



**Flora and Fauna Assessment of
No 26-61 (Lot 1 DP 349727) Nikko Road,
Warnervale NSW (Ref Number:2017-17-05)**



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1. Introduction

Enviro Ecology have been engaged by Kingston Property Fund Pty Ltd C-/O the property owner to carry out a Flora and Fauna Assessment of No 26-61 (Lot 1 DP 349727) Nikko Road, Warnervale NSW within the Central Coast LGA, hereafter referred to as the subject property (Figure 1-1).

The proposed development is to subdivide the subject property into 75 small lot housing (Figure 1-2) within the subject property (Figure 1-1). This report examines the terrestrial flora assemblages and faunal species and their habitats within the location of proposed development (Figure 1-2) subject to clearing activities. The report then determines the impacts of the clearing works upon local biodiversity. It summarises proposed mitigation measures as well as the assessment under the *Environmental Planning and Assessment Act 1979* and under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*.

To establish the impacts of the proposal a review of the development plans has been undertaken.

1.1 Terminology

This report uses the following terminology:

- Subject property is defined as the yellow boundary on the aerial photograph see (Figure 1:1)
- Study area is defined also as the yellow boundary on the aerial photograph see (Figure 1-1);
- Subject site is defined as the red boundary on the aerial photograph (Figure 1-1);
- TSC Act abbreviates the *Threatened Species Conservation Act 1995*;
- EPBC Act abbreviates the *Environment Protection and Biodiversity Conservation Act 1999*;
- EP&A Act abbreviates the *Environmental Planning and Assessment Act 1979*;
- OEH abbreviates Office of Environment & Heritage (NSW);
- LGA abbreviates Local Government Area;
- Threatened species refers to those flora and fauna species listed as vulnerable, endangered or critically endangered under the TSC Act or EPBC Act
- EEC abbreviates Endangered Ecological Community; and
- WSUD abbreviates Water Sensitive Urban Design.

1.2 Legislative context

All proposals assessed under the *Environmental Planning and Assessment Act 1979* must include an examination of the threatened biodiversity, or their habitats, that are likely to occur within the development area or that may be indirectly affected by the construction and operation of a proposal. In the event that threatened biodiversity is within the vicinity of a proposal, the application must also include an assessment of the potential impact.

Other Commonwealth and State legislation relevant to the protection of flora, fauna and biodiversity within the study area include:

- (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*
- *Threatened Species Conservation Act 1995*
- *Fisheries Management Act 1994*
- *Water Management Act 2000*
- *Water Management Amendment Act 2008*
- *National Parks and Wildlife Act 1974*
- *Noxious Weeds Act 1993*.
- *State Environmental Planning Policy No 44—Koala Habitat Protection*
- *Wyong Shire Council Squirrel Glider Habitat Assessment*

These Acts and policies have been addressed where they apply.

1.3 Site Description

The planning and cadastral details of the subject property are provided in (Table 1-1). The property is bordered by Nikko Road to the west and north west, to the east partially by native vegetation and south by Kanowna Road (Figure 1-1).

Table 1-1 Site details

Location	No 26-61 (Lot 1 DP 349727) Nikko Road, Warnervale NSW
Subject property	35947m2 or 3.6ha (approx)
Subject site (vegetation loss)	1.1ha
Topographic Map	Wyang 1:25000
Local Government Area	Central Coast
Elevation	19-20m AHD
Slope	The property falls to the north and within the northern portion beyond the creek falls to the south towards a creekline that passes through the northern portion of the subject property
Aspect	East-west

1.4 Study objectives

The objectives of this report are to:

- Conduct a targeted fauna survey and habitat assessment to determine the likelihood of occurrence of threatened or Migratory species of animal occurring within the study area
- Conduct a floral survey to identify any threatened species of plant present or considered likely to occur within the proposal area.
- Determine and describe the characteristics and condition of the vegetation communities and flora.
- Determine the presence, or likelihood of occurrence, of threatened biodiversity listed under the *Threatened Species Conservation Act 1995* or *Environment Protection and Biodiversity Conservation Act 1999* occurring within the study area
- Describe and assess likely impacts of the project on biodiversity
- Undertake significance assessments for threatened biodiversity that occur or have potential habitat within the study area
- Propose amelioration measures to mitigate or minimise impacts on the ecological values of the study area.

Figure 1-1 Study area



Figure 1-2 Proposed Development



2. Methodology

This ecological assessment was based on the results of a desktop review and site inspections on the 17th of May, 14th - 20th & 25th of June, 1st, 10th of July and on the 6th of August 2017 by Mr John Whyte B.Bio.Sc (Majors Botany & Zoology) of Enviro Ecology. This assessment has been prepared to identify potential impacts as a result of the proposed activity on biodiversity.

2.1 Licensing

All work was carried out under the appropriate licences, including a scientific licence as required under Clause 22 of the National Parks and Wildlife Regulations 2002 and Section 132C of the *National Parks and Wildlife Act 1974*, and an Animal Research Authority issued by the Department of Industry & Investment.

2.2 Nomenclature

Names of plants used in this document follow Harden (Harden 1992; Harden 1993; Harden 2000; Harden 2002) with updates from PlantNet (Royal Botanic Gardens 2017). Scientific names are used in this report for species of plant. Scientific and common names of plants are listed in Appendices A and C.

Names of vertebrates follow the Census of Australian Vertebrates (CAVS) database maintained by the Department of Sustainability, Environment, Water, Population and Communities (Department of Sustainability, Environment, Water, Population and Communities 2017). Common names are used in the report for species of animal. Scientific names are included in species lists found in Appendices B and D.

2.3 Database searches and literature review

This assessment included a review of:

- Topographic maps
- Aerial photographs
- Vegetation Mapping of the area (Bell S 2002) The natural vegetation of the Wyong Local Government Area, Central Coast, New South Wales. Wyong, Unpublished report to Wyong Shire Council, East Coast Flora Survey.
- Database searches, as summarised in Table 2-1.

Table 2-1 Database searches

Database	Search date	Area searched	Reference
Bionet Atlas of NSW Wildlife	17 th of May 2017	Locality (10 km)	(Office of Environment & Heritage 2017)
PlantNet Database	17 th of May 2017	Locality (10 km)	(Royal Botanic Gardens 2017)
Protected Matters Search Tool	17 th of May 2017	Locality (10 km)	(Department of Sustainability, Environment, Water, Population and Communities 2017)

2.4 Field Survey

Inspections of the site were undertaken on the 17th of May, 14th- 20th & 25th of June, 1st, 10th of July and on the 6th of August 2017. This included:

- Four quadrats & a random meander survey recording all species of plant encountered within the study area
- Searching for specialised fauna habitat resources such as roosting/nesting hollows, foraging resources e.g. feed trees
- Targeted surveys for flora and fauna (Section 2.4)
- Opportunistic fauna surveys during the flora survey

2.5 Flora Surveys

A combination of quadrat and traverse flora surveys was used to assess native floral diversity, dominant species, condition of vegetation communities and search for Threatened species within the study area. The flora survey effort was determined to exceed the suggested minimum survey requirements of the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* (refer to table 3-2, Department of Environment and Conservation 2004).

Table 2-2 Suggested survey technique and effort for plant quadrats

Survey technique	Suggested minimum effort per stratification unit
Quadrat	1 quadrat for areas <2 ha
	2 quadrats for area 2-50 ha
	3 quadrats for areas 51-250 ha
	5 quadrats for areas 251-500 ha
	10 quadrats for areas 5,001-1,000 ha, plus 1 additional quadrat for each extra 100 ha thereof
Traverse surveys	30 minutes for each quadrat sampled within the same stratification unit as the quadrat

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

2.5.1 Quadrat surveys

Quadrat surveys were completed to provide a quantitative examination of species abundance in each vegetation community. Quadrat surveys are also likely to detect inconspicuous species that may be missed by random meander or transect surveys (Department of Environment and Conservation 2004).

Four vegetation quadrats were placed randomly within the vegetation within the study area in a north-south direction to sample vegetation, Vegetation quadrats were 400 m² (10x40m) within which all floral species were identified and assigned a vegetative cover abundance rating based on the following modified Braun-Blanquet scale:

Table 2-3 Braun-Blanquet scale

1	<5% - Rare or few individuals	3 or less individuals
2	<5% - Common	Consistent throughout plot
3	Cover >5% and <25%	
4	Cover <25% and <50%	
5	Cover >50% and <75%	
6	Cover >75%	

2.5.2 Random meander surveys

Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random manner throughout the site recording all species observed. The survey is continued until no additional species are observed within a patch. Random meander surveys also allow the boundaries between various vegetation communities and condition of vegetation to be recorded and are valuable for recording species that may not occur within quadrats including, Threatened species (Department of Environment and Conservation 2004).

Individual random meander surveys were separated whenever there was a significant change in vegetation community type or condition. For each random meander survey, the vegetation community was determined based on the dominant canopy species and the structure formation in accordance with Specht (1981) with reference to existing mapped vegetation communities. A random meander was conducted throughout the entire study area.

2.5.3 Vegetation condition

The condition of vegetation communities is an important criterion to determine suitable habitats for Threatened species and the conservation status of certain ecological communities. Vegetation in the study area was assigned to one of the following condition classes (refer Table 2-4).

Table 2-4 Vegetation community condition classes

Condition Class	Criteria
Good	Vegetation still retains the species complement and structural characteristics of the pre-European equivalent. Such vegetation has usually changed very little over time and displays resilience to weed invasion due to intact groundcover.
Moderate	Vegetation generally still retains its structural integrity, but has been disturbed and has lost some component of its original species complement. Weed invasion can be significant in such remnants
Poor	Vegetation that has lost most of its species and is significantly modified structurally. Often such areas now have a discontinuous canopy of the original tree cover and very few shrubs. Exotic species, such as introduced pasture grasses or weeds, replace much of the indigenous ground cover. Environmental weeds are often co dominant with the original indigenous species.

2.6 Terrestrial fauna

2.6.1 Fauna habitats

Fauna habitat assessments were undertaken to assess the likelihood of Threatened species of animal (those species identified from the literature and database review) to occur in the study area. Fauna habitat characteristics assessed included the:

- structure and floristics of the canopy, understorey and ground vegetation, including the presence of flowering and fruiting trees providing potential foraging resources
- presence of hollow-bearing trees providing roosting and breeding habitat for arboreal mammals, birds and reptiles
- composition of the ground cover vegetation, leaf litter, rock outcrops and fallen timber to provide protection for ground-dwelling mammals, reptiles and amphibians
- Presence of waterways (ephemeral or permanent) and water bodies.

The assessment of these fauna habitat characteristics enabled an overall assessment of fauna habitat condition within the study area (refer Table 2-5).

Table 2-5 Vegetation community condition classes

Fauna habitat condition class	Description
Good	A full range of fauna habitat components are usually present (e.g. old-growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
Moderate	Some fauna habitat components may be missing (e.g. old growth trees, fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
Poor	Many fauna habitat elements in low quality remnants have been lost, including old-growth trees (e.g. due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive past clearing.

2.6.2 SEPP 44 Koala habitat assessment

The site is located in the Wyong Shire Local Government Area, which is listed under Schedule 1 of *State Environmental Planning Policy - 44 Koala Habitat Protection* (SEPP 44). The likelihood of the site to be 'potential koala habitat' or 'core koala habitat' was assessed. Under *State Environmental Planning Policy - 44 Koala Habitat Protection*, the following definitions apply:

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

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

Koala habitat was assessed by inspecting all feed trees to identify indicative scratches on the trunk and droppings around the bases of feed trees.

2.6.3 Squirrel Glider habitat Assessment

Squirrel Glider Habitat Assessment- Squirrel Glider habitat on the study area to be assessed accordance to the document "Wyong Shire Council Interim Ecological Assessment Information Required to Assess Clearing Impacts within Squirrel Glider Habitat in Wyong Shire" (Wyong Shire Council 2000).

2.6.4 Fauna survey

The presence of faunal species in the study area was determined primarily through consideration of suitable habitats, with species of animal present on the site recorded opportunistically during the vegetation and habitat assessments and through direct survey. Although recording Threatened species during field survey can confirm their presence in an area, a lack of Threatened species records does not necessarily indicate the absence of the species from the site when suitable habitat is present. By the very nature of their rarity, Threatened species are often difficult to detect. Suitable habitat is, therefore, an important factor to consider when determining the potential presence of Threatened species.

The following fauna surveys were completed in the study area due to the presence of the ground cover vegetation, hollows, leaf litter and fallen timber and potential to provide protection for ground-dwelling mammals, reptiles and amphibians.

The assessment of these fauna habitat characteristics enabled an overall assessment of fauna habitat condition within the study area.

2.6.5 Diurnal Birds

Diurnal birds were recorded within the study area over 1.5 hour observation periods on three morning and five afternoons. During the site inspections the entire study area was traversed and birds were identified either from sightings or characteristic calls. The number of each species and the activity at the time of sighting (foraging, breeding, or flying) was also recorded.

Additional birds species not recorded during this survey period were also opportunistically recorded throughout the study area whilst completing vegetation surveys and habitat assessments.

Birds were observed and identified using binoculars. Calls were generally identified in the field by the observer. If an unknown call was heard it is recorded and identified using reference libraries.

2.6.6 Nocturnal Birds

The presence of Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*) & Barking Owl (*Ninox connivens*) were targeted by broadcasting taped calls through a 15 watt Toa 'Fauna-tech' amplifier. Calls were played for 5-minute periods at 5-minute intervals. This was followed with quiet listening and spotlighting. Nocturnal calls for birds were not played until nocturnal spotlight survey were completed for nocturnal mammals. Searches for evidence of Owl roosts and potential Owl roosting / breeding hollows were made during surveys of the study area. Any whitewash, or regurgitated pellets found were noted.

Spotlighting using a Led Lenser H14 Head torch (220 Lumens) and a hand held lamp of 750,000 candlelight power (100W halogen globe). This technique involved walking amongst the treed area of the study area so that a maximum number of trees could be observed this occurred for approximately 2 hours after dark during five evening site visits (14th - 20th).

Photograph 2-1 Tawny Frogmouth recorded during spotlighting surveys



2.6.7 Arboreal and Terrestrial Mammals

Assessment was made of 'found' scats, chew markings, diggings, runways and scratches during visits to the site

The presence of Squirrel Gliders from the locality was targeted by broadcasting taped calls through a 15 watt Toa 'Fauna-tech' amplifier. Calls were played for 5-minute periods at 5-minute intervals during the five night site visits. This was followed with quiet listening and spotlighting.

Spotlighting for nocturnal mammalian fauna was carried out using a Led Lenser H14 Head torch (220 Lumens) and a hand held lamp of 750,000 candlelight power (100W halogen globe). This technique involved walking amongst the treed area of the study area so that a maximum number of trees could be observed this occurred for approximately 2 hours after dark during five evening site visits (14th- 20th).

2.6.8 Micro-chiropteran bats

Micro-chiropteran bats were surveyed by echolocation using an Anabat Mk 2 detector in a fixed position within the study area (Figure 2-1). Anabats were sighted along flight lines (open sight lines amongst vegetation). Mega-chiropteran bat species, such as Grey-headed Flying-fox (*Pteropus poliocephalus*), were surveyed by targeting flowering Smooth-barked Apple / fruiting trees during spotlighting activities.

2.6.9 Amphibians

Frog searches were completed at all locations where frogs were heard vocalising to confirm species identification. Persistent rainfall proceeding on the day of the field survey has resulted in good conditions for identifying frogs. Species were recorded by sightings, captures and call characteristics.

Amphibians were surveyed by vocal call identification, by using a tape recorder to record male calls in suitable places and then comparing these to known calls. Amphibians were also surveyed by habitat searches.

Any amphibians found are visually identified and when required to be examined are handled with Latex gloves and kept moist until release. Spotlighting for nocturnal amphibians was also carried out using a hand held lamp of 750,000 candlelight power (100W halogen globe). This technique involved walking amongst the open forest/woodland areas of the study area. Species of herpetofauna were also opportunistically recorded whilst completing vegetation surveys and habitat assessments.

2.6.10 Reptiles

Searches for reptiles in likely localities such as under logs, rubbish debris, leaf litter observed within the site. Surveys were undertaken during diurnal visits to the site. Spotlighting of terrestrial habitats suitable for reptiles also occurred during nocturnal amphibian surveys.

2.6.11 Stag Surveys

A stag watch was undertaken for three hollow-bearing trees identified within the study area (Figure 2-1) to determine the presence of hollow-dependent fauna species within the study area. The hollow-bearing trees were watched for approximately 30min before sunset and for 1 hour after sunset. A handheld

spotlight with a red filter was used to identify fauna species encountered exiting hollows.

2.7 Significant Assessments

Significance assessments were carried out for threatened species, populations or communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* that were known or predicted to occur in the project locality (10 kilometres from the study site) and that had a moderate to high likelihood of occurring within the study site based on suitable habitat or observation in the field.

For species, populations and communities listed under the *Threatened Species Conservation Act 1995* significance assessments were completed in accordance with threatened species assessment guidelines (Department of Environment and Climate Change 2007). For species or communities listed under the *Environment Protection and Biodiversity Conservation Act 1999*, significance assessments were completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of the Environment and Heritage 2006).

