironbark open-forest and woodland areas, particularly favouring wet, fertile soils, such as along creek flats and broad river valleys. They also inhabit wet lowland coastal forests dominated by swamp mahogany and spotted gum, which is found within the study area. They spend much of their time feeding on the nectar from eucalypts such as the Mugga Ironbark, White Box and Yellow Box, and Blakeley's Red Gum on which they are reliant. The Regent honeyeater has specific breeding areas that are not located within the study area. The Swift parrot utilises a variety of different Eucalypt habitats throughout its breeding and foraging range. These are typically dominated by *E. leucoxylon, E. tricarpa, E. sideroxylon* and *E. microcarpa*. Grey box/yellow gum woodland is also utilised in New South Wales.
Conclusion	The habitat requirements necessary for these species are not abundant within the study area, with limited nesting and foraging habitat available. While most of these resources will not be disturbed by the proposed activity, it is unlikely the area currently contains a substantial population of either Regent honeyeaters or Swift parrots. Therefore it is unlikely the proposed actions will lead to a long term decrease in the size of any existing population.
Criteria	• **reduce the area of occupancy of the species**
Response	The Regent honeyeater occupies a 300 km^2 area (200 km^2 in NSW), that is currently decreasing in size, with the species absent from areas it has previously been recorded in. The Swift parrot occupies approximately 4000 km^2, an area that also appears to be declining. Massive habitat loss is potentially responsible for the decline in area of occupancy. The study area is approximately 271 ha and any potential loss of foraging habitat is estimated at up to 12 ha.
Conclusion	Given the scale of the area of occupancy compared to the affected habitat within the study area, it is highly unlikely that the proposed actions will reduce the occupancy of the Regent honeyeater or Swift parrot.
Criteria	• **fragment an existing population into two or more populations**
Response	No population of either species has been identified within the study area. The proposed works will not substantially increase the divide between vegetation, with mitigation strategies in place to retain remnant vegetation and hollow bearing trees. These species are both highly mobile, with the Regent honeyeater undertaking migratory movements between areas with abundant food supplies (flowering eucalypts and insects) and the Swift parrot migrating between Tasmania (breeding season) and mainland Australia (non-breeding season).
Conclusion	It is highly unlikely that the proposed actions will result in the fragmentation of a potential existing population of Regent honeyeaters or Swift parrots.
Criteria	• **adversely affect habitat critical to the survival of a species**
Response	No critical habitat has been declared for either of these species.
Conclusion	Not applicable.
Criteria	• **disrupt the breeding cycle of a population**
Response	The Swift parrot migrates to Tasmania in breeding season (September - January) from wintering habitat on the Australian mainland. This species shows high site fidelity, but is also influence by resource availability. Breeding success strongly influenced by flowering resources in Tasmania. The Regent honeyeater breeds from May – March, with an activity peak in September – November linked to flowering of key eucalypt and mistletoe species.

	This species has three main breeding sites; Capertree Valley and Bundarra-Barraba areas in NSW and north-eastern Victoria.
Conclusion	As this site is outside the breeding areas and has insufficient foraging resources it is unlikely that the proposed actions will disrupt the breeding cycle of a population of either species.
Criteria	• **modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
Response	The study area only provides limited foraging, roosting and nesting opportunities. The study area contains some hollow bearing trees and remnant vegetation that will be retained. Any vegetation removed by the proposed actions are unlikely to be important to the long-term survival of these species.
Conclusion	It is unlikely that availability or quality of habitat will be reduced to the extent that either species is likely to decline.
Criteria	• **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**
Response	Sections of the study area are highly disturbed and modified and there is evidence of invasive fauna (i.e. fox and rabbit) and weed species. Mitigation strategies include the retention of remnant vegetation where possible and weed removal/control.
Conclusion	The proposed actions are unlikely to result in additional invasive species becoming established.
Criteria	• **introduce disease that may cause the species to decline**
Response	No diseases have been identified as a threat to the Regent honeyeater. Beak and feather disease is capable of affecting the Swift parrot and can result in high nestling mortality. It is spread by the movements of common species carrying the disease.
Conclusion	The proposed actions are unlikely to aid the spread of beak and feather disease.
Criteria	• **interfere with the recovery of the species**
Response	Clearance of large trees and high-quality habitat, grazing preventing native vegetation regeneration and removal of large areas of box-ironbark for harvesting all negatively affect the Regent honeyeater and Swift parrot. Abatement of these key threats will be beneficial to the recovery of the species.
Conclusion	Despite the fact that this proposal will require the removal of vegetation on site, it is not expected that this will adversely impact on the potential for these species to recover in this area, due to the limited amount of habitat to be removed and its low quality as habitat for these species.

Overall Conclusion

Given the highly modified and low quality habitat, the size of the area of vegetation to be removed, along with similar/higher quality habitats adjacent to the study area, it is unlikely that the proposed works will negatively impact upon these species, their habitat or potential for recovery.

Referral to DoE is not required.

Mitigation Measures

Retain remnant mature vegetation where possible as potential foraging and nesting habitat. Any landscaping and revegetation should include native plant species endemic to the area and include species of all strata types (ground cover, mid storey and canopy species) to enhance the remnant vegetation on the site and provide habitat for native fauna.

Apus pacificus (Fork-tailed Swift) and *Hirundapus caudacutus* (White-throated Needletail)

Criteria	**An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:** **i. substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species**
Response	The Study Area is modified and occurs within the context of a busy motorway. Vegetation and habitat in general in this area is likely to be heavily influenced by edge-effects. Use of the study area by the Fork-tailed Swift and White-throated Needletail would be rare. The relative importance of the affected area in relation to nearby available habitat is considered to be minor.
Conclusion	Given the degraded state of the study area and its infrequency of use, the proposal would not substantially modify, destroy or isolate an important area of habitat for the Fork-tailed Swift or the White-throated Needletail.
Criteria	**ii. result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species**
Response	Given the mitigation measures involved it is unlikely that the proposal would induce invasive species to become established in any area of important habitat for these species.
Conclusion	The proposed actions are unlikely to result in an invasive species that is harmful to one of the migratory species becoming established in an area of important habitat for the migratory species.
Criteria	**iii. seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species**
Response	Use of the study area by the Fork-tailed Swift and White-throated Needletail would be rare and would not involve an ecologically significant proportion of their populations. Both species breed in the northern hemisphere.
Conclusion	It is highly unlikely that the proposed actions will disrupt the lifecycle of an ecologically significant proportion of the population of these migratory species.

Overall Conclusion

As the study area provides only intermittent suitable habitat it is considered that the proposal will not have a significant impact on these migratory species.

Referral to Department of Environment is not required.

