48 Burton Road, Mount Hutton

Flora and Fauna Assessment

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Report Number: 25461
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Prepared for:

ELEEBANA SHORES RETIREMENT LIVING

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Document Status

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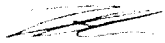
Draft	Draft for Client Review (modification of Proposal)	LW	ZA	30.10.2013
Final	Final for Client Review	LW	ZA	31.10.2013

Approval for Issue

Name	Signature	Date
Ziggy Andersons		31-10-2013

Summary

RPS Australia East Pty Ltd (RPS) was engaged by EJE Architecture in May 2010 on behalf of Eleebana Shores Retirement Living, to prepare a Flora and Fauna Assessment for a residential development (the Proposal) at 48 Burton Road, Mount Hutton (the study area), in the Lake Macquarie Local Government Area. At the time of assessment, the Proposal involved the development of a retirement village comprising of approximately 76 units and associated infrastructure, including internal roads and utilities.

A modification to the Proposal was made in August 2013. The Proposal now involves the development of 104 dwellings, comprising a mixture of one-storey villas and two-storey apartments. The Proposal also includes a recreation centre and swimming pool, a "pocket park" and other landscaped areas, and associated infrastructure including internal roads, driveways and utilities.

This Flora and Fauna Assessment has been prepared in accordance with the Lake Macquarie City Council (LMCC) *Flora and Fauna Survey Guidelines* (2012), and aims to determine potential impacts on biodiversity that may result from the Proposal. Database searches were undertaken to identify existing records of threatened species, populations and endangered ecological communities occurring within the study area and the surrounding locality. Flora and fauna surveys were undertaken across the study area in April 2010 and more recently in October 2013.

A total of 102 vascular plant species were recorded in the study area, comprising 56 native species and 47 exotic species. A list of plant species recorded in the study area is provided in Appendix 1. No threatened flora species listed under the TSC Act or the EPBC Act were detected within the study area. No ROTAP listed flora species were detected within the study area during flora surveys. Three noxious weeds and two Weeds of National Significance occur in the study area.

Three vegetation communities were identified within the study area: Landscaped Gardens, Exotic Grassland with Scattered Trees and Freshwater Creek. No Threatened Ecological Communities were identified in the study area.

A total of 37 terrestrial vertebrate fauna species were recorded during field surveys of the study area. 28 species of birds, five species of mammals and four species of amphibians were aurally and visually identified from the study area. One threatened species was identified from the study area: *Pteropus poliocephalus* (Grey-headed Flying-fox). One species listed as a Migratory species were identified from the study area: *Ardea ibis* (Cattle Egret).

Potential impacts that may arise as a result of unmitigated activities associated with the construction of the Proposal include:

- Loss of native vegetation, including Endangered Ecological Communities and threatened flora species.
- Loss of fauna habitat including that of threatened and migratory species.
- Habitat fragmentation/ loss of fauna habitat connectivity.
- Alteration and degradation of aquatic habitats.

Impacts on the identified ecological values should be avoided as far as practicable. Where impacts cannot be avoided, a range of mitigation measures have been recommended to ameliorate impacts on the biodiversity values during and following construction. Assessments of Significance have been prepared for the threatened flora and fauna species known or likely to be impacted by the Proposal. These assessments concluded no threatened flora of fauna species would be significantly impacted by the Proposal. These threatened species and communities do not require further consideration.

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1.0 Introduction

RPS Australia East Pty Ltd (RPS) was engaged by EJE Architecture in May 2010, to prepare a Flora and Fauna Assessment for a residential development (the Proposal) at 48 Burton Road, Mount Hutton (the study area), in the Lake Macquarie Local Government Area. At the time of assessment, the Proposal involved the development of a retirement village comprising of approximately 76 units and associated infrastructure, including internal roads and utilities.

A modification to the Proposal was made in August 2013. In accordance with Section 3.11 of the Lake Macquarie City Council (LMCC) *Flora and Fauna Survey Guidelines* (2012), the Flora and Fauna Assessment prepared in May 2010 is no longer valid, as more than 12 months have lapsed since the Assessment was published.

Subsequently, a flora and fauna survey was required, to assess the potential occurrence of any threatened species, population and ecological communities that have been listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Fisheries Management Act 1994* (FM Act) or *Threatened Species Conservation Act 1995* (TSC Act), since the preparation of the previous assessment. The study area was assessed with reference to the modified Proposal.

1.1 Proposal Description

The Proposal now involves the development of 104 dwellings, comprising a mixture of one-storey villas and two-storey apartments. The Proposal also includes a recreation centre and swimming pool, a "pocket park" and other landscaped areas, and associated infrastructure including internal roads, driveways and utilities. The eastern portion of the study area will remain undeveloped, primarily due to development restrictions in "waterfront land". An unnamed creek transects the study area, and waterfront land is defined as land within 40 metres of this creek. Existing vegetation in this area will be retained, which includes several large eucalypts. In total, the development footprint covers 4.04 hectares and 0.86 hectares of vegetation in the eastern portion of the study area is to be retained.

1.2 Study Area

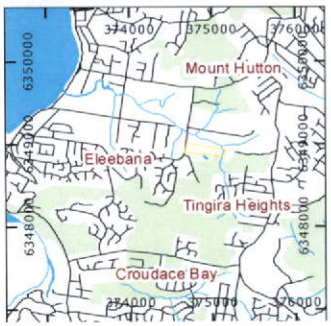
The study area comprises Lot 11 and 12 DP 830292, located at 48 Burton Road, Mount Hutton, within the Lake Macquarie City Council (Figure 1). The study area covers 4.96 hectares and is bound by Ducks Crossing Restaurant to the south, Burton Road to the east and semi-rural residential dwellings to the north and west. The study area currently supports a residential dwelling, horse yards and horse training facilities. Topography of the study area is generally flat. An unnamed drainage line transects the eastern portion of the study area and flows from south to north.

1.3 Purpose and Scope

This Flora and Fauna Assessment has been prepared in accordance with the Lake Macquarie City Council (LMCC) *Flora and Fauna Survey Guidelines* (2012), and aims to determine potential impacts on biodiversity that may result from the Proposal. The key objectives of this Flora and Fauna Assessment are:

- Identify and describe the flora and fauna species, habitat, populations and ecological communities within the study area that occur or are considered likely to occur in the study area;
- Identify and describe the flora and fauna species, habitat, populations and ecological communities in the study area listed under *Threatened Species Conservation Act 1995* (TSC Act), *Fisheries Management Act 1994* (FM Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that occur or are considered likely to occur within the study area.

- Assess impacts of the Proposal on species, ecological communities and populations listed under the TSC Act, FM Act and/or EPBC Act area that occur or are considered likely to occur in the study area.
- Describe measures to be implemented to avoid, minimise, manage or mitigate the impacts of the Proposal.



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DATA SOURCES
RPS
EJE Architects

Tracking ID: 103239-1-A Compiled: 31 October 2013

Study Area

Drainage line

RPS

FIGURE 1

Study Area Location

1.4 Legislation and Policy

1.4.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as matters of National Environmental Significance. Matters of NES identified in the Act include:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (listed under the Ramsar Convention).
- Threatened species and communities.
- Migratory species protected under international agreements.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mines).

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of NES require approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities (the Minister).

1.4.2 NSW Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act 1995* (TSC Act) provides for the protection and management of threatened species, populations and ecological communities listed under the schedules 1, 1A and 2 of the Act. The purpose of the TSC Act is to:

- Conserve biological diversity and promote ecologically sustainable development.
- Prevent the extinction and promote the recovery of threatened species, populations and ecological communities.
- Protect the critical habitat of those species, populations and ecological communities that are endangered.
- Eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities.
- Ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed.
- Encourage the conservation of threatened species, populations and ecological communities through co-operative management.

1.4.3 NSW Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) provides for the identification, conservation and recovery of threatened fish, aquatic invertebrates and marine vegetation. The Act also covers the identification and management of key threatening processes which affect threatened species or could cause other species to become threatened.

If a planned development or activity is likely to have any impact on a threatened species listed under the FM Act, an Assessment of Significance must be undertaken. If the impacts are likely to be significant, or if critical habitat is affected, a species impact statement must be prepared

1.4.4 Native Vegetation Act 2003

A site inspection was undertaken with Tony Voller (Catchment Management Authority), on the 15 April 2010 to discuss the removal of native vegetation within the site. Another site meeting occurred with David Russell (Catchment Management Authority) and he has provided advice on information required to undertake their assessment and also provided a preliminary assessment for the proposal.

1.4.5 Water Management Act 2000

Controlled activities in, on or under waterfront land are regulated under the *Water Management Act 2000* (WM Act 2000). The NSW Office of Water (NSWOW) is responsible for assessing the impact of controlled activities and is required to give approval for activities within and adjacent to watercourses.

No development is proposed within waterfront land, defined as land within 40 metres of a watercourse. As a result, the Proposal does not require approval under the WM Act 2000. In accordance with Clause 39 of the *Water Management (General) Regulation 2011,* the proponent is exempt from section 91E (1) of the WM Act in relation to controlled activities that are carried out in, on or under waterfront land, that are specified in Part 2 of Schedule 5.

1.5 Qualifications and Licensing

1.5.1 Qualifications

This report was written by Laura Worthington BSc (Hons.), and reviewed by Ziggy Andersons BSc of RPS Australia Pty Ltd.

1.6 Licensing

- Research was conducted under the following licences:
- NSW National Parks and Wildlife Service Scientific Investigation Licence S10300 (Valid 31 December 2013);
- Animal Research Authority (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2014);
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2014); and
- Certificate of Accreditation of a Corporation as an Animal Research Establishment (Trim File No: 01/1522 & Ref No: AW2001/014) issued by NSW Agriculture (Valid 22 May 2014).

2.0 Methodology

2.1 Desktop Research

2.1.1 Database Searches

Three database searches were undertaken to identify State and Commonwealth records of threatened entities and Commonwealth matters of national environmental significance (NES). Databases interrogated for this purpose were:

- The NSW Bionet Wildlife Atlas which is managed by the NSW Office of Environment and Heritage (OEH). A coordinate search using the centre point of the study area (-32.99083 151.66111) was undertaken to determine threatened species records listed under the *Threatened Species Conservation Act 1995* (TSC Act) to within 10 kilometres of the study area.
- The Protected Matters Search Tool which is managed by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). A coordinate search using the centre point of the study area (-32.99083 151.66111) was undertaken to determine Matters of National Environmental Significance listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to within 10 kilometres of the study area.
- The Department of Primary Industries Records Viewer which is managed by the NSW Department of Industry and Investment. A search of the Hunter/Central Rivers Catchment Management Authority (CMA) was undertaken to determine threatened fish species records listed under the *Threatened Species Conservation Act 1995* (TSC Act) to within 10 kilometres of the study area, due to the presence of a creek in the study area.

2.1.2 Literature Review

A review of relevant information was undertaken to provide an understanding of ecological values occurring or potentially occurring in the study area and wider region. Reports, vegetation maps, topographic maps, aerial photography and literature reviewed included, but were not limited to, the following:

- Aerial Photograph Interpretation (API) to determine the broad categorisation of vegetation within the study area;
- Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) – Vegetation Survey, Classification and Mapping (NPWS 2000, House 2003);
- Hunter Bird Observers Club (HBOC) records
- Birdata (web version of Birds Australia's New Atlas of Australian Birds)
- A review of GIS data including topographic maps, SEPP 14 Wetland Mapping, Soil Landscapes and Acid Sulphate Soil Potential.

2.2 Field Surveys

A brief site inspection of study area was conducted by RPS on 15th April 2013. A flora and fauna survey involving diurnal and nocturnal techniques was undertaken on 19th April 2010. A tree survey was also undertaken on this date across the study area, during which every tree was identified to species and the following attributes were recorded: canopy spread, tree height, Diameter at Breast Height (DBH), whether the tree contained hollows or if it was dead or alive.

Following modifications to the Proposal in August 2013, an additional flora and fauna survey was undertaken on 14 October 2013, involving diurnal and nocturnal survey techniques.

Weather conditions at the time of surveys are detailed in Table 1 (BOM 2013). The weather records were recorded from the Cooranbong (Lake Macquarie AWS) weather station (station 061412) for the surveyed dates.

Table 1 Weather conditions during field surveys

Attribute	19 April 2010	15 October 2013
Temperature	19 °C	18.5
Wind	SE 19km/h	SE 11km/h
Cloud	25%	44%
Rain (24 hrs to 9:00am)	0mm	11.5mm
Sun Rise	06:17	05:14
Sun Set	17:27	18:05

2.2.2 Flora

In accordance with the LMCC Flora and Fauna Survey Guidelines (2010) for highly disturbed sites, the following flora survey techniques were undertaken across the study area.

The entire study area was traversed on foot and all species observed were recorded. Notes were made on the structure and condition of the vegetation in, and adjoining, the study area. Targeted searches for threatened plant species with potential habitat within the study area were undertaken during the random meanders.

During the terrestrial flora survey the vegetation condition was assessed and rated according to the degree to which it resembled relatively natural, undisturbed vegetation. The condition assessment was based on visual assessment of the current habitat condition for each of the vegetation communities within the study area. Features examined to determine condition included: native species richness, native cover in each stratum, exotic cover, litter and bare ground cover, number of trees with hollows, woody debris, regeneration, diameter at breast height, canopy recruitment and tree health.

2.2.3 Fauna

In accordance with the LMCC Flora and Fauna Survey Guidelines (2010), for highly disturbed sites less than five hectares in size, the following fauna survey techniques were undertaken across the study area.

The entire study area was traversed on foot and all species and evidence of fauna presence observed was recorded. An inventory of fauna species recorded in the study area was compiled. Diurnal field surveys involved:

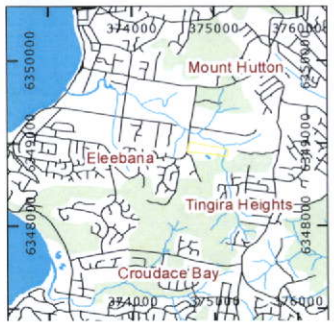
- Direct visual observations of animal activity.

- Aural recognition of bird calls during a diurnal bird census.
- Aural recognition of frog calls.
- Targeted amphibian and reptile searches were conducted in suitable habitat, involving raking leaf litter and turning logs, rocks and other debris.
- Searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, skeletal material of vertebrate fauna, scratches and diggings, whitewash, regurgitation pellets and prey remains from owls, chewed fruit or seed remains indicative of past feeding by frugivorous or other birds such as Fruit-Doves and Cockatoos).

Nocturnal surveys (Figure 2) involved:

- Spotlighting along foot traverses for direct visual observations of nocturnal animal activity.
- Call-playback for aural recognition of threatened owls and frogs within the study area. Upon arrival, listening for vocalisations for 10 minutes was undertaken. Calls were played intermittently for 15 minutes, followed by another listening period of 10 minutes.
- Targeted searches for frogs, involving searching microhabitats, including turning logs and rocks and searching fringing vegetation of the drainage line.
- Stationary placement of ultrasonic bat call detection devices (Anabat).

Detailed fauna survey techniques such as trapping, hair tubes and harp trapping were not undertaken within the study area due to the absence of habitat for species targeted by these techniques.



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DATA SOURCES
RPS
Lower Hunter and Central Coast Regional vegetation survey VIS_ID 2225

TrackingID: 103236-1-A Compiled: 31 October 2013

Study Area

Drainage line

Fauna survey methodology

- Anabat
- Call-playback (frogs)
- Call-playback (owls and arboreal mammals)
- Spotlight Transect

RPS

FIGURE 2

Field Survey Methodology

2.2.3.2 Habitat Assessment

An assessment of the relative habitat value present in the study area was undertaken. This assessment focused primarily on the identification of specific habitat types and resources in the study area favoured by known threatened species from the region. The assessment also considered the potential value of the study area (and surrounds) for all major guilds of native flora and fauna.

Habitat assessment was based on the specific habitat requirements of each threatened fauna species in regards to home range, feeding, roosting, breeding, movement patterns and corridor requirements. Consideration was given to contributing factors including topography, soil, light and hydrology for threatened flora and assemblages.

2.3 Likelihood of Occurrence of Threatened Species Criteria

The database searches identified threatened flora and fauna species that have been recorded or that are likely to occur within 10 kilometres of the study area. The probability that each threatened species occurs within the study area was determined as being either Unlikely, Possible, Likely or Known, based on the criteria in Table 2.

Table 2 Likelihood of occurrence criteria for threatened species

Likelihood of occurrence	Criteria - one or more of the following conditions applies
Unlikely	The species has not been recorded previously in the study area or nearby, and is beyond the current known geographic range. The species has specific habitat requirements that are not present in the study area. The species is considered extinct.
Possible	The species has historically been recorded in the study area (>20 years ago) The species has specific habitat requirements that are present in the study area, but in a poor or modified condition. The species is unlikely to maintain a resident population in the study area, however may occasionally utilise resources within the study area.
Likely	The species has recently been recorded in the study area (ie within last 20 years). The species has specific habitat requirements that are present in the study area and are in good condition. The species is known or likely to maintain resident populations in proximity to the study area. The species is known or likely to regularly utilise resources in the study area.
Known	The species was recorded in the study area during the current survey.

2.4 Limitations

The flora and fauna surveys for this assessment were carried out over two days and one night in autumn 2010 and one day and night in spring 2013. This assessment is based on the condition of the study area at the time of field investigation and the information provided by Eleebana Shores Retirement Living on the nature of the proposal at the date of publication of this document.

The brevity and seasonal timing of the field investigation means that the full spectrum of flora and fauna species likely to occur on the study area may not be fully quantified or described in this report. Some plant species that occur in the local area, such as cryptic species, are annuals and are present only in the seed bank for much of the year. Other plant species are perennial but are inconspicuous or difficult to identify unless flowering.

Similarly, some fauna species that have been recorded in the local area occur on a seasonal or migratory basis, and may be absent from the locality for much for the year. Fauna behaviours may have also affected detectability; species that are easily disturbed or cryptic may not have been detected during surveys. It is possible that a number of flora and fauna species occurring in the study area were not detected during the current survey due to the above factors.

These potential limitations have been addressed by a thorough literature research and review and through identifying potential habitats for flora and fauna species and assessing the potential for targeted species to occur on the study area based on previous records, the type and condition of habitats present, the land use throughout the study area and surrounds, and the landscape context. The precautionary principle was applied where marginal habitat was identified or predicted to occur or where species are migratory or nomadic and were therefore likely to utilise habitat components at some stage during their life cycle.

3.0 Results

3.1 Flora

3.1.1 Desktop Research

3.1.1.1 Database Searches

Based on database search results, 26 plant species listed under the EPBC and/or TSC Act are either known or have the potential to occur within 10 kilometres of the study area (Table 3).

Table 3 Threatened flora occurring within 10 kilometres of the study area

Scientific name	Common name	EPBC Act status	TSC Act status
Acacia bynoeana	Bynoe's Wattle	Endangered	Vulnerable
Angophora inopina	Charmhaven Apple	Vulnerable	Vulnerable
Asterolasia elegans	-	Endangered	-
Callistemon linearifolius	Netted Bottle Brush	-	Vulnerable
Chamaesyce psammogeton	Sand Spurge	-	Endangered
Corybas dowlingii	Red Helmet Orchid	-	Endangered
Cryptostylis hunteriana	Leafless Tongue-orchid	Vulnerable	-
Cynanchum elegans	White-flowered Wax Plant	Endangered	Endangered
Diuris praecox	Rough Doubletail	Vulnerable	Vulnerable
Epacris purpurascens var. purpurascens	-	-	Vulnerable
Eucalyptus camfieldii	Camfield's Stringybark	Vulnerable	Vulnerable
Genoplesium insignis	Variable Midge Orchid	-	Endangered
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Vulnerable	Vulnerable
Grevillea shiressii	-	Vulnerable	Vulnerable
Maundia triglochinoides	-	-	Vulnerable
Melaleuca biconvexa	Biconvex Paperbark	Vulnerable	Vulnerable
Muehlenbeckia costata	Scrambling Lignum	-	Vulnerable
Pterostylis gibbosa	Illawarra Greenhood	Endangered	-
Pultenaea maritima	Coast Headland Pea	-	Vulnerable
Rutidosis heterogama	Heath Wrinklewort	Vulnerable	Vulnerable
Senecio spathulatus	Coast Groundsel	-	Endangered
Streblus pendulinus	Siah's Backbone	Endangered	-

Scientific name	Common name	EPBC Act status	TSC Act status
Syzygium paniculatum	Magenta Lilly Pilly	Vulnerable	Endangered
Tetratheca glandulosa	-	Vulnerable	Vulnerable
Tetratheca juncea	Black-eyed Susan	Vulnerable	Vulnerable
Zannichellia palustris	-	-	Endangered

Based on database search results, one threatened population listed under the EPBC and/or TSC Acts is either known or have the potential to occur within 10 kilometres of the study area (Table 4).