2.8 Limitations

Within the study area varying degrees of non-uniformity of flora and fauna habitats are encountered. Hence no sampling technique can entirely eliminate the possibility that a species is present within a study area (e.g. species of plant present in the seed bank). The conclusions in this report are based upon data acquired for the study area and the environmental field surveys and are, therefore, merely indicative of the environmental condition of the study area at the time of survey, including the presence or otherwise of species. It should also be recognised that conditions of the study area, including the presence of threatened species, can change with time.

Habitat assessments were completed for all threatened fauna species identified as a result of the database searches to determine whether or not suitable habitat for threatened fauna species occurred within the site. This is a more conservative approach and is likely to include species that are difficult to detect.

Figure 2-1 Flora and fauna survey locations within the study area



3. Results Methodology

3.1 Vegetation mapping

Two vegetation maps cover the study area:

- Vegetation mapping of the area (Bell S 2002). The natural vegetation of the Wyong Local Government Area, Central Coast, New South Wales. Wyong, Unpublished report to Wyong Shire Council, East Coast Flora Survey.
- Lower Hunter and Central Coast Regional Environment Management Strategy Vegetation Survey, Classification and Mapping; Lower Hunter and Central Coast Region (LHCCREMS) (Lower Hunter and Central Coast Regional Environmental Management Strategy 2000)

The vegetation within the study area was ground-truthed and was found to best represented by (Bell 2002) vegetation mapping. The other vegetation mapping project (LHCCREMS) ((Lower Hunter and Central Coast Regional Environmental Management Strategy 2000) was less consistent with the findings of the current survey.

3.2 Vegetation communities

Three vegetation communities were recorded from the study area.

Detailed description of these vegetation communities has been provided below with a complete list of flora species recorded across the subject property presented within (Appendix A).

Figure 3-1 Field verified vegetation community and hollow-bearing trees recorded from the study area



3.2.1 Map unit 28 Narrabeen Buttonderry Footslopes Forest

Map unit 28 Narrabeen Buttonderry Footslopes Forest (NBFF) community was found to occupy the entire study area. This community contained a similar floristic structure throughout. The vegetation condition of this community was found to be in moderate-good condition with only small area along the northern boundary containing understorey weed species.

Community Description

Canopy

Tree species commonly encountered were *Melaleuca nodosa* (Ball Honey-Myrtle), *Angophora costata* (Smooth-barked Apple), *Eucalyptus capitellata* (Brown Stringybark) with the occasional occurrence of *Corymbia maculata* (Spotted Gum), *Eucalyptus paniculata* (Grey Ironbark). The canopy ranged in height from approximately 8-18 m tall with a projected foliage cover of >15-35%.

Sub-Canopy

The sub-canopy was dominated by *Melaleuca nodosa* (Ball Honey-Myrtle) with the occasional occurrence of *Glochidion fernandi* (Cheese Tree), *Allocasuarina littoralis* (Black She-oak) & *Pittosporum undulatum* (Sweet Pittosporum) individual was also recorded. The sub-canopy was to a height of approximately 2-4m with a projected foliage cover of >5%.

Shrub understorey

Shrub species recorded were *Acacia longifolia*, *Banksia spinulosa/integrifolia*, & *Persoonia linearis/levis*. Shrubs were approximately 0.1-1.5 m tall with a projected foliage cover of >5%.

The ground layer was dominated by native groundcover species *Entolasia stricta*, *Microlaena stipoides* (Wallaby Grass), *Themeda australis* (Kangaroo Grass), *Imperata cylindrica* (Blady Grass), *Gahnia clarkei*, & *Dianella caerulea*. The ground layer along the northern boundary adjacent to cleared area was dominated by *Nephrolepis cordifolia* (Fish-bone Fern). *Gahnia sieberiana* was the dominant groundcover adjacent to an overland flow-path which passes through the subject property in a south-easterly direction.

The ground layer was to a height of 0.1-0.2m with a projected foliage cover of 50-70%.

Climbers

Climbing species recorded were: *Parsonsia straminea* (Common Silkpod), *Cassytha pubescens* & *Hardenbergia Violaceae* (Native Violet).



Photograph 3-1 Map unit 28 Narrabeen Buttonderry Footslopes Forest



Photograph 3-2 Map unit 28 Narrabeen Buttonderry Footslopes Forest within the western portion of the study area

3.2.2 Map unit 30 Narrabeen Dooralong Spotted Gum-Ironbark Forest

The Narrabeen Dooralong Spotted Gum-Ironbark Forest (NDSGIF) community has been subject to past clearing of sub-canopy, shrub and ground vegetation. Despite past disturbance the NDSGIF community still retains native canopy dominance. This community was assessed as being in low-moderate condition (Table 2-3) at the time of the site inspections.

Community Description

Canopy

Tree species commonly encountered were *Corymbia maculata* (Spotted Gum), *Eucalyptus paniculata* ssp. *paniculata* with the occasional occurrence of *Eucalyptus acmenoides* (White Mahogany). The canopy ranged in height from approximately 19-30m tall with a projected foliage cover of 15-45%.

Sub-Canopy

The sub-canopy was dominated by thickets of *Melaleuca nodosa* (Ball Honey-Myrtle) with the occasional occurrence of *Glochidion fernandi* (Cheese Tree) & *Pittosporum undulatum* (Sweet Pittosporum) being also recorded. The sub-canopy was to a height of approximately 2-4m with a projected foliage cover of >5%.

Shrub understorey

Shrub species recorded were *Lantana camara* (Lantana) & *Acacia longifolia*, Shrubs were approximately 0.1-1.5 m tall with a projected foliage cover of >5%.

Ground understorey

The ground layer was dominated predominately by exotic species however within intact areas dominated by *Melaleuca nodosa* the understorey was found to be in better condition.

Groundcover within the northern portion of this community was dominated by native groundcover species *Entolasia stricta*, *Microlaena stipoides* (Wallaby Grass), *Themeda australis* (Kangaroo Grass), *Imperata cylindrica* (Blady Grass), *Gahnia clarkei*, & *Dianella caerulea*.

The ground layer along the southern boundary adjacent to cleared area was dominated by *Nephrolepis cordifolia* (Fish-bone Fern), *Rubus fruticosus* (Blackberry), *Kikuyu* (*Pennisetum clandestinum*), *Paspalum dilatatum* (Paspalum), *Taraxacum officinale* (Dandelion) and *Plantago lanceolata*. The ground layer was to a height of 0.1-0.2m with a projected foliage cover of 50-70%.

Climbers

Climbing species recorded were: *Parsonsia straminea* (Common Silkpod), *Cassytha pubescens* & *Hardenbergia violaceae* (Native Violet).



Photograph 3-3 Map unit 30 Narrabeen Dooralong Spotted Gum-Ironbark Forest



Photograph 3-4 Map unit 30 Narrabeen Dooralong Spotted Gum-Ironbark Forest

3.3 Species of plant

A total of one-hundred thirty-five (135) species of plant were recorded from the study area, of which 101 species (75%) were native (Appendix A). The most diverse families recorded were Poaceae & Myrtaceae (Appendix A).

Thirty-four (34) species of weed were recorded from the study area, of five (5) are listed (Table 3-1) under the *Noxious Weeds Act 1993*. Lantana (*Lantana camara*) is also listed as a Weed of National Significance (Thorp and Lynch 2000).

Table 3-1 Noxious weed recorded within the study area

Weed	Legal requirements
<i>Senecio madagascariensis</i> (Fireweed)	Mandatory measures must not be imported into the state or sold.
<i>Asparagus aethiopicus</i>	Mandatory measures must not be imported into the state or sold.
<i>Rubus fruticosus</i> (Blackberry)	Mandatory measures must not be imported into the state or sold.
<i>Eichhornia crassipes</i> (Water Hyacinth)	Mandatory measures must not be imported into the state or sold.
Lantana (<i>Lantana species</i>)*	Regional recommended measure; The plant should be eradicated from the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment

Note: * Weeds of National Significance (Thorp and Lynch 2000)

3.4 Regionally Significant Plant Species

The following species listed as Keystone Species in DCP 14 were observed within the study area:

Table 3-2 Keystone Plant Species recorded from the study area

Scientific Name	Common Name	Potential Schedule 1 or 2 Fauna
<i>Acacia irrorata</i> and other 'gum' producing <i>Acacia species</i>	Wattle	Squirrel Glider
<i>Acacia longifolia</i>	Wattle	Squirrel Glider
<i>Angophora costata</i>	Sydney Red Gum	Squirrel Glider
<i>Banksia integrifolia</i>	Banksia	Squirrel Glider
<i>Banksia oblongifolia</i>	Banksia	Squirrel Glider
<i>Banksia spinulosa</i>	Banksia	Squirrel Glider
<i>Corymbia gummifera</i>	Red Bloodwood	Squirrel Glider
<i>C. maculata</i>	Spotted Gum	Squirrel Glider/Yellow-bellied Glider
<i>E. fibrosa</i>	Broad leaved Ironbark	Regent Honeyeater
<i>E. paniculata</i>	Grey Ironbark	Regent Honeyeater
<i>Melaleuca quinquenervia</i> and other local <i>Melaleuca species</i>		Ringtail Possum
<i>Xanthorrhoea spp</i>	Grass Tree	Squirrel Glider

3.5 Species of animal

3.5.1 Amphibians

Four common species of frog were identified during the surveys; the majority of frogs were recorded calling from the creekline that passes through the northern portion of the study area. The Eastern Dwarf Tree Frog (*Litoria fallax*), Pearson's Tree Frog (*Litoria peronii*), Brown-striped Frog (*Limnodynastes peronii*) & Common Eastern Froglet (*Crinia signifera*) were all identified.

No threatened frogs listed under the TSC or EPBC Acts were identified within the study area despite the presence of suitable habitat and targeted surveys being conducted. All suitable breeding habitats for amphibious species are to be retained within the study area.

3.5.2 Reptiles

One common species of lizard known as the Grass Skink (*Lampropholis delicata*) were observed within the study area. Habitat for reptiles within the subject site is considered to be moderate due to the presence of native vegetation and microhabitats, leaf litter & hollow logs. Habitats outside of the study area are considered to be of higher quality and are likely to support more species of reptile.

3.5.3 Birds

Thirty-one species of bird were identified within the study area (Appendix B).

The vegetation within the site provides a range of foraging opportunities for birds but despite this at the time of the bird survey very few species were recorded from the area subject to clearing. Very few birds species were recorded within from the study area. The low number of bird species recorded within this community may be attributed to the lack of flowering and fruiting trees and shrubs at the time of the survey.

The vegetation upon adjacent properties provides similar foraging opportunities and habitats for bird species than that which was identified within the study area.

No Glossy Black-cockatoo (*Calyptorhynchus lathamii*) or Gang-gang Cockatoo (*Callocephalon fimbriatum*) chew sites were identified during the surveys within the study area despite the presence of *Allocasuarina littoralis* (Black-She Oak) within the study area.

3.5.4 Mammals

The targeted surveys resulted in the identification of seven species of mammal within the subject property (Appendix B). Habitat for native mammals within the study area was moderate.

The following species were most frequently identified during nocturnal surveys: Six Common Ringtail Possums, five Brown Antechinus & one Black Rat (*Rattus rattus*) these species were recorded during targeted trapping and spotlighting surveys.

No suitable cave site for threatened cave dwelling bats was recorded from the study area. No Threatened microbats were recorded within the study area despite targeted surveys being conducted. No hollow-bearing trees which would provide a suitable roosting site for tree dwelling microbats are proposed to be removed as a result of the proposal.

Three hollow-bearing trees were identified from the subject property (Figure 2-1) the two hollow within the northern portion of the subject property were occupied by Ring-tailed Possums no fauna species were encountered utilising the hollow within the south-western corner of the subject property.

The blossoms of the canopy trees provide suitable foraging resources for the Grey-headed Flying-fox (*Pteropus poliocephalus*) which was recorded during surveys of the study area (Figure 3-2).

3.5.5 Fauna habitat types

The suitability, size and configuration of the terrestrial fauna habitats were found to correlate broadly with the structure, floristics, connectivity and quality of the local vegetation communities described above. These habitats mostly comprised the Open Forest communities.

The condition class of the habitats within the majority of the Exotic Grassland with Scattered Trees community was assessed as being in poor condition and provided limited habitat value, whilst the Narrabeen Buttonderry Footslopes Forest (NBFF) community within the western portion of the study area was assessed as providing moderate-high habitat value. The NBFF community contained good structural integrity, including the presence of upper, mid and groundcover layers, as well as thick leaf litter and woody debris, with the fauna habitats being assessed as being in a good condition in terms of their overall structure and the presence of microhabitat features.

3.5.6 Fauna microhabitat features

Tree hollows

Three hollow-bearing trees were identified within the subject property (Figure 3-2). Photographs of the three hollow-bearing trees are provided in Appendix G.

Stag surveys were undertaken for all three (3) HBT's with the results presented in the Table 3-3 below.

No suitable nesting trees for large Owls species are likely to be impacted upon as a result of the proposal. The internal dimensions of all hollow-bearing trees are presented within the table below.

Table 3-3 Habitat Trees proposed for removal

HBT No	Scientific Name	Common Name	Type of Hollow	Size of Hollow (cm)	Fauna identified
1	Dead tree	Dead tree	Spout hollow	100-200mm	Ring-tailed possum and drey
2	Dead tree	Dead tree	Trunk split	(width 100mm X 100mm)	Ring-tailed possum and drey
3	Corymbia maculata	Spotted Gum	Spout hollow	(width 300mm X 10mm deep)	Scratches on trunk no fauna identified occupying hollow

Tree hollows typically provide den and nesting habitat for a range of common birds and arboreal mammal species (Gibbons and Lindenmayer 2002), including providing potential habitat for a number of Threatened species including microchiropteran bats and large forest owls. Whether or not tree hollows are used by animals, and which species use them, depends on a number of factors, including hollow characteristics (diameter, height, depth), the number of hollows in a tree, tree health, size, location and spacing (Gibbons and Lindenmayer 2002).

3.6 Squirrel Glider Habitat Assessment

While the study area contains potential foraging habitat for the Squirrel Glider no Squirrel Gliders were observed during the fauna survey.

Squirrel Glider habitat within the study area was assessed in accordance with "Wyang Shire Council Interim Ecological Assessment Information Required to Assess Clearing Impacts within Squirrel Glider Habitat in Wyong Shire" (Wyang Shire Council 2000).

The assessment includes the following:

- (a) Habitat quality (vegetation type);
- (b) Remnant patch size;
- (c) Density of habitat trees;
- (d) Abundance of food plants;
- (e) Habitat vulnerability;
- (f) Disturbance factors.

The vegetation within the subject property comprises three vegetation communities identified as Map unit 38 Narrabeen Buttonderry Foothills Forest

(NBFF), Narrabeen Dooralong Spotted Gum Ironbark Forest (NDSGIF) and Disturbed Riparian vegetation (DRF) (Figure 3-1).

(a) *Habitat Quality*

The NBFF, NDSGIF and DRF communities presented moderate foraging resources only for this species due to the presence of good canopy & shrub layer.

Despite the presence of prominent foraging trees; *Angophora costata* (Smooth-barked Apple), *Corymbia maculata*, *Corymbia gummifera*, *Eucalyptus paniculata* (Grey Ironbark), *Eucalyptus capitellata* (Brown Stringybark), *Melaleuca sp* no Squirrel Gliders were recorded during targeted surveys.

The sub-canopy contains *Allocasuarina littoralis* (Black She-oak) & *Melaleuca nodosa* (Ball-honey Myrtle).

(b) *Remnant Patch Size*

The remnant patch size is connected to an area greater of <1ha; the study area has moderate-good connectivity to other areas of vegetation particularly to the south and partially to the north. The area of habitat proposed for removal is 1.1ha or 1100m² in size.

(c) *Density Habitat Trees*

The density of habitat trees within the subject property was greater than 3 per hectare.

(d) *Abundance of Food Plants of Squirrel Glider*

The abundance of Squirrel Glider food resources is provided in Table 3-3 for the identified vegetation community.

Table 3-4 Squirrel Glider food resource abundance within the study area

Estimated Average No of Plants / hectare in		
Botanical Name	Common Name	NBFF, NDSGIF and DRF communities
<i>Acacia irrorata</i> and other 'gum' producing <i>Acacia</i> species	Wattle	20
<i>Angophora costata</i>	Smooth-barked Apple	20
<i>Banksia spinulosa</i>		8
<i>Banksia oblongifolia</i>		5
<i>Corymbia gummifera</i>	Red Bloodwood	4
<i>Corymbia maculata</i>	Spotted Gum	40
<i>Eucalyptus capitellata</i>	Brown Stringybark	16
<i>Xanthorrhoea spp</i>		10
other local <i>Melaleuca</i> species		1000

(e) *Edge to Width Ratio*

The NBFF, NDSGIF and DRF communities within the study area have a moderate edge to width ratio as the vegetation adjoins cleared land to the west & south (Figure 3-1).

(f) *Habitat Disturbance*

The proposal will remove approximately 1.1ha of highly potential foraging habitat. The study area forms part of a large continuous patch of canopy that

runs in northerly & north-easterly direction. The removal of 1.1ha of vegetation would not likely restrict current Squirrel Glider movement patterns throughout bushland remnants within the locality of the site.

The reduction of canopy vegetation from within the study area will not restrict the movement of Squirrel Gliders in a northerly/north-easterly direction due to the retention of the better quality vegetation within the northern portion of the subject property. No Squirrel Gliders were detected within the study area despite targeted surveys being undertaken, Squirrel Gliders are likely to record as at the time of the site inspection Sugar Gliders was recorded, these species are unlikely to overlap in territories.