Merops ornatus (Rainbow Bee-eater)

Criteria	**An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:** **i. substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species**
Response	The Study Area is modified and occurs within the context of a busy motorway. Vegetation and habitat in general in this area is likely to be heavily influenced by edge-effects. Use of the study area by the Rainbow Bee-eater would be rare. The relative importance of the affected area in relation to nearby available habitat is considered to be minor.
Conclusion	Given the degraded state of the study area and its infrequency of use, the proposal would not substantially modify, destroy or isolate an important area of habitat for the Rainbow Bee-eater.
Criteria	**ii. result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species**
Response	Given the mitigation measures involved it is unlikely that the proposal would induce invasive species to become established in any area of important habitat for this species.
Conclusion	The proposed actions are unlikely to result in an invasive species that is harmful to the Rainbow Bee-eater becoming established in an area of important habitat.
Criteria	**iii. seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species**
Response	Use of the study area by the Rainbow Bee-eater would be rare and would not involve an ecologically significant proportion of their populations. It is unlikely that the site supports breeding habitat for this species.
Conclusion	It is highly unlikely that the proposed actions will disrupt the lifecycle of an ecologically significant proportion of the population of this species.

Overall Conclusion

As the study area provides only intermittent suitable habitat it is considered that the proposal will not have a significant impact on this species.

Referral to Department of Environment is not required.

Melaleuca biconvexa (Biconvex paperbark) and *Angophora inopina* (Charmhaven apple)

Grouping: Grows in damp places, often near streams or low-lying areas. The site is considered to provide suitable habitat for these species.

Criteria	**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:** • **lead to a long-term decrease in the size of an important population of a species**
Response	No populations of *Angophora inopina* were found in the study area. 20.3 ha of suitable habitat for these species occurs within the study area (9, 7a, 7c and 3a). However, only a small area (about 1 ha) of this habitat is likely to be affected by the proposed actions for construction of temporary access tracks. No important populations of this species have been identified. There are some reliable records of *Melaleuca biconvexa* in Site 3a, but just outside the proposal area (OEH 2013). Clearing of these individuals is not required as part of the proposal. Exclusion zones will be established around individuals of this species as a precautionary measure. No further *Melaleuca biconvexa* were identified within the area to be impacted by the proposal during field surveys. *Melaleuca biconvexa* (Biconvex paperbark) is known to occur in the Gosford and Wyong areas with most populations on private land or on road reserves. Multiple stems may arise from single rootstocks so that an estimate of population size is not possible from visual inspection of stands. The main identified threats to Biconvex paperbark are land clearing; alteration to water tables; too-frequent fire; and grazing or trampling by stock. (www.environment.gov.au › ... › SPRATSPRAT, 2013) *Angophora inopina* (Charmhaven apple) is known to occur in the Wyong and Lake Macquarie local government areas, where large patches (approximately 1250 ha) of intact habitat have been mapped (Wyong Shire Council, 2003). The main identified threats to *A. inopina* are habitat loss, fragmentation and water table alteration from residential, agricultural and industrial developments; frequent fire; grazing and trampling by animals; and competition from weeds, in particular Whiskey grass (*Andropogon virginicus*) www.environment.gov.au/.../species/.../64832-conservation-advice.pdf. *2013*
Conclusion	The proposed actions will not lead to a long-term decrease in the size of an important population of these species
Criteria	• **reduce the area of occupancy of an important population**
Response	20.3 ha of suitable habitat for these species occurs within the study area (9, 7a, 7c and 3a). However, only a small area (about 1 ha) of this habitat is likely to be affected by the proposed actions for construction of temporary access tracks. No important populations of this species have been identified and no individuals will be affected by the proposal.
Conclusion	The proposed actions will not reduce the extent of area of occupancy of an important population of these species.
Criteria	• **fragment an existing important population into two or more populations**
Response	No individuals of these species will be removed as a result of the proposal. 20.3 ha of suitable habitat for these species occurs within the study area (9, 7a, 7c and 3a). However, only a small area (about 1 ha) of this habitat is likely to be affected by the proposed actions for construction of temporary access tracks. No important populations of this species have been identified.
Conclusion	The proposed actions will not fragment an existing population into two or more populations.
Criteria	• **adversely affect habitat critical to the survival of a species**
Response	No populations of these species were found in the study area. 20.3 ha of suitable habitat for these species occurs within the study area (9, 7a, 7c and 3a). However, only a small area (up to 0.1 ha) of this habitat would be affected by the proposed actions for construction of temporary access tracks.
Conclusion	The proposed actions will not adversely affect habitat critical to the survival of this species.

Criteria	• **disrupt the breeding cycle of an important population(s)**
Response	No important populations of this species have been identified and no individuals will be affected by the proposal.
Conclusion	No important populations of this species have been identified and no individuals will be affected by the proposal.
Criteria	• **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
Response	Only a small amount of potential habitat for these species would be affected. The Proposed actions will not fragment or isolate viable habitat for these species. Standard industry mitigation measures will be implemented to minimise the risk of indirect impacts on the native vegetation in the study site and on any adjoining patches of native vegetation in the area.
Conclusion	The proposed actions will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Criteria	• **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**
Response	No populations of these species were found in the study area. Only a small amount of potential habitat for these species would be affected. Standard industry mitigation measures will be implemented to minimise the risk of invasive species becoming established in native vegetation in the study site and on any adjoining patches of native vegetation in the area that may provide potential habitat for these species.
Conclusion	The proposed actions will not result in invasive species that are harmful to these vulnerable species becoming established in the vulnerable species' habitat.
Criteria	• **introduce disease that may cause the species to decline**
Response	Standard industry mitigation measures will be implemented to minimise the risk of spreading disease.
Conclusion	The proposed actions are unlikely to result in the introduction of disease if the mitigation measures below are implemented.
Criteria	• **interfere substantially with the recovery of the species**
Response	To date, no recovery plan has been developed under the EPBC Act for these threatened species
Conclusion	Not applicable

Overall Conclusion

While there is potential for these species to occur within a small area of the study area, no *Angophora inopina* were identified in the study area and the records of *Melaleuca biconvexa* in Site 3a are outside of the proposal area and will not be affected by the proposal. The proposed works are not likely to impact on their long term survival. No further *Melaleuca biconvexa* were identified within the area to be impacted by the proposal during field surveys.

Referral to DoE is not required.

Mitigation Measures

Establish exclusion zones around any individuals of *Melaleuca biconvexa* in Site 3a as a precautionary measure.

Retain mature trees and shrubs in remnant vegetation in and adjacent to stock pile areas.

Avoid disturbance of native vegetation (groundcover, shrubs and trees) for construction of temporary access tracks to stockpile sites.

Use existing tracks and previously cleared/disturbed land for stockpile areas and temporary access tracks.

Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established.