Table 4 Threatened populations occurring within 10 kilometres of the study area

Threatened Population	Status under EPBC Act	Status under TSC Act
Eucalyptus parramattensis C. Hall. subsp. *parramattensis* in Wyong and Lake Macquarie local government areas		Endangered Population

Based on database search results, one Threatened Ecological Community (TEC) listed under the EPBC and/or TSC Acts are either known or have the potential to occur within 10 kilometres of the study area (Table 5).

Table 5 Threatened Ecological Communities occurring within 10 kilometres of the study area

Ecological Community	Status under EPBC Act	Status under TSC Act
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	

3.1.1.2 LHCCREMS Vegetation Community Mapping

LHCCREMS vegetation mapping (House 2003) identifies two vegetation communities within the study area (Figure 3). The mapping of the vegetation communities produced by LHCCREMS (House 2003) relied on aerial photograph interpretation and very limited ground truthing. It is recognised that this mapping methodology is sometimes limited in accuracy, particularly in its application to smaller areas on a site-specific basis.

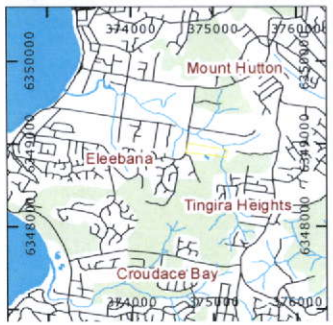
Map Unit 11 Coastal Sheltered Apple – Peppermint Forest

Coastal Sheltered Apple – Peppermint Forest is mapped across much of the eastern portion of the study area, in association with the drainage line and adjoining areas. Canopy cover is variously classified as "Sparse" (Woodland) which ranges between 20 and <50% canopy cover, and "Mid-Dense (Open Forest) which ranges between 50 <100% canopy cover. This community typically comprises *Eucalyptus piperita, Angophora costata, Allocasuarina torulosa, Acacia longifolia, Dodonaea triquetra, Callicoma serratifolia, Zieria smithii, Acacia myrtifolia, Pultenaea villosa* and *Ceratopetalum gummiferum*. This community tends to dominate in shallow drainage lines in small catchments around northern and central Lake Macquarie. *E. piperita* as a dominant is diagnostic species (Bell and Driscoll 2013).

Map Unit 30 Coastal Plains Smooth-barked Apple Woodland

Coastal Plains Smooth-barked Apple Woodland is mapped as occurring across a small area of the south-eastern corner of the study area. Canopy cover is classified as Sparse (Woodland), and ranges between 20 and <50% canopy cover. This community is known to comprise *Angophora costata, Eucalyptus umbra,*

Corymbia gummifera, Eucalyptus capitellata, Allocasuarina littoralis, Banksia spinulosa, Acacia myrtifolia, Leptospermum polygalifolium, Lambertia Formosa, Dillwynia retorta, Themeda australis, s Entolasia stricta, Pteridium esculentum, Lomandra oblique, Phyllanthus hirtellus, Imperata cylindrical, Lepidosperma laterale and *Eucalyptus piperita.* This community is widespread in the northern and central parts of Lake Macquarie. Lack of Scribbly Gum is diagnostic, although *E. haemastoma* does occur sparingly in some areas. *E. umbra* can dominate in some areas, and this may form a distinct variant (Bell and Driscoll 2013).



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DATA SOURCES
RPS
EJE Architects

TrackingID: 103239-1-A Compiled: 31 October 2013

Study Area

Drainage line

LCCREMS Vegetation Communities

Coastal Plains Smooth-barked Apple Woodland

Coastal Sheltered Apple - Peppermint Forest

RPS

FIGURE 3

Lower Hunter REMS VISmap225

3.1.2 Field Survey

3.1.2.1 Flora Species

A total of 102 vascular plant species were recorded in the study area, comprising 56 native species and 47 exotic species. A list of plant species recorded in the study area is provided in Appendix 1. No threatened flora species listed under the TSC Act or the EPBC Act were detected within the study area. No ROTAP listed flora species were detected within the study area during flora surveys. The probability for each locally occurring threatened species is outlined in section 3.1.2.4.

3.1.2.2 Tree Survey

A total of 269 trees were identified during the tree survey. The results of the tree survey, in which attributes for each tree occurring within the study area were recorded (including species, canopy spread, height) are outlined in Appendix 2.

3.1.2.3 Noxious Weeds

The *Noxious Weeds Act* 1993 imposes obligations on occupiers of land to control noxious weeds declared for their area. The control requirements for the classes of noxious weeds recorded in the study area are presented in Table 6.

Table 6 Weed control classes and requirements

Control Class	Weed type	Control requirements
Class 1	Plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 2	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 3	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.	The plant must be fully and continuously suppressed and destroyed.
Class 4	Plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.
Class 5	Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.	There are no requirements to control existing plants of Class 5 weeds. However, the weeds are "notifiable" and a range of restrictions on their sale and movement exists.

Three exotic species recorded in the study area are listed as noxious weeds in the Lake Macquarie local government area (Table 7). Two of the noxious weeds are also listed as Weeds of National Significance under the National Weeds Strategy (DPI 2013).

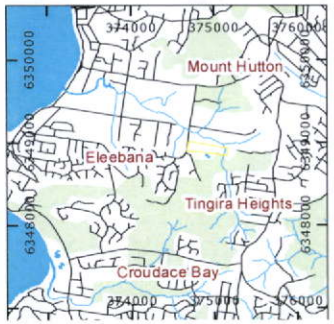
Table 7 Noxious weeds recorded in the study area

Scientific name	Common name	Noxious weed control class	Weed of National Significance	Location in study area
Lantana camara	Lantana	4	Yes	Freshwater Creek
Sagittaria platyphylla	Sagittaria	5	Yes	Freshwater Creek
Ageratina adenophora	Crofton Weed	4	No	Freshwater Creek

3.1.2.4 Vegetation Communities

The study area supports highly modified native vegetation. Ground-truthing of LHCCREMS mapping has determined that vegetation of the study area is not consistent with either Map Unit 11 Coastal Sheltered Apple – Peppermint Forest or Map Unit 30 Coastal Plains Smooth-barked Apple Woodland. Throughout the study area, the groundlayer consists almost entirely of exotic grasses, while the understorey has been almost entirely cleared. Native vegetation persists as scattered shrubs and canopy trees.

Three broad vegetation communities were identified as occurring within the study area; Landscaped Gardens, Exotic Grassland with Scattered Trees, and Freshwater Creek (Figure 4). No Threatened Ecological Communities were identified from the study area.



N
W E
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0 25 50 100
Meters

APPROX SCALE 1:1,800 @ A4

GDA 1994 MGA Zone 54

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

DATA SOURCES
RPS
EJE Architects

TrackingID: 103239-1-A Compiled: 22 October 2013

- Study Area
- Landscaped Gardens
- Exotic Grassland with Scattered Trees
- Freshwater Creek
- Dam

RPS

FIGURE 4

Vegetation Communities

Landscaped Gardens

Landscaped Gardens consist of maintained lawns that surround existing residential dwellings, with a scattered native and exotic trees and garden beds containing predominantly exotic horticultural plantings.

Plate 1 Landscaped Gardens

Canopy: To 15 metres with 5-15% PFC (per cent foliage cover). Commonly occurring canopy trees include , *Eucalyptus umbra* (Broad-leaved White Mahogany), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus capitellata* (Brown Stringybark), *Angophora costata* (Smooth-barked Apple), *Allocasuarina torulosa* (Forest Oak), *Cupressus sp.* (Cypress), *Archontophoenix cunninghamiana* (Bangalow Palm), *Liquidambar styraciflua* (Sweet Gum), *Grevillea robusta* (Silky Oak), *Melia azedarach var. australasica* (White Cedar) and *Allocasuarina littoralis* (Black She-oak).

Understorey: To 4 metres with 10% PFC. Scattered shrubs include *Callistemon salignus* (Willow Bottlebrush), *Acacia longifolia var. longifolia* (Sydney Golden Wattle) and various exotic horticultural planting such as *Camellia* sp. (Camellia) and *Strelitzia reginae* (Bird of Paradise).

Groundlayer: To 0.5-0.7 meters with 20-30% PFC. The groundlayer is dominated by exotic grasses and herbs, including *Pennisetum clandestinum* (Kikuyu), *Cynodon dactylon* (Common Couch), *Paspalum dilatatum* (Paspalum). Horticultural plantings of the groundlayer include *Agapanthus praecox* (Agapanthus) and *Impatiens walleriana* (Busy Lizzie).

Classification: Due to the high levels of disturbance and modification of the vegetation this vegetation community is not consistent with any vegetation community mapped and described by LHCCREMS vegetation mapping (House 2003).

Exotic Grassland with Scattered Trees

This vegetation community consists of large areas of grazed grassland dominated by exotic grasses such as *Pennisetum clandestinum* (Kikuyu), *Paspalum dilatatum* (Paspalum), *Chloris gayana* (Rhodes Grass) and *Cynodon dactylon* (Common Couch). Canopy trees and scattered and commonly occurring species include *Eucalyptus punctata* (Grey Gum), *Eucalyptus umbra* (Broad-leaved White Mahogany) and *Corymbia gummifera* (Red Bloodwood). Shrubs are generally absent. This community covers much of the study area and is currently heavily grazed by horses.

Plate 2 Exotic Grasslands with Scattered Trees

Canopy: To 10-22 metres with 3 to 10% PFC. Canopy species include *Eucalyptus umbra* (Broad-leaved White Mahogany), *Eucalyptus punctata* (Grey Gum), *Eucalyptus piperita* (Sydney Peppermint) and *Corymbia gummifera* (Red Bloodwood).

Understorey: Absent.

Groundlayer: To 0.2 metres with variable 70 to 95% PFC. The groundlayer is dominated by *Pennisetum clandestinum* (Kikuyu), with *Cynodon dactylon* (Common Couch), *Hypochaeris radicata* (Flatweed), *Trifolium repens* (White Clover), *Euchiton involucratus* (Star Cudweed), *Taraxacum officinale* (Dandelion), *Anagallis arvensis* (Scarlet Pimpernel) and *Cerastium glomeratum* (Mouse-ear Chickweed) also commonly occurring.

Classification: Due to the high levels of disturbance and modification of the vegetation this vegetation community is not consistent with any vegetation community mapped and described by LHCCREMS vegetation mapping (House 2003).

Freshwater Creek

Vegetation associated with the freshwater creek that flows through the eastern portion of the study area includes aquatic vegetation and fringing grasses, herbs and shrubs. Riparian vegetation has been almost entirely cleared, with Exotic Grassland with Scattered Trees adjoining the tops of the creek bank.

Plate 3 Freshwater Creek

Canopy: To 7m with 5% PFC. Canopy trees include sparse occurrences of *Glochidion ferdinandi* (Cheese Tree) and *Melaleuca linariifolia* (Snow in Summer).

Understorey: To 3m with 5% PFC. Scattered shrubs include *Lantana camara* (Lantana) *Acacia longifolia* (Sydney Golden Wattle), *Ligustrum sinense* (Small-leaved Privet) and *Phytolacca octandra* (Inkweed).

Groundlayer: To 1.5m with variable 70 to 95% PFC. Commonly occurring species include *Persicaria lapathifolia* (Pale Knotweed), *Ipomoea cairica* (Blue Morning Glory), *Oplismenus aemulus* (Basket Grass), *Bidens pilosa* (Cobblers Pegs), *Entolasia marginata* (Bordered Panic), *Calochlaena dubia* (False Bracken) and *Ageratina adenophorum (*Crofton Weed). Aquatic species within the creek itself include *Damasonium minus* (Starfruit) and *Sagittaria platyphylla* (Sagittaria).

Classification: Due to the high levels of disturbance and modification of the vegetation this vegetation community is not consistent with any vegetation community mapped and described by LHCCREMS vegetation mapping (House 2003).

3.1.2.5 Probability of occurrence of threatened flora species

The probability of each of the locally recorded threatened flora species to occur within the study area was assessed using knowledge of each species' habitat and lifecycle requirements with regard to the habitat present within the study area (Table 8). Species were assessed as being either Unlikely, Possible, Likely or Known to occur in the study area. The location and number of nearby, recent records were also considered in determining probability of occurrence.

Table 8 Probability of threatened flora species identified from the locality to occur in the study area

Scientific name	Common Name	Habitat preference/ known distribution	Probability of occurrence in the study area
Acacia bynoeana	Bynoe's Wattle	Small, prostrate shrub found in low heath and open woodland, generally on loamy clays and sand. Occurs from the Lower Hunter south to Southern Highlands. Locally this species has been recorded within five discrete portions of land scattered around the foreshores of Lake Macquarie, within the Lake Macquarie State Recreation Area (SRA). Recorded habitat within the Lake Macquarie SRA is Coastal Plains Scribbly Gum Woodland, characterised by an open canopy of *Eucalyptus haemastoma, Angophora inopina, Eucalyptus capitellata* and *Corymbia gummifera*.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Angophora inopina	Charmhaven Apple	Small to medium tree found in shallow sandy soils in open woodland, swamp woodland and wet heath. The main occurrences of this species are in the Wyong and Lake Macquarie LGA's (from Charmhaven to Wyee and Morisset, and north to near Toronto), with disjunct populations also in Port Stephens LGA (south of Karuah).	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Asterolasia elegans		A tall, thin shrub to 3 m high. Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Known from only seven populations. Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest, on Hawkesbury sandstone.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Callistemon linearifolius	Netted Bottle Brush	Shrub that grows in dry sclerophyll forest on the coast and adjacent ranges. Re-sprouting / juvenile specimens difficult to distinguish from other Callistemon species such as *C. rigidus* (Red Bottlebrush) or *C. linearis* (Narrow-leaved Bottlebrush) without the aid of flowering parts. Little habitat information is available on this species generally but in the Hunter Valley this species has been recorded where dry forest habitats interface with salt tolerant vegetation communities, such as Swamp Oak Rushland Forest and Riparian Melaleuca forest. Significant populations were recently found within Werakata National Park around the Cessnock area and	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species. This species is unlikely to be impacted by the Proposal. An

Scientific name	Common Name	Habitat preference/ known distribution	Probability of occurrence in the study area
		surrounding properties.	Assessment of Significance is not required for this species.
Chamaesyce psammogeton	Sand Spurge	Herb that forms mats to 1 m across. Distribution is along the coast from south of Jervis Bay (at Currarong, Culburra and Seven Mile Beach National Park) to Queensland (and Lord Howe Island). Grows on fore-dunes, pebbly strandlines and exposed headlands, often with Spinifex (*Spinifex sericeus*) and Prickly Couch (*Zoysia macrantha*)	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Cryptostylis hunteriana	Leafless Tongue-orchid	A very rare leafless, saprophytic orchid, which has a symbiotic relationship with a mycorrhizal fungi which provides the plant with all its nutrient requirements. This orchid remains underground for the majority of its lifecycle, flowering periodically, when conditions are optimal to reproduce. This species is extremely cryptic as it does not flower every year. This species is known to occur within a range of habitats including woodlands to swamp heaths. Within the Hunter region, larger populations have been typically found in woodland dominated by *Eucalyptus racemosa* (Scribbly gum), and prefers areas with an open grassy understorey. The species typically prefers moist sandy soils in sparse to dense heath and sedgeland, or moist to dry clay loams in coastal forests.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Cynanchum elegans	White-flowered Wax Plant	Occurs scattered along the NSW Northern Coast to Wollongong usually in dry, littoral or subtropical rainforest and occasional scrub or woodland, can occur across a wide range of habitats. Flowers between August to May peaking early summer, flowers numbers can vary from plant to plant from sparse to abundant. The species response to fire is unknown.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Diuris praecox	Rough Doubletail	Found predominantly in coastal Eucalypt forests on hilltops or slopes which usually have a grassy to fairly dense understorey. This species has been recorded at a number of dry woodland locations to the south east of Lake Macquarie.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is

Scientific name	Common Name	Habitat preference/ known distribution	Probability of occurrence in the study area
			not required for this species.
Epacris purpurascens var. purpurascens		An erect shrub, 50-150 cm high, that grows in sclerophyll forest, scrubs and swamps, influence by strong shale soils. Killed by fire and regenerates from soil stored seed. Found in the Gosford and Sydney districts.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Eucalyptus camfieldii	Camfield's Stringybark	Tree or mallee to 10m high, but often less. Rare and localised, in coastal shrub heath on sandy soils on sandstone, often restricted drainage, often on sandy ridges. Also found on in low open woodland of the slightly more fertile inland areas. Commonly found associated species are *Eucalyptus oblonga* (Narrow-leaved Stringybark), *E. capitellata* (Brown Stringybark) and *E. haemastoma* (Scribbly Gum).	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Genoplesium insignis	Variable Midge Orchid	Recorded from four localities between Chain Valley Bay and Wyong in Wyong local government area. Grows in patches of *Themeda australis* (Kangaroo Grass) amongst shrubs and sedges in heathland and forest. Associated vegetation at Chain Valley Bay is described as dry sclerophyll woodland dominated by *Eucalyptus haemastoma* (Scribbly Gum), *Corymbia gummifera* (Red Bloodwood), *Angophora costata* (Smooth-barked Apple) and *Allocasuarina littoralis* (Black She-oak). Fewer than twenty plants are recorded from three localities, while the number of plants present at the fourth locality (Chain Valley Bay) is not recorded. Flowering period is September to October.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Occurs in light, sandy or clayey soils in woodlands over shales. Can occur from heath to shrubby woodland. Occurs from low lying flats to upper slopes and ridge crests. Has been recorded from along side track and open slightly disturbed sites. Most plants appear capable of suckering from a rootstock. Much confusion surrounds the taxonomy of this species and other similar Grevillea taxa (S. Bell pers. comm.), and a NPWS-funded study of the species is currently in progress.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.

Scientific name	Common Name	Habitat preference/ known distribution	Probability of occurrence in the study area
Grevillea shiressii		A tall shrub to 2 - 5 m high. Known from two populations near Gosford, on tributaries of the lower Hawkesbury River north of Sydney. Grows along creek banks in wet sclerophyll forest with a moist understorey in alluvial sandy or loamy soils.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Maundia triglochinoides		Perennial freshwater plant to 80 cm high. Grows semi-submerged in swamps, creeks or shallow freshwater 30–60 cm deep on heavy clay, low nutrients. Associated with wetland species *Triglochin procera*.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Melaleuca biconvexa	Biconvex Paperbark	A shrub to small tree, which grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered areas from Jervis Bay to Port Macquarie. Re-sprouts after fire.	Possible. This species has been recorded within a 10 km radius of the study area and the vegetation adjacent to the study area contains potential habitat. However despite targeted searches this species was not located within the study area. In accordance with the precautionary principle, an Assessment of Significance has been prepared for this species (Appendix 4).
Muehlenbeckia costata	Scrambling Lignum	A scrambler with decumbent stems, sporadically occurs after disturbance on North Coast, Northern and Central Tablelands. Mostly in rocky, higher-altitude sites following disturbance such as fire or clearing for powerlines. One record in SRA near Newcastle.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Pterostylis gibbosa	Illawarra Greenhood	Known from a small number of populations in the Hunter region	Unlikely. This species was not identified

Scientific name	Common Name	Habitat preference/ known distribution	Probability of occurrence in the study area
		(Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage.	within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Pultenaea maritima	Coast Headland Pea	A prostrate, mat forming shrub. Within NSW, the species has been recorded from Newcastle north to Byron Bay on 16 headlands. Occurs in grasslands, shrublands and heath on exposed coastal headlands.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Rutidosis heterogama	Heath Wrinklewort	Small asteraceous herb which grows in heath on sandy soils and moist areas in open forest. Has been recorded in disturbed areas along roadsides. Rediscovered in the Hunter Region growing in disturbed areas and adjacent parcels of bushland within the Cessnock LGA. In the Hunter Region prefers Spotted Gum/Ironbark Forest.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Senecio spathulatus	Coast Groundsel	Sprawling to prostrate perennial herb to 0.5 mm high, ± glabrous. *Senecio spathulatus* is a specialised coastal species occurring mostly on frontal dunes and forming low, broad clumps. It is characterised by short fleshy leaves, large fleshy flower heads and large fruit with a persistent pappus. Flowers most of the year.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Streblus pendulinus	Siah's Backbone	Tree or large shrub to 6m. Found in warmer rainforests including well developed rainforest, gallery forest and drier, more seasonal rainforest, chiefly along watercourses.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species.