(g) Proximity to Existing or Future Residential Development

The study area is bounded to the north & west by Nikko Road, east by rural residential and to the south by Kanowna Road (Figure 1-1). Canopy vegetation within the study area is primarily in a north-south direction.

Conclusion of Squirrel Glider Assessment

No Squirrel Gliders have been recorded within the study area despite targeted surveys; however, habitat for this species does exist. There is a low likelihood of occupation of Squirrel Gliders within and adjacent to the subject property. However due to the presence of Sugar Gliders it is highly unlikely that both species would co-occur within the study area. The proposed development has been designed to maintain a 20m+ riparian corridor connectivity across the subject property to facilitate the movement of fauna species.

3.7 SEPP 44 Koala Habitat Assessment

No Koala feed trees listed on Schedule 2 of State Environmental Planning Policy No. 44 - Koala Habitat Protection were observed within the study area. Therefore this study area is not considered to contain 'Potential Koala Habitat' as defined by SEPP 44.

No Koalas were observed during the fauna survey and there was no evidence (Scats or scratches) of previous Koala habitation in the area. The study area is also not considered to be 'Core Koala Habitat' as defined by SEPP 44.

As such the study area is not considered to comprise Potential Koala Habitat as defined under SEPP 44 and no further assessment under this Policy is required.

3.8 Threatened biodiversity

This section details the threatened biodiversity recorded or likely to occur within the study area. This is based on those species recorded or predicted to occur within the locality from database searches (section 2.2) and the nature of the habitats observed within the vicinity of the proposed works during field surveys (Appendices C and D).

For those species, populations and communities with a medium or high likelihood of occurrence within the study area, an impact of significance assessment has been prepared (Appendix E).

Figure 3-2 Threatened fauna species recorded from the subject property



3.8.1 Threatened ecological communities

Seven endangered ecological communities were identified from desktop review to occur within the locality of the study area (Table 3-5).

Table 3-5 Endangered Ecological Communities known from the Locality

Scientific Name	Common Name
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions	Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions	Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions
Low woodland with heathland on indurated sand at Norah Head	Low woodland with heathland on indurated sand at Norah Head
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	River-Flat Eucalypt Forest on Coastal Floodplains
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Swamp sclerophyll forest on coastal floodplains
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	Swamp oak floodplain forest
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	Sydney Freshwater Wetlands in the Sydney Basin Bioregion

No endangered ecological communities listed under either the TSC or EBCT Acts were identified from the study area.

3.8.2 Endangered populations

Two threatened populations were identified from the desktop review to occur within the locality of the site:

- *Eucalyptus oblonga* (Narrow-leaved Stringybark) population at Bateau Bay; and
- *Eucalyptus parramattensis* subsp. *parramattensis* population in the Wyong and Lake Macquarie LGAs

No endangered populations were identified nor were the habitats which were identified within the study area considered to be suitable for the aforementioned populations.

3.8.3 Threatened Flora

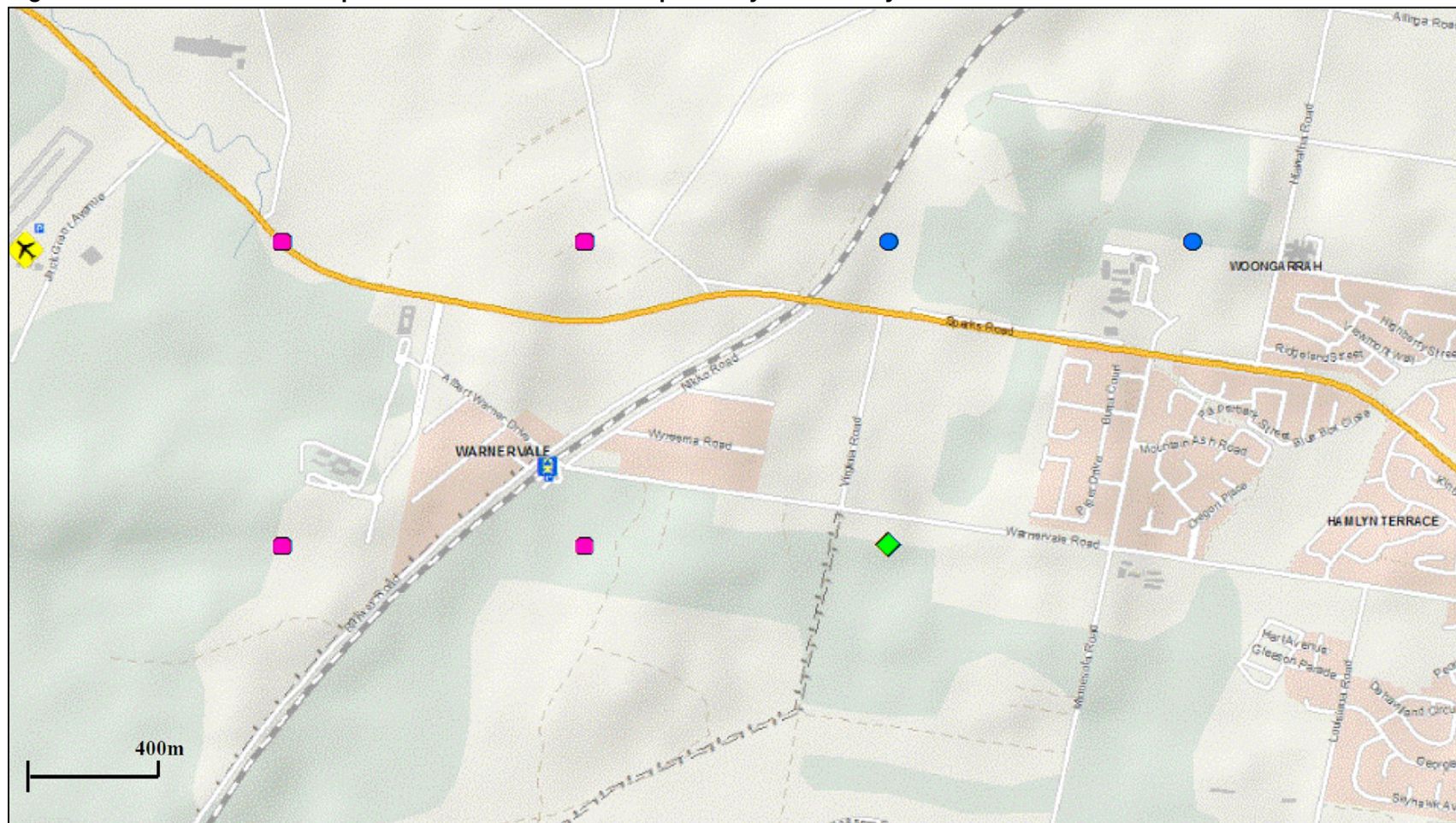
No threatened species of plant was recorded in the subject property during this investigation, despite thirty threatened flora species having been identified as a result of the database searches within the locality. Intensive targeted surveys were conducted throughout the study area, but despite this no threatened species of flora were recorded. A number of orchids and the Wyong Daisy (Figure 3-3) are considered to have suitable habitat within the northern portion of the study area which is mapped as containing Map unit 28 Narrabeen Buttonderry Foothills Forest. The suitable habitat for Wyong Daisy and the Orchids is to be retained and not affected by the proposed development, a limitation of the flora surveys was that the targeted surveys were undertaken outside the peak flowering period for Wyong Daisy which was spot flowering at the time of the site inspections, the reference population to the north of Nikko road on the northern side of Sparks road contained two plants in flower at the time of site inspection, despite intensive targeted surveys being conducted within the study area and the frontage of Nikko road no Wyong Daisy's were identified. A number of cryptic orchids species have been recorded from the locality (Figure 3-4) of the study area and are undetectable outside of the flowering period, notwithstanding all suitable habitats for cryptic orchids are to be retained within the northern portion of the study area.

Eleven Rare or Threatened Australian Plants (ROTAP) species were identified within a 10km locality of the study area (Royal Botanic Gardens 2017). No ROTAP species were identified within the study area.

Table 3-6 ROTAP species recorded within a 10km locality of the Study area

Family Name	Species Name	Suitable habitat within the subject property
Asteraceae	<i>Rutidosia heterogama</i>	Yes
Elaeocarpaceae	<i>Tetratheca juncea</i>	No
Fabaceae - Mimosoideae	<i>Acacia bynoeana</i>	Yes
Myrtaceae	<i>Angophora inopina</i>	Yes
	<i>Callistemon linearifolius</i>	Yes
	<i>Eucalyptus fergusonii</i> <i>subsp fergusonii</i>	No
	<i>Eucalyptus camfieldii</i>	Yes
	<i>Syzygium paniculatum</i>	Yes
Orchidaceae	<i>Arthrochilus prolixus</i>	No
	<i>Diuris praecox</i>	No
Zamiaceae	<i>Macrozamia flexuosa</i>	No

Figure 3-3 Threatened orchid species recorded within close proximity to the study area



Legend

- ▲ ^^Thick Lip Spider Orchid (*Caladenia tessellata*)
- ^^Corunastylis sp. Charmhaven (NSW896673)
- ◆ ^^Leafless Tongue Orchid (*Cryptostylis hunteriana*)
- ▲ ^^Variable Midge Orchid (*Genoplesium insigne*)
- ^^Wyong Sun Orchid (*Thelymitra adorata*)

^^ Category 2 sensitive spp.0.01°(~1km) rounded

Atlas of NSW Wildlife records Orchids



Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. Location accuracy varies. Maps from the website are interactive: map displays can be modified from the original extent and a maximum of 5 species can be selected to display. Map may contain errors and omissions. Neither the Office of Environment and Heritage nor any other data custodian will accept liability for any loss, damage, cost or expenses incurred as a result of the use of, or reliance upon, the information in the map. Map copyright the State of NSW through the Office of Environment and Heritage.

Your Selection: Licensed Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Plants in selected area [North: -33.19 West: 151.39 East: 151.49 South: -33.29] returned a total of 1,296 records of 16 species.

Report generated on 25/07/2017 9:57 AM

Figure 3-4 Wyong daisy records recorded from Nikko Road



Legend  Heath Wrinklewort (<i>Rutidosia heterogama</i>)  <i>Eucalyptus parramattensis</i> C. Hall. subsp. <i>parramattensis</i> in Wyong and Lake Macquarie local government areas	Atlas of NSW Wildlife records Threatened flora  Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. Location accuracy varies. Maps from the website are interactive: map displays can be modified from the original extent and a maximum of 5 species can be selected to display. Map may contain errors and omissions. Neither the Office of Environment and Heritage nor any other data custodian will accept liability for any loss, damage, cost or expenses incurred as a result of the use of, or reliance upon, the information in the map. Map copyright the State of NSW through the Office of Environment and Heritage. Your Selection: Licensed Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Plants in selected area [North: -33.19 West: 151.39 East: 151.49 South: -33.29] returned a total of 1,296 records of 16 species. Report generated on 25/07/2017 9:57 AM
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3.8.4 Threatened fauna

Seventy-nine threatened fauna species were identified as a result of the database searches as occurring or having potential to occur within the locality of the study area (Appendix D).

Based on the habitat assessment and targeted surveys there is potential habitat within the study area for seventeen threatened fauna species that may be impacted through the removal of foraging habitat (Appendix D). Impact assessments have been prepared for these species (Appendices E & F).

3.8.5 Migratory species

Migratory species are protected under the international agreement to which Australia is a signatory, including the Japan-Australia Migratory Bird Agreement, the China-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered Matters of National Environmental Significance and are protected under the *Environment Protection and Biodiversity Conservation Act 1999*.

Forty-seven migratory species were identified from the Department of Sustainability, Environment, Water, Population and Communities (Department of Sustainability, Environment, Water, Population and Communities 2017) within the locality. None were recorded during the site inspections. One migratory species the Rufous fantail was considered to have suitable habitat within the study area: The study area is not considered to be important habitat for any Migratory species in accordance with the EPBC Act.

3.9 Critical habitat

Critical habitat is listed under both the *Threatened Species Conservation Act 1995* and the *Environment Protection and Biodiversity Conservation Act 1999*. Critical habitat is the whole or any part or parts of an area or areas of land comprising the habitat of an endangered species, an endangered population or an endangered ecological community that is critical to the survival of the species, population or ecological community (Department of Environment and Conservation 2004).

The Directors-Generals of both the State and Federal departments of environment (Office of Environment & Heritage and the Department of Sustainability, Environment, Water, Population and Communities respectively) maintain a register of critical habitat. Habitat that is not listed on these register, however consistent with the definition above, may also be considered as critical habitat.

No listed critical habitat occurs within the study area and no critical habitat is likely to be affected by the proposal.

4. Impacts

The following discussion presents an assessment of the potential impacts of the proposal on biodiversity in the study area.

4.1 Impacts on threatened species or populations

Seventeen threatened fauna species listed under the *TSC Act* and/ or the *EPBC Act* were recorded, predicted to occur, or have habitat within the vicinity (10 km radius) of the study area. Impact assessments have been prepared which has concluded that the proposal is not likely to have a significant impact upon threatened species, endangered population or endangered ecological communities.

4.2 Key threatening processes

Key Threatening Process under the *Threatened Species Conservation Act* (NSW National Parks and Wildlife Service 2003) that are likely to further increase within the study area are:

- Clearing of native vegetation.
- Removal of one hollow-bearing tree
- Invasion of native plant communities by exotic perennial grasses.
- Removal of dead Wood.
- Invasion of native plant communities by exotic perennial grasses.
- Infection of native plants by *Phytophthora cinnamomi* - key threatening process listing. The proposal has potential to introduce or spread *Phytophthora cinnamomi* within the impact area and into adjacent bushland. Mitigations measures are to be implemented to prevent spread of *Phytophthora cinnamomi*. Mitigation measures have been put in place to reduce the chance of infection of *Phytophthora cinnamomi* into the site.

4.3 Mitigation measures

4.3.1 Fencing of the construction zone

When accessing the site, contractors are to use only the designated access roads. Suitable fixed fencing (e.g. three strand stock fencing) and colour tape or Para-webbing should be used to delineate the maximum allowable extent of area subject to thinning works (Subject site).

If any tape is disturbed, it is to be immediately replaced along the appropriate alignment.

Fences and Para-webbing delineating the area subject to vegetation works are to remain intact for the duration of works. If any of these barriers are disturbed, it is to be repaired or replaced as soon as practicable.

4.3.2 Animal welfare

Animal injury has potential to occur throughout various construction operations. In the event that any sick, injured or orphaned native animals are located during construction, WIRES should be contacted to assist in capture, handling and welfare of the animal (contact No: 13000 WIRES or 1300 094 737).

A suitably qualified ecologist or wildlife handler should be on site during the felling of trees specifically for the removal of one hollow-bearing tree (Figure 3-1). The qualified Ecologist is to hold a Section 132 licence issued by the Office of Environment & Heritage and a current Animal Ethics licence issued by the Department of Industries and Investment.

4.4 Impacts on trees

4.4.1 Habitat Trees

Three (3) hollow-bearing trees were identified from the study area and are proposed for removal. The location of the three hollow-bearing tree's proposed for removal are shown on the Figure 2.1 above. No suitable nesting trees for large Owls species are likely to be impacted upon as a result of the proposal. The internal dimensions of all hollow-bearing trees are presented within the table below.

Table 4-1 Habitat Trees proposed for removal

HBT No	Scientific Name	Common Name	Type of Hollow	Size of Hollow (cm)	Fauna identified
1	Dead tree	Dead tree	Spout hollow	100-200mm	Ring-tailed possum and drey
2	Dead tree	Dead tree	Trunk split	(width 100mm X 100mm)	Ring-tailed possum and drey
3	<i>Corymbia maculata</i>	Spotted Gum	Spout hollow	(width 300mm X 10mm deep)	Scratches on trunk no fauna identified occupying hollow

4.4.2 Truck and machine wash down areas

Vehicles and other equipment to be used in clearing within the construction zone and general construction equipment (such as excavators etc) are to be received completely free of soil, seeds and plant material before entering the site to prevent the introduction of exotic plant species and pathogens. Equipment failing inspection should be sent away for cleaning. Appropriate records of inspections shall be maintained.

Build ups of mud, soil and organic matter present on vehicles during wet and muddy conditions shall be manually removed prior to vehicles entering/leaving the construction site.

Works and vehicular movements shall cease if wet and muddy conditions develop/persist during construction zone clearing to limit the movement of soil and organic matter onto, through and from the construction zones, minimising the potential for the spread of weeds.

5. Significance Assessments

Projects assessed under the *Environmental Planning and Assessment Act 1979* should consider the significance of impacts and the Department of Environment and Climate Change's *Threatened species assessment guidelines-The assessment of significance* (2007). The factors for consideration under this assessment address the likelihood and significance of the impacts on threatened species life cycle, habitat and recovery.

Threatened biodiversity listed under the *Environment Protection and Biodiversity Conservation Act 1999* are required to be assessed following the *Principal Significant Impact Guidelines* (Department of the Environment and Heritage 2005). The factors for consideration under this assessment include considerable overlap with the state significance assessments. This assessment however also addresses conservation status, population size and area of occupancy, likelihood of the establishment of invasive species of introduction of disease in addition to species life cycle, habitat and recovery.

No endangered populations, endangered ecological communities, threatened flora were identified within the study area during the current surveys that would be directly or indirectly affected by the proposal.