Rutidosis heterogama (Heath Wrinklewort), Pimelea curviflora var. curviflora, Acacia bynoeana (Bynoe's wattle), Cryptostylis hunteriana (Leafless tongue-orchid)

Grouping: Groundcover and low shrub in heath and shrubby woodland to open forest on sand or sandy clay substrate

Criteria	**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:** • **lead to a long-term decrease in the size of an important population of a species**
Response	No populations of these species were found in the study area. 24.8 ha of suitable habitat for these species occurs within the study area (sites 1, 2, and 4). Up to 5 ha of potential habitat for these species in site 2 is proposed to be cleared for the construction of additional exit lane at the northern end of the study area. 2.25 ha of this area is regrowth that has been previously cleared in the 1980's. *Pimelea curviflora* var*. curviflora is* known from about 20 locations from the coastal area of northern Sydney to Maroota in the north-west, most sites with only a few plants or approximately less than 100 plants (NSW Scientific Committee, 1998). This species was recorded in Garigal National Park in 1992 and in Muogamarra Nature Reserve in 1971, but has not been recorded in these areas in subsequent surveys (*Pimelea curviflora* var*. curviflora* Conservation Advice, SPRAT database, www.environment.gov.au/.../species/.../4182-conservation-advice.pdf. 2013). *Rutidosis heterogama* (Heath Wrinklewort) is known from the Hunter Valley to Maclean, Wooli to Evans Head, and Torrington. It is mostly found in heath, open forest and woodland on clay soil, and is often found along disturbed roadsides. The low population numbers known for this species put it at increased risk of local extinction. www.environment.gov.au/.../species/.../13132-conservation-advice.pdf. *2013*. *Acacia bynoeana* (Bynoe's wattle) is known to occur from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. It occurs in heath or dry sclerophyll forest on sandy soils preferring open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. The species is currently known from about 30 locations, with the size of the populations at most locations being very small (1-5 plants). http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10006 *Cryptostylis hunteriana* (Leafless tongue-orchid) is known to occur in a wide variety of habitats with the bulk of known populations in NSW, however, the total population size is unknown. Populations are highly localised, and plants are often found singly or as small colonies. In NSW, one population north of Bulahdelah is estimated to have over 100 plants and the second, which is east of the town, has an unknown number of individuals but is described as the "largest known population in Australia". The largest population that Bell (2001) surveyed was 50 individuals at Lemon Tree Passage with the majority of populations of known size being 20 individuals or less. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies
Conclusion	The proposed actions will not lead to a long-term decrease in the size of an important population of these species.
Criteria	• **reduce the area of occupancy of an important population**
Response	No populations of these species were found in the study area. 24.8 ha of suitable habitat for these species occurs within the study area (sites 1, 2, and 4). Up to 5 ha of potential habitat for these species in site 2 is proposed to be cleared for the construction of additional exit lane at the northern end of the study area. 2.25 ha of this area is regrowth that has been previously cleared in the 1980s.
Conclusion	The proposed actions will not reduce the extent of area of occupancy of an important population of these species.
Criteria	• **fragment an existing important population into two or more populations**

Response	No populations of these species were found in the study area. 24.8 ha of suitable habitat for these species occurs within the study area (sites 1, 2, and 4). Up to 5 ha of potential habitat for these species in site 2 is proposed to be cleared for the construction of additional exit lane at the northern end of the study area. Approximately 2 ha of this area is regrowth that has been previously cleared in the 1980s.
Conclusion	The proposed actions will not fragment an existing population into two or more populations.
Criteria	• **adversely affect habitat critical to the survival of a species**
Response	No populations of these species were found in the study area. 24.8 ha of suitable habitat for these species occurs within the study area (sites 1, 2, and 4). Up to 5 ha of potential habitat for these species in site 2 is proposed to be cleared for the construction of additional exit lane at the northern end of the study area. Approximately 2 ha of this area is regrowth that has been previously cleared in the 1980s.
Conclusion	The proposed actions will not adversely affect habitat critical to the survival of this species.
Criteria	• **disrupt the breeding cycle of an important population(s)**
Response	No important populations of this species have been identified and no individuals will be affected by the proposal.
Conclusion	No important populations of this species have been identified and no individuals will be affected by the proposal.
Criteria	• **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
Response	No populations of these species were found in the study area. Only a small amount of potential habitat for these species (5 ha) would be affected. The proposed actions will not fragment or isolate viable habitat for these species. Standard industry mitigation measures will be implemented to minimise the risk of indirect impacts on the native vegetation in the study site and on any adjoining patches of native vegetation in the area.
Conclusion	The proposed actions will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Criteria	• **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**
Response	No populations of these species were found in the study area. Only a small amount of potential habitat for these species (5 ha) would be affected. Standard industry mitigation measures will be implemented to minimise the risk of invasive species becoming established in native vegetation in the study site and on any adjoining patches of native vegetation in the area that may provide potential habitat for these species.
Conclusion	The proposed actions will not result in invasive species that are harmful to these vulnerable species becoming established in the vulnerable species' habitat.
Criteria	• **introduce disease that may cause the species to decline**
Response	Standard industry mitigation measures will be implemented to minimise the risk of spreading disease.
Conclusion	The proposed actions are unlikely to result in the introduction of disease if the mitigation measures below are implemented.
Criteria	• **interfere substantially with the recovery of the species**
Response	To date, no recovery plan has been developed under the EPBC Act for these threatened species
Conclusion	Not applicable

Overall Conclusion

While there is potential for these species to occur within a small area of the site, no species were identified

and the proposed works are not likely to impact on their long term survival.

Referral to DoE is not required.

Mitigation Measures

Retain mature trees and shrubs in remnant vegetation in and adjacent to roadside works.

Avoid disturbance of native vegetation (groundcover, shrubs and trees) in and adjacent to roadside works.

Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established. All pathogens (e.g. Chytrid, Myrtle Rust and Phytophthora) are to be managed in accordance with the Roads and Maritime *Biodiversity Guidelines - Guide 7 (Pathogen Management)* (RTA, 2011) and *DECC Statement of Intent 1: Infection of native plants by Phytophthora cinnamomi* (for Phytophthora). Declared noxious weeds are to be managed according to requirements under the *Noxious Weeds Act 1993* and the Roads and Maritime *Biodiversity Guidelines - Guide 6 (Weed Management)* (RTA, 2011).