Scientific name	Common Name	Habitat preference/ known distribution	Probability of occurrence in the study area
			This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Syzygium paniculatum	Magenta Lilly Pilly	A shrub to small tree, found in sub-tropical and littoral rainforest on sandy soils or sheltered gullies mostly near water courses. Distribution between Bulahdelah and Jervis Bay. Hunter Region records confined to the Lake Macquarie hinterland (DEC 2005).	Possible. This species has been recorded within a 10 km radius of the study area and the vegetation within the study area contains potential habitat. However, despite targeted searches this species was not located within the study area. In accordance with the precautionary principle, an Assessment of Significance has been prepared for this species (Appendix 4).
Tetratheca glandulosa	-	It is found in heath and woodland communities, with a range restricted to the North Shore of Sydney and an area north of the Hawkesbury River. *T. glandulosa* prefers well-drained soils in an open sunny position.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Tetratheca juncea	Black-eyed Susan	Occurs in a variety of forested and heathy habitats. Usually found in low open forest/woodland with a mixed understorey and grassy groundcover. Most commonly found on well drained sites and on ridges, although they have been found on upper slopes, mid slopes and occasionally in gullies.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Zannichellia palustris		An aquatic plant growing in slightly saline stationary or slowly flowing water. Recorded in Hexham Swamp and on Kooragang Island. NSW populations die back every summer.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.

3.2 Fauna

3.2.1 Desktop Research

3.2.1.1 Database Searches

Based on database search results, 68 fauna species (excluding pelagic and aerial marine species such as turtles, whales, saltwater fish, albatrosses and petrels) listed under the EPBC and/or TSC Act are either known or have the potential to occur within 10 kilometres of the study area (Table 9).

Table 9 Threatened fauna occurring within 10 kilometres of the study area

Scientific name	Common name	EPBC Act status	TSC Act status
Amphibians			
Crinia tinnula	Wallum Froglet		Vulnerable
Litoria aurea	Green and Golden Bell Frog	Vulnerable	
Litoria littlejohni	Littlejohn's Tree Frog	Vulnerable	
Mixophyes balbus	Stuttering Frog	Endangered	Vulnerable
Mixophyes iterates	Giant Barred Frog	Endangered	
Pseudophryne australis	Red-crowned Toadlet		Vulnerable
Birds			
Anseranas semipalmata	Magpie Goose		Vulnerable
Anthochaera phrygia	Regent Honeyeater	Endangered	Critically Endangered
Botaurus poiciloptilus	Australasian Bittern	Endangered	
Burhinus grallarius	Bush Stone-curlew		Endangered
Calidris ferruginea	Curlew Sandpiper		Endangered
Calidris tenuirostris	Great Knot		Vulnerable
Callocephalon fimbriatum	Gang-gang Cockatoo		Vulnerable
Calyptorhynchus lathami	Glossy Black-Cockatoo		Vulnerable
Charadrius leschenaultii	Greater Sand-plover		Vulnerable
Charadrius mongolus	Lesser Sand-plover		Vulnerable
Chthonicola sagittata	Speckled Warbler		Vulnerable
Circus assimilis	Spotted Harrier		Vulnerable
Daphoenositta chrysoptera	Varied Sittella		Vulnerable
Dasyornis brachypterus	Eastern Bristlebird	Endangered	
Ephippiorhynchus asiaticus	Black-necked Stork		Endangered
Epthianura albifrons	White-fronted Chat		Vulnerable

Scientific name	Common name	EPBC Act status	TSC Act status
Erythrotriorchis radiatus	Red Goshawk	Vulnerable	Vulnerable
Glossopsitta pusilla	Little Lorikeet		Vulnerable
Haematopus fuliginosus	Sooty Oystercatcher		Vulnerable
Haematopus longirostris	Pied Oystercatcher		Endangered
Hieraaetus morphnoides	Little Eagle		Vulnerable
Irediparra gallinacean	Comb-crested Jacana		Vulnerable
Ixobrychus flavicollis	Black Bittern		Vulnerable
Lathamus discolour	Swift Parrot	Endangered	Endangered
Limicola falcinellus	Broad-billed Sandpiper		Vulnerable
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)		Vulnerable
Neophema pulchella	Turquoise Parrot		Vulnerable
Ninox connivens	Barking Owl		Vulnerable
Ninox strenua	Powerful Owl		Vulnerable
Onychoprion fuscata	Sooty Tern		Vulnerable
Oxyura australis	Blue-billed Duck		Vulnerable
Pandion cristatus	Eastern Osprey		Vulnerable
Petroica boodang	Scarlet Robin		Vulnerable
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)		Vulnerable
Ptilinopus magnificus	Wompoo Fruit-Dove		Vulnerable
Ptilinopus regina	Rose-crowned Fruit-Dove		Vulnerable
Ptilinopus superbus	Superb Fruit-Dove		Vulnerable
Rostratula australis	Australian Painted Snipe	Vulnerable	
Stagonopleura guttata	Diamond Firetail		Vulnerable
Stictonetta naevosa	Freckled Duck		Vulnerable
Tyto novaehollandiae	Masked Owl		Vulnerable
Tyto tenebricosa	Sooty Owl		Vulnerable
Mammals			
Cercartetus nanus	Eastern Pygmy-possum		Vulnerable
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Vulnerable
Dasyurus maculates	Spotted-tailed Quoll	Endangered	Vulnerable
Falsistrellus tasmaniensis	Eastern False Pipistrelle		Vulnerable

Scientific name	Common name	EPBC Act status	TSC Act status
Kerivoula papuensis	Golden-tipped Bat		Vulnerable
Miniopterus australis	Little Bentwing-bat		Vulnerable
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat		Vulnerable
Mormopterus norfolkensis	Eastern Freetail-bat		Vulnerable
Myotis macropus	Southern Myotis		Vulnerable
Petaurus australis	Yellow-bellied Glider		Vulnerable
Petaurus norfolcensis	Squirrel Glider		Vulnerable
Petrogale penicillata	Brush-tailed Rock-wallaby	Vulnerable	
Phascolarctos cinereus	Koala	Vulnerable	Vulnerable
Potorous tridactylus tridactylus	Long-nosed Potoroo	Vulnerable	
Pseudomys novaehollandiae	New Holland Mouse	Vulnerable	
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Vulnerable
Scoteanax rueppellii	Greater Broad-nosed Bat		Vulnerable
Vespadelus troughtoni	Eastern Cave Bat		Vulnerable
Reptiles			
Hoplocephalus bungaroides	Broad-headed Snake		Vulnerable
Hoplocephalus stephensii	Stephens' Banded Snake		Vulnerable

A total of 13 migratory species listed under the EPBC are either known or have the potential to occur within 10 kilometres of the study area (Table 10).

Table 10 Migratory fauna species occurring within 10 kilometres of the study area

Scientific name	Common name	EPBC Act status	TSC Act status
Apus pacificus	Fork-tailed Swift	Migratory	-
Ardea alba	Great Egret,	Migratory	-
Ardea ibis	Cattle Egret	Migratory	-
Gallinago hardwickii	Latham's Snipe,	Migratory	-
Haliaeetus leucogaster	White-bellied Sea-Eagle	Migratory	-
Hirundapus caudacutus	White-throated Needletail	Migratory	-
Merops ornatus	Rainbow Bee-eater	Migratory	-
Monarcha melanopsis	Black-faced Monarch	Migratory	-
Monarcha trivirgatus	Spectacled Monarch	Migratory	-
Myiagra cyanoleuca	Satin Flycatcher	Migratory	-

Scientific name	Common name	EPBC Act status	TSC Act status
Pandion haliaeetus	Osprey	Migratory	-
Rhipidura rufifrons	Rufous Fantail	Migratory	-
Rostratula benghalensis (sensu lato)	Painted Snipe	Migratory	-

3.2.2 Field Survey

3.2.2.1 Fauna Species

A total of 37 terrestrial vertebrate fauna species were recorded during field surveys of the study area (Appendix 3). 28 species of birds, five species of mammals and four species of amphibians were aurally and visually identified from the study area.

One threatened species was identified from the study area: *Pteropus poliocephalus* (Grey-headed Flying-fox). One species listed as a Migratory species were identified from the study area: *Ardea ibis* (Cattle Egret). The probability of for all other locally occurring threatened species to occur within the study area is outlined in section 3.2.2.5.

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

The Grey-headed Flying fox is listed as a Vulnerable species under both the TSC Act and EPBC Act. This species was observed overflying the study area during the nocturnal spotlight survey undertaken in April 2010 (Figure 5).

The Grey-headed Flying-fox occurs from Bundaberg in Queensland in the north to Melbourne in Victoria to the south, typically between the coast and the western slopes of the Great Dividing Range. In NSW, it occurs along the east coast, eastern slopes of the Great Dividing Range and the tablelands. The species may be found in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps, while additional foraging is provided by urban gardens and cultivated fruit crops.

The Grey-Headed Flying-Fox is a highly mobile species with a nightly feeding range of 20 to 50 kilometres from a roosting camp. Diet typically comprises a wide variety of flowering and fruiting plants (Tidemann 1995, Churchill 1998); in summer, diet mainly comprises fruits of rainforest trees and vines in addition to the nectar and blossom of Eucalyptus, Melaleuca and Banksia. In winter, diet is dominated by nectar and blossom.

Non-indigenous and exotic tree species introduced to the urban landscape provide additional foraging habitat for this species within the locality; where previously existed a period of reduced availability of native food resource during the winter months, non-native species now supply food resources throughout the year (Parry-Jones & Augee 2001, Williams et al 2006).

Grey-headed Flying-foxes roost in large numbers, with up to tens of thousands of flying foxes using individual camps for mating, birth and rearing of young. Camps are typically located in gullies, close to water, in vegetation with a dense canopy, within 20 kilometres of a regular food source. Site fidelity to camps is high, with some camps being used for over 100 years (NPWS 2001). The closest camp to the study area is located in Blackbutt Reserve, approximately 6 kilometres to the north-east.

The study area does not contain roosting habitat (a camp) for this species. Habitat features of the study area which may support the Grey-Headed Flying-Fox include foraging habitat provided by a number of flowering exotic and native trees, predominantly eucalypts, located within the study area. A list of Grey-headed Flying Fox feed trees was compiled by Eby and Law (2008), comprising 59 species that provide a source of

blossom and 46 species that provide a source of fruit. In accordance with the species listed by and Law (2008), flora species that offer a blossom or fruit resource to the Grey-headed Flying Fox that occur in the study area include *Angophora costata (*Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus piperita* (Sydney Peppermint), *Eucalyptus punctata* (Grey Gum), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus saligna* (Sydney Blue Gum), *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Grevillea robusta (*Silky Oak).

Ardea ibis (Cattle Egret)

The Cattle egret is listed as a Migratory species under the EPBC Act. This species was visually observed within the study area during the field survey undertaken in April 2010 (Figure 5).

In Australia the Cattle Egret is a partial migrant; some of the population migrates to New Zealand, while the remainder migrates locally. The birds migrate from breeding colonies in south-east Queensland and north-east NSW to spend winter in either south-east Australia or New Zealand.

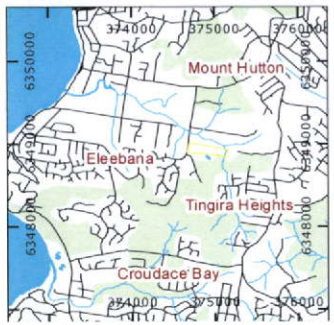
The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation.

The Cattle Egret feeds mostly on grasshoppers, but is known to consume other insects including cicadas, centipedes, spiders, cattle ticks, frogs (including cane toads), lizards (particularly skinks) and small mammals. The Cattle Egret usually follows cattle, horses, sheep, goats and other large animals, and prey upon up insects or worms disturbed by the trampling of such animals.

The Cattle Egret roosts in trees, or amongst ground vegetation in or near lakes and swamps. It has also been recorded roosting near human settlement and industrial areas.

On the east coast, The Cattle Egret breeds between October and January. The species forms breeding colonies in wooded swamps such as mangrove forests, Melaleuca swamps and the eucalypt/lignum swamps of the Murray-Darling Basin. They may breed in artificial situations or close to urban areas; generally the nesting trees are inundated except where breeding on small islands. Nests are sited usually in middle to upper branches.

Within the study area, the Cattle Egret may follow horses within the Exotic Grassland with Scattered Tree vegetation community, and forage for invertebrates disturbed during horse grazing activities. The study area does not support a breeding colony due to an absence of preferred breeding habitat (wooded swamp).



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Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

DATA SOURCES
RPS
EJE Architects

TrackingID: 103239-1-A Compiled: 31 October 2013

- Study Area
- Drainage line
- Cattle Egret
- Grey-headed flying fox
- Hollow-bearing Tree

RPS

FIGURE 5

Locations of Threatened and Migratory Fauna Species

3.2.2.2 Fauna Habitat

Fauna habitat complexity across much of the study area is low, due to an absence of many habitat components important for breeding, foraging and sheltering of fauna. Native vegetation has been almost entirely cleared. The canopy of scattered myrtaceous species (including a diversity eucalypts and paperbarks) offer a seasonal nectar, pollen, eucalypt sap and acacia gum resource to birds such as Noisy Miner (*Manorina melanocephala*), Red Wattlebird (*Anthochaera carunculata*) and Rainbow Lorikeet (*Trichoglossus haematodus*). Myrtaceous and flowering species would also offer a potential foraging resource to arboreal mammals such as Common Brushtail Possum (*Trichosurus vulpecular).* Micro-chiropteran bat species (microbats) may forage for invertebrates above the canopy of scattered trees, although no microbats were recorded in the study area during nocturnal surveys. Two hollow-bearing trees were located within the study area (Figure 5). One hollow bearing tree is located to the east of the oval horse training track; the other is in close proximity to the watercourse in the north-eastern part of the study area. These hollow-bearing trees may provide potential nesting or roosting habitat for a range hollow-dependent fauna species.

Scattered shrubs may offer sheltering and foraging habitat for small birds. Grassy areas provide foraging habitat for ground-feeding birds such as Australian magpie (*Cracticus tibicen*) and Magpie lark (*Grallina cyanoleuca)* and terrestrial mammals. Other groundlayer habitat features such as rocky features, well-developed leaf litter, ground timber and hollow logs are generally absent.

Dams and the Freshwater Creek offers habitat to a diversity of aquatic bird species, such as Australian wood duck (Chenonetta jubata) and Purple swamphen (*Porphyrio porphyrio).* Aquatic emergent vegetation and fringing grasses and sedges offer sheltering habitat to frogs such as Eastern Dwarf Tree Frog (*Litoria fallax*), Peron's tree frog (*Litoria peronii) and* Striped Marsh Frog (*Limnodynastes peronii).*

3.2.2.3 SEPP 44 Koala Habitat

Schedule 2 of State Environmental Planning Policy (SEPP) No. 44 – 'Koala Habitat Protection' lists 10 tree species that are considered indicators of 'Potential Koala Habitat'. The presence of any of the species listed on a site proposed for development triggers the requirement for an assessment for 'Potential Koala Habitat'. SEPP 44 defines potential Koala Habitat as "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".

One tree species (*Eucalyptus punctata* - Grey Gum) listed in Schedule 2 of SEPP No. 44 – Koala Habitat Protection occurs within the study area. Of the 269 canopy trees identified in the study area, 36 are *Eucalyptus punctata* (13%). Conservatively, the study area may be considered as 'Potential Koala Habitat' as defined by SEPP 44.

The State Environmental Planning Policy (SEPP) No. 44 defines Core Koala Habitat as "an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population". Field surveys did not detect any Koalas within the study area, nor were any secondary evidence such as scats or scratches indicative of a resident or vagrant koala population detected in the study area. Therefore the study area does not constitute Core Koala Habitat as defined in SEPP 44.

3.2.2.4 Fauna Corridors and Habitat Linkages

The study area is located within a semi-rural residential landscape which has been subject to extensive vegetation clearing. Canopy trees in the study provide marginal canopy connectivity to habitat contained within Tingira Heights Nature Reserve, which adjoins the neighbouring property to the south. Arboreal

mammals and birds may travel into and through the study area via this tenuous vegetated link of canopy trees. The lack of an intact understory or vegetated groundlayer reduces the likelihood of many other animals moving into and through the study area such as small cover-dependent mammals, birds, reptiles and amphibians. The presence and abundance of domestic dogs in the study area and adjoining properties may deter the movement of koalas between trees. The movement of highly mobile birds, large terrestrial mammals and flying mammals (microchiropteran and megachiropteran bats species) is unlikely to be significantly reduced by fragmented habitat connectivity within the study area.

3.2.2.5 Probability of occurrence of threatened and migratory fauna species

The probability of each of the locally recorded threatened fauna species to occur within the study area was assessed using knowledge of each species' habitat and lifecycle requirements with regard to the habitat present within the study area (See Table 11). The probability of each of the locally recorded migratory fauna species to occur within the study area is assessed in Table 12.

Species were assessed as being either Unlikely, Possible, Likely or Known to occur in the study area. The location and number of nearby, recent records were also considered in determining probability of occurrence. Pelagic and/or aerial marine species such as turtles, whales, petrels and albatrosses, and saltwater fish species such as Black Rockcod, were not considered as the study area does not comprise marine habitat.

Table 11 Probability of threatened fauna species identified from the locality to occur in the study area

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
Amphibians			
Crinia tinnula	Wallum Froglet	Occurs in coastal, low-lying acid Paperbark forest, within the 'wallum country' (often on sandy soils). Known to occur within wet forest habitats in the Lower Hunter and western Lake Macquarie. Its distribution ranges from Maryborough in Queensland south to Kurnell near Sydney. Large populations have been recorded in the Myall Lakes National Park area and Moffats Swamp Nature Reserve near Medowie and it has been recorded on the western side of Lake Macquarie on the Morisset peninsula.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Litoria aurea	Green and Golden Bell Frog	Litoria aurea was formerly known to inhabit the eastern seaboard of New South Wales and Victoria from Byron Bay to the Gippsland Lake Region as well as highland sites (New England District, south-western slopes of N.S.W. and Monaro District). Recent literature indicates that it is no longer found on sites above an altitude of 300m above sea level. *L. aurea* species inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. *L. aurea* is thought to be displaced from more established sites by other frog species thus explaining its existence on disturbed sites. Inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. Thought to be displaced from more established sites by other frog species, thus explaining its existence on	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
		disturbed sites.	
Litoria littlejohni	Littlejohn's Tree Frog	Occurs on the plateaus and eastern plains of the Great Dividing Range from scattered locations between the Watagan Mountains NSW south to Buchan in Victoria. It is pale brown with dark speckles. Occurs along permanent rocky creeks with thick fringing vegetation associated with Eucalypt woodlands and heaths among sandstone outcrops. Despite its very large distribution there are very few records of the Litoria littlejohni. It is known to call through most of the year with a peak in Summer. Clusters of up to 60 eggs are attached to submerged twigs, stems or branches, often near the banks of still pools or clear, slowly flowing streams. Metamorphosis occurs mostly in the months of December and January.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Mixophyes balbus	Stuttering Frog	In NSW, known only from three locations south of Sydney. Inhabits rainforest and wet, tall forest in the foothills and escarpment east of the Great Dividing Range. Requires streams with rock shelves or shallow riffles for breeding in summer. Outside of breeding period, species is found under deep leaf little and thick understory vegetation on forest floor.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Mixophyes iterates	Giant Barred Frog	Occurs from the east coast west to the Hawkesbury River, where it inhabits rainforests, moist eucalypt forest or nearby dry eucalypt forest below elevations of 1000m. Require shallow, flowing rocky streams for breeding in summer. Outside of breeding period, is found sheltering and foraging amongst deep, damp leaf litter.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Pseudophryne australis	Red-crowned Toadlet	Generally restricted to Hawkesbury Sandstone where it may be found beside temporary creeks, gutters and soaks and under rocks and logs. Breeds in deep leaf litter inundated with heavy rain (Robinson, M, 1996). This species isn't commonly found near permanent flowing streams but prefers permanently moist soaks and areas of dense vegetation or litter along or near headwater stream beds. Typically found in open woodland and heath communities.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Birds			