A number of threatened species animal are considered likely to occur or utilise the habitats within the study area (Appendices C & D) intermediately. Significance assessments for these species concluded that the proposal is unlikely to result in a significant impact to any threatened species (refer Appendices E & F).

6. Conclusions

The vegetation within the study area is in good condition, with very little disturbance.

Three (3) hollow-bearing trees were identified from the subject property (Figure 3-2) of which one (1) is proposed for removal.

Habitats within the study area are considered likely to support seventeen highly mobile transient threatened species of animal comprising of three species of bird and fifteen species of mammal most of which are microbats.

Significance assessments in accordance with section 5A of the *Environmental Planning and Assessment Act 1979* and *EPBC Act - Principal Significant Impact Guidelines 1.1. Matters of National Environmental Significance* (Department of the Environment and Heritage 2005) determined that the project was unlikely to result in a significant impact to any threatened biodiversity listed under the *Threatened Species Conservation Act 1995* or *Environment Protection and Biodiversity Conservation Act 1999*.

7. References

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Appendix A

Species of flora recorded

Table 7-1 Flora species recorded within the study area

Family Name	Scientific Name	Common Name	Native	Q1	Q2	Q3
Acanthaceae						
	<i>Pseuderanthemum variabile</i>	Pastel Flower	Y	-	-	-
	<i>Thunbergia alata</i>	Black-eyed Susan	N	-	-	-
Adiantaceae						
	<i>Adiantum aethiopicum</i>	Common Maidenhair	Y	-	-	-
	<i>Cheilanthes sieberi</i>	Mulga Fern	Y	-	-	-
	<i>Pellaea falcata</i>	Sickle Fern	Y	-	-	-
Apiaceae						
	<i>Centella asiatica</i>	Pennywort	Y	-	-	-
	<i>Hydrocotyle bonariensis</i>		N	-	-	-
Apocynaceae						
	<i>Parsonsia straminea</i>	Common Silkpod	Y	-	-	-
Araliaceae						
	<i>Polyscias sambucifolia</i>	Elderberry Panax	Y	-	-	-
Arecaceae						
	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	Y	-	-	-
	<i>Livistona australis</i>	Cabbage Palm	Y	-	-	-
Asclepiadaceae						
	<i>Marsdenia suaveolens</i>	Scented Marsdenia	Y	-	-	-
Asparagaceae						
	<i>Asparagus aethiopicus</i>	Asparagus Fern	N	-	-	-
Asteraceae						
	<i>Ageratina adenophora</i>	Crofton Weed	N	-	-	-
	<i>Bidens pilosa</i>	Cobbler's Pegs	N	-	-	-
	<i>Cirsium vulgare</i>	Spear Thistle	N	-	-	-
	<i>Hypochaeris radicata</i>	Catsear	N	-	-	-
	<i>Senecio madagascariensis</i>	Fireweed	N	-	-	-
	<i>Sonchus oleraceus</i>	Common Sowthistle	N	-	-	-
Azollaceae						
	<i>Azolla sp.</i>		Y	-	-	-
Caprifoliaceae						
	<i>Lonicera japonica</i>	Japanese Honeysuckle	N	-	-	-
Casuarinaceae						
	<i>Allocasuarina littoralis</i>	Black Sheoak	Y	-	-	-
Celastraceae						
	<i>Maytenus silvestris</i>	Narrow-leaved Orangebark	Y	-	-	-
Commelinaceae						
	<i>Commelina cyanea</i>	Native Wandering Jew	Y	-	-	-
Convolvulaceae						
	<i>Dichondra repens</i>	Kidney Weed	Y	-	-	-
Crassulaceae						
	<i>Bryophyllum delagoense</i>	Mother of millions	N	-	-	-
Cyatheaceae						
	<i>Cyathea australis</i>	Rough Treefern	Y	-	-	-
Cyperaceae						
	<i>Baumea sp.</i>		Y	-	-	-
	<i>Carex appressa</i>	Tussock Sedge	Y	-	-	-
	<i>Cyperus eragrostis</i>	Umbrella Sedge	N	-	-	-
	<i>Eleocharis sphacelata</i>	Tall Spike Rush	Y	-	-	-
	<i>Gahnia clarkei</i>		Y	-	-	-
	<i>Gahnia sieberiana</i>		Y	-	-	-
	<i>Lepidosperma laterale</i>		Y	-	-	-
	<i>Lepidosperma sp.</i>		Y	-	-	-

Family Name	Scientific Name	Common Name	Native	Q1	Q2	Q3
Davalliaceae						
	<i>Nephrolepis cordifolia</i>	Fishbone Fern	Y	-	-	-
Dennstaedtiaceae						
	<i>Pteridium esculentum</i>	Bracken	Y	-	-	-
Dicksoniaceae						
	<i>Calochlaena dubia</i>	Common Ground Fern	Y	-	-	-
Dilleniaceae						
	<i>Hibbertia aspera</i>		Y	-	-	-
	<i>Hibbertia empetrifolia</i>		Y	-	-	-
Epacridaceae						
	<i>Epacris pulchella</i>	NSW Coral Heath	Y	-	-	-
	<i>Leucopogon juniperinus</i>		Y	-	-	-
Euphorbiaceae						
	<i>Breynia oblongifolia</i>	Coffee Bush	Y	-	-	-
	<i>Glochidion ferdinandi</i>	Cheese Tree	Y	-	-	-
Fabaceae (Faboideae)						
	<i>Bossiaea obcordata</i>		Y	-	-	-
	<i>Daviesia ulicifolia</i>	Gorse Bitter Pea	Y	-	-	-
	<i>Erythrina X sykesii</i>	Coral tree	N	-	-	-
	<i>Glycine clandestina</i>		Y	-	-	-
	<i>Glycine tabacina</i>		Y	-	-	-
	<i>Hardenbergia violacea</i>	False Sarsaparilla	Y	-	-	-
	<i>Pultenaea paleacea</i>		Y	-	-	-
Fabaceae (Mimosoideae)						
	<i>Acacia decurrens</i>	Black Wattle	Y	-	-	-
	<i>Acacia irrorata</i>	Green Wattle	Y	-	-	-
	<i>Acacia longifolia</i>	Sydney Golden Wattle	Y	-	-	-
	<i>Acacia terminalis</i>	Sunshine Wattle	Y	-	-	-
Geraniaceae						
	<i>Geranium homeanum</i>		Y	-	-	-
Gleicheniaceae						
	<i>Sticherus flabellatus</i>	Umbrella Fern	Y	-	-	-
Goodeniaceae						
	<i>Goodenia heterophylla</i>		Y	-	-	-
Haloragaceae						
	<i>Gonocarpus micranthus</i>		Y	-	-	-
	<i>Gonocarpus tetragynus</i>		Y	-	-	-
	<i>Gonocarpus teucroides</i>		Y	-	-	-
Iridaceae						
	<i>Watsonia sp.</i>		Y	-	-	-
Juncaceae						
	<i>Juncus cognatus</i>		N	-	-	-
Lauraceae						
	<i>Cassytha glabella</i>		Y	-	-	-
	<i>Cinnamomum camphora</i>	Camphor Laurel	N	-	-	-
Lindsaeaceae						
	<i>Lindsaea linearis</i>	Screw Fern	Y	-	-	-
Lobeliaceae						
	<i>Pratia purpurascens</i>	Whiteroot	Y	-	-	-
Lomandraceae						
	<i>Lomandra filiformis</i>	Wattle Matt-rush	Y	-	-	-
	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	Y	-	-	-
	<i>Lomandra obliqua</i>		Y	-	-	-
Malvaceae						

Family Name	Scientific Name	Common Name	Native	Q1	Q2	Q3
	<i>Sida rhombifolia</i>	Paddy's Lucerne	N	-	-	-
Myrtaceae						
	<i>Angophora costata</i>	Sydney Red/Rusty Gum	Y	-	-	-
	<i>Corymbia gummifera</i>	Red Bloodwood	Y	-	-	-
	<i>Corymbia maculata</i>		Y	-	-	-
	<i>Eucalyptus agglomerata</i>	Blue-leaved Stringybark	Y	-	-	-
	<i>Eucalyptus capitellata</i>	Brown Stringybark	Y	-	-	-
	<i>Eucalyptus fibrosa</i>	Red Ironbark	Y	-	-	-
	<i>Eucalyptus paniculata</i>	Grey Ironbark	Y	-	-	-
	<i>Kunzea ambigua</i>	Tick Bush	Y	-	-	-
	<i>Leptospermum grandifolium</i>	Woolly Teatree	Y	-	-	-
	<i>Leptospermum polygalifolium</i>		Y	-	-	-
	<i>Melaleuca nodosa</i>		Y	-	-	-
	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	Y	-	-	-
	<i>Melaleuca sieberi</i>		Y	-	-	-
	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree	Y	-	-	-
Oleaceae						
	<i>Ligustrum lucidum</i>	Large-leaved Privet	N	-	-	-
	<i>Ligustrum sinense</i>	Small-leaved Privet	N	-	-	-
	<i>Notelaea longifolia</i>	Large Mock-olive	Y	-	-	-
Orchidaceae						
	<i>Cryptostylis erecta</i>	Tartan Tongue Orchid	Y	-	-	-
	<i>Cryptostylis subulata</i>	Large Tongue Orchid	Y	-	-	-
Oxalidaceae						
	<i>Oxalis perennans</i>		Y	-	-	-
Philydraceae						
	<i>Philydrum lanuginosum</i>	Frogsmouth	Y	-	-	-
Pittosporaceae						
	<i>Billardiera scandens</i>	Appleberry	Y	-	-	-
	<i>Pittosporum undulatum</i>	Sweet Pittosporum	Y	-	-	-
Poaceae						
	<i>Andropogon virginicus</i>	Whisky Grass	N	-	-	-
	<i>Anisopogon avenaceus</i>	Oat Speargrass	Y	-	-	-
	<i>Austrostipa</i> sp.		Y	-	-	-
	<i>Briza maxima</i>	Quaking Grass	N	-	-	-
	<i>Briza minor</i>	Shivery Grass	N	-	-	-
	<i>Chloris gayana</i>	Rhodes Grass	N	-	-	-
	<i>Cynodon dactylon</i>	Common Couch	Y	-	-	-
	<i>Echinopogon caespitosus</i>		Y	-	-	-
	<i>Ehrharta erecta</i>	Panic Veldtgrass	N	-	-	-
	<i>Entolasia marginata</i>	Bordered Panic	Y	-	-	-
	<i>Eragrostis brownii</i>	Brown's Lovegrass	Y	-	-	-
	<i>Imperata cylindrica</i>	Bladey Grass	Y	-	-	-
	<i>Microlaena stipoides</i>		Y	-	-	-
	<i>Oplismenus aemulus</i> var. <i>aemulus</i>		Y	-	-	-
	<i>Paspalum dilatatum</i>	Paspalum	N	-	-	-
	<i>Pennisetum clandestinum</i>	Kikuyu Grass	N	-	-	-
	<i>Setaria gracilis</i>	Slender Pigeon Grass	N	-	-	-
	<i>Themeda australis</i>	Kangaroo Grass	Y	-	-	-
Polygonaceae						
	<i>Muehlenbeckia gracillima</i>		Y	-	-	-
	<i>Rumex crispus</i>	Curled Dock	N	-	-	-
Pontederiaceae						
	<i>Eichhornia crassipes</i>	Water Hyacinth	N	-	-	-

Family Name	Scientific Name	Common Name	Native	Q1	Q2	Q3
Proteaceae						
	<i>Banksia ericifolia</i>	Heath Banksia	Y	-	-	-
	<i>Banksia marginata</i>		Y	-	-	-
	<i>Banksia oblongifolia</i>		Y	-	-	-
	<i>Banksia spinulosa</i>		Y	-	-	-
	<i>Lambertia formosa</i>	Mountain Devil	Y	-	-	-
	<i>Persoonia linearis</i>	Narrow-leaved Geebung	Y	-	-	-
Rosaceae						
	<i>Rubus fruticosus</i>	Blackberry complex	N	-	-	-
Rubiaceae						
	<i>Richardia brasiliensis</i>	Mexican Clover	N	-	-	-
Rutaceae						
	<i>Philotheca buxifolia</i> ssp. <i>obovata</i>		Y	-	-	-
Sapindaceae						
	<i>Dodonaea triquetra</i>		Y	-	-	-
Smilacaceae						
	<i>Smilax glyciphylla</i>	Sweet Sarsparilla	Y	-	-	-
Thymelaeaceae						
	<i>Pimelea linifolia</i>		Y	-	-	-
Typhaceae						
	<i>Typha orientalis</i>	Broad-leaved Cumbungi	Y	-	-	-
Verbenaceae						
	<i>Lantana camara</i>	Lantana	N	-	-	-
	<i>Verbena bonariensis</i>	Purpletop	N	-	-	-
	<i>Verbena brasiliensis</i>		N	-	-	-
	<i>Verbena rigida</i>	Veined Verbena	N	-	-	-
Violaceae						
	<i>Viola hederacea</i>		Y	-	-	-
Xanthorrhoeaceae						
	<i>Xanthorrhoea macronema</i>		Y	-	-	-
	<i>Xanthorrhoea media</i>		Y	-	-	-

Appendix B

Species of animal recorded

Table 7-2 Fauna species recorded within the study area

Family Name	Common Name	Scientific Name	Survey Type
Reptile			
Scincidae	Garden Skink	<i>Lampropholis guichenoti</i>	O, S
Amphibian			
Hylidae	Eastern Dwarf Tree Frog	<i>Litoria fallax</i>	C
Hylidae	Peron's Tree Frog	<i>Litoria peroni</i>	C
Myobatrachidae	Common Eastern Froglet	<i>Crinia signifera</i>	C
Myobatrachidae	Brown-striped Frog	<i>Limnodynastes peronii</i>	C
Avian			
Anatidae	Australian Wood Duck	<i>Chenonetta jubata</i>	O
Artamidae	Australian Magpie	<i>Gymnorhina tibicen</i>	O, C
Artamidae	Grey Butcherbird	<i>Cracticus torquatus</i>	O, C
Artamidae	Pied Butcherbird	<i>Cracticus nigrogularis</i>	O, C
Artamidae	Pied Currawong	<i>Strepera graculina</i>	O, C
Cacatuidae	Galah	<i>Cacatua roseicapilla</i>	O, C, F
Cacatuidae	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	O, C
Cacatuidae	Yellow-tailed Black Cockatoo	<i>Calyptorhynchus funereus</i>	O, C
Charadriidae	Masked Lapwing	<i>Vanellus miles</i>	O
Cinclosomatidae	Eastern Whipbird	<i>Psophodes olivaceus</i>	O
Columbidae	Crested Pigeon	<i>Ocyphaps lophotes</i>	O
Corvidae	Australian Raven	<i>Corvus coronoides</i>	O, C
Dicruridae	Grey Fantail	<i>Rhipidura fuliginosa</i>	O
Dicruridae	Magpie-lark	<i>Grallina cyanoleuca</i>	O
Dicruridae	Willie Wagtail	<i>Rhipidura leucophrys</i>	O
Halcyonidae	Laughing Kookaburra	<i>Dacelo novaeguineae</i>	O, C
Hirundinidae	Welcome Swallow	<i>Hirundo neoxena</i>	O
Maluridae	Superb Fairy-Wren	<i>Malurus cyaneus</i>	O
Meliphagidae	Noisy Miner	<i>Manorina melanocephala</i>	O, C
Meliphagidae	Red Wattlebird	<i>Anthochaera carunculata</i>	O, C
Muscicapidae	Bassian Thrush	<i>Zoothera lunulata</i>	O
Pachycephalidae	Golden Whistler	<i>Pachycephala pectoralis</i>	O, C
Pachycephalidae	Grey Shrike-thrush	<i>Colluricincla harmonica</i>	O, C
Pardalotidae	White-browed Scrubwren	<i>Sericornis frontalis</i>	O
Pardalotidae	Yellow Thornbill	<i>Acanthiza nana</i>	O
Podargidae	Tawny Frogmouth	<i>Podargus strigoides</i>	O, Sp
Psittacidae	Australian King-Parrot	<i>Alisterus scapularis</i>	O
Psittacidae	Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	O, C
Rallidae	Purple Swampphen	<i>Porphyrio porphyrio</i>	O
Strigidae	Southern Boobook	<i>Ninox novaeseelandiae</i>	O, C, Sp
Sturnidae	Common Myna	<i>Acridotheres tristis</i>	O, C
Mammals			
Macropodidae	Kangaroo	<i>Macropus sp.</i>	O, Sp
Macropodidae	Swamp Wallaby	<i>Wallabia bicolor</i>	O, Sp
Muridae	Black Rat	<i>Rattus rattus</i>	O, Sp
Petauridae	Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	O, Sp
Phalangeridae	Common Brushtail Possum	<i>Trichosurus vulpecula</i>	Sc

Family Name	Common Name	Scientific Name	Survey Type
Molossidae	White-striped freetail bat	<i>Austronomus australis</i>	H, A
Pteropodidae	Grey-headed flying fox	<i>Pteropus poliocephalus</i>	O, Sp, C
Vespertilionidae	Chocolate Wattled Bat	<i>Chalinolobus morio</i>	A
Vespertilionidae	Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	A
Vombatidae	Common Wombat	<i>Vombatus ursinus</i>	Sp, Sc, D

Key:

A	-	Anabat	C	-	Call Identification
O	-	Observation	P	-	Call Playback Response
F	-	Feather	S	-	Habitat Search
Sp	-	Spotlight	Sc	-	Scat, Track

Appendix C

Threatened flora species recorded
in the locality

Appendix C Threatened Flora species recorded in the locality

This appendix details the Threatened species of plant that have either been recorded in the local area based on records the Bionet *Atlas of NSW Wildlife* Office of Environment & Heritage, 2017 data received 17th of May 2017 and records from the Royal Botanical Gardens. Threatened species with habitat likely to occur in the locality were also considered based on records from the *EPBC Protected Matters Search Tool* Department of Sustainability, Environment, Water, Population and Communities 2017 data received 17th of May 2017.