Species: *Tetratheca juncea* (Black-eyed susan)

Criteria	**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:** • **lead to a long-term decrease in the size of an important population of a species**
Response	*Tetratheca juncea is* known found in sandy, occasionally moist heath and in dry sclerophyll vegetation. The total population size of Black-eyed susan is difficult to estimate accurately due to the species' habit of clumping. Plant clumps are commonly counted during survey work and used as a surrogate for individual plants. The total population size of Black-eyed susan has previously been estimated to be between 9,881 and 11,893 plant clumps (approximately 10,000 individuals). It is estimated there are 162 subpopulations in the Wyong LGA). This species was not recorded in the study area during field survey, however there are reliable records in Site 1c (7 records). The proposed actions will require the removal of native vegetation (about 0.41 hectares) that is suitable habitat in Site 1c that could impact this species. Based on known data, this population would not meet the definition of an important population because there is less than 1000 plant clumps, there is low plant clump density, habitat is not rare, although the study area contains 'important habitat' (DSEWPAC 2011) there is less than 500 plant clumps, it is not at distributional limits and is not in close proximity to a protected area. It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species.
Conclusion	The proposed actions will not lead to a long-term decrease in the size of an important population of these species.
Criteria	• **reduce the area of occupancy of an important population**
Response	This species was not recorded in the study area during field survey, however there are reliable records in Site 1c (7 records). The proposed actions will require the removal of native vegetation (about 0.41 hectares) that is suitable habitat in Site 1c that could impact this species. Based on known data, this population would not meet the definition of an important population because there is less than 1000 plant clumps, there is low plant clump density, habitat is not rare, although the study area contains 'important habitat' (DSEWPAC 2011) there is less than 500 plant clumps, it is not at distributional limits and is not in close proximity to a protected area. There is approximately 9 hectares of potential habitat in the study area to be removed including about 0.41 hectares of known habitat in Site 1c. Modelled habitat for the *Tetratheca juncea* Central Coast meta-population is about 25,716 hectares remaining (Driscoll 2012, LMCC 2013). Total potential habitat to be cleared in the study area represents about 0.03% of the remaining potential habitat in the region. Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible. It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species.
Conclusion	The proposed actions will not reduce the extent of area of occupancy of an important population of this species.

Criteria	• **fragment an existing important population into two or more populations**
Response	Based on known data, this population would not meet the definition of an important population because there is less than 1000 plant clumps, there is low plant clump density, habitat is not rare, although the study area contains 'important habitat' (DSEWPAC 2011) there is less than 500 plant clumps, it is not at distributional limits and is not in close proximity to a protected area. A local population includes a subpopulation. It is considered that a 500m gap between populations may represent a distinct population (DSEWPAC 2011). This distance is based on the maximum flight distance of pollinators (LMCC 2013). From desktop assessment it is assumed any *Tetratheca juncea* population present within Site 1c is a distinct population with an absence of any further existing records within a 500m radius. This species was not identified in the study area during field survey as it was not the optimal time of year to undertake survey for this species. However there are reliable records (7) accurate to 10m in suitable habitat in Site 1c. The proposed actions will not directly impact the known locations of individuals or plant clumps within Site 1c. The proposal does have the potential to indirectly impact any individuals within a 20 metre buffer of the construction footprint where habitat removal will occur (LMCC 2013). Two of the seven records may be within a 20m buffer of the proposed construction impact area. However this potential indirect impact will not fragment the exiting population into two or more populations. This assessment assumes NSW Wildlife Atlas records from 2005 are still present on site and recommendations are made for pre-clearing surveys to also be undertaken to confirm their presence/location during flowering season. Exclusion zones should then be established to avoid impacts on individuals of this species.
Conclusion	The proposed actions will not fragment an existing population into two or more populations.
Criteria	• **adversely affect habitat critical to the survival of a species**
Response	There is approximately 9 hectares of potential habitat in the study area to be removed including about 0.41 hectares of known habitat in Site 1c where there are existing records of *Tetratheca juncea*. The proposed actions will not directly impact the known locations of individuals or plant clumps within Site 1c. The proposal does have the potential to indirectly impact any individuals within a 20 metre buffer of the construction footprint where habitat removal will occur (LMCC 2013). Two of the seven records may be within a 20m buffer of the proposed construction impact area. Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible. Modelled habitat for the *Tetratheca juncea* Central Coast meta-population is about 25,716 hectares remaining (Driscoll 2012, LMCC 2013). Total potential habitat to be cleared in the study area represents about 0.03% of the remaining potential habitat in the region.
Conclusion	The proposed actions will not adversely affect habitat critical to the survival of this species.

Criteria	• **disrupt the breeding cycle of an important population**
Response	This species was not identified in the study area during field survey as it was not the optimal time of year to undertake survey for this species. However there are reliable records (7) accurate to 10m in suitable habitat in Site 1c. The proposed actions will not directly impact the known locations of individuals or plant clumps within Site 1c. The proposal does have the potential to indirectly impact any individuals within a 20 metre buffer of the construction footprint where habitat removal will occur (LMCC 2013). Two of the seven records may be within a 20m buffer of the proposed construction impact area. Based on known data, this population would not meet the definition of an important population because there is less than 1000 plant clumps, there is low plant clump density, habitat is not rare, although the study area contains 'important habitat' (DSEWPAC 2011) there is less than 500 plant clumps, it is not at distributional limits and is not in close proximity to a protected area. It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species.
Conclusion	The proposed action is unlikely to disrupt the breeding cycle of an important population.
Criteria	• **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
Response	There is approximately 9 hectares of potential habitat in the study area to be removed including about 0.41 hectares of known habitat in Site 1c. Modelled habitat for the *Tetratheca juncea* Central Coast meta-population is about 25,716 hectares remaining (Driscoll 2012, LMCC 2013). Total potential habitat to be cleared in the study area represents about 0.03% of the remaining potential habitat in the region. It is proposed that the presence of the species is confirmed during flowering season and additional searches of Site 1c are undertaken. Exclusion zones should be established to avoid impacts on individuals of this species. Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible.
Conclusion	The proposed actions will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Criteria	• **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**
Response	Exclusion zones should be established to avoid impacts on individuals of this species. There is approximately 9 hectares of potential habitat in the study area to be removed. Standard industry mitigation measures will be implemented to minimise the risk of invasive species becoming established in the study area and on any adjoining patches of native vegetation in the area that may provide potential habitat for these species.
Conclusion	The proposed actions will not result in invasive species that are harmful to these vulnerable species becoming established in the vulnerable species' habitat.
Criteria	• **introduce disease that may cause the species to decline**
Response	Standard industry mitigation measures will be implemented to minimise the risk of spreading disease.
Conclusion	The proposed actions are unlikely to result in the introduction of disease if the mitigation measures below are implemented.

Criteria	• **interfere substantially with the recovery of the species**
Response	To date, no recovery plan has been developed under the EPBC Act for this threatened species. Priority activities recommended by OEH to assist this species include: • Undertake targeted searches for the species in known or potential habitat during its flowering period prior to any clearing or development. • Install stormwater control mechanisms to prevent off-site impacts from development upslope of populations. • Undertake weed control as required using removal methods that will not impact on the species (hand pull or cut and paint weeds).
Conclusion	Not applicable

Overall Conclusion

This species was not recorded in the study area during field survey, however there are reliable records in Site 1c. The proposed actions will require the removal of native vegetation (about 0.4ha) in Site 1c that could indirectly impact this species. The known data for the population recorded within the study area does not meet the definition of an important population under the EPBC Act criteria for *Tetratheca juncea*.

It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species. As long as these mitigation measures are implemented, the proposal is unlikely to significantly affect this species.

Referral to DoE is not required.

Mitigation Measures

Undertake targeted survey during flowering season and establish exclusion zones around individuals and their habitat.

Avoid disturbance of native vegetation (groundcover, shrubs and trees) in and adjacent to roadside works.

Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established. All pathogens (eg Chytrid, Myrtle Rust and Phytophthora) are to be managed in accordance with the Roads and Maritime *Biodiversity Guidelines - Guide 7 (Pathogen Management)* and DECC Statement of Intent 1: Infection of native plants by Phytophthora cinnamomi (for Phytophthora). Declared noxious weeds are to be managed according to requirements under the *Noxious Weeds Act 1993* and the Roads and Maritime *Biodiversity Guidelines - Guide 6 (Weed Management)* (RTA, 2011).

Species: *Grevillea parviflora* subsp. *parviflora* (Small-flower grevillea)

Criteria	**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:** • **lead to a long-term decrease in the size of an important population of a species**
Response	*Grevillea parviflora* subsp. *parviflora* (Small-flower grevillea) is known to occur in disjunct populations occur in the Lower Hunter Valley. It inhabits a range of vegetation types from heath and shrubby woodland to open forest. Populations are also found in disturbed sites along roads and tracks and within open areas of habitat (NSW NPWS, 2002). Populations vary mostly from small (less than 20 plants) to medium size (50–100 plants) and large (more than 200 plants). www.environment.gov.au/.../species/.../64910-conservation-advice.pdf. 2013. This species was not recorded in the study area during field survey, however there are reliable records in Site 3a (15-20 plants). There is approximately 9 hectares of potential habitat in the study area that would be affected however none of the known habitat in Site 3a adjoining the existing M1 will be removed. It is proposed that the presence of the species in Site 3a is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species. Based on known data, this population would not meet the definition of an important population because there are less than 500 stems and less than 40ha patch of habitat.
Conclusion	The proposed actions will not lead to a long-term decrease in the size of an important population of these species.
Criteria	• **reduce the area of occupancy of an important population**
Response	This species was not recorded in the study area during field survey, however there are reliable records in Site 3a. It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established with a 20 metre buffer to avoid impacts on individuals of this species. Based on known data, the population in Site 3a would not meet the definition of an important population because there are less than 500 stems. There is approximately 9 hectares of potential habitat in the study area to be removed however none of the known habitat in Site 3a adjoining the existing M1 will be removed. Potential habitat for the *Grevillea parviflora subsp. parviflora* within a 10km radius is about 7000 hectares remaining. Total potential habitat to be cleared in the study area represents about 0.1% of the remaining potential habitat in the region. Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible. It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species.
Conclusion	The proposed actions will not reduce the extent of area of occupancy of an important population of this species.

Criteria	• **fragment an existing important population into two or more populations**
Response	Based on known data, the population in Site 3a would not meet the definition of an important population because there are less than 500 stems and <40ha patch of habitat. It is considered that a 500m gap between populations may represent a distinct population, this distance is based on the maximum flight distance of pollinators (LMCC 2013a). From desktop assessment it is assumed any *Grevillea parviflora subsp. parviflora* population present within Site 3a is a distinct population with an absence of any further existing records within a 500m radius. It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species and no vegetation is to be removed within a 20 metre buffer of known *Grevillea parviflora* records in Site 3a adjoining the existing M1.
Conclusion	The proposed actions will not fragment an existing population into two or more populations.
Criteria	• **adversely affect habitat critical to the survival of a species**
Response	There is approximately 9 hectares of potential habitat in the study area to be removed however none of the known habitat in Site 3a adjoining the existing M1 will be removed. The proposed actions will not directly impact the known locations of individuals within Site 3a. Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible. Potential habitat for the *Grevillea parviflora subsp. parviflora* within a 10km radius is about 7000 hectares remaining. Total potential habitat to be cleared in the study area represents about 0.1% of the remaining potential habitat in the region.
Conclusion	The proposed actions will not adversely affect habitat critical to the survival of this species.
Criteria	• **disrupt the breeding cycle of an important population**
Response	This species was not identified in the study area during field survey, however there are reliable records in suitable habitat in Site 3a. The proposed actions will not directly impact the known locations of individuals within Site 3a. It is proposed that the presence of the species is confirmed during flowering season and exclusion zones established with a 20 metre buffer to avoid impacts on individuals of this species. Based on known data, this population would not meet the definition of an important population because there is less than 1000 plant clumps, there is low plant clump density, habitat is not rare, although the study area contains 'important habitat' (DSEWPAC 2011) there is less than 500 plant clumps, it is not at distributional limits and is not in close proximity to a protected area. Based on known data, the population in Site 3a would not meet the definition of an important population because there are less than 500 stems and <40ha patch of habitat.
Conclusion	The proposed action is unlikely to disrupt the breeding cycle of an important population.

Criteria	• **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
Response	There is approximately 9 hectares of potential habitat in the study area to be removed however none of the known habitat in Site 3a adjoining the existing M1 will be removed. Potential habitat for the *Grevillea parviflora subsp. parviflora* within a 10km radius is about 7000 hectares remaining. Total potential habitat to be cleared in the study area represents about 0.1% of the remaining potential habitat in the region. It is proposed that the presence of the species is confirmed during flowering season and additional searches of Site 3a are undertaken. Exclusion zones should be established with a 20 metre buffer from the existing M1 to avoid impacts on individuals of this species. Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible.
Conclusion	The proposed actions will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Criteria	• **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**
Response	Exclusion zones should be established to avoid impacts on individuals of this species. There is approximately 9 hectares of potential habitat in the study area to be removed. Standard industry mitigation measures will be implemented to minimise the risk of invasive species becoming established in the study area and on any adjoining patches of native vegetation in the area that may provide potential habitat for these species.
Conclusion	The proposed actions will not result in invasive species that are harmful to these vulnerable species becoming established in the vulnerable species' habitat.
Criteria	• **introduce disease that may cause the species to decline**
Response	Standard industry mitigation measures will be implemented to minimise the risk of spreading disease.
Conclusion	The proposed actions are unlikely to result in the introduction of disease if the mitigation measures below are implemented.
Criteria	• **interfere substantially with the recovery of the species**
Response	To date, no recovery plan has been developed under the EPBC Act for this threatened species. Priority activities recommended by OEH to assist this species include: • Ensure that this species is considered in all planning matters on land that contains or may contain populations. • Mark and fence off sites during development/road maintenance activities. • Undertake weed control using methods that will not impact on populations of *G. parviflora* subsp. *parviflora* (avoid spraying in the vicinity of the plants and either hand pull weeds or cut and paint them).
Conclusion	Not applicable

Overall Conclusion

This species was not recorded in the study area during field survey, however there are reliable records in Site 3. There is approximately 9 hectares of potential habitat in the study area to be removed however none of the known habitat in Site 3a adjoining the existing M1 will be removed. The known data for the population recorded within the study area does not meet the definition of an important population under the EPBC Act criteria for *Grevillea parviflora subsp. parviflora*.

It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this adjoining the M1 in Site 3a. As long as these mitigation measures are implemented, the proposal is unlikely to significantly affect this species.

Referral to DoE is not required.

Mitigation Measures

Undertake targeted survey during flowering season and establish exclusion zones around individuals and their habitat.