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
Anseranas semipalmata	Magpie Goose	Relatively common in the Australian northern tropics. Had disappeared from south-eastern Australia by 1920, however since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW. Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges, also small flocks may occur in dry ephemeral swamps, wet grasslands and floodplains. Most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Anthochaera phrygia	Regent Honeyeater	Two main breeding areas occur in NSW, that being the Barraba District and Capertee Valley. Within its range it is mostly recorded in Box-Ironbark Eucalypt associations along creek flats, river valleys and foothills. Common western feed trees include *Eucalyptus alba* (White Box), *E. melliodora* (Yellow Box) and *E. sideroxylon* (Mugga Ironbark). Coastal food resources include *Corymbia maculata* (Spotted Gum), *E. fibrosa* (Broad-leaved Ironbark), *E. crebra* (Narrow-leaved Ironbark) and various Stringybark sp.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Botaurus poiciloptilus	Australasian Bittern	Widespread distribution but uncommon across south-eastern Australia. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spike rushes (*Eleoacharis* spp), where it forages at night for amphibians, invertebrates and crustaceans. Nests are built within densely vegetated wetlands on a platform of reeds.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. Dams and Freshwater Creek do not support tall, dense vegetation. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Burhinus grallarius	Bush Stone-curlew	Rare throughout south-eastern Australia where it inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Forages nocturnally for insects and small vertebrates. Nests in a shallow scrape on the ground.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. Dams and Freshwater Creek do not support tall, dense vegetation. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
Calidris ferruginea	Curlew Sandpiper	Distributed around most of the coastline of Australia (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach cast seagrass or seaweed. It roosts on a shingle, shell or sand beaches; spits or islets on the coast or in wetlands; or sometimes in salt marsh, among beach cast seaweed, or on rocky shores.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Calidris tenuirostris	Great Knot	In NSW, the species has been recorded at scattered sites along the coast to about Narooma. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Callocephalon fimbriatum	Gang-gang Cockatoo	Found in the summer months in tall mountain forests and woodlands, and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Also occurs within *Eucalyptus pauciflora* (Snow Gum) woodland and occasionally in temperate rainforest. Nest in hollows and favours old growth communities.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Calyptorhynchus lathami	Glossy Black-Cockatoo	Occurs in forests and woodlands where it forages predominantly on Allocasuarina cones. Favoured species include *Allocasuarina littoralis* (Black She-oak), *A. torulosa* (Forest She-oak) and *A. verticillata* (Drooping She-oak. In the Riverina area inhabits *Casuarina cristata* stands (Belah) requires large Eucalypt tree hollows for nesting.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Charadrius leschenaultii	Greater Sand-plover	Occurs in coastal areas in all states; the species is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches with large	Unlikely. This species was not identified within the study area during field surveys. The study area does not

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
		intertidal mudflats or sandbanks, as well as sandy estuarine lagoons. The species does not breed in Australia. Forages for invertebrates in mud or sand.	support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Charadrius mongolus	Lesser Sand-plover	Distribution is widespread in coastal regions, and has been recorded in all states. Usually occurs in coastal littoral and estuarine environments. It inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. It also sometime occurs in short saltmarsh or among mangroves. Feeds mostly on extensive, freshly-exposed areas of intertidal sandflats and mudflats in estuaries or beaches, or in shallow ponds in saltworks. Roosts near foraging areas, on beaches, banks, spits and banks of sand or shells. The species does not breed in Australia.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Chthonicola sagittata	Speckled Warbler	In NSW, occurs throughout the hills and tablelands of the Great Dividing Range, rarely from the coast. Inhabits Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies where it forages for insects and seeds. Nests in a depression in the ground or the base of a low dense plant, often among fallen branches and other litter.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Circus assimilis	Spotted Harrier	Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and chenopod shrub. It can be found most commonly in open grassland, but occur quite commonly as well in agricultural land. Also forages over edge habitats of inland wetlands.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Daphoenositta chrysoptera	Varied Sittella	This species inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. Ironbark sp. are favoured and D. chrysoptera is commonly found in Ironbark	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
		associated forests.	Significance is not required for this species.
Dasyornis brachypterus	Eastern Bristlebird	Distribution confined to three disjunct areas in NSW: the Queensland/NSW border, the Illawarra and the NSW/Victoria border. Species inhabits dense, low vegetation including heath and open woodland with a heathy understorey. Forages on the ground for insect, rarely flies. Nest constructed on the ground amongst dense vegetation.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Ephippiorhynchus asiaticus	Black-necked Stork	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. Also recorded from small isolated swamps. It has also been recorded on farm dams and sewage treatment ponds.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Epthianura albifrons	White-fronted Chat	In NSW, occurs in association with damp, open habitats below 1000m elevation along the coast (such as wetlands and saltmarsh), and in association with waterways in the west. Forage for insects on the ground. Nests in low vegetation elevated from the ground.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Erythrotriorchis radiatus	Red Goshawk	Sparsely dispersed across coastal and sub-coastal Australia, from western Kimberley Division to north-eastern NSW and occasionally on continental islands. Found in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia. Hunts for birds; mammals, reptiles and insects are rarely taken. Nests in large trees, frequently the tallest and most massive in a tall stand, typically within one km of permanent water.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Glossopsitta pusilla	Little Lorikeet	*Glossopsitta pusilla* extends from Cairns to Adelaide coastally and to inland locations. Commonly found in dry, open eucalypt forests and woodlands. Can be found in roadside vegetation to woodland remnants. *G. pusilla* feeds on abundant flowering Eucalypts, but will also take nectar from;	Possible. This species was not detected during targeted field surveys on study area at the time of survey. The study area offers potential foraging habitat to

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
		Melaleuca sp and Mistletoe sp. *Eucalyptus albens* (White Box) and *E. meliodora* (Yellow Box) are favoured food sources on the western slopes in NSW. On the eastern slopes and coastal areas favoured food sources are *Corymbia maculata* (Spotted Gum), *E. fibrosa* (Broad-leaved Ironbark), *E. robusta* (Swamp Mahogany) and *E. pilularis* (Blackbutt). Nesting takes place in hollow bearing trees.	the species. In accordance with the precautionary principle, an Assessment of Significance has been prepared for this species (Appendix 4).
Haematopus fuliginosus	Sooty Oystercatcher	Sooty Oystercatchers are found around the entire Australian coast. The species inhabits rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Sooty Oystercatchers breed in spring and summer, predominately on offshore islands, occasionally on isolated promontories.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Haematopus longirostris	Pied Oystercatcher	The Pied Oystercatcher is distributed around the entire Australian coastline and inhabits intertidal flats of inlets and bays, open beaches and sandbanks. The species nests mostly on coastal or estuarine beaches and occasionally in saltmarsh or grassy areas.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Hieraaetus morphnoides	Little Eagle	Inhabits open eucalypt forest, woodland and open woodland. Birds of inland NSW can occur across riparian woodland and acacia woodland. Can be found across the mainland except the most densely forested areas of the great divide. It requires a tall living tree within a forested area for nesting. Occurs across the western slopes and southern, central and northern tablelands.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Irediparra gallinacean	Comb-crested Jacana	This species inhabits mostly deep permanent freshwater wetlands that are abundant with floating aquatic vegetation that forms dense mats or rafts on the surface of the water. Known to breed as far south as Mandalong within the Hunter.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
Ixobrychus flavicollis	Black Bittern	Solitary species, living near water (estuarine to brackish) in mangroves and other trees which need to form only a narrow fringe of cover. Generally stays close to permanent water and dense vegetation. Has been known to be over permanent water in rainforest. A riparian species that occasionally ventures into the open within estuarine habitats. Roosts in trees or on the ground amongst dense reeds. Nests are built in spring on branches overhanging water and consist of either sticks, or reeds, or both.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Lathamus discolour	Swift Parrot	On the mainland this species frequents Eucalypt forests and woodlands with large trees having high nectar production during winter. Mainland winter foraging sites often vary from year to year as a consequence of varying eucalypt blossoming cycles. Preferred winter flowering species in NSW include *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Broad-leaved Ironbark), *E. crebra* (Narrow-Leaved Ironabrk), *E. sideroxylon* (Mugga Ironbark), *E. albens* (White Box) and *E. tereticornis* (Forest Red Gum). *Lathamus discolour* also uses these species for lerping. Such species include *E. fibrosa* (Broad-leaved Ironbark), *E. moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum). Nests only in Tasmania during spring/summer. L. discolor uses some of these tree species for roosting purposes as well.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Limicola falcinellus	Broad-billed Sandpiper	The Broad Billed Sandpiper breeds in northern Siberia before migrating southwards in winter to Australia. During winter, the species inhabits sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Eastern subspecies occurs from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range. Inhabits forests or woodlands dominated by box and ironbark eucalypts where it forages for insects and nectar. Nests high in tree crown.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Neophema pulchella	Turquoise Parrot	Inhabits forests and woodlands with suitable nest hollows and grassy foraging	Unlikely. This species was not

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
		areas. Prefers to feed in the shade of trees and spend most of its time on the ground searching for seeds of grasses and herbaceous plants. Found on the slopes of the divide in NSW with some more easterly sites on the Cumberland Plain and in the Hunter Region. Has been recorded within the Cessnock LGA.	identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Ninox connivens	Barking Owl	Occurs mainly in dry sclerophyll woodland. Nests in large Eucalypt hollows, and roosts in hollows or thick vegetation. Can be found roosting in dense Acacia sp. and Casuarina sp. or the dense clumps of Eucalypt trees. More commonly found west of the divide and on the slopes. Favours tree lined watercourses, with hollow bearing tress. Hunts a range of prey species including birds and both terrestrial and arboreal mammals.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Ninox strenua	Powerful Owl	Occurs in sclerophyll forests and woodlands where suitable prey species occur (being predominantly arboreal mammals). Requires large hollows, usually in Eucalypt trees, for nesting. Favours gullies, drainage lines and creek lines. Roosts in dense vegetation within such species as *Syncarpia glomulifera* (Turpentine), *Allocasuarina littoralis* (Black She-Oak), *Acacia melanoxylon* (Blackwood), *Angophora floribunda* (Rough-barked Apple), *Exocarpos cupressiformis* (Cherry Ballart) and *Melaleuca nodosa*.	Possible. This species was not detected during targeted field surveys in the study area at the time of survey. The study area offers potential foraging habitat to the species. In accordance with the precautionary principle, an Assessment of Significance has been prepared for this species (Appendix 4).
Oxyura australis	Blue-billed Duck	A frequenter of deep freshwater swamps with thick vegetation. This species is wholly aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive. Most birds will leave their breeding swamps in favour of larger more open swamps and lakes for over-wintering. Most birds will nest in *Typha* sp. (Cumbungi) over deep water during spring/summer; they will also nest in trampled *Muehlenbeckia* sp. (Lignum) and *Eleocharis obicis* (Spike-rush). In NSW mostly occurring within 300km of the Murray-Darling basin, but may occur in more coastal areas during dry inland conditions.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Pandion cristatus	Eastern Osprey	Requires water bodies for fishing in close proximity (usually <1km) to suitably tall nesting site such as dead tree, power pole etc. Essentially and estuarine species, but an accidental species to inland / freshwater wetland habitats. They occur over habitats such as heath, woodland and forest when travelling to and from foraging sites.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species.

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
			This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Petroica boodang	Scarlet Robin	In NSW this species occupies open forests and woodlands from the coast to the inland slopes. Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Occurs along the east coast of Australia. In NSW, species is known from western slopes of Great Dividing Range, western plains, Hunter Valley and north coast. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains where it forages for invertebrates. Roosts and nests in shrubs or sapling eucalypts. Generally unable to cross large open areas.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Ptilinopus magnificus	Wompoo Fruit-Dove	Generally lives in rainforest of many variations, though it also frequents brushes of coastal districts as well as Eucalypt forests and mangroves. Favoured rainforest habitat consists of sub-tropical to dry rainforest and quite commonly littoral rainforest. They feed entirely on fruit from vines, trees and shrubs and mostly feed in the tops of trees or just under the foliage, where the fruit grows. *Ptilinopus regina* can be locally nomadic according to fruiting or part migratory according to fruit ripening.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Ptilinopus regina	Rose-crowned Fruit-Dove	Frugivorous bird favouring rainforest, occasionally straying to other forest types containing fruiting trees. A nomadic species that sometimes roosts in dry forest adjacent to rainforest habitats and is known to access small rainforest remnants. Feeds on diverse range of fruits from trees and vines. Follows ripening fruit.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
			for this species.
Ptilinopus superbus	Superb Fruit-Dove	Occurs in rainforest and similar closed forests including, monsoon forest, regrowth, lantana thickets and woodland adjoining rainforest at all altitudes. Forages high in the canopy eating fruits of figs and palms. A part-migratory species that migrates and south. In winter some birds migrate south to the area of the Hunter, Sydney, Illawarra and South Coast.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Rostratula australis	Australian Painted Snipe	A small freshwater and estuarine wader, which prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Stagonopleura guttata	Diamond Firetail	Widely distributed in NSW, known from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. Not common in coastal districts. Found mainly in grassy eucalypt woodlands, occasionally open forest and riparian areas. Forages on the ground for seeds and insects. Roost and nest amongst shrubby understorey.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Stictonetta naevosa	Freckled Duck	Found in association with large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers. Disperses during extensive inland droughts when it may be found along the east coast. Nests in dense vegetation at or near water level. Forages for aquatic vegetation.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Tyto novaehollandiae	Masked Owl	Found in a range of habitats, more commonly found in dry eucalypt forests and woodlands. A forest owl which often hunts on forest edges and also roadsides. Requires large Eucalypt hollows for nesting and these hollows are also preferred for roosting sites. Breeding has also been recorded in caves. Recorded at Medowie,	Possible. This species was not detected during targeted field surveys on study area at the time of survey. The study area offers potential foraging habitat to

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
		Heddon Greta and the Dungog area (RPS ecologist pers. obs.).	the species. In accordance with the precautionary principle, an Assessment of Significance has been prepared for this species (Appendix 4).
Tyto tenebricosa	Sooty Owl	Occurs in wet Eucalypt forest and rainforest with tall emergent trees, often in easterly facing gullies. Within these areas this species hunts for a range of mainly mammalian prey at all levels of the forest strata. Roosts in tree hollow or dense canopy vegetation. Also nests in large Eucalypt tree hollows. Has been observed on ground to catch its prey (RPS ecologist pers. obs.).	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Mammals			
Cercartetus nanus	Eastern Pygmy-possum	Occurs from the coast inland to the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Inhabits woodlands and heath, occasionally rainforest where it forages for nectar and pollen of banksias, eucalypts and bottlebrushes. Shelters in tree hollows, rotten stumps, holes in the ground or abandoned bird-nests.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Chalinolobus dwyeri	Large-eared Pied Bat	This species forages in tall open forests and the edges of rainforest. It roosts in mine shafts and similar structures. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of Hirundo ariel (Fairy Martin), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy.	Possible. This species was not detected during targeted field surveys on study area at the time of survey. The study area offers marginal foraging habitat. In accordance with the precautionary principle, an Assessment of Significance has been prepared for this species (Appendix 4).
Dasyurus maculates	Spotted-tailed Quoll	Found in a variety of forested habitats. These habitats include sclerophyll forest and woodlands, coastal heaths and rainforest. Occasional venture into open areas, treeless plains and rocky outcrops. Has been known to steal poultry. This species creates a den in fallen hollow logs	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
		or among rocky outcrops. Generally does not occur in otherwise suitable habitats that are in close proximity to urban development.	this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	This species is found in a variety of forest types such as open forests, woodlands and wetter sclerophyll forests (usually with trees >20m). This species roosts in tree hollows. Hunts beetles, moths, weevils and other flying insects below or just above the canopy.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Kerivoula papuensis	Golden-tipped Bat	Golden-tipped Bat is distributed along the east coast of Australia in scattered locations from Cape York Peninsula in Queensland to south of Eden in southern NSW. It is found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. Also recorded in tall open forest, *Casuarina*-dominated riparian forest and coastal *Melaleuca* forests. Roost mainly in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests, also in tree hollows, dense foliage and epiphytes; located in rainforest gullies on small first- and second-order streams.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Miniopterus australis	Little Bentwing-bat	Prefers to forage in well-vegetated areas, such as within wet and dry sclerophyll forests and rainforests and also dense coastal Banksia scrub. Requires caves or similar structures for roosting habitat. Occasionally roost in tree hollows. Largely confined to more coastal areas. Often found roosting with Miniopterus schreibersii (Eastern Bentwing-bat).	Possible. This species was not detected during targeted field surveys on site at the time of survey. The study area offers potential foraging habitat to the species. In accordance with the precautionary principle, an Assessment of Significance has been prepared for this species (Appendix 4).
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	This species utilises a range of habitats for foraging, including rainforest, wet and dry sclerophyll forests, woodlands and open grasslands. Feed above the canopy catching moths and other flying insects. Requires caves or similar structures for roosting habitat such as derelict mines, disused buildings and storm-water tunnels.	Possible. This species was not detected during targeted field surveys on study area at the time of survey. The study area offers potential foraging habitat to the species. In accordance with the precautionary principle, an Assessment of Significance has been prepared for this species (Appendix 4).

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
Mormopterus norfolkensis	Eastern Freetail-bat	This species forages predominantly in dry forests and woodlands east of the divide. Individuals have been recorded in riparian zones in rainforest and wet sclerophyll forest. Forages above the canopy or forest edges. It roosts in tree hollows, under bark and within man-made structures.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Myotis macropus	Southern Myotis	Usually found near bodies of water, including estuaries, lakes, reservoirs, rivers and large streams, often in close proximity to their roost site. Although usually recorded foraging over wet areas, it also utilises a variety of wooded habitats adjacent to such areas including rainforest, wet and dry sclerophyll forest, woodland, and swamp forest. Roosts in small colonies of between 15 and several hundred individuals in caves, mines and disused railway tunnels.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Petaurus australis	Yellow-bellied Glider	Usually associated with tall, mature wet Eucalypt forest usually with high rainfall and nutrient rich soils. Also known from tall dry open forest and mature woodland. In the north of NSW they favour mixed coastal forests to dry escarpment forests and in the south they prefer moist coastal gullies to creek flats and tall montane forests. The diverse diet of this species is primarily made up of Eucalypt nectar, sap, honey dew, manna and invertebrates found under decorticating bark and pollen. Tree hollows for nest sites are essential, as are suitable food trees in close proximity.	Possible. This species was not detected during targeted field surveys on study area at the time of survey. The study area offers potential foraging habitat to the species. In accordance with the precautionary principle, an Assessment of Significance has been prepared for this species (Appendix 4).
Petaurus norfolcensis	Squirrel Glider	Occurs in eucalypt forests and woodlands where it feeds on sap exudates and blossoms. This species is generally absent from rainforest and closed forest. A wide range of forest types have been recorded as habitat for *Petaurus norfolcensis*, these include, *Eucalyptus camaldulensis* (River Red Gum) Forest, Box-Ironbark Forests in the west, *E. pilularis* (Blackbutt), *E. tereticornis* (Forest Red Gum) and *Corymbia gummifera* (Red Bloodwood) Forest, *Banksia integrifolia* (Coastal Banksia) Heathland and *E. punctata* (Grey Gum)/*C. maculata* (Spotted Gum)/ *E. paniculata* ssp. *paniculata* (Grey Ironbark) Forests. In these areas tree hollows are utilised for nesting sites. Also requires winter foraging resources when the availability of normal food resources may be limited, such as winter-flowering shrub and small tree species. As such *P.*	Possible. This species was not detected during targeted field surveys on study area at the time of survey. The study area offers potential foraging habitat to the species. In accordance with the precautionary principle, an Assessment of Significance has been prepared for this species (Appendix 4).