Table 7-3 Threatened flora species recorded in the locality

Family Name	Scientific Name	Common Name	TSC Act	EPBC Act	ROTAP	Habitat	Likelihood of occurrence within the study area
Asteraceae	<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	2Va	Occurs in coastal districts from Maclean to the Hunter Valley and inland to the Torrington region. Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides (Department of Environment and Conservation 2005; Royal Botanic Gardens 2005).	High Previous records of this species were identified as part of the rezoning along the frontage of Nikko Road (Umwelt 2013) (Figure 3-4) however despite targeted surveys being undertaken when this species was flowering no individuals were identified. The surveys were undertaken outside of the peak flowering period for this species, notwithstanding the development is not located within the area previously identified as containing suitable habitat for this species, all suitable habitat for this species is to be retained. No further assessment considered necessary.
Euphorbiaceae	<i>Chamaesyce psammogeton</i>	Sand Spurge	E1			Occurs in coastal regions of NSW where it grows on sand dunes near the sea (Harden 2000). Grows on fore-dunes and exposed headlands, often with Spinifex (<i>Spinifex sericeus</i>) (Department of Environment and Conservation 2005).	Low No suitable habitat was recorded from the study area for this species.
Fabaceae (Faboideae)	<i>Pultenaea maritima</i>		V			<i>Pultenaea maritima</i> occurs in New South Wales and Queensland and is restricted to grasslands on exposed coastal headlands. Within NSW, the species has been recorded from Newcastle north to Byron Bay.	Low No suitable habitat was recorded from the study area for this species.
Fabaceae (Mimosoideae)	<i>Acacia bynoeana</i>	Bynoe's Wattle	E1	V	3V	Occurs south of Dora Creek-Morriset area to Berrima and the Illawarra region and west to the Blue Mountains. It grows mainly in heath and dry sclerophyll forest on sandy soils (Harden 2002). Seems to prefer open, sometimes disturbed sites such as trail margins and recently burnt areas. Typically occurs in association with <i>Corymbia gummifera</i> , <i>Eucalyptus haemastoma</i> , <i>E. gummifera</i> , <i>E. parramattensis</i> , <i>E. sclerophylla</i> , <i>Banksia serrata</i> and <i>Angophora bakeri</i> (NSW National Parks and Wildlife Service 1999).	Low Targeted surveys were undertaken within the study area for this species, despite targeted surveys being undertaken during the flowering period no specimens were recorded.
Juncaginaceae	<i>Maundia triglochoides</i>	-	V			Occurs north from Sydney. Grows in swamps, creeks or shallow freshwater 30 to 60 cm deep on heavy clay, low nutrients. Associated with wetland species such as	Low Targeted surveys were undertaken within the study area for this

Family Name	Scientific Name	Common Name	TSC Act	EPBC Act	ROTAP	Habitat	Likelihood of occurrence within the study area
						<i>Triglochin procerum</i> (Harden 1993).	species, despite targeted surveys being undertaken no specimens were recorded. All areas of suitable habitat are to be retained for this species.
Lamiaceae	<i>Prostanthera askania</i>	Tranquility Mintbush	E1	E	2V	Restricted to the Ourimbah--Narara area where it currently known to exist in five populations. It grows in sclerophyll forest on ridges in or adjacent to rainforest grows in sclerophyll forest on ridges in or adjacent to rainforest (Harden 1992; NSW Scientific Committee 1998).	Low No suitable habitat was recorded from the study area for this species.
Myrtaceae	<i>Angophora inopina</i>	Charmhaven Apple	V	V		Restricted to the Charmhaven - Wyee area where it grows in open dry sclerophyll woodland of <i>Eucalyptus haemastoma</i> and <i>Corymbia gummifera</i> with a dense shrub understorey. Occurs on deep white sandy soils over sandstone, often with some gravelly laterite (NSW Scientific Committee 1998; Harden 2002).	Low Targeted surveys were undertaken within the study area for this species, despite targeted surveys being undertaken during the flowering period no specimens were recorded.
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V		2Ri	Occurs chiefly from Georges to the Hawkesbury River where it grows in dry sclerophyll forest, open forest, scrubland or woodland on sandstone. Found in damp places, usually in gullies (Robinson 1994; Fairley and Moore 2002; Harden 2002). Within the Sydney region, recent records are limited to the Hornsby Plateau area near the Hawkesbury River (NSW Scientific Committee 1999).	Low Targeted surveys were undertaken for this species which failed to detect this species within the study area.
Myrtaceae	<i>Eucalyptus camfieldii</i>	Heart-leaved Stringybark	V	V	2Vi	Occurs from Tomago to the Royal National Park where it grows in coastal shrub heath in sandy soils on sandstone (Harden 2002).	Low Targeted surveys were undertaken for this species which failed to detect this species within the study area.
Myrtaceae	<i>Eucalyptus parramattensis ssp. decadens</i>		V	V	2V	Locally frequent, grows in dry sclerophyll woodland on sandy soils in low, often wet sites (Harden 2002).	Low Targeted surveys were undertaken within the study area for this species, despite targeted surveys being undertaken during the flowering period no specimens were recorded.
Myrtaceae	<i>Eucalyptus pumila</i>	Pokolbin Mallee	V	V	2Vi	Now only known from a single stand near Pokolbin where it grows in sclerophyll shrubland on skeletal soil on sloping sandstone (Harden 2002). Previously recorded from Muswellbrook and Wyong {Department of Environment and Conservation, 2005 #389}.	Low No suitable habitat was recorded from the study area for this species.
Myrtaceae	<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V		Occurs as disjunct populations in coastal New South Wales from Jervis Bay to Port Macquarie, with the main concentration of records is in the Gosford/Wyong area (NSW Scientific Committee 1998). Grows in damp places, often near streams, or low-lying areas on alluvial soils of low slopes or sheltered aspects (Harden 2002; Department of Environment and Climate Change 2008).	Low Targeted surveys were undertaken for this species which failed to detect this species within the study area.

Family Name	Scientific Name	Common Name	TSC Act	EPBC Act	ROTAP	Habitat	Likelihood of occurrence within the study area
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	V	V	3Ri	Occurs between Buladelah and St Georges Basin where it grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea (Harden 2002). On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities (Department of Environment and Climate Change 2008).	Low Targeted surveys were undertaken for this species which failed to detect this species within the study area.
Orchidaceae	<i>Caladenia porphyrea</i>		E1			<i>Caladenia porphyrea</i> has a highly restricted geographic distribution. It has been recorded from 2 localities in the Wyong local government area c. 2 km apart (NSW Department of Environment and Conservation 2006). It grows in heath and heathy forest and woodland, sometimes on exposed headland. Altitude 10-40 metres. It grows within soils that are grey to white sands and sandy loam and flowers between September-October (Gunninah Environmental Consultants 2003)	Low No suitable habitat was recorded from the study area for this species. No suitable habitat exists from the subject site for this species.
Orchidaceae	<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	E1	V	3V	Occurs south of Swansea where it grows on clay loam or sandy soils (Harden 1993). Prefers low open forest with a heathy or sometimes grassy understorey (Bishop 2000). Within NSW, currently known from two disjunct areas; one population near Braidwood on the Southern Tablelands and three populations in the Wyong area on the Central Coast. Previously known also from Sydney and South Coast areas (NSW Scientific Committee 2002). Flowers appear between September and November (but apparently generally late September or early October in extant southern populations).	Low/moderate Suitable habitat exists for this species from the Narrabeen Buttenderry Footslopes Forest which is to be retained within the northern portion of the study area. All suitable habitats for this species are to be retained, as such no further assessment deemed necessary.
Orchidaceae	<i>Corunastylis sp. Charmhaven</i>		CE			<i>Corunastylis sp.</i> Charmhaven is restricted to a single location in the Gorokan/Charmhaven area. It occurs within low woodland to heathland with a shrubby understorey and ground layer. Dominants include <i>Allocasuarina littoralis</i> , <i>Leptospermum juniperinum</i> , <i>Melaleuca nodosa</i> , <i>Callistemon linearis</i> and <i>Schoenus brevifolius</i> (NSW Scientific Committee 2012). The geographic distribution of <i>Corunastylis sp.</i> Charmhaven (NSW896673) is very highly restricted. The area of occupancy and extent of occurrence were estimated to be 4 km ² (NSW Scientific Committee 2012).	High Previous records of this species were identified as part of the rezoning along the frontage of Nikko Road (Umwelt 2013) however survey was completed outside of the flowering period as such confirmation of this species presence/absence could not be confirmed, notwithstanding the development is not located within the area previously identified as containing this species, all suitable habitat for this species is to be retained. No further assessment considered necessary.

Family Name	Scientific Name	Common Name	TSC Act	EPBC Act	ROTAP	Habitat	Likelihood of occurrence within the study area
Orchidaceae	<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V	3V	Occurs south from the Gibraltar Range, chiefly in coastal districts but also extends on to tablelands. Grows in swamp-heath and drier forest on sandy soils on granite & sandstone. Occurs in small, localised colonies most often on the flat plains close to the coast but also known from some mountainous areas growing in moist depressions and swampy habitats (Harden 1993; NSW National Parks and Wildlife Service 1999).	Low/moderate Suitable habitat exists for this species from the Narrabeen Buttenderry Foothills Forest which is to be retained within the northern portion of the study area. All suitable habitats for this species are to be retained, as such no further assessment deemed necessary.
Orchidaceae	<i>Diuris praecox</i>	Rough Double Tail	V	V	2V	Occurs in coastal and near-coastal districts from Ourimbah to Nelson Bay where it grows in sclerophyll forest (Harden 1993) often on hilltops or slopes (Bishop 2000). It produces leaves and flowering stems in winter.	Low No suitable habitat exists from the subject site for this species.
Orchidaceae	<i>Genoplesium insignis</i>		E1			This terrestrial orchid occurs between Chain Valley Bay and Wyong in Wyong local government area. It grows in heathland and forest and is associated with <i>Themeda australis</i> amongst shrubs and sedges. Typically it occurs in dry sclerophyll woodland dominated by <i>Eucalyptus haemastoma</i> , <i>Corymbia gummifera</i> , <i>Angophora costata</i> and <i>Allocasuarina littoralis</i> (Department of Environment and Climate Change 2009). Flowering period is September to October.	Low/moderate Suitable habitat exists for this species from the Narrabeen Buttenderry Foothills Forest which is to be retained within the northern portion of the study area. All suitable habitats for this species are to be retained, as such no further assessment deemed necessary.
Orchidaceae	<i>Thelymitra</i> sp. ' <i>Adorata</i> '	Wyong Sun orchid	CE	E		A hairless terrestrial orchid, dying back annually to a tuberous rootstock which flowers from September-October. The flowering stem usually emerges in September. The species habitat is woodland with a grassy understorey in well drained clay-loam or shale derived soils (Jones 2006). Occurs primarily within Dooralong Spotted Gum Ironbark Forest Map unit 30 (Gunninah Environmental Consultants 2003)	Low/moderate Suitable habitat exists for this species from the Narrabeen Buttenderry Foothills Forest which is to be retained within the northern portion of the study area. All suitable habitats for this species are to be retained, as such no further assessment deemed necessary.
Proteaceae	<i>Grevillea parviflora</i> ssp. <i>parviflora</i>	Small-flower Grevillea	V	V		Mainly known from the Prospect area (but now extinct there) and lower Georges River to Camden, Appin and Cordeaux Dam areas, with a disjunct populations near Putty, Cessnock and Cooranbong. Grows in heath or shrubby woodland in sandy or light clay soils usually over thin shales (NSW Scientific Committee 1998; Harden 2002). Flowering has been recorded between July to December as well as April-May	Low Targeted surveys were undertaken during this species flowering period which failed to detect this species within the study area.
Tremandraceae	<i>Tetratheca glandulosa</i>		V	V	2V	Occurs from Mangrove Mountain to the Blue Mountains where it grows in sandy or rocky heath or scrub (Harden 1992). Associated with shale-sandstone transition habitat where shale-cappings occur over	Low No suitable habitat exists from the subject site for this species.

Family Name	Scientific Name	Common Name	TSC Act	EPBC Act	ROTAP	Habitat	Likelihood of occurrence within the study area
						sandstone, with associated soil landscapes such as Lucas Heights, Gynea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities correspond broadly to Benson & Howell's Sydney Sandstone Ridgetop Woodland (Map Unit 10ar). Common woodland tree species include: <i>Corymbia gummifera</i> , <i>C. eximia</i> , <i>Eucalyptus haemastoma</i> , <i>E. punctata</i> , <i>E. racemosa</i> , and/or <i>E. sparsifolia</i> , with an understorey dominated by species from the families Proteaceae, Fabaceae, and Epacridaceae (Department of Environment and Climate Change 2008).	
Tremandraceae	<i>Tetratheca juncea</i>	Black-eyed Susan	V	V	3Vi	Occurs in coastal districts from Buladelah to Port Macquarie where it grows in dry sclerophyll forest and occasionally swampy heath in sandy, (Harden 1992) low nutrient soils with a dense understorey of grasses. Specifically it is known to occur within Smooth-barked Apple Woodland and Coastal Foothills Spotted Gum Woodland (NSW National Parks and Wildlife Service, 2000 #392; NSW National Parks and Wildlife Service, 2000 #393; NSW National Parks and Wildlife Service, 2000 #344}. sporadic flowering, the flowering season between late August and the end of November (in dry years) and between August and January (in wet years).	Low No suitable habitat exists from the subject site for this species.

1) V= Vulnerable, E1 = Endangered (TSC Act) E2= Endangered Population

2) ROTAP (Rare or Threatened Australian Plants, Briggs and Leigh 1996) is a conservation rating for Australian plants.

1 = Species only known from one collection. 2 = Species with a geographic range of less than 100km in Australia. 3 = Species with a geographic range of more than 100km in Australia,

X = Species presumed extinct; no new collections for at least 50 years. E = Endangered species at risk of disappearing from the wild state if present land use and other causal factors continue to operate, V = Vulnerable species at risk of long-term disappearance through continued depletion. R = Rare, but not currently considered to be endangered. K = Poorly known species that are suspected to be threatened. C = Known to be represented within a conserved area.

a = At least 1,000 plants are known to occur within a conservation reserve(s). i = Less than 1,000 plants are known to occur within a conservation reserve(s). The reserved population size is unknown. t = The total known population is reserved. + = The species has a natural occurrence overseas.

3) V = Vulnerable, E = Endangered (*Environment Protection and Biodiversity Conservation Act 1999*).

Appendix D

Threatened fauna species recorded
in the locality

Appendix D Threatened fauna species recorded in the locality

This appendix details the Threatened species of plant that have either been recorded in the local area based on records the *Atlas of NSW Wildlife* Department of Environment & Heritage, 2017, data received 17th of May 2017 and records from the Royal Botanical Gardens. Threatened species with habitat likely to occur in the locality were also considered based on records from the *EPBC Protected Matters Search Tool* Department of Sustainability, Environment, Water, Population and Communities 2017, data received 17th of May 2017.