Avoid disturbance of native vegetation (groundcover, shrubs and trees) in and adjacent to roadside works.

Standard industry mitigation measures will be implemented to minimise the risk of spreading disease and invasive species becoming established. All pathogens (eg Chytrid, Myrtle Rust and Phytophthora) are to be managed in accordance with the Roads and Maritime *Biodiversity Guidelines - Guide 7 (Pathogen Management)* and DECC Statement of Intent 1: Infection of native plants by Phytophthora cinnamomi (for Phytophthora). Declared noxious weeds are to be managed according to requirements under the *Noxious Weeds Act 1993* and the Roads and Maritime *Biodiversity Guidelines - Guide 6 (Weed Management)* (RTA, 2011).

Potorous tridactylus tridactylus (Long-nosed Potoroo)

Criteria	**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:** • **lead to a long-term decrease in the size of an important population of a species**
Response	While the proposal is within the known range of this species there are no records of its occurrence within 10 km on the NSW Wildlife Atlas. As such it is not expected that there are any important populations of this species in the vicinity of the proposal. A maximum of 15.31 hectares of potential Long-nosed Potoroo habitat will be removed as part of this proposal. This represents less than 0.1% of nearby available habitat. As such it is unlikely that the proposal will have an adverse effect on the size of an important population.
Conclusion	The proposed works are unlikely to lead to a long-term decrease in the size of an important population of Long-nosed Potoroo.
Criteria	• **reduce the area of occupancy of an important population**
Response	While the proposal is within the known range of this species there are no records of its occurrence within 10 km on the NSW Wildlife Atlas. As such it is not expected that there are any important populations of this species in the vicinity of the proposal.
Conclusion	It is unlikely the proposed actions will reduce the area of occupancy of any potential important population.
Criteria	• **fragment an existing important population into two or more populations**
Response	While the proposal is within the known range of this species there are no records of its occurrence within 10 km on the NSW Wildlife Atlas. As such it is not expected that there are any important populations of this species in the vicinity of the proposal.
Conclusion	It is unlikely that an important population would be fragmented.
Criteria	• **adversely affect habitat critical to the survival of a species**
Response	While the proposal is within the known range of this species there are no records of its occurrence within 10 km on the NSW Wildlife Atlas. As such it is not expected that there is any critical habitat to the survival of this species present within the proposal area.
Conclusion	The proposed actions are unlikely to adversely affect habitat critical to the survival of this species.
Criteria	• **disrupt the breeding cycle of an important population/s**
Response	While the proposal is within the known range of this species there are no records of its occurrence within 10 km on the NSW Wildlife Atlas. As such it is not expected that there are any important populations of this species in the vicinity of the proposal.
Conclusion	The proposed actions are unlikely to disrupt the breeding cycle of any potential important koala population.
Criteria	• **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
Response	The proposal will lead to a minor reduction in the in the availability of habitat through the clearing of a strip of land adjacent to the existing motorway. This clearing will remove a maximum of 15.31 hectares of potential Long-nosed Potoroo habitat. This represents less than 0.1% of nearby available habitat. As such it is unlikely that the proposal will have an adverse effect on the species such that it is likely to decline.
Conclusion	It is unlikely that the proposal will have an adverse effect on the species such that it is likely to decline.
Criteria	• **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**
Response	The proposed works do not involve procedures that are likely to increase the potential for

	invasive species to be present if best practice techniques are employed.
Conclusion	With adherence to best practice construction techniques and ongoing management, the proposal will not result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.
Criteria	• **introduce disease that may cause the species to decline**
Response	The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques are employed.
Conclusion	With adherence to best practice construction techniques and ongoing management, the proposal will not introduce disease that may cause the species to decline.
Criteria	• **interfere substantially with the recovery of the species**
Response	The proposed works constitutes part of the key threatening process of 'clearing native vegetation'. As has been established above however, the proportion of habitat to be cleared relative to nearby available habitat (less than 0.1%) means that this proposal is unlikely to interfere substantially with the recovery of this species.
Conclusion	It is unlikely that the actions proposed will interfere substantially with the recovery of the species.

Overall Conclusion

The proposed development is not considered to have a negative impact upon the Long-nosed Potoroo. This is due to the small amount of habitat to be removed, the lack of any records for this species within a 10 km radius of the proposal and the mitigation measures provided.

A referral to DoE is not required.

Mitigation Measures

Invasive species and disease control measures.

Phascolarctos cinereus (koala)

Criteria	**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:** • **lead to a long-term decrease in the size of an important population of a species**
Response	Koala habitat surveys undertaken for this project did not detect the presence of koalas within the study area. Further, whilst the site is listed in the Draft EPBC Act referral guidelines for the vulnerable koala (Doe 2013) as a known/likely to occur location for the species, an assessment undertaken in accordance with these guidelines indicated that the site did not contain habitat critical to the survival of the koala and therefore it is considered that an important population is not present. Further to this, remnant eucalypts are to be retained in all ESUs where koala food trees represent 15% or greater of the existing canopy (sites 3a and 7c).
Conclusion	The proposed works are unlikely to lead to a long-term decrease in the size of an important population of koala.
Criteria	• **reduce the area of occupancy of an important population**
Response	Koala habitat surveys undertaken for this project did not detect the presence of koalas within the study area. Further, whilst the site is listed in the Draft EPBC Act referral guidelines for the vulnerable koala (Doe 2013) as a known/likely to occur location for the species, an assessment undertaken in accordance with these guidelines indicated that the site did not contain habitat critical to the survival of the koala and therefore it is considered that an important population is not present. Further to this, remnant eucalypts are to be retained in all ESUs where koala food trees represent 15% or greater of the existing canopy (sites 3a and 7c).
Conclusion	It is unlikely that a population exists within the study area. However potential koala habitat is to be retained. Therefore it is unlikely the proposed actions will reduce the area of occupancy of any potential important population.
Criteria	• **fragment an existing important population into two or more populations**
Response	Koala habitat surveys undertaken for this project did not detect the presence of koalas within the study area. Further, whilst the site is listed in the Draft EPBC Act referral guidelines for the vulnerable koala (Doe 2013) as a known/likely to occur location for the species, an assessment undertaken in accordance with these guidelines indicated that the site did not contain habitat critical to the survival of the koala and therefore it is considered that an important population is not present. Further to this, remnant eucalypts are to be retained in all ESUs where koala food trees represent 15% or greater of the existing canopy (sites 3a and 7c).
Conclusion	It is unlikely that an important population would be fragmented.
Criteria	• **adversely affect habitat critical to the survival of a species**
Response	Koala habitat surveys undertaken for this project did not detect the presence of koalas within the study area. Further, whilst the site is listed in the Draft EPBC Act referral guidelines for the vulnerable koala (Doe 2013) as a known/likely to occur location for the species, an assessment undertaken in accordance with these guidelines indicated that the site did not contain habitat critical to the survival of the koala. Further to this, remnant eucalypts are to be retained in all ESUs where koala food trees represent 15% or greater of the existing canopy (sites 3a and 7c).
Conclusion	The proposed actions are unlikely to adversely affect habitat critical to the survival of this species.
Criteria	• **disrupt the breeding cycle of an important population/s**
Response	Koala habitat surveys undertaken for this project did not detect the presence of koalas within the study area. Further, whilst the site is listed in the Draft EPBC Act referral guidelines for