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
		norfolcensis requires habitat with a mix of eucalypt, acacia and *Banksia* sp. with winter and summer flowering species and smooth/rough barked Eucalypts.	
Petrogale penicillata	Brush-tailed Rock-wallaby	Occurs in forests and woodlands along the Great Divide and on the western slopes in escarpment country with rocky outcrops, steep rocky slopes, gorges, boulders and isolated rocky areas. The majority of populations favour north-facing aspects, but some southern aspects have been recorded. Apart from the critical rock structure *Petrogale penicillata* also requires adjacent vegetation types, associated types include, dense rainforest, wet sclerophyll, vine thicket, dry sclerophyll forest and open forest. They also require suitable caves and rocky overhangs for shelter and also for 'lookout' posts.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Phascolarctos cinereus	Koala	Occurs in forests and woodlands where it requires suitable feed trees (particular *Eucalyptus* spp.) and habitat linkages. It feeds on the foliage of more than 70 Eucalypt sp. and more than 30 non-Eucalypt sp., but will select preferred feed within its home range. Home range varies according to available habitat. Will occasionally cross open areas, although it becomes more vulnerable to predator attack and road mortality during these excursions.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Potorous tridactylus tridactylus	Long-nosed Potoroo	Prefers cool rainforest, wet sclerophyll forest and heathland. Essentially, requires dense understorey with occasional open areas. These open areas most likely consist of sedges, ferns, heath or grass-trees. Sleeps by day in a nest on the ground, and digs for succulent roots, tubers, fungi and subterranean insects. Some diggings seemingly attributable to this species may belong to *Isoodon macrourus* (Northern Brown Bandicoot). Generally east of the divide, hides by day in dense vegetation, sometimes feeds during winter during daylight hours during overcast or low light conditions.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Pseudomys novaehollandiae	New Holland Mouse	Fragmented distribution across Tasmania, Victoria, NSW and Queensland where it inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. Forages for seeds, insects, leaves, flowers and fungi. Shelters and nests communally in burrows.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
Pteropus poliocephalus	Grey-headed Flying-fox	Forages over a large area for nectar / fruits etc. Occurs across subtropical and temperate forest, sclerophyll forest and woodlands, heaths, swamps, urban gardens and cultivated crops. Frequently observed to forage in flowering Eucalypts. Seasonally roosts in communal base camps situated within wet sclerophyll forests or rainforest. These camps are usually located within 20km's of their food source. Frequently observed to forage in flowering Eucalypts.	Known. This species was detected during targeted field surveys on study area at the time of survey. The study area supports foraging habitat for this species An Assessment of Significance is not required for this species
Scoteanax rueppellii	Greater Broad-nosed Bat	Forages in moister gullies and wet sclerophyll forests as well as in lightly wooded areas and open spaces/ ecotones, most commonly found in tall wet forest. Open woodland and habitat and dry open forest suits the direct flight of this species as it searches for beetles and other larvae. This species roosts in tree hollows, although has been recorded in buildings.	Possible. This species was not detected during targeted field surveys on study area at the time of survey. The study area offers potential foraging habitat to the species. In accordance with the precautionary principle, an Assessment of Significance has been prepared for this species (Appendix 4).
Vespadelus troughtoni	Eastern Cave Bat	A cave dweller, known from wet sclerophyll forest and tropical woodlands from the coast and Dividing Range to the drier forests of the semi-arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally in buildings. In all situations, the roost sites are frequently in reasonably well-lit areas.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Reptiles			
Hoplocephalus bungaroides	Broad-headed Snake	Largely confined to Triassic sandstones, including the Hawkesbury, Narellan and Shoalhaven formations, within the coast and ranges. Nocturnal, sheltering by day in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. In summer it is known to become semi-arboreal in its search for prey including geckos and skinks, and will shelter in hollows in large trees within 200 m of rocky escarpments. Hoplocephalus bungaroides is regarded as potentially dangerous, although it has not been attributed to any human fatalities. Destruction of habitat, particularly the removal of sandstone slabs has lead to a decline in numbers.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Hoplocephalus stephensii	Stephens' Banded Snake	The species is distributed along the coast and ranges from Southern Queensland to Gosford in NSW. Stephen's banded snake	Unlikely. This species was not identified within the study

Scientific name	Common name	Habitat preference/ known distribution	Probability of occurrence in the study area
		inhabits rainforest and eucalypt forests and rocky areas up to 950 metres in altitude. The species is nocturnal and hunts for frogs, lizards, birds and small mammals. During the day, the species shelters between loose bark and tree trunks, amongst vines, or in hollow trunks limbs, rock crevices or under slabs during the day. The species may bask inside trunk or branch hollows exposed to the sun or openly bask in upper canopy of trees.	area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.

Table 12 Probability of migratory fauna species identified from the locality to occur in the study area

Scientific name	Common Name	Habitat preference/ known distribution	Probability of occurrence in the study area
Apus pacificus	Fork-tailed Swift	Migrates from north-eastern Asia for the summer. Summer distribution is throughout Australia. Spend almost all day and night on the wing, hunting resting and sleeping.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Ardea alba	Great Egret	Occurs throughout Australia excluding arid areas. Inhabit lakes, swamps, dams and rivers and occasionally damp grasslands. Wades through shallows to hunt fish and invertebrates. Constructs a nest platform in a tree over water.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Ardea ibis	Cattle Egret	Migrates south from Asia and northern Australia for the winter. Occurs in woodlands and wetlands, damp pasture and grassland around the northern, eastern and western Australian coasts where it forages for invertebrates. Commonly forage in proximity to grazing cattle. Nest in trees and shrubs along watercourses.	Known. This species was identified within the study area during field surveys. Study area supports foraging habitat.
Gallinago hardwickii	Latham's Snipe	Migrates to south-east Australia for the summer. Inhabits freshwater wetlands on or near the coast, generally among dense cover. Also known from short-grassed marshes and wet, treeless grasslands. Occasionally found in crops and pasture. An omnivorous species that forages in soft mudflats or shallow water. Roosts amongst	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species.

Scientific name	Common Name	Habitat preference/ known distribution	Probability of occurrence in the study area
		low vegetation during the day.	This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Haliaeetus leucogaster	White-bellied Sea-Eagle	Occurs throughout coastal Australia, along the coast, large lowland rivers and lakes. Occasionally found in association with inland lakes. Mainly hunts over water for aquatic animals; small terrestrial mammals and carrion may be taken from land. Typically nests in large trees to 30m, less often in smaller trees, on rocks or the ground.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Hirundapus caudacutus	White-throated Needletail	Migrates from northern Asia to eastern Australia for the summer. In NSW, occurs from the coast to the western slopes of the Great Dividing Range. Species is almost exclusively aerial, most commonly recorded above open forest and rainforest. Rarely recorded flying over treeless areas. Forages aerially for insects. May roost aerially or in tree canopies or hollows in forests and woodland.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. Species may forage aerially above study area. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Merops ornatus	Rainbow Bee-eater	Occurs throughout mainland Australia, excluding arid areas. Southern populations migrate north in winter. Found in open forest, woodland, shrubland and occasionally remnant vegetation within farmland, orchards and vineyards. Forages aerially for insects. Roosts in small shrubby trees. Constructs a tunnel in which to nest, in sandy bank or bare flat ground.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. Species may forage aerially above study area. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Monarcha melanopsis	Black-faced Monarch	Migrates to south-eastern coast of Australia from the north-eastern coast. Found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. Forages on the wing or amongst vegetation for insects. Nests in small tree or shrub 3-6m above ground.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required

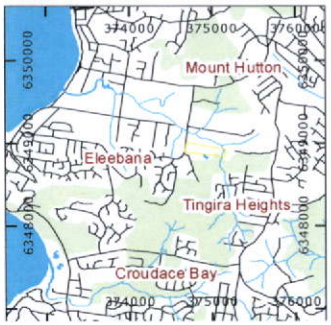
Scientific name	Common Name	Habitat preference/ known distribution	Probability of occurrence in the study area
			for this species.
Monarcha trivirgatus	Spectacled Monarch	Found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. Prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves. Feeds on insects, foraging mostly below the canopy in foliage and on tree trunks or vines. Builds a small cup nest of fine bark, plant fibres, moss and spider web in a tree fork or in hanging vines, 1 m - 6 m above the ground, often near water	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Myiagra cyanoleuca	Satin Flycatcher	Occurs along east coast of Australia, migrates north to Cape York Peninsula and Papua New Guinea in winter. Inhabits tall, wet eucalypts forests in gullies where it forages for insects. Nests in tree 3-25 m above ground.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Pandion haliaeetus	Osprey	Occurs in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. Mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia Requires extensive areas of open fresh, brackish or saline water for foraging. Nests are constructed in a variety of natural and artificial sites including in dead or partly dead trees or bushes; on cliffs, rocks, rock stacks or islets; on the ground on rocky headlands, coral cays, deserted beaches, sandhills or saltmarshes; and on artificial nest platforms	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Rhipidura rufifrons	Rufous Fantail	Occurs throughout east coast of Australia, migrates from eastern NSW to north-eastern Queensland and Papua New Guinea in winter. Inhabits rainforest, wet forest, swamp woodlands and mangroves, where it forages amongst a shrubby understorey for insects. Constructs a nest suspended from a tree fork.	Unlikely. This species was not identified within the study area during field surveys. The study area does not support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.
Rostratula benghalensis (sensu lato)	Painted Snipe	Occurs throughout Australia. Inhabits shallow freshwater wetlands, vegetated ephemeral and permanent lakes and swamps, and inundated grasslands. Roosts during the day in dense vegetation and is active at dusk, throughout the night	Unlikely. This species was not identified within the study area during field surveys. The study area does not

Scientific name	Common Name	Habitat preference/ known distribution	Probability of occurrence in the study area
		and dawn. It nests on the ground amongst tall reed-like vegetation near water, and forages near the water's edge and on mudflats for invertebrates and seeds.	support preferred habitat for this species. This species is unlikely to be impacted by the Proposal. An Assessment of Significance is not required for this species.

4.0 Impact Assessment

4.1 Description of Proposal Activities

The development of 104 dwellings, comprising a mixture of one-storey villas and two-storey apartments, requires the removal of all vegetation from Landscapes Gardens and from a large proportion of Exotic Grassland with Scattered Tree vegetation communities. Native vegetation occurring within 40 metres of the unnamed creek will be retained, which includes several large eucalypts. No development is proposed within 40 metres of the drainage line. The Proposal will result in the development of substantial areas of impervious services, such as internal roads, driveways and footpaths. In summary, the development footprint covers 4.04 hectares and 0.86 hectares of vegetation is to be retained, illustrated in Figure 6.



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GDA 1994 MGA Zone 54

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

DATA SOURCES
RPS
EJE Architects

TrackingID: 103239-1-A Compiled: 31 October 2013

- Study Area
- Drainage line
- Development Footprint
- Vegetation to be Retained

RPS

FIGURE 6

Development Footprint

4.2 Likely Impacts

4.2.1 Loss of native vegetation

The development footprint of the Proposal covers 4.04 hectares and will result in the removal of all vegetation from Landscapes Gardens and from a large proportion of Exotic Grassland with Scattered Tree vegetation communities. Freshwater Creek vegetation and some Exotic Grassland with Scattered Tree vegetation will be retained in the east of the study area (a total of 0.86 hectares), although noxious weeds should be removed from this community.

4.2.2 Loss of threatened flora species

No threatened species were identified from the study area. Of the 20 plant species listed under the EPBC two species, *Melaleuca biconvex* (Biconvex Paperbark) and *Syzygium paniculatum* (Magenta Lilly Pilly) were assessed to possibly occur within the study area. These species were not identified during field survey; however, potential habitat for the species occurs in the study area. Assessments of Significance have been undertaken for these two species due to the presence of potential habitat (Appendix 4).

4.2.3 Loss of fauna habitat

The clearing of vegetation will result in the loss of specific fauna habitat components, such as nesting and foraging resources (myrtaceous and flowering trees and shrubs), aquatic habitats (dams). These resources offer sheltering, foraging, nesting and roosting habitat to a variety of fauna occurring within the locality.

Two hollow-bearing trees occur within the study area (Trees 91 and 250, see Appendix 2). Tree 250 is alive (though leaning to the south at approximately 60 degrees) and contains a hollow with an aperture of approximately 20cm. This tree is expected to be retained within the riparian corridor. The other hollow bearing tree (No. 91) is located to the east of the oval horse training track. This tree is dead, contains a hollow of approximately 3cm, and is to be retained by the proposal. However, due to the tree being dead and if it poses a safety issue, then it may have to be removed. If this is the case then, a suitable nest boxes is recommended to be installed in a tree in the eastern section of the study area.

4.2.4 Impacts on threatened and migratory fauna species

One threatened species was identified from the study area: *Pteropus poliocephalus* (Grey-headed Flying-fox). One species listed as a Migratory species were identified from the study area: *Ardea ibis* (Cattle Egret).

The Proposal will result in the removal of foraging habitat for the Grey-Headed Flying-Fox. Flora species that offer a blossom or fruit resource to the Grey-headed Flying Fox that occur in the study area and that will be removed include *Angophora costata (*Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus piperita* (Sydney Peppermint), *Eucalyptus punctata* (Grey Gum), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus saligna* (Sydney Blue Gum), *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Grevillea robusta* (Silky Oak). The area of Grey-Headed Flying-Fox foraging habitat to be cleared does not comprise a significant area of habitat within the wider locality. Tingira Heights Nature Reserve, smaller parks and reserves in the locality contain an abundance and diversity of potential foraging habitat for the Grey-Headed Flying-Fox. Street and garden trees in the locality offer further foraging habitat to the species. As a result, the removal of a small area of seasonal foraging habitat is unlikely to have a significant impact on the Grey-Headed Flying-Fox.

The Proposal will also result in the removal of foraging habitat for the Cattle Egret. Within the study area, the Cattle Egret may follow horses within the Grassland with Scattered Tree vegetation community, and forage for invertebrates disturbed during horse grazing activities. The study area does not support a breeding

colony due to an absence of preferred breeding habitat (wooded swamp). Foraging habitat of the study area does not comprise a significant area of habitat within the wider locality. Similar foraging habitat occurs throughout the locality within other semi-rural residential properties and public parks and reserves. As a result, the removal of a small area of foraging habitat is unlikely to have a significant impact on the Cattle Egret.

Database search determined that 68 fauna species (excluding pelagic marine and aerial marine species such as turtles, whales, saltwater fish, albatrosses and petrels) listed under the EPBC and/or TSC Act are either known or have the potential to occur within 10 kilometres of the study area. An Assessments of Significance has been undertaken for Grey-Headed Flying-Fox, and for 10 other fauna species listed under the TSC Act that were considered to Possibly occur in the study area due to the presence of potential habitat (Appendix 4).

An EPBC Significant Impact Assessment has been undertaken for the Cattle Egret (Appendix 5). An action is likely to have a significant impact on a migratory species, listed under the EPBC Act, if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

4.2.5 Habitat fragmentation/ loss of fauna habitat connectivity

The study area is located within a semi-rural residential landscape which has been subject to extensive vegetation clearing. The removal of vegetation from Landscapes Gardens and from a large proportion of Exotic Grassland with Scattered Tree is unlikely to significantly increase habitat fragmentation within the locality. However, clearing of vegetation within the study area may reduce the capacity of some less mobile fauna to move within and between patches of remaining habitat. This is particularly relevant to locally occurring small, ground-dwelling fauna such as amphibians, reptiles and small ground-dwelling and arboreal mammals

4.2.6 Alteration and degradation of aquatic habitats

No development is proposed within 40 metres of the unnamed creek. As a result, potential degradation of aquatic habitats associated with the Freshwater Creek is low. Mitigation measures to further reduce impacts on aquatic habitat are outlined in Section 5.

4.3 Key Threatening Processes

The Proposal is likely to result in the operation of one or more key threatening processes or the exacerbation of one or more key threatening processes currently in operation in the study area. Key threatening processes are listed under the TSC Act, FM Act and EPBC Act.

4.3.1 Clearing of Native Vegetation

The proposal is likely to contribute to the Key Threatening Process 'Clearing of Native Vegetation' as the development as proposed would involve clearing of some small areas of remnant native vegetation. This KTP is, however, not believed to be of significance to any of the threatened species addressed due to the presence of large tracts of similar habitat opportunities in the immediate area and the small and highly disturbed nature of the study area. Recommendations made in this report pertaining to retention of habitat

and appropriate landscaping provides a means to conserve and enhance some areas of such habitat on study area.

4.3.2 Invasion and establishment of exotic vines and scramblers

The proposal has the potential to contribute to the Key Threatening Process "Invasion and establishment of exotic vines and scramblers". This would occur through the escape of exotic plants from any newly created landscaped gardens or from the dumping of garden refuse within adjoining bushland areas. This potential KTP can be controlled by the judicious use of selected landscape species that pose a minimum of invasion potential and by educating the occupants of the new development regarding the ecological impacts of inappropriate refuse dumping.

4.3.3 Invasion, establishment and spread of *Lantana camara*

The study area presently contains scattered occurrences of *Lantana camara*. Presently this situation contributes to this KTP and has the potential to exacerbate the effects of invasion and possible spread of this species within the local area. The proposed development will provide an opportunity to control *Lantana camara* within the study area as part of the overall weed management strategy for the proposed development. It is considered that management of this species will decrease the effect of this KTP within the study area and local area.

4.3.4 Loss of Hollow-bearing Trees

Two hollow bearing trees were observed within the study area. These trees were:

- Tree No. 91 – A Dead Stag containing 1x 3cm hollow branch, located at the eastern end of the oval horse training track.
- Tree No. 250 – A Sydney Peppermint containing 1x 20cm hollow, near the creekline bend.

It is expected that both trees will be retained within the study area. However, if Tree No. 91 requires removal because it is dead and poses a safety risk, then a nest box will be installed in one of the trees on the eastern section of the study area.

4.3.5 Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

No development is proposed within 40 metres of the unnamed creek. As a result, potential degradation of aquatic habitats associated with the Freshwater Creek is low. Mitigation measures to further reduce impacts on aquatic habitat are outlined in Section 5.

4.3.6 Predation by the feral cat (*Felis catus*)

In order to ameliorate this KTP it is recommended that strict restrictions be placed on companion animal ownership within the proposed development. It is acknowledged that cats are a low maintenance companion well suited for the elderly within developments such as this. In recognition of this KTP, and the desire for the elderly to keep companion animals of all types it is recommended that strict controls be placed on the ownership of companion animals within the proposed development rather than an outright ban. This could include rules stating that animals are to be kept under control at all times. This control can be achieved by requiring residents to control their animals by confining them indoors, the requirement for leads (cats and dogs) at all times outside of the house, construction of adequate fencing or installing commercially available and approved mesh "cat runs". This will prevent animals from roaming free and will remove the effects of this KTP within the proposed development.

4.3.7 Invasion of Native Plant Communities by Exotic Perennial Grasses

The proposal is likely to contribute to the Key Threatening Process "Invasion of native plant communities by exotic perennial grasses". Invasion by exotic perennial grasses is an identified threat to particular species of native flora and the particular bird species that are reliant on these plants. Activities including road works and management of roadside areas are listed as factors that may advantage the establishment of exotic perennial grasses. Slashing, weed control, movement or addition of fertilisers and nutrients and changes to drainage often aids the spread of these grasses. All of these activities could potentially occur either during or post development. Due to previous human activities in the area, the introduction of weeds is evident within the study area. Many of the perennial exotic grasses establish following disturbances such as construction works. This may result in local and regional declines of many native species and communities including threatened species that have potential habitat within the study area. The study area currently supports incursions of exotic perennial grasses and disturbed areas associated with construction of the Proposal may be subject to exotic grass invasion.

4.3.8 Human Caused Climate Change

The proposal is likely to contribute to the Key Threatening Process "Human Caused Climate Change" as a result of clearing vegetation and modification of the environment. It is considered that clearing and modification of the landscape could constitute a minor incremental change. Thus the extent to which the proposal would contribute to this process is considered unlikely to be significant.

5.0 Management and Mitigation Measures

Where impacts cannot be avoided, safeguards should be implemented to mitigate these impacts during construction (Table 13).

A Vegetation Management Plan (VMP) will be prepared prior to construction that will outline strategies, actions and a works schedule to assist in the management of vegetation to be retained in the study area, and any areas that will be revegetated.

Table 13 Recommended mitigation measures

Activity	Impact	Mitigation Measure
Soil disturbance related to site establishment and earthworks	Sedimentation and erosion leading to a reduction in water quality and degradation of aquatic habitat	Install appropriate drainage infrastructure (e.g. sediment basins, diversion drains), sediment and erosion controls prior to the commencement of construction.
		Clearing of vegetation is not to be undertaken during overland flow events.
		Clearly identifying sensitive areas and areas for construction and managing clearing such that clearing activities are constrained to these approved areas only.
		Locate soil or mulch stockpiles away from watercourses and key stormwater flow paths to limit potential transport of these substances into the watercourses via runoff.
		Dust suppression activities to be undertaken where appropriate.
		Stabilisation of disturbed areas, including revegetation in accordance with the VMP, is to be undertaken as soon as practicable after disturbance.
		Emergency response protocols and procedures for implementation in the event of a contaminant spill or leak to be clearly articulated in the Construction Environmental Management Plan.
		Spill kits to be located to allow for timely response to uncontained spills. Site inductions are to include a briefing on the sue of spill kits.

Activity	Impact	Mitigation Measure
	Weed establishment and invasion	Management of noxious weeds are to be undertaken in accordance with the *Noxious Weeds Act* 1993.
Vegetation clearance	Loss of fauna habitat	Consider the installation of nest boxes in trees to be retained that may offer alternative nesting habitat to hollow-dependent species recorded in the study area.
		High visibility plastic fencing is to be installed to clearly define the limits of the works area as to not further encroach on fauna habitat.
Construction in proximity to Freshwater Creek	Degradation of Riparian Zones	Install appropriate drainage infrastructure (e.g. sediment basins, diversion drains), sediment and erosion controls prior to the commencement of construction.
		Construction disturbance areas will be clearly demarcated to avoid accidental clearing or stockpiling in proximity to the Freshwater Creek
Construction of pavement, slabs and building structures	Altered hydrological regimes related to an increase in impervious surface such as changes in runoff and infiltration, redirection of flows	Landscaped zones to capture gross pollutants and oil and grits from pavement. These areas can be regularly maintained to remove rubbish and can be renewed on a regular basis.
Hot works (including vegetation clearing requiring heat producing equipment)	Outbreak of bushfire	Hot work not to be undertaken on declared total fire ban days. Vehicles and plant should not block fire trails. Bushfire awareness included in staff induction and in toolbox talks pre-commencement.

6.0 Conclusion

This Flora and Fauna Assessment documents the biodiversity occurring within study area for the Proposal. It describes terrestrial and aquatic flora and fauna species that occur within the study area; identifies vegetation communities and habitat types and determines the likely occurrence of threatened species and their habitats within the study area.