Table 7-4 Threatened fauna species recorded in the locality

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
Amphibians					
<i>Crinia tinnula</i>	Wallum Froglet	V		Occurs along coast from south-eastern Queensland to Sydney. Mostly associated with swamps, dams and flooded roadside ditches, usually in heathland, where it is confined to acid, paperbark swamps and sedge swamps of the 'wallum' country. Males call anytime of year. Breed in late winter (Anstis 2002; NSW National Parks and Wildlife Service 2002).	Low Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. All suitable habitat for this species is to be retained within the study area.
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin, from Wollemi National Park in the north and extending south to Jervis Bay; and a southern population occurring in disjunct pockets from about Narooma south into eastern Victoria. In the northern population there is a marked preference for sandstone ridgetop habitat and broader upland valleys. In these locations the frog is associated with small headwater creeklines and along slow flowing to intermittent creeklines. The vegetation is typically woodland, open woodland and heath and may be associated with 'hanging swamp' seepage lines and where small pools form from the collected water. They have also been observed occupying artificial ponded structures such as fire dams, gravel 'borrows', detention basins and box drains that have naturalised over time and are still surrounded by other undisturbed habitat. In the southern population, records from Narooma, Bega, Bombala and eastern Victoria appear to be associated with Devonian igneous and sedimentary formations and Ordovician metamorphic and are generally from more heavily timbered areas. However, again there appears to be an association with ridgetops, headwaters and slow flowing streams. Do not appear to inhabit areas that have been cleared for agriculture or for urban development. Breed in summer and autumn in burrows in the banks of small creeks. Often spends significant periods of time underground during unfavourable conditions and to avoid detection during the day. (Cogger 2000; NSW National Parks and Wildlife Service 2001).	Low No suitable habitat was recorded from the study area for this species.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
<i>Litoria aurea</i>	Green and Golden Bell Frog	E1	V	Has a fragmented distribution of mainly near coastal locations from Lakes Entrance (Victoria) to south of the NSW-Queensland border as far west as Bathurst in the more elevated southern tablelands and central slopes of NSW. Various types of habitat utilised has been documented. For breeding utilises a wide range of water bodies, including both natural and man-made structures, such as marshes, dams and stream sides, and ephemeral locations that are more often dry than wet. Is found in various small pockets of habitat in otherwise developed areas and has the tendency of often turning up in highly disturbed sites. Lotic situations such as fast flowing streams appear to be one of the few water bodies not utilised, at least for breeding purposes. Habitat attributes associated with the various water bodies occupied by the GGBF, and that appear to make such habitat more likely to be occupied, include that the water body is shallow, still or slow flowing, ephemeral and/or widely fluctuating, unpolluted and without heavy shading. Permanent water bodies are also known to be used and there is historical evidence of occupation of large, often deep and permanent bodies of water. There is a clear preference shown by GGBF for sites with a complexity of vegetation structure and associated terrestrial habitat attributes that appear to favour the species include extensive grassy areas and an abundance of shelter sites such as rocks, logs, tussock forming vegetation and other cover, considered to be used for foraging and shelter. Over-wintering sites may be adjacent to or some distance away from breeding sites; such sites include the bases of dense vegetation tussocks, beneath rocks, timber, within logs or beneath ground debris, including human refuse such as sheet iron, but the full range of possible habitat used for this purpose is not yet well understood (Department of Environment and Conservation 2004; Department of Environment and Conservation 2005).	Low Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys.
<i>Litoria brevipalmata</i>	Green Thighed Frog	V		The species inhabits coastal forest and bushland from south-east QLD to Ourimbah NSW and breeding takes place only after heavy summer rains when calling males gather around temporary or semi-permanent ponds and flooded ditches. Egg masses are often laid in temporary ponds and their survival may depend on subsequent rains around grassy semi-permanent ponds in late spring and summer (Cogger 2000).	Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. All suitable habitat for this species is to be retained within the study area.
<i>Litoria littlejohni</i>	Heath Frog	V	V	Distributed along the eastern slopes of the Great Dividing Range from Watagan State Forest near Wyong, south to Buchan in north-eastern Victoria. It appears to be 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 on high exposed ridges during summer. It is not known from coastal habitats (NSW Scientific Committee 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Mixophyes balbus</i>	Stuttering Frog	E1	V	Terrestrial species, found in rainforest, Antarctic beech forest or wet	Low

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
				sclerophyll forest. The species depends on freshwater streams and riparian vegetation for breeding and habitation. No records are known from riparian habitat that has been disturbed (Cogger 2000; NSW Scientific Committee 2003).	No suitable habitat was recorded from the study area for this species.
<i>Mixophyes iteratus</i>	Giant Barred Frog	E1	E	Terrestrial species which occurs in rainforests, Antarctic beech or wet sclerophyll forests. Feeds on insects and smaller frogs (Cogger 2000). The species is associated with permanent flowing drainages, from shallow rocky rainforest streams to slow-moving rivers in lowland open forest. It is not known to utilise still water areas (NSW Scientific Committee 1999). More prevalent at lower altitudes and in larger streams than its congeners, although has been recorded up to 1000 metres asl. (NSW National Parks and Wildlife Service 1999).	Low No suitable habitat was recorded from the study area for this species.
<i>Pseudophryne australis</i>	Red-crowned Toadlet	V		Occurs within 160 km of Sydney where it is restricted to Hawkesbury Sandstone. It breeds in deep grass and debris adjacent to ephemeral drainage lines. When not breeding individuals are found scattered on sandstone ridges under rocks and logs (Cogger 2000).	Low No suitable habitat was recorded from the study area for this species.
Fish					
<i>Prototroctes maraena</i>	Australian Grayling		V	It is a mid-water, freshwater species, that occurs most commonly in clear, gravelly streams with a moderate flow. Prefers deep, slow flowing pools (NSW Fisheries 2004).	Low No suitable habitat was recorded from the study area for this species.
Invertebrates					
<i>Petalura gigantea</i>	Giant Dragonfly	E1		Found in permanent wetlands, both coastal and upland from moss Vale northwards to southern Queensland (Department of Environment and Conservation 2005).	Low No suitable habitat was recorded from the study area for this species.
Birds					
<i>Ardea alba</i>	Great Egret		M	Great Egrets occur throughout most of the world. They are common throughout Australia, with the exception of the most arid areas. Great Egrets prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands. Great Egrets can be seen alone or in small flocks, often with other egret species, and roost at night in groups. In Australia, the breeding season of the Great Egret is normally October to December in the south and March to May in the north. This species breeds in colonies, and often in association with cormorants, ibises and other egrets. (Australian Museum 2003).	Low Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during surveys. No important habitat for this species in the proposal area as defined under the EPBC Act 1999.
<i>Ardea ibis</i>	Cattle Egret		M	Subspecies <i>A. i. coromanda</i> is found across the Indian subcontinent and Asia as far north as Korea and Japan, and in South-east Asia, Papua New Guinea and Australia (McKilligan 2005).	Low Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during surveys. No important habitat for this species in the proposal area as defined under the EPBC Act 1999.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
<i>Botaurus poiciloptilus</i>	Australasian Bittern	V		Occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spike-rushes. When breeding, pairs are found in areas with a mixture of tall and short sedges but will also feed in more open territory. (Garnett and Crowley 2000; NSW National Parks and Wildlife Service 2002).	Low No suitable habitat was recorded from the study area for this species.
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper		M	Occurs in a variety of habitats: tidal mudflat, mangrove swamps, salt marshes, shallow fresh, brackish, salt inland swamps and lakes; flooded and irrigated paddocks, sewage farms and commercial salt fields (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Calidris alba</i>	Sanderling	V	M	A coastal species found on low and open sand beaches exposed to open sea-swells. A migratory species, it has been recorded in NSW from September to May (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species. The study area contains suitable foraging and nesting habitat but despite this no individuals were detected during targeted surveys.
<i>Calidris canutus</i>	Red Knot		M	Red Knots gather in large flocks on the coast in sandy estuaries with tidal mudflats.	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Calidris ferruginea</i>	Curlew Sandpiper		M	Occurs in inter-tidal mudflats of estuaries, lagoons, mangrove channels and also around lakes, dams, floodwaters and flooded saltbush surrounding inland lakes (Morcombe 2003).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Calidris ruficollis</i>	Red-necked Stint		M	In Australia, Red-necked Stints are found on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. They may also be seen in salt works, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in salt flats, flooded paddocks or damp grasslands. They are often in dense flocks, feeding or roosting.	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Calidris tenuirostris</i>	Great Knot	V	M	Generally a coastal species found on tidal mudflats and sandy ocean shores. A migratory species visiting Australian waters between September and March (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
					No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V		Occurs in wetter forests and woodland from sea level to an altitude over 2000 metres, timbered foothills and valleys, coastal scrubs, farmlands and suburban gardens (Pizzey and Knight 1997).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals or chewed cones were recorded during targeted surveys. An Impact Assessment has been prepared for this species (Appendix E).
<i>Calonectris leucomelas</i>	Streaked Shearwater		M	Habitat largely restricted to pelagic seas, shelf waters and further out. Unusual inshore (Morcombe 2003).	Low No suitable habitat was recorded from the study area for this species.
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo	V		Occurs in eucalypt woodland and forest with <i>Casuarina/Allocasuarina spp.</i> Characteristically inhabits forests on sites with low soil nutrient status, reflecting the distribution of key <i>Allocasuarina species</i> . The drier forest types with intact and less rugged landscapes are preferred by the species. Nests in tree hollows (NSW National Parks and Wildlife Service 1999; Garnett and Crowley 2000).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals or chewed cones were recorded during targeted surveys. An Impact Assessment has been prepared for this species (Appendix E).
<i>Charadrius bicinctus</i>	Double-banded Plover		M	The Double-banded Plover is found on coastal beaches, mudflats, sewage farms, river banks, fields, dunes, upland tussock grasses and shingle.	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Charadrius leschenaultii</i>	Greater Sand Plover	V	M	Entirely coastal in NSW foraging on intertidal sand and mudflats in estuaries, and roosting during high tide on sand beaches or rocky shores. A migratory species it is found in New South Wales generally during the summer months (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Charadrius mongolus</i>	Lesser Sand Plover	V	M	Migratory bird that migrates from the northern hemisphere to coastal areas of northern and east coast of Australia (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Climacteris picumnus</i>	Brown Treecreeper	V		Occurs in eucalypt woodland and adjoining vegetation. Feeds on ants, beetles and larvae on trees and from fallen timber and leaf litter. Usually nests in hollows (Garnett and Crowley 2000).	Low A targeted bird survey was conducted within the study area which failed to detect this species

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
<i>Diomedea amsterdamensis</i>	Amsterdam Albatross		EM	Breeding on Amsterdam Island and foraging mainly in the surrounding Indian Ocean, but possibly occurring as far afield as Tasmania and New Zealand. Breed biennially in colonies among grass tussocks (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Diomedea antipodensis</i>	Antipodean Albatross	V	VM	A nomadic marine species that occasionally breeds off the coast of New South Wales (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Diomedea dabbeni</i>	Tristan Albatross		E	Breeding range now restricted to Inaccessible and Gough Island., having been eliminated from the main island of Tristan de Cunha by 1907. Current global population estimated to contain about 1,000 breeding pairs. There is only one record from Australian waters. Breed biennially in colonies among grass tussocks on isolated sub-Antarctic islands and feed pelagic on squid, fish and crustaceans (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Diomedea exulans</i>	Wandering Albatross	E1	VM	Nomadic marine species, that breeds in small loose colonies among grass tussocks, using a large mud nets, sometimes off the coast of NSW (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Diomedea gibsoni</i>	Gibson's Albatross	V	VM	A nomadic marine species that forages off the coast of New South Wales (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E1		Feed in shallow water up to 0.5 m deep on fish, reptiles and frogs. Build nests in trees close to feeding sites (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species. The study area contains suitable foraging and nesting habitat but despite this no individuals were detected during targeted surveys.
<i>Gallinago hardwickii</i>	Latham's Snipe		M	Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Glossopsitta pusilla</i>	Little Lorikeet	V		Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards Gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets.	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. An Impact Assessment has been prepared for this species (Appendix E).

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
				Flocks numbering hundreds are still occasionally observed and may have been the norm in past centuries.	
<i>Grantiella picta</i>	Painted Honeyeater	V		Lives in dry forests and woodlands. Primary food is the mistletoes in the genus <i>Amyema</i> , though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V		Found on rocky shorelines where it forages on intertidal flats (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Haematopus longirostris</i>	Pied Oystercatcher	V		Occurs in undisturbed beaches, sandpits, sandbars, tidal mudflats, estuaries and coastal islands. Occasionally found on rocky reefs, shores, rock stacks, brackish or saline wetlands and also in grassy paddocks, golf courses or parks near coast. Eggs are laid in shallow scrape in sand on open beach or among low growth behind beach (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		M	Occurs in coastal areas including islands, estuaries, inlets, large rivers, inland lakes and reservoirs. Builds a huge nest of sticks in tall trees near water, on the ground on islands or on remote coastal cliffs (Pizzey and Knight 1997).	Low Targeted surveys were undertaken within the study area and study area which failed to detect this species.
<i>Hirundapus caudacutus</i>	White-throated Needletail		M	Occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. Breeds in the northern hemisphere and migrates to Australia in October-April (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species.
<i>Irediparra gallinacea</i>	Comb-crested Jacana	V		Occurs in floating vegetation of permanent well-vegetated wetlands and dams. Walks on floating plants. Occasionally feeds along muddy wetland margins on east coast of NSW (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the subject site for this species.
<i>Ixobrychus flavicollis</i>	Black Bittern	V		Usually found in dense vegetation in and fringing streams, swamps, tidal creeks and mudflats, particularly amongst swamp she-oaks and mangroves. Feeds on aquatic fauna along streams, in estuaries and beside billabongs and pools. Breeding occurs in summer in secluded places in densely vegetated wetlands. It nests in trees that overhang the water (Garnett and Crowley 2000; NSW National Parks and Wildlife Service 2002).	Low No suitable habitat was recorded from the subject site for this species.
<i>Lathamus discolor</i>	Swift Parrot	E1	E	Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coast including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia is semi-nomadic, foraging in	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. An Impact Assessment has been prepared for this species (Appendix E).

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
				flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering <i>Acacia pycnantha</i> , is indicated. Sites used vary from year to year. (Garnett and Crowley 2000),(Swift Parrot Recovery Team 2001).	
<i>Limicola falcinellus</i>	Broad-billed Sandpiper	V	M	A migratory species that breeds in the northern hemisphere between June and August. Individuals feed both on exposed mudflats and while wading in water (NSW National Parks and Wildlife Service 1999).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Limosa lapponica</i>	Bar-tailed Godwit		M	Occurs in coastal mudflats, sandbars, shores of estuaries, salt marsh and sewage ponds (Morcombe 2003).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Limosa limosa</i>	Black-tailed Godwit	V	M	A coastal species found on tidal mudflats, swamps, shallow river margins and sewage farms. Also found inland on larger shallow fresh or brackish waters. A migratory species visiting Australia between September and May (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Macronectes giganteus</i>	Southern Giant-Petrel	E1	EM	A partly nomadic marine species that forages off the coast of New South Wales (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Macronectes halli</i>	Northern Giant-Petrel	V	VM	Nomadic marine species, that nests as dispersed pairs, often amidst tussocks in dense vegetation. Forages in shores waters of southern Australia and occasionally visits the coast of NSW (Garnett and Crowley 2000).	Low No suitable habitat for this species within the study area. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Merops ornatus</i>	Rainbow Bee-eater		M	Usually occur in open or lightly timbered areas, often near water. Breed in open areas with friable, often sandy soil, good visibility, convenient perches and often near wetlands. Nests in embankments including creeks, rivers and sand dunes. Insectivorous, most foraging is aerial, in clearings (Higgins 1999).	Low Suitable foraging habitat for this species was recorded from the study area. No important habitat for this species in the

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
					proposal area as defined under the <i>EPBC Act 1999</i>
<i>Monarcha melanopsis</i>	Black-faced Monarch		M	Occurs in rainforests, eucalypt woodlands, coastal scrubs, damp gullies in rainforest, eucalypt forest and in more open woodland when migrating (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher		M	Occurs in heavily vegetated gullies, in forests and taller woodlands. During migration it is found in coastal forests, woodlands, mangroves, trees in open country and gardens (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Neophema pulchella</i>	Turquoise Parrot	V		Occurs in the foothills of the great dividing range in eucalypt woodlands and forests with a grassy or sparsely shrubby understorey. Nests in hollows in trees, stumps or even fence posts. It feeds on seeds of both native and introduced grass and herb species (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Ninox connivens</i>	Barking Owl	V		Occurs in dry sclerophyll woodland. In the south west it is often associated with riparian vegetation while in the south east it generally occurs on forest edges. It nests in large hollows in live eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett and Crowley 2000).	Low/Medium Sub-optimal habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted nocturnal spotlighting and diurnal day surveys. An Impact Assessment has been prepared for this (Appendix E).
<i>Ninox strenua</i>	Powerful Owl	V		A sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, casuarina or callitris pine forest and woodland. It often roosts in dense vegetation including rainforest of exotic pine plantations. Generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett and Crowley 2000).	High Sub-optimal habitat for this species was recorded from the study area. This species was recorded calling to the north-west of the study area across Sparks Road during a flora and fauna survey over the 33-39 Railway Road, Warnervale despite this no Powerful Owls were recorded or observed at the time of the targeted surveys within the subject property. An Impact Assessment has been prepared for this species (Appendix E).
<i>Numenius madagascariensis</i>	Eastern Curlew		M	Inhabits coastal estuaries, mangroves, mud flats and sand pits. It is a migratory shorebird which generally inhabits sea and lake shore mud flats, deltas and similar areas, where it forages for crabs and other crustaceans, clam worms and other annelids, molluscs, insects and whatever else it can dig out of the mud with its long, downward-turned bill. Its migration route ranges from its wintering grounds in Australia to its breeding grounds in northern China, Korea and Russia (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Numenius minutus</i>	Little Curlew		M	Little Curlews may gather in large flocks on coastal and inland	Low