	the vulnerable koala (Doe 2013) as a known/likely to occur location for the species, an assessment undertaken in accordance with these guidelines indicated that the site did not contain habitat critical to the survival of the koala. Further to this, remnant eucalypts are to be retained in all ESUs where koala food trees represent 15% or greater of the existing canopy (sites 3a and 7c).
Conclusion	The proposed actions are unlikely to disrupt the breeding cycle of any potential important koala population.
Criteria	• **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
Response	Areas of potential koala habitat within the study area will be retained (sites 3a and 7c). The removal of other vegetation within these and others ESUs will be minor and is not expected to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Conclusion	It is unlikely that the availability or quality of koala habitat will be altered to the extent that the species is likely to decline.
Criteria	• **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**
Response	The proposed works do not involve procedures that are likely to increase the potential for invasive species to be present if best practice techniques are employed.
Conclusion	With adherence to best practice construction techniques and ongoing management, the proposal will not result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.
Criteria	• **introduce disease that may cause the species to decline**
Response	The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques are employed.
Conclusion	With adherence to best practice construction techniques and ongoing management, the proposal will not introduce disease that may cause the species to decline.
Criteria	• **interfere substantially with the recovery of the species**
Response	The proposed works constitutes part of the key threatening process of 'clearing native vegetation'. As has been established above however, most clearing will be undertaken in areas that are not considered potential koala habitat and remnant eucalypts will be retained in areas that are.
Conclusion	It is unlikely that the actions proposed will interfere substantially with the recovery of the species.

Overall Conclusion

The proposed development is not considered to negatively impact upon the koala. This is due to the low value of the potential habitat to be cleared, the retention of food trees and other remnant eucalypts in the areas of potential koala habitat, the lack of signs of koalas present and the mitigation measures provided.

A referral to DoE is not required.

Mitigation Measures

Retention of mature trees and remnant eucalypts within areas of potential koala habitat.

Invasive species and disease control measures.

Pseudomys novaehollandiae (New Holland mouse)

Criteria	**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:** • **lead to a long-term decrease in the size of an important population of a species**
Response	This species has a fragmented distribution, with 6-8 metapopulations. There is a lack of detailed survey data which makes it difficult to estimate the species actual distribution. Broadly this species inhabits coastal areas and up to 100 km inland in sandstone country and can be found in open heathland, open woodland with healthy understorey and vegetated sand dune. Populations are mainly known from reserves and have a preference for floristically rich habitat. The sections of the study area to be affected primarily contain disturbed, modified vegetation with limited or no mid/under-storey.
Conclusion	It is unlikely that the proposed actions will lead to a long-term decrease in the size of an important population of new Holland mouse.
Criteria	• **reduce the area of occupancy of an important population**
Response	This species is social, living in shared burrows with several individuals. The estimated extent of occurrence for this species is estimated around 90,000 km^2 and the species area of occupancy estimated as 420 km^2. Populations are small, with restricted home ranges of 0.4-1.4 ha.
Conclusion	The proposed actions are primarily centered on the existing road and clearing in the median strip. It is unlikely that a population of New Holland mouse exist in these disturbed areas, when remnant vegetation is available nearby. Therefore it is unlikely that there will be a reduction in area of occupancy of an important population.
Criteria	• **fragment an existing important population into two or more populations**
Response	The majority of disturbance will occur in highly modified areas that have been previously cleared and fragmented. The majority of remnant vegetation will be retained on site.
Conclusion	It is unlikely that the proposed actions will fragment an existing important population.
Criteria	• **adversely affect habitat critical to the survival of a species**
Response	No critical habitat has been identified for this species.
Conclusion	Not applicable.
Criteria	• **disrupt the breeding cycle of an important population/s**
Response	Individuals reach sexual maturity around 13 weeks of age in females and 20 weeks in males. This species breeds between late winter and early summer. Timing is related to the abundance and quality of food, rainfall patterns and fire succession. The species feeds primarily on seeds, and can consume leaves, fungi and invertebrates.
Conclusion	As the proposed actions are unlikely to affect nutritional resources, it is also unlikely that the breeding cycle of any potential population will be disrupted.
Criteria	• **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
Response	The New Holland mouse has a preference for floristically rich and diverse habitats. These types of habitats are more likely to be found in the remnant vegetation within the study area. This remnant vegetation is to be retained (where possible), with a small portion of the 271 ha area to be removed.
Conclusion	It is unlikely that the proposed actions will decrease the availability or quality of habitat to the extent that the species is likely to decline.
Criteria	• **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**
Response	Sections of the study area are highly disturbed and modified and there is evidence of invasive fauna (i.e. Fox and Rabbit) and weed species. Mitigation strategies include the

	retention of remnant vegetation where possible and weed removal/control.
Conclusion	The proposed actions are unlikely to result in additional invasive species becoming established.
Criteria	• **introduce disease that may cause the species to decline**
Response	Die-back induced by *Phytophthora cinnamomi* has been identified as a threat to the New Holland Mouse. The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques are employed.
Conclusion	With adherence to best practice construction techniques and ongoing management, the proposal will not introduce disease that may cause the species to decline.
Criteria	• **interfere substantially with the recovery of the species**
Response	Threats to this species include loss and modification of habitat, weed invasion, overgrazing, die-back, predation by invasive predators and climate change. While a small amount of potential habitat will be lost, it is minimal. The proposed actions are unlikely to exacerbate any of the additional threats to the New Holland mouse.
Conclusion	It is unlikely that the proposed actions will interfere with the recovery of this species.

Overall Conclusion

It is unlikely that the proposed actions will have a negative impact on the New Holland mouse due to the high level of existing disturbance to part of the study area and the mitigation strategies in place.

A referral to DoE is not required.

Mitigation Measures

Retention of remnant vegetation. Minimise risk of establishment and spread of invasive species due to the proposed development activities.