A total of 102 vascular plant species were recorded in the study area, comprising 56 native species and 47 exotic species. A list of plant species recorded in the study area is provided in Appendix 1. No threatened flora species listed under the TSC Act or the EPBC Act were detected within the study area. No ROTAP listed flora species were detected within the study area during flora surveys. Three noxious weeds and two Weeds of National Significance occur in the study area.

Three vegetation communities were identified within the study area: Landscaped Gardens, Exotic Grassland with Scattered Trees and Freshwater Creek. No Threatened Ecological Communities were identified in the study area.

A total of 37 terrestrial vertebrate fauna species were recorded during field surveys of the study area. 28 species of birds, five species of mammals and four species of amphibians were aurally and visually identified from the study area. One threatened species was identified from the study area: *Pteropus poliocephalus* (Grey-headed Flying-fox). One species listed as a Migratory species were identified from the study area: *Ardea ibis* (Cattle Egret).

Potential impacts that may arise as a result of unmitigated activities associated with the construction of the Proposal include:

- Loss of native vegetation, including Endangered Ecological Communities and threatened flora species.
- Loss of fauna habitat including that of threatened and migratory species.
- Habitat fragmentation/ loss of fauna habitat connectivity.
- Alteration and degradation of aquatic habitats.

Impacts on the identified ecological values should be avoided as far as practicable. Where impacts cannot be avoided, a range of mitigation measures have been recommended to ameliorate impacts on the biodiversity values during and following construction. Assessments of Significance have been prepared for the threatened flora and fauna species known or likely to be impacted by the Proposal. These assessments concluded no threatened flora of fauna species would be significantly impacted by the Proposal. These threatened species and communities do not require further consideration.

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Appendix 1

Flora Species Inventory

Family	Scientific Name	Common Name
	TREES	
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm
Arecaceae	*Howea* sp.	Exotic Palm
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Cupressaceae	*Cupressus* sp*	Cypress
Ebenaceae	*Diospyros kaki**	Persimmon
Euphorbiaceae	*Glochidion ferdinandii*	Cheese Tree
Hamamelidaceae	*Liquidambar styraciflua**	Sweet Gum
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Meliaceae	*Melia azedarach* var. *australasica*	White Cedar
Myrtaceae	*Acmena smithii*	Lillypilly
Myrtaceae	*Angophora costata*	Smooth-barked Apple
Myrtaceae	*Corymbia gummifera*	Red Bloodwood
Myrtaceae	*Eucalyptus botryoides*	Bangalay / Southern Mahogany
Myrtaceae	*Eucalyptus capitellata*	Brown Stringybark
Myrtaceae	*Eucalyptus piperita* subsp. *piperita*	Sydney Peppermint
Myrtaceae	*Eucalyptus punctata*	Grey Gum
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Myrtaceae	*Eucalyptus saligna*	Sydney Blue Gum
Myrtaceae	*Eucalyptus* sp.	non-endemic (planted)
Myrtaceae	*Eucalyptus umbra* subsp. *umbra*	Broad-leaved White Mahogany
Myrtaceae	*Lophostemon confertus*	Brush Box
Myrtaceae	*Melaleuca decora*	-
Myrtaceae	*Melaleuca linariifolia*	Snow in Summer
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark
Myrtaceae	*Melaleuca stypheloides*	Prickly-leaved Tea Tree
Myrtaceae	*Tristaniopsis laurina*	Water Gum
Proteaceae	*Grevillea robusta*	Silky Oak
	SHRUBS	
Apocnynaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush
Mimosaceae	*Acacia longifolia* var. *longifolia*	Sydney Golden Wattle
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush
Oleaceae	*Ligustrum sinense**	Small-leaved Privet
Phytolaccaceae	*Phytolacca octandra**	Inkweed
Rutaceae	*Murraya paniculata*	Orange Jessamine
Theaceae	*Camellia* sp. (cultivar)*	Camellia
Verbenaceae	*Lantana camara**	Lantana
Strelitziaceae	*Strelitzia reginae**	Bird of Paradise
	GROUNDCOVERS	
Apiaceae	*Centella asiatica*	Swamp Pennywort
Apiaceae	*Foeniculum vulgare**	Fennel
Asteraceae	*Conyza sumatrensis**	Fleabane
Asteraceae	*Ageratina adenophorum**	Crofton Weed

Family	Scientific Name	Common Name
Asteraceae	*Ambrosia artemisifolia**	Annual Ragweed
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Asteraceae	*Cirsium vulgare**	Spear Thistle
Asteraceae	*Coreopsis lanceolata**	-
Asteraceae	*Euchiton involucratus*	Star Cudweed
Asteraceae	*Senecio madagascariensis**	Fireweed
Asteraceae	*Sonchus oleraceus**	Common Sow-thistle
Asteraceae	*Taraxacum officinale**	Dandelion
Asteraceae	*Vittadinia hispidula* var. *hispidula*	-
Balsaminaceae	*Impatiens walleriana**	Busy Lizzie
Brassicaceae	*Capsella bursa-pastoris**	Shepherds purse
Carophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed
Convolvulaceae	*Dichondra repens*	Kidney Weed
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern
Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Dicksoniaceae	*Calochlaena dubia*	False Bracken
Fabaceae	*Trifolium arvense**	Haresfoot Clover
Fabaceae	*Trifolium repens**	White Clover
Gentianaceae	*Centaurium erythraea**	Pink Stars
Geraniaceae	*Geranium homeanum*	Northern Cranesbill
Liliaceae	*Agapanthus praecox**	Agapanthus
Liliaceae	*Allium triquetrum**	Three-cornered Onion
Lobeliaceae	*Pratia purpurascens*	Whiteroot
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush
Malvaceae	*Malva parviflora**	Small-flowered Mallow
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Myrsinaceae	*Anagallis arvensis**	Scarlet Pimpernel
Oxalidaceae	*Oxalis corniculata**	Yellow Wood Sorrel
Plantaginaceae	*Plantago lanceolata**	Ribwort
Poaceae	*Andropogon virginicus**	Whisky Grass
Poaceae	*Bromus molliformis**	Soft Brome
Poaceae	*Chloris gayana**	Rhodes Grass
Poaceae	*Cynodon dactylon*	Common Couch
Poaceae	*Echinopogon caespitosus* var. *caespitosus*	Tufted Hedgehog Grass
Poaceae	*Entolasia marginata*	Bordered Panic
Poaceae	*Entolasia stricta*	Wiry Panic
Poaceae	*Oplismenus aemulus*	Basket Grass
Poaceae	*Panicum simile*	Two Colour Panic
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Paspalum urvillei**	Vasey Grass
Poaceae	*Pennisetum clandestinum**	Kikuyu
Poaceae	*Phragmites australis*	Common Reed
Poaceae	*Poa affinis*	-
Poaceae	*Themeda australis*	Kangaroo Grass
Polygonaceae	*Acetosella vulgaris**	Sheep Sorrel

Family	Scientific Name	Common Name
Polygonaceae	*Persicaria lapathifolia*	Pale Knotweed
Polygonaceae	*Rumex crispus**	Curled Dock
Portulacaceae	*Portulaca oleracea*	Purslane
Solanaceae	*Solanum nigrum**	Black Nightshade
Verbenaceae	*Verbena bonariensis**	Purpletop
Violaceae	*Viola hederacea*	Ivy-leaved Violet
AQUATIC PLANTS		
Alismataceae	*Damasonium minus*	Starfruit
	*Sagittaria platyphylla**	Sagittaria
CLIMBERS		
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle
Convolvulaceae	*Ipomoea cairica**	Blue Morning Glory
Fabaceae	*Desmodium varians*	-
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily
Menispermiaceae	*Stephania japonica* var. *discolor*	Snake Vine

Appendix 2

Tree Survey Results

Tree No	Scientific Name	Common Name	Canopy Spread (m)	Height (m)	DBH (cm)	Comment
1	*Eucalyptus umbra*	Broad-leaved White Mahogany	8	12	80	
2	*Allocasuarina littoralis*	Black She-oak	3	6	40	
3	*Eucalyptus botryoides*	Bangalay	12	15	70	Planted
4	*Melaleuca linariifolia*	Snow in Summer	4	5	40	
5	*Eucalyptus saligna*	Sydney Blue Gum	12	12	100	Planted
6	*Allocasuarina littoralis*	Black She-oak	5	10	40	
7	*Melaleuca quinquenervia*	Broad-leaved Paperbark	5	10	70	
8	*Melaleuca decora*	-	4	8	40	
9	*Callistemon salignus*	Willow Bottlebrush	2	6	30	Planted
10	*Tristaniopsis laurina*	Water Gum	3	8	30	Planted
11	*Lophostemon confertus*	Brush Box	3	8	40	Planted
12	*Melaleuca quinquenervia*	Broad-leaved Paperbark	4	10	80	
13	*Casuarina glauca*	Swamp Oak	4	12	40	
14	*Eucalyptus robusta*	Swamp Mahogany	4	12	30	Planted
15	*Cinnamomum camphora*	Camphor Laurel	4	4	60	Planted
16	*Allocasuarina littoralis*	Black She-oak	6	12	90	
17	*Eucalyptus* sp.	Non-endemic Eucalyptus	5	12	50	Planted
18	*Cinnamomum camphora*	Camphor Laurel	5	4	50	Planted
19	*Liquidambar styraciflua*	Sweet Gum	3	8	40	Planted
20	*Cupressus* sp.	Cypress	2	8	80	Planted
21	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	9	40	
22	*Eucalyptus umbra*	Broad-leaved White Mahogany	2	11	50	
23	*Eucalyptus umbra*	Broad-leaved White Mahogany	5	10	50	
24	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	9	30	
25	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	9	40	
26	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	10	40	
27	*Eucalyptus umbra*	Broad-leaved White Mahogany	6	8	50	
28	*Liquidambar styraciflua*	Sweet Gum	3	8	50	Planted
29	*Cupressus* sp.	Cypress	3	8	80	Planted
30	*Callistemon salignus*	Willow Bottlebrush	4	6	50	Planted
31	*Liquidambar styraciflua*	Sweet Gum	5	8	50	Planted
32	*Angophora costata*	Smooth-barked Apple	6	12	60	

Tree No	Scientific Name	Common Name	Canopy Spread (m)	Height (m)	DBH (cm)	Comment
33	*Cupressus* sp.	Cypress	4	8	100	Planted
34	*Eucalyptus umbra*	Broad-leaved White Mahogany	6	10	70	
35	*Cupressus* sp.	Cypress	10	18	100	Planted
36	*Angophora costata*	Smooth-barked Apple	10	18	100	
37	*Corymbia gummifera*	Red Bloodwood	8	12	90	
38	-	Dead	8	12	80	No Hollows
39	*Eucalyptus umbra*	Broad-leaved White Mahogany	8	12	80	
40	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	8	40	
41	*Eucalyptus capitellata*	Brown Stringybark	2	8	40	
42	*Angophora costata*	Smooth-barked Apple	8	16	100	
43	*Callistemon salignus*	Willow Bottlebrush	4	6	60	Planted
44	*Eucalyptus umbra*	Broad-leaved White Mahogany	3	6	60	
45	*Angophora costata*	Smooth-barked Apple	8	14	100	
46	*Eucalyptus umbra*	Broad-leaved White Mahogany	5	12	70	
47	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	10	50	
48	*Eucalyptus umbra*	Broad-leaved White Mahogany	6	10	50	
49	*Eucalyptus umbra*	Broad-leaved White Mahogany	6	12	80	
50	*Angophora costata*	Smooth-barked Apple	8	12	100	
51	*Corymbia gummifera*	Red Bloodwood	6	8	80	
52	*Eucalyptus umbra*	Broad-leaved White Mahogany	3	8	40	
53	*Eucalyptus capitellata*	Brown Stringybark	5	10	70	
54	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	10	50	
55	*Eucalyptus saligna*	Sydney Blue Gum	12	12	100	Planted
56	*Eucalyptus umbra*	Broad-leaved White Mahogany	3	8	40	
57	*Callistemon salignus*	Willow Bottlebrush	3	4	30	Planted
58	*Angophora costata*	Smooth-barked Apple	8	17	100	
59	*Angophora costata*	Smooth-barked Apple	4	8	40	
60	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	9	40	
61	*Eucalyptus piperita* subsp. *piperita*	Sydney Peppermint	8	16	120	
62	*Corymbia gummifera*	Red Bloodwood	8	16	60	
63	*Angophora costata*	Smooth-barked Apple	8	14	100	
64	*Angophora costata*	Smooth-barked Apple	8	12	70	
65	*Archontophoenix cunninghamiana*	Bangalow Palm	4	10	60	

Tree No	Scientific Name	Common Name	Canopy Spread (m)	Height (m)	DBH (cm)	Comment
66	*Archontophoenix cunninghamiana*	Bangalow Palm	4	10	60	
67	*Archontophoenix cunninghamiana*	Bangalow Palm	4	8	50	
68	*Archontophoenix cunninghamiana*	Bangalow Palm	4	12	50	
69	-	Exotic Palm	2	10	80	Planted
70	-	Exotic Palm	1	6	80	Planted
71	*Archontophoenix cunninghamiana*	Bangalow Palm	4	6	80	
72	-	Exotic Palm	2	4	80	Planted
73	*Acmena smithii*	Lily-pilly	8	10	100	Planted
74	-	Dead	8	14	100	
75	*Melaleuca decora*	-	4	6	60	
76	*Eucalyptus punctata*	Grey Gum	10	12	80	
77	-	Dead	4	8	40	No Hollows
78	*Eucalyptus punctata*	Grey Gum	10	12	80	
79	*Angophora costata*	Smooth-barked Apple	3	10	40	
80	*Angophora costata*	Smooth-barked Apple	3	10	40	
81	*Angophora costata*	Smooth-barked Apple	4	9	70	
82	*Angophora costata*	Smooth-barked Apple	8	12	70	
83	-	Dead	10	10	100	No Hollows
84	*Eucalyptus umbra*	Broad-leaved White Mahogany	3	6	40	
85	-	Dead	3	8	80	No Hollows
86	*Angophora costata*	Smooth-barked Apple	4	10	50	
87	*Eucalyptus punctata*	Grey Gum	4	10	50	
88	*Angophora costata*	Smooth-barked Apple	4	10	50	
89	*Angophora costata*	Smooth-barked Apple	8	10	50	
90	*Angophora costata*	Smooth-barked Apple	8	12	100	
91	-	Dead	8	12	80	1x 3cm hollow
92	*Corymbia gummifera*	Red Bloodwood	10	12	80	
93	*Eucalyptus punctata*	Grey Gum	8	12	80	
94	*Eucalyptus punctata*	Grey Gum	8	12	80	
95	-	Dead	10	12	90	No Hollows
96	-	Dead	6	10	50	No Hollows
97	*Eucalyptus punctata*	Grey Gum	10	14	110	
98	-	Dead	10	12	80	No Hollows
99	-	Dead	10	12	80	No Hollows
100	*Eucalyptus punctata*	Grey Gum	10	12	100	
101	*Eucalyptus punctata*	Grey Gum	10	10	70	
102	*Eucalyptus punctata*	Grey Gum	8	14	110	Lge termite nest
103	-	Dead	4	12	80	No Hollows

Tree No	Scientific Name	Common Name	Canopy Spread (m)	Height (m)	DBH (cm)	Comment
104	-	Dead	2	6	60	
105	*Eucalyptus* sp.	Planted	10	10	90	Planted
106	*Eucalyptus punctata*	Grey Gum	4	6	40	
107	*Eucalyptus punctata*	Grey Gum	4	8	50	
108	*Eucalyptus punctata*	Grey Gum	8	8	80	
109	*Angophora costata*	Smooth-barked Apple	10	12	90	
110	-	Dead	6	10	80	No Hollows
111	-	Dead	6	10	60	No Hollows
112	-	Dead	8	14	120	No Hollows
113	*Eucalyptus punctata*	Grey Gum	10	16	150	
114	*Eucalyptus punctata*	Grey Gum	8	12	100	
115	-	Dead	6	10	70	No Hollows
116	*Eucalyptus punctata*	Grey Gum	12	16	180	
117	-	Dead	6	10	50	No Hollows
118	*Eucalyptus punctata*	Grey Gum	8	12	80	
119	*Eucalyptus punctata*	Grey Gum	10	12	100	
120	-	Dead	4	12	80	No Hollows
121	-	Dead	8	12	70	No Hollows
122	*Melaleuca linariifolia*	Snow in Summer	4	6	80	
123	*Melaleuca linariifolia*	Snow in Summer	4	4	40	
124	*Eucalyptus umbra*	Broad-leaved White Mahogany	6	12	90	
125	-	Dead	6	12	60	
126	*Corymbia gummifera*	Red Bloodwood	6	12	60	
127	-	Exotic Palm	4	8	60	Planted
128	*Angophora costata*	Smooth-barked Apple	3	3	80	
129	*Angophora costata*	Smooth-barked Apple	3	8	20	
130	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	8	40	
131	*Angophora costata*	Smooth-barked Apple	6	12	80	
132	*Angophora costata*	Smooth-barked Apple	5	10	60	
133	*Eucalyptus umbra*	Broad-leaved White Mahogany	8	10	60	
134	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	5	50	
135	*Cupressus* sp.	Cypress	1	8	40	Planted
136	-	Dead	3	8	30	
137	*Melaleuca linariifolia*	Snow in Summer	6	8	60	
138	*Eucalyptus robusta*	Swamp Mahogany	3	4	30	
139	*Cupressus* sp.	Cypress	1	8	40	Planted
140	*Melaleuca linariifolia*	Snow in Summer	5	10	40	
141	*Melaleuca linariifolia*	Snow in Summer	2	3	20	
142	*Cupressus* sp.	Cypress	1	10	40	Planted
143	*Melaleuca linariifolia*	Snow in Summer	3	8	70	

Tree No	Scientific Name	Common Name	Canopy Spread (m)	Height (m)	DBH (cm)	Comment
144	-	Dead	1	8	60	
145	*Melaleuca linariifolia*	Snow in Summer	1	7	40	
146	*Cupressus* sp.	Cypress	1	8	40	Planted
147	*Cupressus* sp.	Cypress	1	10	40	Planted
148	*Melaleuca linariifolia*	Snow in Summer	2	4	20	
149	*Melaleuca linariifolia*	Snow in Summer	2	4	20	
150	*Melaleuca linariifolia*	Snow in Summer	4	4	80	
151	*Cupressus* sp.	Cypress	2	6	60	Planted
152	*Cupressus* sp.	Cypress	2	6	60	Planted
153	*Cupressus* sp.	Cypress	1	10	60	Planted
154	*Cupressus* sp.	Cypress	1	8	60	Planted
155	*Cupressus* sp.	Cypress	1	8	60	Planted
156	*Cupressus* sp.	Cypress	1	8	40	Planted
157	*Cupressus* sp.	Cypress	1	8	40	Planted
158	*Cupressus* sp.	Cypress	1	4	30	Planted
159	*Corymbia gummifera*	Red Bloodwood	4	12	40	
160	*Cupressus* sp.	Cypress	1	7	40	Planted
161	*Eucalyptus punctata*	Grey Gum	10	12	120	
162	*Eucalyptus punctata*	Grey Gum	2	4	30	
163	*Eucalyptus punctata*	Grey Gum	6	12	60	
164	*Eucalyptus punctata*	Grey Gum	2	4	30	
165	*Eucalyptus umbra*	Broad-leaved White Mahogany	6	12	70	
166	*Angophora costata*	Smooth-barked Apple	4	8	50	
167	*Angophora costata*	Smooth-barked Apple	4	10	40	
168	*Corymbia gummifera*	Red Bloodwood	6	12	60	
169	*Eucalyptus umbra*	Broad-leaved White Mahogany	3	8	50	
170	*Angophora costata*	Smooth-barked Apple	10	8	60	
171	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	12	50	
172	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	12	50	
173	*Angophora costata*	Smooth-barked Apple	4	12	50	
174	*Corymbia gummifera*	Red Bloodwood	4	8	40	
175	*Angophora costata*	Smooth-barked Apple	8	14	80	
176	*Angophora costata*	Smooth-barked Apple	6	12	60	
177	*Angophora costata*	Smooth-barked Apple	4	12	50	
178	*Corymbia gummifera*	Red Bloodwood	4	12	50	
179	*Angophora costata*	Smooth-barked Apple	4	10	60	
180	*Angophora costata*	Smooth-barked Apple	6	10	60	
181	*Angophora costata*	Smooth-barked Apple	6	10	50	
182	*Corymbia gummifera*	Red Bloodwood	4	10	60	
183	*Angophora costata*	Smooth-barked Apple	4	8	50	