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
				grasslands and black soil plains in northern Australia, near swamps and flooded areas. They also feed on playing fields, paddocks and urban lawns.	No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Numenius phaeopus</i>	Whimbrel		M	Migrates to Taiwan, Philippines, PNG, and a race breeding in NE Siberia is found on the north and south-eastern coastlines of Australia. Juveniles arrive to Australia from spring to early summer. Usually only juveniles remain in Australia but very occasionally adults in breeding plumage may be seen in Australian winters (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Oxyura australis</i>	Blue-billed Duck	V		Relatively sparse throughout species range. Regularly found breeding in south-east Queensland, north-east South Australia and throughout New South Wales. Found on temperate, fresh to saline, terrestrial wetlands, and occupies artificial wetlands. Prefers deep permanent open water, within or near dense vegetation. Nest in rushes, sedge, Lignum <i>Muehlenbeckia cunninghamii</i> and paperbark <i>Melaleuca</i> (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Pluvialis fulva</i>	Pacific Golden Plover		M	Prefers sandy, muddy or rocky shores, estuaries and lagoons, reefs, saltmarsh, and or short grass in paddocks and crops. The species is usually coastal, including offshore islands; rarely far inland. Often observed on beaches and mudflats, sand flats and occasionally rock shelves, or where these substrates intermingle; harbours, estuaries and lagoons (Marchant and Higgins 1993).	Low No suitable habitat was recorded from the study area for this species.
<i>Pluvialis squatarola</i>	Grey Plover		M	The Grey Plover is almost entirely coastal, being found mainly on marine shores, inlets, estuaries and lagoons with large tidal mudflats or sand flats for feeding, sandy beaches for roosting, and also on rocky coasts.	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the <i>EPBC Act 1999</i> .
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	V		Found throughout western slopes and plains, southern and central tablelands and occurring in Northern Rivers area, mid-north coast and the Hunter Valley of NSW. Lives in open forest and woodland, acacia shrubland and adjoining farmland. Large stick dome nest with spout-like entrance (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species.
<i>Pterodroma leucoptera</i>	Gould's Petrel	E1	EM	A marine species, it nests on islands among rocks and debris of Cabbage Tree Palms. It feeds on fish, cephalopods and other marine animals (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Pterodroma neglecta</i>	Kermadec Petrel		V	An oceanic species that forages in the tropical and subtropical pacific ocean (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V		Occurs in rainforests and fringes, scrubs, mangroves and wooded stream-margins, lantana thickets, isolated figs, pittosporums, lilly pillies and blackberries (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
<i>Puffinus assimilis</i>	Little Shearwater	V		A marine species that occurs over the Tasman Sea and possibly the Coral Sea. The species breeds on island in burrows dug in soft soil among mats of succulents or among loose rocks and they forage far out to sea (Garrett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Puffinus griseus</i>	Sooty Shearwater		M	A nomadic marine species that occasionally breeds off the coast of New South Wales. The sooty shearwater returns from the North Pacific Ocean and Southern Ocean to breed in small numbers on islands south of Port Stephens (Garrett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Puffinus pacificus</i>	Wedge-tailed Shearwater		M	Return from the North Pacific to their burrows on islands off the coast of NSW. Marine nomadic species that visits land to breed. Known breeding colony at Mutton-bird island near Coffs Harbour (Garrett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Puffinus tenuirostris</i>	Short-tailed Shearwater		M	Nomadic marine species that breeds on islands along the eastern and southern coastlines of Australia, from the central coast of NSW to Western Australia (Garrett, 2000 #21).	Low No suitable habitat was recorded from the study area for this species.
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	V		Occurs in a wide range of eucalypt dominated vegetation with a grassy understorey and is often found on rocky ridges or in gullies. It feeds on seeds and insects and builds domed nests on the ground (Garrett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Rhipidura rufifrons</i>	Rufous Fantail		M	Occurs in a range of habitats including the undergrowth of rainforests/wetter eucalypt forests/gullies, monsoon forests, paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks and gardens. When migrating they may also be recorded on farms, streets and buildings. Migrates to SE Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range (Pizzey and Knight 1997).	Low No suitable habitat was recorded from the study area for this species. No important habitat for this species in the proposal area as defined under the EPBC Act 1999.
<i>Rostratula benghalensis</i>	Painted Snipe	E1	VM	Inhabits shallow, vegetated, temporary or infrequently filled wetlands, including where there are trees such as <i>Eucalyptus camaldulensis</i> (River Red Gum), <i>E. populnea</i> (Poplar Box) or shrubs such as <i>Muehlenbeckia florulenta</i> (Lignum) or <i>Sarcocornia quinqueflora</i> (Samphire). Feeds at the water's edge and on mudflats on seeds and invertebrates, including insects, worms, molluscs and crustaceans. Males incubate eggs in a shallow scrape nest (Garrett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Stagonopleura guttata</i>	Diamond Firetail	V		Occurs in a range of eucalypt dominated communities with a grassy understorey including woodland, forest and mallee. Most populations occur on the inland slopes of the dividing range. Feed on seeds, mostly of grasses (Garrett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Sterna albifrons</i>	Little Tern	E1	M	A coastal species found along the coast of New South Wales. They nest between the high tide mark and shore vegetation on undisturbed and un-vegetated sites near estuaries and adjacent freshwater lakes. They feed on fish taken from inshore waters (Garrett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Sula dactylatra</i>	Masked Booby	V	M	Seabird throughout tropical and subtropical seas, with a breeding population on Lord Howe Island (Department of Environment and	Low No suitable habitat was recorded from the

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
				Climate Change 2007).	study area for this species.
<i>Thalassarche bullei</i>	Buller's Albatross		VM	An oceanic species that has been recorded off the coast of New South Wales (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Thalassarche cauta</i>	Shy Albatross	V	VM	An oceanic species that has been recorded off the coast of New South Wales (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Thalassarche melanorhynchus</i>	Black-browed Albatross	V	VM	Nomadic marine species that breeds on subantarctic island outside Australian waters, but moves northwards in non-breeding seasons. The waters off southern Australia between Brisbane and Perth are the principal feeding area of birds (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Thalassarche salvini</i>	Salvin's Albatross		VM	An oceanic species that has been recorded off the coast of New South Wales (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Thalassarche steadi</i>	White-capped Albatross		VM	An oceanic species that has been recorded off the coast of New South Wales (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Tringa stagnatilis</i>	Marsh Sandpiper		M	Occurs in coastal and inland wetlands (salt or fresh water), estuarine and mangrove mudflats, beaches, shallow or swamps, lakes, billabongs, temporary floodwaters, sewage farms and salt-works ponds (Morcombe 2003).	Low No suitable habitat was recorded from the study area for this species.
<i>Tyto novaehollandiae</i>	Masked Owl	V		Occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett and Crowley 2000).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted nocturnal spotlighting and diurnal day surveys. An Impact Assessment has been prepared for this (Appendix E).
<i>Tyto tenebricosa</i>	Sooty Owl	V		Occurs in wet eucalypt forest and rainforest on fertile soils with tall emergent trees. Typically found in old growth forest with a dense understorey but also occurs in younger forests if nesting trees are present nearby. It nests in large hollows within eucalypts and occasionally caves. It hunts in open and closed forest for a range of arboreal and terrestrial mammals including introduced species and sometimes birds (Garnett and Crowley 2000).	Low No suitable habitat was recorded from the study area for this species.
<i>Xanthomyza phrygia</i>	Regent Honeyeater	E1	EM	Occurs mostly in box-ironbark forests and woodland and prefers the wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with <i>Casuarina cunninghamiana</i> and <i>Amyema cambagei</i> are important for feeding and breeding. Important food trees include <i>Eucalyptus sideroxylon</i> (Mugga Ironbark), <i>E. albens</i> (White Box), <i>E. melliodora</i> (Yellow Box) and <i>E. leucoxylon</i> (Yellow Gum) (Garnett and Crowley 2000).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted nocturnal spotlighting and diurnal day surveys. An Impact Assessment has been prepared for this (Appendix E).
<i>Xenus cinereus</i>	Terek Sandpiper	V	M	Found on tidal mudflats and estuaries and on shores and reefs of	Low

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
				offshore islands (Pizzey and Knight 1997).	No suitable habitat was recorded from the study area for this species.
Mammals					
<i>Aepyprymnus rufescens</i>	Rufous Bettong	V		Distribution: From Cooktown in north Queensland, to north-east NSW, where it occurs east of the Dividing Range. In Queensland, it still occurs on both sides of the Great Divide. Macro-habitat: Found in a variety of forest types from wet sclerophyll to dry open woodland, where grass tussocks or fallen timber are present. Also known to occupy a mosaic of open forest and grasslands. Microhabitat: It appears to prefer a more open forest structure, with a sparse shrub layer and a diverse ground cover. Builds nests in grass tussocks and under logs. Strongly associated with dry sclerophyll forest particularly those dominated by Spotted Gum (NSW National Parks and Wildlife Service 1999).	Low No suitable habitat was recorded from the study area for this species.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Occurs in moderately wooded habitats and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins. Thought to forage below the forest canopy for small flying insects (Churchill 1998).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. An Impact Assessment has been prepared for this species (Appendix E).
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	Occurs from the Bundaberg area in south-east Queensland, south through NSW to western Victoria and Tasmania. In NSW, it occurs on both sides of the Great Dividing Range and north-east NSW represents a national stronghold (NSW National Parks and Wildlife Service 1999). Occurs in wide range of forest types, although appears to prefer moist sclerophyll and rainforest forest types, and riparian habitat. Most common in large un-fragmented patches of forest. It has also been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in riparian areas, it also ranges over dry ridges. Nests in rock caves and hollow logs or trees. Feeds on a variety of prey including birds, terrestrial and arboreal mammals, small macropods, reptiles and arthropods (NSW National Parks and Wildlife Service 1999; NSW National Parks and Wildlife Service 1999).	Low No suitable habitat was recorded from the study area for this species.
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings. Forages within the canopy of dry sclerophyll forest. It prefers wet habitats where trees are more than 20 metres high (Churchill 1998).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. An Impact Assessment has been prepared for this species (Appendix E).
<i>Isoodon obesulus</i>	Southern Brown Bandicoot	E1	E	Occurs in a variety of habitats in south-eastern Australia, including heathland, shrubland, dry sclerophyll forest with heathy understorey, sedgeland and woodland. Many of the habitats are prone to fire (NSW National Parks and Wildlife Service 1999).	Low No suitable habitat was recorded from the study area for this species.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
<i>Kerivoula papuensis</i>	Golden-tipped Bat	V		Predominantly distributed throughout Indonesia, New Guinea and the Philippines, the species has been observed on the east coast of NSW and Victoria. Prefers moist dense vegetation in coastal forests, near to where wet and dry forests meet and often in the vicinity of creeks. Possibly prefers ecotonal habitats (such as creek lines) for feeding and passage and an ability to manoeuvre in dense vegetation (Strahan 1995).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. An Impact Assessment has been prepared for this species (Appendix E).
<i>Miniopterus australis</i>	Little Bent-wing Bat	V		Feeds on small insects beneath the canopy of well timbered habitats including rainforest, Melaleuca swamps and dry sclerophyll forests. Roosts in caves and tunnels and has specific requirements for nursery sites. Distribution becomes coastal towards the southern limit of its range in NSW. Nesting sites are in areas where limestone mining is preferred (Strahan 1995).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. An Impact Assessment has been prepared for this species (Appendix E).
<i>Miniopterus schreibersii</i>	Eastern Bent-wing Bat	V		Usually found in well timbered valleys where it forages on small insects above the canopy. Roosts in caves, old mines, stormwater channels and sometimes buildings and often return to a particular nursery cave each year (Churchill 1998).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. An Impact Assessment has been prepared for this species (Appendix E).
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		Thought to live in sclerophyll forest and woodland. Small colonies have been found in tree hollows or under loose bark. It feeds on insects above the forest canopy or in clearings at the forest edge (Churchill 1998).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. An Impact Assessment has been prepared for this species (Appendix E).
<i>Myotis adversus</i>	Large-footed Myotis	V		Colonies occur in caves, mines, tunnels, under bridges and buildings. Colonies always occur close to bodies of water where this species feeds on aquatic insects (Churchill 1998).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. An Impact Assessment has been prepared for this species (Appendix E).
<i>Petaurus australis</i>	Yellow-bellied Glider	V		Restricted to tall, mature eucalypt forest in high rainfall areas of temperate to sub-tropical eastern Australia. Feeds on nectar, pollen, the sap of eucalypts and sometimes insects. Preferred habitats are productive, tall open sclerophyll forests where mature trees provide shelter and nesting hollows and year round food resources are available from a mixture of eucalypt species (NSW National Parks and Wildlife Service 1999; NSW National Parks and Wildlife Service 2003).	Low No suitable habitat was recorded from the study area for this species.
<i>Petaurus norfolkensis</i>	Squirrel Glider	V		Found in dry sclerophyll forest and woodland but not found in dense coastal ranges. Nests in hollows and feeds on gum of acacias, eucalypt sap and invertebrates (NSW National Parks and Wildlife Service 1999).	Low Sub-optimal habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
					surveys. An Impact Assessment has been prepared for this (Appendix E).
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E1	V	Occurs in inland and sub-coastal south eastern Australia where it inhabits rock slopes. It has a preference for rocks which receive sunlight for a considerable part of the day. Windblown caves, rock cracks or tumbled boulders are used for shelter. Occur in small groups or "colonies" each usually separated by hundreds of metres (NSW National Parks and Wildlife Service 2003).	Low No suitable habitat was recorded from the study area for this species.
<i>Phascolarctos cinereus</i>	Koala	V		Found in sclerophyll forest. Throughout New South Wales, Koalas have been observed to feed on the leaves of approximately 70 species of eucalypt and 30 non-eucalypt species. However, in any one area, Koalas will feed almost exclusively on a small number of preferred species. The preferred tree species vary widely on a regional and local basis. Some preferred species in NSW include Forest Red Gum <i>Eucalyptus tereticornis</i> , Grey Gum <i>E. punctata</i> , and Monkey Gum <i>E. cypellocarpa</i> and Ribbon Gum <i>E. viminalis</i> . In coastal areas, Tallowwood <i>E. microcorys</i> and Swamp Mahogany <i>E. robusta</i> are important food species, while in inland areas White Box <i>E. albens</i> , Bimble Box <i>E. populnea</i> and River Red Gum <i>E. camaldulensis</i> are favoured (NSW National Parks and Wildlife Service 1999; NSW National Parks and Wildlife Service 2003).	Low No suitable habitat was recorded from the study area for this species.
<i>Potorous tridactylus</i>	Long-nosed Potoroo	V	V	Disjunct distribution along coastal south-east Australia from near Gladstone in Queensland, to south-west Victoria and in Tasmania. Found from sea level up to 1500 metres in altitude generally in areas with rainfall greater than 760 millimetres. In NSW, it is found throughout coastal and sub-coastal areas. Occurs in a range of habitats: coastal forest and woodland with a moderately dense heathy understorey, dense coastal scrubs or heath, wet and dry sclerophyll forest and sub-tropical, warm temperate and cool temperate rainforest of the eastern slopes and highlands. Often associated with gullies and forest ecotones. Open areas are used for foraging while areas of dense groundcover or understorey provide areas for shelter and protection from predators. Relatively thick ground cover is a major habitat requirement and it seems to prefer areas with light sandy soils. Feeds at dusk on roots, tubers, fungi, insects and their larvae and other soft bodied animals in the soil. Moves up and down slope as food resources become seasonally available (Johnston 1995; NSW National Parks and Wildlife Service 1999).	Low No suitable habitat was recorded from the study area for this species.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species. Feeds on the flowers and nectar of eucalypts and native fruits including lilly pillies. It roosts in the branches of large trees in forests or mangroves (Churchill 1998; NSW National Parks and Wildlife Service 2001).	High This species was recorded from the study area (Figure 3-2). An Impact Assessment has been prepared for this (Appendix E).

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within the study area
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat	V		Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts in tree hollows. Thought to be a migratory species (Churchill 1998).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. An Impact Assessment has been prepared for this (Appendix E).
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks but it may also forage in rainforest. Typically it forages at a height of 3-6 metres but may fly as low as one metre above the surface of a creek. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings (Churchill 1998).	Low/Medium Suitable habitat for this species was recorded from the study area. Despite this no individuals were recorded during targeted surveys. An Impact Assessment has been prepared for this (Appendix E).
<i>Vespadelus trougtoni</i>	Eastern Cave Bat	V		A cave-dwelling species found in eastern Australia from Cape York to NSW. They inhabit tropical mixed woodland and wet sclerophyll forests on the coast and the dividing range, but extend into drier forests on the western slopes (Churchill 1998).	Low No suitable habitat was recorded from the study area for this species.
Reptiles					
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E1	V	A nocturnal species that occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer (Webb and Shine 1994; Webb and Shine 1998).	Low No suitable habitat was recorded from the study area for this species.
<i>Hoplocephalus stephensii</i>	Stephen's Banded Snake	V		Found in coastal areas from Gosford district to southern QLD. Arboreal snake usually encountered in the wetter sclerophyll or rainforests which occur within its range (Cogger 2000).	Low No suitable habitat was recorded from the study area for this species.

Notes:

1. V= Vulnerable, E1 = Endangered, E2 = Endangered Population (*Threatened Species Conservation Act 1995*) (*Fisheries Management Act 1994*)
2. V = Vulnerable, E = Endangered, M = Migratory, C = Conservation Dependent (*Environment Protection and Biodiversity Conservation Act 1999*) (*Fisheries Management Act 1994*)

Appendix E

TSC Assessments of Significance

Assessment of Significance

Council is required to consider the impact upon threatened species from any development or activity via the process of a 7 part test of significance in accordance with section 5A of the *Environmental Planning and Assessment Act 1979*. The significance of the assessment is then used to determine the need for a more detailed Species Impact Statement (SIS).

The following 7 part test of significance relies on the ecological assessment provided in Sections 3.8, & Appendices C & D above and should be read as such. It is considered that the study area provides potential habitat for the following threatened species and will be assessed accordingly in the following seven-part test:

Threatened Fauna

- *Lathamus discolor* (Swift Parrot)
- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)
- *Glossopsitta pusilla* (Little Lorikeet)
- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Tyto novaehollandiae* (Masked Owl)
- *Kerivoula papuensis* (Golden-tipped Bat)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus australis* (Little Bent-wing Bat)
- *Miniopterus schreibersii* (Eastern Bent-wing Bat)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Large-footed Myotis)
- *Petaurus norfolcensis* (Squirrel Glider)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail Bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

The '7 part test of significance' is as follows.