Pteropus poliocephalus (Grey-headed flying-fox)

Criteria	**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:** • **lead to a long-term decrease in the size of an important population of a species**
Response	Habitat on the site is highly modified with only a small amount of feed tree species (flowering Eucalypts and Melaleucas), no fruiting trees and limited shelter tree species potentially available. No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists.
Conclusion	The mature trees that are to be affected as part of the proposed works are not considered to provide foraging resources suitable to sustain a local Grey-headed flying-fox population. Therefore the extent of flying-fox habitat to be removed or modified is minor. The proposed works will not lead to a long-term decrease in the size of an important population.
Criteria	• **reduce the area of occupancy of an important population**
Response	This species requires foraging resources and roosting sites. Roosting sites have large numbers of Grey-headed flying-foxes congregating in large trees. No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists.
Conclusion	The mature trees that are to be affected as part of the proposed works are not considered to provide foraging resources suitable to sustain a Grey-headed flying-fox population. Therefore the extent of habitat to be removed or modified is minor. The proposed works will not reduce the areas of occupancy of an important population.
Criteria	• **fragment an existing important population into two or more populations**
Response	Grey-headed flying-foxes can travel up to 60-70 km per night in search of foraging resources and migrates in response to changes in amount and location of flowering. No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists. Remnant vegetation will be retained on site which will limit further fragmentation of habitat.
Conclusion	Given the restricted habitat available, this species ability to adapt foraging behaviour to resource availability and high level of mobility, it is highly unlikely that the proposed actions will result in the fragmentation of an existing important population of Grey-headed flying-fox.
Criteria	• **adversely affect habitat critical to the survival of a species**
Response	No critical habitat has been declared for this species.
Conclusion	Not applicable
Criteria	• **disrupt the breeding cycle of an important population/s**
Response	Following breeding, females relocate with young to maternal camps. No roosting sites or maternal camps were identified on site. No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists.
Conclusion	Given that important resources for breeding are not available on site, it is highly unlikely that the proposed actions will disrupt the breeding cycle of an important population.
Criteria	• **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
Response	Habitat within the study area to be affected by the proposal is highly modified with only a small amount of feed tree species (flowering Eucalypts and Melaleucas), no fruiting trees and limited shelter tree species potentially available. No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists. Grey-headed flying-foxes can travel up to 60-70 km per night in search of foraging resources and migrates in response to changes in amount and location of flowering. Some large trees will be retained on site adjacent to roadside vegetation which will limit further fragmentation of habitat.

Conclusion	The proposed actions are highly unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.
Criteria	• **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**
Response	The proposed works do not involve procedures that are likely to increase the potential for invasive species to be present if best practice techniques are employed.
Conclusion	With adherence to best practice construction techniques and ongoing management, the proposal will not result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.
Criteria	• **introduce disease that may cause the species to decline**
Response	The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques are employed.
Conclusion	With adherence to best practice construction techniques and ongoing management, the proposal will not introduce disease that may cause the species to decline.
Criteria	• **interfere substantially with the recovery of the species**
Response	An action plan has been developed and recovery strategies for the Grey-headed flying-fox include abatement of threats such as habitat loss and fragmentation, competition and hybridisation, pollutants and pathogens.
Conclusion	While a small amount of potential habitat will be cleared, mitigation measures recommend the retention of mature and remnant vegetation where possible. Therefore It is unlikely that the actions proposed will interfere substantially with the recovery of the species.

Overall Conclusion

The proposed development is not considered to negatively impact on the Grey-headed flying-fox. This is due to the low value of the potential habitat to be affected and the lack of breeding/roosting camps.

A referral to DoE is not required.

Mitigation Measures

Retention of remnant vegetation.

Appendix F: Risk matrix – likelihood of occurrence based on desktop and ground-truthing

	Likelihood of Occurrence based on further investigations e.g. on-ground						
	Descriptions	Species not identified and suitable habitat occurs > 10 km away from the Study Site	Species not identified but suitable habitat occurs within 1 km of the Study Site	Species not identified and no suitable habitat occurs within the Study Site	Species not identified but partially disturbed or degraded habitat occurs within the Study Site	Species not identified but suitable habitat occurs within the Study Site	Species identified and suitable habitat occurs within the Study Site
Likelihood of Occurrence - based on desktop assessments		F	E	D	C	B	A
Expected to occur during the proposal or beyond the Proposal (i.e. recent records exist in high numbers)	A	M	M	H	H	H	H
Could occur during the Proposal or beyond the Proposal (i.e. recent records exists)	B	L	M	M	H	H	H
Possible under exceptional circumstances (i.e. recent records exists but low in number)	C	L	L	M	M	H	H
Unlikely to occur during the Proposal (i.e. old records but low in number)	D	L	L	L	M	M	H
Very unlikely to occur during the Proposal (i.e. only old records)	E	EL	L	L	L	M	M
Extremely rare or previously unknown to occur (i.e. no records)	F	EL	EL	L	L	L	M

Risk extremely Low (EL): extremely unlikely to occur	Risk Low (L): unlikely to occur	Risk Medium (M): could possibly occur	Risk High (H): Highly likely to occur/does occur

Appendix G: Photographic record

Ancillary sites

Plate 1: Site 3a – Remnant spotted gum-ironbark forest

Plate 2: Site 3b – Cleared grassland with remnant mature hollow bearing trees

Plate 3: Site 4c – cleared, open grassland (eastern side of Warren Road)

Plate 4: Site 5 – Cleared grassland within Warnervale Airport, northern end of Jack Grant Drive

Plate 5: Site 6 – Cleared grassland within Warnervale Airport, southern end of Jack Grant Drive

Plate 6: Site 7a - Swamp drain along boundary fence of north-bound service station

Plate 7: Site 7b – Cleared pasture with isolated remnant trees

Plate 8: Site 7c – Remnant Swamp Sclerophyll Forest on Coastal Floodplain (EEC)

Plate 9: Site 7d – Cleared grassland adjacent to remnant EEC

Plate 10: Site 7e – Remnant Swamp Sclerophyll Coastal Forest (SSCF) vegetation (EEC)

Plate 11: Site 9 – Cleared grassland with remnant roadside vegetation and weed species

Roadside verge – road widening

Plate 12: Site 8a – Cleared roadside vegetation at Yarramalong Road, Hue Hue Road and Alison Road intersection

Plate 13: Site 8b – Small remnant patch of stringybark – spotted gum – smooth-barked apple trees at Yarramalong Road, Hue Hue Road and Alison Road intersection

Plate 14: Site 10 - Remnant patch Blackbutt forest adjacent to roadside verge west of the M1

Plate 15: Site 11 – Remnant Smooth-barked Apple - Turpentine – Blackbutt open forest adjacent to east side of Wyong Road Interchange and M1 overpass

Median strip – road widening

Plate 16: Cleared, open vegetation within median of M1

Plate 17: Riparian vegetation between M1 bridge crossings of Wyong River

Plate 18: Native vegetation regrowth within median of M1

Motorway interchange and intersection works

Plate 19: Site 1a – Undisturbed remnant vegetation between M1 and on-ramp from Doyalson Link Road

Plate 20: Site 2a –Spotted Gum Ironbark Forest between M1 and off-ramp to Doyalson Link Road

Plate 21: Site 2b – Disturbed remnant vegetation cleared in 1983, between M1 and off ramp to Doyalson Link Road

Plate 22: Site 4a, 4b – Remnant spotted gum-ironbark forest corner of Warren Road and Sparks Road junction

Plate 23: Site 1c – Remnant native vegetation Doyalson Interchange east