Tree No	Scientific Name	Common Name	Canopy Spread (m)	Height (m)	DBH (cm)	Comment
184	*Corymbia gummifera*	Red Bloodwood	4	8	40	
185	*Angophora costata*	Smooth-barked Apple	6	12	50	
186	*Eucalyptus punctata*	Grey Gum	8	12	90	
187	*Eucalyptus punctata*	Grey Gum	10	14	100	
188	*Eucalyptus punctata*	Grey Gum	6	12	80	
189	*Angophora costata*	Smooth-barked Apple	8	12	80	
190	*Melaleuca quinquenervia*	Broad-leaved Paperbark	5	8	70	
191	*Angophora costata*	Smooth-barked Apple	8	12	90	
192	-	Exotic Palm	3	6	40	Planted
193	-	Exotic Palm	4	8	50	Planted
194	-	Exotic Palm	4	8	50	Planted
195	-	Exotic Palm	2	4	40	Planted
196	-	Exotic Palm	4	6	40	Planted
198	-	Exotic Palm	4	8	50	Planted
199	*Liquidambar styraciflua*	Sweet Gum	6	10	50	Planted
200	*Liquidambar styraciflua*	Sweet Gum	4	8	40	Planted
201	*Cinnamomum camphora*	Camphor Laurel	4	6	50	Planted
202	*Liquidambar styraciflua*	Sweet Gum	3	8	50	Planted
203	*Allocasuarina littoralis*	Black She-oak	8	10	90	
204	*Melaleuca quinquenervia*	Broad-leaved Paperbark	4	8	90	
205	-	Persimmon?	3	4	30	Planted
206	*Lophostemon confertus*	Brush Box	6	8	70	Planted
207	*Angophora costata*	Smooth-barked Apple	3	10	40	
208	*Angophora costata*	Smooth-barked Apple	8	10	80	
209	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	4	40	
210	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	4	40	
211	*Angophora costata*	Smooth-barked Apple	5	6	50	
212	*Eucalyptus punctata*	Grey Gum	2	3	40	
213	*Eucalyptus piperita* subsp. *piperita*	Sydney Peppermint	3	6	30	
214	*Eucalyptus punctata*	Grey Gum	10	12	60	
215	*Eucalyptus piperita* subsp. *piperita*	Sydney Peppermint	3	6	30	
216	*Angophora costata*	Smooth-barked Apple	8	10	50	
217	*Eucalyptus punctata*	Grey Gum	4	12	40	
218	*Eucalyptus punctata*	Grey Gum	8	12	80	
219	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	12	30	

Tree No	Scientific Name	Common Name	Canopy Spread (m)	Height (m)	DBH (cm)	Comment
220	*Eucalyptus punctata*	Grey Gum	8	12	50	
221	*Corymbia gummifera*	Red Bloodwood	4	12	50	
222	*Eucalyptus punctata*	Grey Gum	8	12	70	
223	*Angophora costata*	Smooth-barked Apple	5	10	35	
224	*Eucalyptus punctata*	Grey Gum	10	10	80	
225	*Angophora costata*	Smooth-barked Apple	3	4	30	
226	*Angophora costata*	Smooth-barked Apple	3	6	30	
227	*Eucalyptus umbra*	Broad-leaved White Mahogany	5	10	50	
228	*Eucalyptus umbra*	Broad-leaved White Mahogany	4	6	30	
229	*Eucalyptus punctata*	Grey Gum	8	12	80	
230	*Glochidion ferdinandii*	Cheese Tree	4	8	40	
231	*Angophora costata*	Smooth-barked Apple	6	12	60	
232	*Angophora costata*	Smooth-barked Apple	4	12	50	
233	*Angophora costata*	Smooth-barked Apple	4	12	50	
234	*Corymbia gummifera*	Red Bloodwood	4	12	50	
235	*Angophora costata*	Smooth-barked Apple	4	12	70	
236	*Angophora costata*	Smooth-barked Apple	4	10	40	
237	*Corymbia gummifera*	Red Bloodwood	2	4	40	
238	*Melaleuca linariifolia*	Snow in Summer	8	12	50	
239	*Melaleuca linariifolia*	Snow in Summer	1	4	30	
240	*Corymbia gummifera*	Red Bloodwood	6	12	50	
241	*Eucalyptus punctata*	Grey Gum	4	8	50	
242	*Melaleuca linariifolia*	Snow in Summer	1	4	30	
243	*Eucalyptus punctata*	Grey Gum	2	6	30	
244	*Eucalyptus umbra*	Broad-leaved White Mahogany	2	8	30	
245	*Corymbia gummifera*	Red Bloodwood	6	12	60	
246	*Angophora costata*	Smooth-barked Apple	6	12	60	
247	*Angophora costata*	Smooth-barked Apple	8	12	50	
248	*Angophora costata*	Smooth-barked Apple	10	14	100	
249	*Corymbia gummifera*	Red Bloodwood	6	12	60	
250	*Eucalyptus piperita* subsp. *piperita*	Sydney Peppermint	8	12	150	1x20cm hollow
251	*Eucalyptus punctata*	Grey Gum	8	12	100	
252	*Eucalyptus punctata*	Grey Gum	8	12	80	
253	*Eucalyptus capitellata*	Brown Stringybark	3	10	40	
254	*Melaleuca stypheloides*	Prickly-leaved Tea Tree	3	8	40	
255	*Corymbia gummifera*	Red Bloodwood	4	12	60	
256	*Angophora costata*	Smooth-barked Apple	6	12	30	
257	*Allocasuarina torulosa*	Forest Oak	4	13	34	Planted
258	*Allocasuarina torulosa*	Forest Oak	4	11	30	Planted

Tree No	Scientific Name	Common Name	Canopy Spread (m)	Height (m)	DBH (cm)	Comment
259	*Allocasuarina torulosa*	Forest Oak	3	12	30	Planted
260	*Allocasuarina torulosa*	Forest Oak	5	14	30	Planted
261	*Casuarina glauca*	Swamp Oak	6	18	32	Planted
262	*Allocasuarina torulosa*	Forest Oak	5	15	26	Planted
263	*Allocasuarina littoralis*	Black She-oak	4	14	32	Planted
264	*Allocasuarina torulosa*	Forest Oak	6	15	36	Planted
265	*Allocasuarina torulosa*	Forest Oak	7	15	60	Planted
266	*Allocasuarina torulosa*	Forest Oak	5	15	34	Planted
267	*Allocasuarina torulosa*	Forest Oak	6	18	34	Planted
268	*Allocasuarina torulosa*	Forest Oak	6	18	38	Planted
269	*Eucalyptus robusta*	Swamp Mahogany	6	16	25	

Appendix 3

Fauna Species Inventory

Group	Scientific Name	Common Name	Status	Observation Type
Amphibians	*Crinia signifera*	Common Eastern Froglet		Aural
Amphibians	*Limnodynastes peronii*	Striped Marsh Frog		Aural
Amphibians	*Litorea fallax*	Dwarf tree frog		Aural
Amphibians	*Litoria peronii*	Peron's tree frog		Aural
Birds	*Acridotheres tristis*	Common Myna	*	Visual
Birds	*Anas superciliosa*	Pacific Black Duck		Visual
Birds	*Anser anser domesticus*	Domestic Goose	*	Visual
Birds	*Ardea ibis*	Cattle Egret	Migratory (EPBC Act	Visual
Birds	*Cacatua galerita*	Sulphur-crested Cockatoo		Visual
Birds	*Columba livia*	Rock Dove	*	Visual
Birds	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		Aural
Birds	*Corvus coronoides*	Australian Raven		Call
Birds	*Cracticus nigrogularis*	Pied Butcherbird		Visual
Birds	*Cracticus tibicen*	Australian Magpie		Visual
Birds	*Dacelo novaeguineae*	Laughing Kookaburra		Visual
Birds	*Egretta novaehollandiae*	White-faced Heron		Visual
Birds	*Elanus axillaris*	Black-shouldered Kite		Visual
Birds	*Eolophus roseicapillus*	Galah		Visual
Birds	*Eudynamys orientalis*	Eastern Koel		Aural
Birds	*Eurystomus orientalis*	Dollarbird		Visual
Birds	*Gallinula tenebrosa*	Dusky Moorhen		Visual
Birds	*Gallus domesticus*	Domestic Chicken		Visual
Birds	*Grallina cyanoleuca*	Magpie lark		Aural
Birds	*Manorina melanocephala*	Noisy Miner		Visual

Group	Scientific Name	Common Name	Status	Observation Type
Birds	*Ocyphaps lophotes*	Crested Pigeon		Visual
Birds	*Platycercus eximius*	Eastern Rosella		Visual
Birds	*Porphyrio porphyrio*	Purple Swamphen		Visual
Birds	*Scythrops novaehollandiae*	Channel-billed Cuckoo		Aural
Birds	*Strepera graculina*	Pied Currawong		Visual
Birds	*Threskiornis molucca*	Australian White Ibis		Visual
Birds	*Trichoglossus haematodus*	Rainbow Lorikeet		Visual
Birds	*Vanellus miles*	Masked Lapwing		Visual
Mammal	*Canis familiaris*	Dog	*	Visual
Mammal	*Equus caballus*	Horse	*	Visual
Mammal	*Felis catus*	Cat	*	Visual
Mammal	*Pteropus poliocephalus*	Grey-headed Flying-fox	Vulnerable (EPBC Act) Vulnerable (TSC Act)	Visual
Mammals	*Trichosurus vulpecula*	*Common brushtail possum*		Visual

Appendix 4

Assessments of Significance

Melaleuca biconvexa (Biconvex Paperbark)

(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.**

Melaleuca biconvexa (Biconvex Paperbark) occurs in disjunct populations in coastal NSW from Jervis Bay to Port Macquarie with the main concentration of records in the Gosford / Wyong Area. *M. biconvexa* is a shrub to small tree with papery bark which flowers for a short period of up to 4 weeks in summer. It may occur in dense stands adjacent to watercourses, in association with other Melaleuca species or as an understorey species in wet forest. Present populations are threatened by land clearing, filling, excavation for construction of floodwater detention basins and alteration to water tables. This species is not ROTAP-listed.

The species was not recorded in the study area. Freshwater Creek vegetation supports marginal habitat for the species. This habitat is of low quality due to previous long-term land management practices such as underscrubbing, slashing, removal of native vegetation and grazing of horses.

The proposed development is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

(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.**

Melaleuca biconvexa is not an endangered population within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

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

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

Melaleuca biconvexa is not an endangered ecological community within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

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

Melaleuca biconvexa is not an endangered ecological community within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

(d) **in relation to the habitat of a threatened species, population or ecological community:**

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

The species was not recorded in the study area. Freshwater Creek vegetation supports marginal habitat for the species.

The development footprint of the Proposal covers 4.04 hectares and will result in the removal of all vegetation from Landscapes Gardens and from a large proportion of Exotic Grassland with Scattered Tree vegetation communities. Freshwater Creek vegetation and some Exotic Grassland with Scattered Tree vegetation will be retained in the east of the study area (a total of 0.86 hectares).

As potential habitat for the species is being retained in the study area, the proposed action is unlikely to have an adverse effect on the long-term survival of *Melaleuca biconvexa* in the locality.

(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**

The study area is located within a semi-rural residential landscape which has been subject to extensive vegetation clearing. Approximately 0.8 hectares of potential habitat will be retained in the east of the study area. Therefore it is considered that the proposed development is unlikely to fragment or isolate any areas of habitat from other areas of habitat as a result of the proposed action.

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

The importance of the habitat to be removed is considered to be low because the study area offers marginal potential habitat for *Melaleuca biconvexa*. This is primarily due to past land management practices such as underscrubbing, slashing, weed invasion, removal of native vegetation over large portions of the site grazing and associated trampling. It is therefore considered that the proposed action is unlikely to remove important habitat for the long-term survival of *Melaleuca biconvexa* within the locality.

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

Critical habitat for *Melaleuca biconvexa* has not been gazetted. Therefore the action proposed will not have an adverse effect on any critical habitat (either directly or indirectly).

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

A Recovery Plan or threat abatement Plan has not been produced for *Melaleuca biconvexa*. However, it is considered that the proposed action will not contravene any strategies or plans to manage this species or its habitats.

(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 action proposed may result in the operation of several Key Threatening Processes such as:

- Removal of Native Vegetation,
- Invasion and establishment of exotic vines and scramblers,
- Invasion, establishment and spread of *Lantana camara,*
- Invasion of native plant communities by *Chrysanthemoides monilifera* (Bitou bush and boneseed),
- Invasion of native plant communities by exotic perennial grasses,
- Loss of hollow-bearing trees, and
- Removal of dead wood and dead trees

Approximately 0.8 hectares of potential habitat will be retained in the east of the study area.
The vegetation to be removed from the study area comprises highly modified vegetation due to previous long-term land management practices and under-scrubbing and removal of native vegetation for the grazing of horses. The proposed development may facilitate the spread of weed species such as exotic vines and scramblers, *Lantana camara, Chrysanthemoides monilifera* and exotic perennial grasses. The impacts of this KTP can be reduced through appropriate controls and mitigation measures during and after road

construction.

Conclusion

Melaleuca biconvexa was not recorded in the study area during a targeted survey for this species. Freshwater Creek vegetation offers marginal potential habitat to the species, and this habitat is being retained. As a result, it is considered unlikely that the proposal represents a significant impact to the species, particularly if the mitigation measures listed in Section 7 are implemented.

Syzygium paniculatum (Magenta Lilly Pilly)

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,

Syzygium paniculatum (Magenta Lillypilly) is a small to medium sized rainforest tree, which grows from 3-8m high. The bark is flaky and leaves are lanceolate to obovate 4.5 -10cm long. Leaves are generally dark green and glabrous (shiny) on the upper surface and paler underneath. Plants have white inflorescences that form at the end of each branch. The common name of this species is derived from the pink to red colouring of the ripe fruit.

S. paniculatum is endemic to New South Wales and occurrences of the species are often separated by considerable distances. Five broad metapopulations have been recognised, including: Jervis Bay, Coalcliff, Botany Bay, Central Coast and Seal Rocks (DECC 2007). These comprise a total of 43 known subpopulations, in addition to six unconfirmed records, from the Sydney Basin Bioregion, and the NSW North Coast Bioregion (DECC 2007, after Thackway and Creswell 1995). The extent of occurrence is approximately 15,000 km^2 and the area of occupancy (based on a 2 km grid, as recommended by IUCN 2006) is approximately 180-210 km^2 (Mackenzie & Keith 2008).

The three largest subpopulations on the Central Coast account for nearly three-quarters of the total known extant population (DECC 2007). Estimates for the number of mature plants within 30 of the known populations suggest that these comprise a total of approximately 530-1,320 plants (DECC 2007, Mackenzie & Keith 2008). The total population of *S. paniculatum* is unlikely to contain more than 1,200-2,600 mature plants, even assuming that each of the remaining unsurveyed subpopulations include as many as 50-100 mature plants. A more realistic assumption, that unsurveyed subpopulations contain, on average, as many mature individuals as surveyed populations, suggests that the actual number of mature individuals is likely to be 760-1,900 (Mackenzie & Keith 2008). These estimates indicate that there is a low number of mature individuals in the total population of *S. paniculatum*.

The past land management practices or activities such as underscrubbing, slashing, weed invasion, removal of native vegetation over large portions of the site, grazing and associated trampling has degraded the habitat potential for this species. Therefore it is considered that the potential habitat value of the study area for *Syzygium paniculatum* is marginal to poor.

This species was not observed within the study area during surveys. Freshwater creek vegetation offers marginal potential habitat to the species. Due to the presence of other areas of equal or better habitat within the local area it is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

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

Syzygium paniculatum is not an endangered population within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

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

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

Syzygium paniculatum is not an endangered ecological community within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

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

Syzygium paniculatum is not an endangered ecological community within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

d) in relation to the habitat of a threatened species, population or ecological community:

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

The species was not recorded in the study area. Freshwater Creek vegetation supports marginal habitat for the species.

The development footprint of the Proposal covers 4.04 hectares and will result in the removal of all vegetation from Landscapes Gardens and from a large proportion of Exotic Grassland with Scattered Tree vegetation communities. Freshwater Creek vegetation and some Exotic Grassland with Scattered Tree vegetation will be retained in the east of the study area (a total of 0.86 hectares).

As potential habitat for the species is being retained in the study area, the proposed action is unlikely to have an adverse effect on the long-term survival of *Syzygium paniculatum* in the locality.

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

The study area is located within a semi-rural residential landscape which has been subject to extensive vegetation clearing. Approximately 0.8 hectares of potential habitat will be retained in the east of the study area. Therefore it is considered that the proposed development is unlikely to fragment or isolate any areas of habitat from other areas of habitat as a result of the proposed action.

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

The importance of the habitat to be removed is considered to be low because study area provides supports low quality potential habitat for this species. This is primarily due to past land management practices such as underscrubbing, slashing, weed invasion, removal of native vegetation over large portions of the site, grazing and associated trampling. It is therefore considered that the proposed action is unlikely to remove important habitat for the long-term survival of this species within the locality.

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

Critical habitat for *Syzygium paniculatum* has not been gazetted. Therefore the action proposed will not have an adverse effect on any critical habitat (either directly or indirectly).

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

A Recovery Plan or threat abatement Plan has not been produced for *Syzygium paniculatum*. However, it is considered that the proposed action will not contravene any strategies or plans to manage this species or its habitats.

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 action proposed is likely to result in the operation of several Key Threatening Processes such as:

- Removal of Native Vegetation,
- Invasion and establishment of exotic vines and scramblers,
- Invasion, establishment and spread of *Lantana camara,*
- Invasion of native plant communities by *Chrysanthemoides monilifera* (Bitou bush and boneseed),
- Invasion of native plant communities by exotic perennial grasses,
- Loss of hollow-bearing trees, and
- Removal of dead wood and dead trees

Approximately 0.86 hectares of potential habitat will be retained in the east of the study area.

The vegetation to be removed from the study area comprises highly modified vegetation due to previous long-term land management practices and under-scrubbing and removal of native vegetation for the grazing of horses. The proposed development may facilitate the spread of weed species such as exotic vines and scramblers, *Lantana camara, Chrysanthemoides monilifera* and exotic perennial grasses. The impacts of this KTP can be reduced through appropriate controls and mitigation measures during and after road construction.

Conclusion

Syzygium paniculatum was not recorded in the study area during a targeted survey for this species. Freshwater Creek vegetation offers marginal potential habitat to the species, and this habitat is being retained. As a result, it is considered unlikely that the proposal represents a significant impact to the species, particularly if the mitigation measures listed in Section 7 are implemented.

Forest Owls

Tyto novaehollandiae (Masked Owl)

In NSW *Tyto novaehollandiae* (Masked Owl) is distributed throughout the length of the Great Dividing Range and extend from the coast to the western slopes. Recent surveys in south-eastern NSW have shown T. novaehollandiae to be widespread, albeit at very low population densities. *T. novaehollandiae* occupies a range of environments from tall, wet Eucalypt forest to dry woodland, and often, but not always, at the ecotone with cleared land.

Their diet is comprised almost exclusively of ground-dwelling or scansorial prey. Such prey includes Rats, Marsupial Mice, Bandicoots and sometimes Rabbits. *T. novaehollandiae* will perch for long periods, up to several hours, in an exposed area, waiting to ambush a passing prey animal. On occasions other prey such as small arboreal mammals or birds are taken. Recent surveys have revealed that the diet of T. novaehollandiae is largely dependent on the location and habitat type in which they hunt. Studies conducted in a completely forested environment in south-eastern NSW found that prey was comprised entirely of native mammals (such as Dasyurids and native Rats). Conversely, studies conducted on a pair of Owls living in a human-modified environment near Warners Bay found that prey was comprised entirely of introduced species (such as Black Rats and House Mice) (Kavanagh 2002). The female of this pair from the Warners Bay area was radio-tracked and was found to spend the vast majority of its hunting time (over 80%) in modified (non-forested) environments (Kavanagh and Murray 1996). As such, it appears that T. novaehollandiae is able to adapt to modified environments for both the type of hunting habitat and the prey taken.

T. novaehollandiae nest and prefer to roost by day in hollows inside large, old trees. These trees are often but not always in or near gullies. The species generally requires an entrance to the tree hollow of around 20-25 cm in diameter. They also roost by day among the dense foliage of leafy trees such as *Acmena smithii* (Lilly Pilly) and other rainforest species. Other roosting areas have been recorded in the Eastern Lake Macquarie area such as within introduced *Cupressus* (Pine) trees (Kavanagh and Murray 1996). There are several records of *T. novaehollandiae* nesting and roosting in caves on the Nullabor Plain. The breeding season, like that for other Tyto owls, is variable but there is a tendency for breeding to occur in autumn-winter. Two or three young are produced, although some pairs do not breed in every year. Pairs appear to mate for life and occupy exclusive territories in the order of 1000ha in size.