- 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,**

***Lathamus discolor* (Swift Parrot)**

This species feeds mainly on nectar from eucalypt flowers, particularly Blue Gum (*Eucalyptus globulus*). On the mainland, the Swift Parrot congregates where winter flowering species such as Red Ironbark (*Eucalyptus sideroxylon*), White Box (*Eucalyptus albens*), Yellow Gum (*Eucalyptus leucoxylon*) and Swamp Gum (*Eucalyptus ovata*) are present (Saunders and Heinsohn 2008). The Swift Parrot is a migratory species that breeds in Tasmania and its offshore islands in summer (Swift Parrot Recovery Team 2001). In late March almost the entire population migrates to mainland Australia (Swift Parrot Recovery Team 2001). It is considered that the *Eucalyptus robusta* (Swamp Mahogany) specimens within the study area provide a potential foraging resource for this species. Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Calyptorhynchus lathami* (Glossy Black-Cockatoo)**

The Glossy Black-cockatoo inhabits mountain forests, coastal woodland, open forest and trees bordering watercourses where there are substantial stands of *Allocasuarina*. They choose trees with larger cone crops but show no sign of selecting trees on the basis of cone size – concentrating foraging in trees with a high ratio of total seed weight to cone weight (Crowley and Garnett 2001). They breed in hollow trees or stumps usually in Eucalypts. It is considered that potential foraging habitat exists on the study area within the *Allocasuarina* sp. present. Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Glossopsitta pusilla* (Little Lorikeet)**

Little Lorikeets 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. In south-east Queensland (McAlpine, Heyenga et al. 2007), Little Lorikeets were more likely to occupy forest sites with relatively short to intermediate logging rotations (15–23 years) and sites that have had short intervals (2.5– 4 years) between fires. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands White Box *Eucalyptus albens* and Yellow Box *E. melliodora* are particularly important food sources for pollen and nectar respectively. They are also reported as feeding on fruits, particularly those of mistletoes (Higgins and Peter 2002). Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Ninox connivens* (Barking Owl)**

The Barking Owl utilises eucalypt forests, woodlands and adjacent cleared areas for foraging and large hollows for nesting and breeding (Garnett & Crowley 2000). This species usually roosts in large densely foliated trees, either among foliage or on bare branch below foliage, sometime quite low (Garnett & Crowley 2000). The study area contains potential foraging habitat for this species particularly within the ecotones between the forested and cleared areas of land. The Barking Owl was not recorded during nocturnal spotlighting and diurnal day surveys nor was there any whitewash recorded from the study area indicating the presence of roosting owl species. The local area contains extensive amounts of similar and higher quality habitat for this species. It is considered that the proposal is unlikely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

***Ninox strenua* (Powerful Owl)**

The Powerful Owl inhabits mature rainforest and wet and dry eucalypt forest utilising Eucalypt forests and woodlands and adjacent cleared areas for foraging. Large trees with hollows at least 0.5m deep are required for shelter and breeding (Department of Environment and Conservation 2005). Mated pairs of Powerful Owl roost together or separately, maintaining several roost sites throughout their territory which are used in rotation shifting with the availability of prey. It is considered that the study area provides potential foraging habitat for this species. Despite the presence of potential foraging habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Tyto novaehollandiae* (Masked Owl)**

The Masked Owl is widespread through forests and woodlands, utilising caves for shelter in treeless country. The Masked Owl is known to utilise forest margins and isolated stands of trees within agricultural land (Department of Environment and Conservation 2005). This species is often found in heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained (Department of Environment and Conservation 2005). The Masked Owl requires old mature trees with large hollows for breeding and as diurnal roosting sites, being dependent upon hollow bearing trees all year round rather than only during the breeding season. It is considered that the study area provides potential foraging habitat for this species. Despite the presence of potential foraging habitat, this species was not recorded during the fauna survey within any hollow-bearing trees. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Kerivoula papuensis* (Golden-tipped Bat)**

The Golden-tipped Bat inhabits rainforest or rainforest with a well-developed overstorey of eucalypts or brushbox. This species specialises in feeding upon Orb Spiders which have been found in 99% of there diet remains. Roosts mainly in abandoned nests of the Yellow-throated Scrub Wren and Brown greygones. Also roots within vines and twigs made and tree hollows. Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Chalinolobus dwyeri* (Large-eared Pied Bat)**

It is probable that the Large-eared Pied Bat forages for insects below the forest canopy. During the day these bats may roost in caves, mine tunnels and the abandoned nests of Fairy Martins (Hoye and Dwyer 1998). The Large-eared Pied Bat may also utilise tree hollows (Schultz, Coles et al. 1999). The Large-eared Pied Bat is mainly found in drier habitat including dry sclerophyll and woodland, east and west of the Great Dividing Ranges. However Hoye (Hoye and Dwyer 1998) suggest that from records of the species in subalpine woodland, moist eucalypt forest and near rainforest, it may tolerate a greater range of habitats. The distribution of this bat ranges from inland and south-eastern QLD to central-eastern and north-eastern NSW. It is considered that the study area provides potential foraging habitat for this species. Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Falsistrellus tasmaniensis* (Eastern False Pipistrelle)**

The Eastern False Pipistrelle inhabits warm to cool temperate moist and dry open forests. Little is known about the biology of this species although it has been recorded in logged and un-logged areas, preferring open areas for foraging. The Eastern False Pipistrelle roosts mainly in tree hollows, occasionally utilising caves and abandoned buildings. It is considered that the study area provides potential foraging habitat for this species. Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Miniopterus australis* (Little Bent-wing Bat)**

The Little Bentwing-bat forages below the canopy within open forests and woodlands, feeding on small insects. It is considered that the proposed development is unlikely to disrupt the life cycle of the Little Bentwing-bat species within the local area such that a viable local population will be placed at risk of extinction.

***Miniopterus schreibersii* (Eastern Bent-wing Bat)**

The Eastern Bentwing-bat is confined to areas where there are caves with potential temperature, humidity and physical dimensions to permit breeding. This species occupies a range of habitats, mainly near the coast and utilises caves, old mines, stormwater channels, under bridges and occasionally buildings for roosting. It is considered that the study area provides potential foraging habitat for this species. Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Mormopterus norfolkensis* (Eastern Freetail-bat)**

The Eastern Freetail-bat forages above and within the canopy of open forests and woodlands, feeding on small insects. The Eastern Freetail-bat is thought to roost predominantly in tree hollows and occasionally in buildings. It is considered that the study area provides potential foraging habitat for this species. Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Myotis macropus* (Large-footed Myotis)**

The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. It is considered that the study area provides potential foraging habitat for this species. Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Petaurus norfolcensis* (Squirrel Glider)**

The Squirrel Glider inhabits dry sclerophyll forest and woodland nesting in small tree hollows (Quin 1995). The presence of mature, hollow-bearing eucalypts is a critical characteristic of habitat occupied by Squirrel Gliders as they are utilised for nesting and breeding (Quin 1995). It is considered that the study area provides potential habitat for this species. Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Pteropus poliocephalus* (Grey-headed Flying-fox)**

The Grey-headed Flying-fox is found in a variety of habitats including rainforest, mangroves, paperbark swamps, wet and dry sclerophyll forests and cultivated areas (Churchill 2008). Grey-headed Flying Foxes congregate in large camps of up to 200,000 individuals, depending on availability of surrounding blossoming plants, from early until late summer (Churchill 2008). Camps are commonly formed in gullies, typically not far from water and in vegetation with a dense canopy. Roost sites are an important resource where mating, birth and rearing of young occurs as well as providing refuge (Strahan 1995) These bats eat the fruit or blossoms of more than 80 species of plants. Their major food source is eucalypt blossom and native fruits from a variety of tree species. Native figs (*Ficus spp*) account for a large percentage of the fruit eaten. They are also known to rain orchids of cultivated fruit. The Grey headed Flying-fox has a nightly feeding range of 20 to 50km from their camp (Churchill 2008). This species was recorded foraging within flowering spotted gum at the time of the site inspections (Figure 3-2).

It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat)**

The Yellow-bellied Sheathtail-bat inhabits open country, mallee, eucalypt forests, rainforests, heathland and water bodies. The Yellow-bellied Sheathtail-bat roosts in tree hollows and has been found inhabiting the abandoned nests of Sugar Gliders. It is considered that the study area provides potential foraging habitat for this species. Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would be placed at risk of extinction.

***Scoteanax rueppellii* (Greater Broad-nosed Bat)**

The Greater Broad-nosed Bat inhabits open forests and woodlands, foraging throughout these forest types and also along creeks and small river systems. This species roosts in tree hollows and occasionally old buildings. It is considered that the study area provides potential foraging habitat for this species. Despite the presence of potential habitat, this species was not recorded during the fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle of this species such that a viable local population would 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**

There are no endangered fauna populations within the Wyong LGA.

There are two endangered flora populations within the Wyong LGA, These are:

- *Eucalyptus parramattensis* subsp. *parramattensis* in the Wyong and Lake Macquarie LGAs
- *Eucalyptus oblonga* at Bateau Bay

Despite searches undertaken for both of these species within the study area, no specimens were located.

Therefore it is considered that the action proposed is not likely to have an adverse effect on the life cycle of these species that constitute the endangered populations such that a viable local population of these species is likely to be placed at risk of extinction.

- c) In the case of a critically endangered or endangered ecological community, whether the action proposed:**

- i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
- ii. Is likely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction,

N/A

- d) In relation to the habitat of threatened species, populations or ecological community:**

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

ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

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

i.) The proposal will entail the removal of 1.1ha of habitat for threatened species.

ii.) The study area is connected to natural bushland to the north and south partially to the west of the study area. The vegetation proposed to be removed is at the eastern most point of this continuous patch of vegetation to the west. The proposal will not fragment or isolate currently connected areas of habitat.

Therefore, it is considered that known habitat for a threatened species within the local area and the region are unlikely to become isolated or fragmented as a result of the proposal.

iii.) The proposal will entail the removal of 1.1ha habitat for the threatened aforementioned species. Despite the proposed removal of 1.1ha of habitat for the aforementioned threatened species all are highly mobile and would not be dependent upon the foraging habitat within the study area exclusively as such it is considered that the proposal is unlikely to create an important impact on the long-term survival of threatened species in the locality and is not considered to be significant.

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

The site has not been identified as critical habitat within the provisions of the TSC Act (1995).

Therefore this matter does not require any further consideration.

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

The draft recovery plans have been prepared for the following threatened species with potential habitat within the study area:

- Recovery Plan for the Large Forest Owls (Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*), (DECC 2006).
- Draft Recovery Plan for the Barking Owl (*Ninox connivens*) (NPWS 2003).

It is considered that the proposed development is generally consistent with the objectives or actions of the above mentioned draft recovery plans.

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

The proposal is likely to entail or perpetuate the following key threatening process under the *TSC Act* within the site.

- Clearing of native vegetation.
- Invasion of native plant communities by exotic perennial grasses.
- Removal of five Hollow-bearing tree
- Infection of native plants by *Phytophthora cinnamomi*.
- Human Caused Climate Change.

Conclusion

Given the small area to be removed 1.1ha of habitat from within the study area and the occurrence of larger areas of habitat consistent with that within the study area to the north-south & within the general locality of the impact to the habitats for threatened flora and fauna species are not considered to be significant. Critical habitat will not be affected.

Appendix F

EPBC Significance Assessment

EPBC Assessment of Significance (Grey-headed Flying-fox)

Under the *Environment Protection and Biodiversity Conservation Act 1999*, an action is likely to have a significant impact on a vulnerable species if it affects an important population of the species. Under the Principle Significant Impact Guidelines (Department of the Environment and Heritage 2006) an important population is a population that is necessary for a species' long-term survival and recovery. This may include populations identified in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity
- populations that are near the limit of the species range.

The animals that may use the site are not considered to be part of an important population.

Will the action lead to a long-term decrease in the size of an important population of a species?

Grey-headed Flying-fox utilising the site would not constitute an important population. The proposal will remove of 1.1ha of habitat from within the study area which provide suitable habitat for this species. Clearing of this habitat as result of the proposal represents a small loss of the local extent of similar habitat. No Grey-headed Flying-fox camps will be affected by the proposal. As such, the proposal is unlikely to lead to a long-term decrease in the size of the local population.

Will the action reduce the area of occupancy of an important population?

Grey-headed Flying-fox utilising the site would not be part of an important population. Development of the study area will remove of 1.1ha of habitat, which contains suitable foraging habitat for this species. The Grey-headed Flying-fox is a highly mobile and it may travel up to 50 km each night to forage. Therefore, the local population would not be restricted to habitat resources within the site only.

Will the action fragment an existing important population into two or more populations?

Grey-headed Flying-foxes using the site for foraging purposes would not be part of an important population.

Will the action adversely affect habitat critical to the survival of a species?

No critical habitat has been listed for Grey-headed Flying-fox under the *Environment Protection and Biodiversity Conservation Act 1999*. Known Grey-headed Flying-fox camps may however be considered critical to the survival of local populations. No camps were identified within or near the study area.

Will the action disrupt the breeding cycle of an important population?

Grey-headed Flying-foxes using the study area would not be part of an important population.

Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The study area contains suitable foraging resources for Grey-headed Flying-fox. The action is unlikely to significantly decrease the availability of foraging habitat in the locality as the proposal will result in the removal of 1.1ha of habitat. The large home range of this species allows offsite foraging resources to be accessed and isolation of habitat would not result from the development.

It is unlikely that the development would isolate and decrease the availability of quality habitat to the extent that the species is likely to decline.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

It is highly unlikely that invasive species (such as introduced predators) that are harmful to the Grey-headed Flying-fox would become more established as a result of the action.

Will the action introduce disease that may cause the species to decline?

The proposal would not increase the likelihood of a disease becoming established or proliferating in the local population that would result in a decline of the species.

Will the action interfere with the recovery of the species?

No recovery or threat abatement plans have been prepared for this species. Therefore it is considered that the proposal is unlikely to interfere within the recovery of the Grey-headed Flying-fox.

Conclusion

The Grey-headed Flying-fox is unlikely to be significantly affected by the proposal.

EPBC Assessment of Significance (Large-eared Pied Bat)

Under the *Environment Protection and Biodiversity Conservation Act 1999*, an action is likely to have a significant impact on a vulnerable species if it affects an important population of the species. Under the Principle Significant Impact Guidelines (Department of the Environment and Heritage 2006) an important population is a population that is necessary for a species' long-term survival and recovery. This may include populations identified in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity
- populations that are near the limit of the species range.

The animals that may use the site are not considered to be part of an important population.

Will the action lead to a long-term decrease in the size of an important population of a species?

Large-eared Pied Bats utilising the site would not constitute an important population. The proposal will remove/modify approximately 1.1ha of habitat for this species. Clearing of this community for the proposal represents a small loss of the local extent of similar habitat. No Large-eared Pied Bat roosting sites will be affected by the proposal. As such, the proposal is unlikely to lead to a long-term decrease in the size of the local population.

Will the action reduce the area of occupancy of an important population?

Large-eared Pied Bats utilising the site would not be part of an important population. Development of the study area will remove/modify of 1.1ha of habitat, which contains sub-optimal foraging habitat for this species. The Large-eared Pied Bat is a highly mobile species. Therefore, the local population would not be restricted to habitat resources within the site only.

Will the action fragment an existing important population into two or more populations?

Large-eared Pied Bat using the site for foraging purposes would not be part of an important population.

Will the action adversely affect habitat critical to the survival of a species?

No critical habitat has been listed for Large-eared Pied Bat under the *Environment Protection and Biodiversity Conservation Act 1999*. Known Large-eared Pied Bat maternity caves may however be considered critical to the survival of local populations. No maternity caves were identified within or near the study area.

Will the action disrupt the breeding cycle of an important population?

Large-eared Pied Bats using the study area would not be part of an important population. The breeding patterns of the Large-eared Pied Bat are not likely to be disrupted as this species breeds within a maternity caves, which were absent from the study area. As such it is considered that the proposal is unlikely to disrupt the breeding cycle of an important population of Large-eared Pied Bats.

Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The study area contains foraging resources for Large-eared Pied Bat. The action is unlikely to significantly decrease the availability of foraging habitat in the locality despite the removal of 1.1ha of habitat. The large-eared Pied Bat has a large home range as such this species would not feed exclusively within the study area.

It is unlikely that the development would isolate and decrease the availability of quality habitat to the extent that the species is likely to decline.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

It is highly unlikely that invasive species (such as introduced predators) that are harmful to the Large-eared Pied Bat would become more established as a result of the action.

Will the action introduce disease that may cause the species to decline?

The proposal would not increase the likelihood of a disease becoming established or proliferating in the local population that would result in a decline of the species.

Will the action interfere with the recovery of the species?

No recovery or threat abatement plans have been prepared for this species. Therefore it is considered that the proposal is unlikely to interfere within the recovery of the Large-eared Pied Bat.

Conclusion

The Large-eared Pied Bat is unlikely to be significantly affected by the proposal.

Appendix G

Hollow-bearing Trees

Photograph 7-1 HBT 1 (north-west) to be retained



Photograph 7-2 HBT 2 (North-east) to be retained



Photograph 7-3 HBT 3 & 4 (south-west) to be removed