The reasons for *T. novaehollandiae's* rarity are not fully understood, although clearing of habitat has been identified as a major contributing factor (Higgins 1999). Aside from clearing, other key threats to this species in south-eastern Australia may include loss of nest trees and vigorous regrowth following logging (in forested areas only) (Garnett and Crowley 2000). In the Hunter Region mortality on roads appears to be a common threat to *T. novaehollandiae* (HBOC records), perhaps due to its preference for taking ground-dwelling mammals.

Ninox strenua (Powerful Owl)

The Powerful Owl is found in the coastal areas and adjacent ranges of eastern Australia from South Australia to around Rockhampton in Queensland, generally within 200km from the coast. Within NSW, Powerful Owls are distributed throughout the length of the Great Dividing Range, which is their stronghold, and extend from the coast to the western slopes where they occur in much lower numbers. The Powerful Owl inhabits a wide range of vegetation types from wet Eucalypt forests with a rainforest understorey to dry open forests and

woodlands. The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. The Powerful Owl is the largest predator of nocturnal forest-dwelling animals in Australian forests. Major prey species in NSW forests are the Greater Glider, Common Ringtail Possum, Sugar Glider, Grey-headed Fruit Bat, and several species of diurnal birds, including the Pied Currawong, Magpie and Lorikeets. It rests during the day amid thick foliage, often grasping food-remains. The male of the species employs a slow, far-carrying 'whoo-hoo' call, more deliberate than the females call, which is higher pitched with the second note slightly higher than the first.

Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the ground. These trees are usually found growing on a hillside in heavy forest and may be utilised intermittently for several years. The breeding season of the Powerful Owl is highly synchronised, being strictly winter breeders. One or two young are produced, although some pairs do not breed in every year. Pairs appear to mate for life and occupy exclusive territories in the order of 1000 ha in size.

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,

Potential foraging habitat for the Masked Owl exists within the site as part of a larger home range. The portion of foraging habitat to be removed as a result of the proposed development will represent a relatively small cumulative loss of foraging habitat available to the species in the local area. Therefore, the proposal is not considered likely to result in 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.

Potential foraging habitat for the Powerful Owl exists within the site as part of a larger home range. The portion of foraging habitat to be removed as a result of the proposed development will represent a relatively small cumulative loss of foraging habitat available to the species in the local area. Therefore, the proposal is not considered likely to result in 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.

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,

The Powerful and Masked Owl are not an endangered population at the location of the study area within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

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

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

The Powerful and Masked Owl are not an endangered ecological community within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

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

The Powerful and Masked Owl are not an endangered ecological community within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

d) in relation to the habitat of a threatened species, population or ecological community:

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

The development footprint of the Proposal covers 4.04 hectares and will result in the removal of all vegetation from Landscapes Gardens and from a large proportion of Exotic Grassland with Scattered Tree vegetation communities. Freshwater Creek vegetation and some Exotic Grassland with Scattered Tree vegetation will be retained in the east of the study area (a total of 0.86 hectares). No nesting habitat for the species was identified in the study area. Vegetation to be cleared areas to be cleared does not comprise a significant area of habitat for prey species that occur within the study area and wider study area.

(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

The study area is located within a semi-rural residential landscape which has been subject to extensive vegetation clearing. The movement of highly mobile birds, such as owls, is unlikely to be significantly reduced by fragmented habitat connectivity within the study area. Therefore it is considered that the proposed development is unlikely to fragment or isolate any areas of habitat from other areas of habitat as a result of the proposed action.

(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,

Potential foraging habitat for these species exists within the study area as part of a larger home range. However, suitable breeding / nesting habitat for this species was absent from the study area and the portion of foraging habitat to be removed as a result of the proposed development will represent a relatively small cumulative loss of foraging habitat available to the species in the local area. Therefore, the portion of foraging habitat to be removed or modified as a result of the proposal is not considered to be of high importance to the long-term survival of the species within the locality.

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

Critical habitat for the Powerful and Masked Owl has not been gazetted. Therefore the action proposed will not have an adverse effect on any critical habitat (either directly or indirectly).

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

The *Recovery Plan for the Large Forest Owls* (DECC 2006a) includes recovery plans for three owl species: *Ninox strenua* (Powerful Owl), *Tyto tenebricosa* (Sooty Owl) and *Tyto novaehollandiae* (Masked Owl). The overall objective this recovery plan is to "ensure that viable populations of the three species continue in the wild in NSW in each region where they presently occur".

The proposed action is unlikely to negatively affect the persistence of the species in the wild and accordingly, will not obstruct the overall objective of this recovery plan.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.
The action proposed is likely to result in the operation of several Key Threatening Processes such as:

- Removal of Native Vegetation,
- Invasion and establishment of exotic vines and scramblers,
- Invasion, establishment and spread of *Lantana camara,*
- Invasion of native plant communities by *Chrysanthemoides monilifera* (Bitou bush and boneseed),

- Invasion of native plant communities by exotic perennial grasses,
- Loss of hollow-bearing trees, and
- Removal of dead wood and dead trees.

Approximately 0.86 hectares of potential habitat will be retained in the east of the study area.

The 4.04 hectares of vegetation to be removed from the study area comprises highly modified vegetation due to previous long-term land management practices and under-scrubbing and removal of native vegetation for the grazing of horses. The proposed development may facilitate the spread of weed species such as exotic vines and scramblers, *Lantana camara, Chrysanthemoides monilifera* and exotic perennial grasses. The impacts of this KTP can be reduced through appropriate controls and mitigation measures during and after road construction.

Conclusion

Neither the Masked Owl or Powerful Owl were recorded in the study area during a targeted survey for this species. The study area offers marginal potential foraging habitat to the species, and does not support nesting habitat for either species. As a result, it is considered unlikely that the proposal represents a significant impact to the species, particularly if the mitigation measures listed in Section 5 are implemented.

Glossopsitta pusilla (Little Lorikeet)

*Glossopsitta pusilla (*Little Lorikeet) is listed as a Vulnerable species under the TSC Act.

The distribution of the Little Lorikeet extends from just north of Cairns, around the east coast of Australia, to Adelaide. In NSW Little Lorikeets are distributed from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets are generally considered to be nomadic with irregular large or small influxes of individuals occurring at any time of year, apparently related to food availability.

The species is known to occur in dry, open eucalypt forests and woodlands and 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.

Little Lorikeets are gregarious, usually foraging in small flocks, often with other species of lorikeet. The species feeds 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. meliodora* are particularly important food sources for pollen and nectar.

The species nests in tree hollows mostly in living smooth-barked eucalypts especially (Manna Gum) *Eucalyptus viminalis*, (Blakely's Red Gum) *E. blakelyi* and (Tumbledown Gum) *E. dealbata.* Nest hollows are occasionally located in dead trees, but birds generally desert hollows within two years of tree death (OEH 2011, OEH 2012)

(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.

The subject sites offers marginal foraging habitat to the Little Lorikeet, including a diversity of flowering eucalypt species. One tree hollow will be lost and one will be retained (in proximity to Freshwater Creek wetland). The hollow to be retained may however be occupied by birds or mirobats The species was not recorded on the subject site during the present study.

As a result, the proposed action is unlikely to have an adverse effect on the life cycle of the Little Lorikeet such that a viable local population is likely to be placed at risk of extinction.

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

The TSC Act defines an 'endangered population' as 'a population specified in Part 2 of Schedule 1' of the Act. The Little Lorikeet is not an 'endangered population', as defined under the TSC Act.

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

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

The TSC Act defines an 'endangered ecological community' as an 'ecological community specified in Part 3 of Schedule 1' of the Act. The Little Lorikeet is not an 'endangered ecological community', as defined under

the TSC Act.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The study area is located within a semi-rural residential landscape which has been subject to extensive vegetation clearing. The movement of highly mobile birds, such as the Little Lorikeet, is unlikely to be significantly reduced by fragmented habitat connectivity within the study area. Therefore it is considered that the proposed development is unlikely to fragment or isolate any areas of habitat from other areas of habitat as a result of the proposed action.

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

No area has been designated as 'critical habitat' under Part 3 of the TSC Act 1995 for the Little Lorikeet.

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

There is currently no Recovery Plan or Threat Abatement Plan in place for the Little Lorikeet.

(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 action proposed is likely to result in the operation of several Key Threatening Processes such as:

- Removal of Native Vegetation,
- Invasion and establishment of exotic vines and scramblers,
- Invasion, establishment and spread of *Lantana camara,*
- Invasion of native plant communities by *Chrysanthemoides monilifera* (Bitou bush and boneseed),
- Invasion of native plant communities by exotic perennial grasses,
- Loss of hollow-bearing trees, and
- Removal of dead wood and dead trees.

The 4.04 hectares of vegetation to be removed from the study area comprises highly modified vegetation due to previous long-term land management practices and under-scrubbing and removal of native vegetation for the grazing of horses. The proposed development may facilitate the spread of weed species such as exotic vines and scramblers, *Lantana camara, Chrysanthemoides monilifera* and exotic perennial grasses. The impacts of this KTP can be reduced through appropriate controls and mitigation measures during and after road construction.

Conclusion

The Little Lorikeet was not recorded in the study area during a targeted survey for this species. The study area offers marginal potential foraging habitat to the species, and does supports only one hollow (potential nesting habitat), that may be occupied by microbats or arboreal mammals. As a result, it is considered unlikely that the proposal represents a significant impact to the species, particularly if the mitigation measures listed in Section 5 are implemented.

Pteropus poliocephalus (Grey-headed Flying-fox)

Grey-Headed Flying-Fox (*Pteropus poliocephalus*) is listed as a Vulnerable species under Part 1 of Schedule 2 of the Threatened Species Conservation Act 1995 (TSC Act). The Grey-Headed Flying fox was observed foraging amongst Eucalypts in the SIMTA site and flying over remnant woodland of the proposed rail corridor south of the SIMTA site.

The Grey-headed Flying-fox occurs from Bunderberg in Queensland in the north to Melbourne in Victoria to the south, typically between the coast and the western slopes of the Great Dividing Range. In NSW, it occurs along the east coast, eastern slopes of the Great Dividing Range and the tablelands. The species may be found in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps, while additional foraging is provided by urban gardens and cultivated fruit crops.

The Grey-Headed Flying-Fox is a highly mobile species with a nightly feeding range from a roosting camp of 20 to 50 kilometres. Diet typically comprises a wide variety of flowering and fruiting plants (Tidemann 1995, Churchill 1998); in summer, diet mainly comprises fruits of rainforest trees and vines in addition to the nectar and blossom of Eucalyptus, Melaleuca and Banksia. In winter, diet is dominated by nectar and blossom. Non-indigenous and exotic tree species introduced to the urban landscape provide additional foraging habitat for this species within the locality; where previously existed a period of reduced availability of native food resource during the winter months, non-native species now supply food resources throughout the year (Parry-Jones & Augee 2001, Williams et al 2006).

Grey-headed Flying-foxes roost in large numbers, with up to tens of thousands of flying foxes using individual camps for mating, birth and rearing of young. Camps are typically located in gullies, close to water, in vegetation with a dense canopy, within 20 kilometres of a regular food source. Site fidelity to camps is high, with some camps being used for over 100 years (NPWS 2001). The closest camp to the study area is located in Blackbutt Reserve, approximately 6 kilometres to the north-east.

The study area does not contain roosting habitat (a camp) for this species. Habitat features of the study area which may support the Grey-Headed Flying-Fox include foraging habitat provided by a number of flowering exotic and native trees, predominantly eucalypts, located within the study area. A list of Grey-headed Flying Fox feed trees was compiled by Eby and Law (2008), comprising 59 species that provide a source of blossom and 46 species that provide a source of fruit. In accordance with the species listed by Eby and Law (2008), flora species that offer a blossom or fruit resource to the Grey-headed Flying Fox that occur in the study area include *Angophora costata* (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus piperita* (Sydney Peppermint), *Eucalyptus punctata* (Grey Gum), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus saligna* (Sydney Blue Gum), *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Grevillea robusta* (Silky Oak).

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,

No roosts or camps were observed within the study area however a large population of this species is known to roost within Blackbutt Reserve approximately 6km to the north-east. It is considered that the study area is well within the foraging range of this camp.

This species was observed overflying the study area during a nocturnal spotlight survey. The study area and surrounding remnant native vegetation corridors currently provide only foraging resources for this species. The trees proposed to be removed however do not comprise a significant area of foraging habitat within the locality for the Grey-Headed Flying Fox. Tingira Heights Nature Reserve together with smaller parks and reserves in the locality contain an abundance and diversity of potential foraging habitat for the Grey-Headed Flying-Fox. It is considered that the proposed action is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

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

The Grey-headed Flying-fox is not an endangered population at the location of the study area within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

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

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

The Grey-headed Flying-fox is not an endangered ecological community within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

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

The Grey-headed Flying-fox is not an endangered ecological community within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

d) in relation to the habitat of a threatened species, population or ecological community:

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

The proposed development is expected to remove approximately 4.04 hectares of highly disturbed remnant native vegetation. Approximately 0.86 hectares habitat will be retained in the study area, which included preferred feed trees for the species. The trees proposed to be removed however do not comprise a significant area of foraging habitat within the locality for the Grey-Headed Flying Fox. Tingira Heights Nature Reserve together with smaller parks and reserves in the locality contain an abundance and diversity of potential foraging habitat for the Grey-Headed Flying-Fox.

(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

The study area is located within a semi-rural residential landscape which has been subject to extensive vegetation clearing. Therefore it is considered that the proposed development is unlikely to further fragment or isolate any areas of habitat from other areas of habitat as a result of the proposed action.

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

The importance of the habitat to be removed is considered to be low because the vegetation within the study area provides seasonal foraging resources for the Grey-headed Flying-fox. The extent of seasonal foraging habitat that will be removed as a result of the proposal does not comprise a significant area of foraging habitat within the locality for the Grey-Headed Flying Fox, considering that Tingira Heights Nature Reserve, parks, reserves and street and garden trees in the locality contain an abundance and diversity of potential foraging habitat for the Grey-Headed Flying-Fox. It is therefore considered that the proposed action is unlikely to remove important habitat for the long-term survival of this species within the locality.

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

Critical habitat for the Grey-headed Flying-fox has not been gazetted. Therefore the action proposed will not have an adverse effect on any critical habitat (either directly or indirectly).

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

threat abatement plan,

A Recovery Plan or threat abatement Plan has not been produced for the Grey-headed Flying-fox. However, it is considered that the proposed action will not contravene any strategies or plans to manage this species or its habitats.

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 action proposed is likely to result in the operation of several Key Threatening Processes such as:

- Removal of Native Vegetation,
- Invasion and establishment of exotic vines and scramblers,
- Invasion, establishment and spread of *Lantana camara,*
- Invasion of native plant communities by *Chrysanthemoides monilifera* (Bitou bush and boneseed),
- Invasion of native plant communities by exotic perennial grasses,
- Loss of hollow-bearing trees, and
- Removal of dead wood and dead trees

As mentioned previously, the proposed action includes the removal of known feed trees that offer a seasonal foraging resource to this species, resulting in habitat loss. However, habitat that will be lost from the study area does not comprise a significant area of foraging habitat in the locality. The removal of feed trees from the study area will not result in population fragmentation or habitat disturbance for the Grey-Headed Flying-Fox.

Conclusion

The study area offers potential foraging habitat to the species. The study area does not support a camp (roosting habitat) for this species. As a result, it is considered unlikely that the proposal represents a significant impact to the species, particularly if the mitigation measures listed in Section 5 are implemented.

Gliders

Petaurus australis (Yellow-bellied Glider)

The Yellow-bellied Glider is a large, active, sociable and vocal glider. The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. This species occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. It feeds primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. The Yellow-bellied Glider extracts sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. They live in small family groups of two to six individuals and are nocturnal. Dens often contain family groups and occur in hollows of large trees. This species is very mobile and they typically occupy large home ranges between 20 to 85ha to encompass dispersed and seasonally variable food resources.

Petaurus norfolkensis (Squirrel Glider)

The Squirrel Glider is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. It inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. It prefers mixed species stands with a shrub or Acacia midstorey. The Squirrel Glider lives in family groups of a single adult male one or more adult females and offspring. They require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, Eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.

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,

Neither he Yellow-bellied Glider or Squirrel Glider were detected or observed within the study area. The study area and surrounding remnant native vegetation corridors provide potential foraging and denning resources for this species. The 4.04 hectares of marginal foraging habitat to be removed as a result of the proposed development will represent a relatively small cumulative loss of foraging habitat available to the species in the local area. The proposal will retain one hollow tree and 0.86 hectares of potential foraging habitat in the east of the study area. It is considered that the proposed action is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

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

The Yellow-bellied Glider and the Squirrel Glider are not an endangered population at the location of the study area within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

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

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

The Yellow-bellied Glider and the Squirrel Glider are not an endangered ecological community within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

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

The Yellow-bellied Glider and the Squirrel Glider are not an endangered ecological community within the Schedules of the *TSC Act* (1995) therefore this section of the 7-part test does not apply.

d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed development is expected to remove approximately 4.04 hectares of highly disturbed remnant native vegetation. Approximately 0.86 hectares of potential foraging habitat will be retained.

(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

The study area is located within a semi-rural residential landscape which has been subject to extensive vegetation clearing. Canopy trees in the study provide marginal canopy connectivity to habitat contained within Tingira Heights Nature Reserve, which adjoins the neighbouring property to the south. Arboreal mammals and birds may travel into and through the study area via this tenuous vegetated link of canopy trees. The proposed development is unlikely to further fragment or isolate any areas of habitat from other areas of habitat as a result of the proposed action.

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

The importance of the habitat to be removed is considered to be low because the vegetation within the study area provides low quality potential resources for Gliders. This is primarily due to the absence of understorey foraging resources and low abundance of winter flowering tree species. There is also a low abundance of sheltering habitat for the species. It is therefore considered that the proposed action is unlikely to remove important habitat for the long-term survival of gliders within the locality.

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

Critical habitat for the Yellow-bellied Glider and the Squirrel Glider has not been gazetted. Therefore the action proposed will not have an adverse effect on any critical habitat (either directly or indirectly).

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

A Recovery Plan or threat abatement Plan has not been produced for the Squirrel Glider. However, it is considered that the proposed action will not contravene any strategies or plans to manage this species or its habitats apart from the removal of a small area of sub-optimal habitat which is lacking in winter flowering species.

There is a recovery plan for the Yellow-bellied Glider. It is considered that the proposed action will not contravene any strategies or plans to manage this species or its habitats apart from the removal of a small area of sub-optimal habitat which is lacking in winter flowering species.

h) 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 action proposed is likely to result in the operation of several Key Threatening Processes such as:

- Removal of Native Vegetation,
- Invasion and establishment of exotic vines and scramblers,
- Invasion, establishment and spread of *Lantana camara,*
- Invasion of native plant communities by *Chrysanthemoides monilifera* (Bitou bush and boneseed),
- Invasion of native plant communities by exotic perennial grasses, and
- Removal of dead wood and dead trees.

The proposed action includes the removal of 4.04 hectares of potential foraging habitat that offer a seasonal foraging resource to gliders. However, habitat that will be lost from the study area does not comprise a significant area of foraging habitat in the locality. The removal of feed trees from the study area will not result in population fragmentation or habitat disturbance for the Squirrel glider or Yellow-bellied glider.

The proposed development may facilitate the spread of weed species such as exotic vines and scramblers, *Lantana camara, Chrysanthemoides monilifera* and exotic perennial grasses. The impacts of this KTP can be reduced through appropriate controls and mitigation measures during and after road construction.

The proposal is likely to contribute to the Key Threatening Process "Removal of dead wood and dead trees" as a result of clearing vegetation and modification of the environment. However, dead trees to be removed generally did not support hollows suitable the Squirrel Glider and Yellow-bellied glider. Clearing of vegetation at this scale represents a small cumulative impact due to the small size of the area to be cleared. As such it is unlikely to significantly contribute to this process on a regional scale. There is also the opportunity to install some of this dead wood if appropriate, in the eastern section of the site.

Conclusion

The study area offers potential marginal foraging habitat to the species. One tree hollow will be lost and one will be retained (in proximity to Freshwater Creek wetland). The hollow to be retained may however be occupied by birds or mirobats. As a result, it is considered unlikely that the proposal represents a significant impact to the species, particularly if the mitigation measures listed in Section 5 are implemented.

Microbats
Chalinolobus dwyeri (Large-eared Pied Bat)

This species was only identified in the late 1960's and as such, very little is known about its distribution or habitat tolerances. The Large Pied Bat ranges from Rockhampton in central Queensland to Bungonia in southern NSW. This species has been recorded to occupy dry sclerophyll forest and woodland, both to the east and west of the Great Divide. Recordings of this species have also been made in subalpine woodland and at the ecotone of rainforest and wet Eucalypt forest.

The Large-eared Pied Bat roosts in caves, abandoned mud-nests of Fairy Martins and mine tunnels. Colonies recorded have ranged in size from 3 to 37 individuals, and are usually located in the twilight area not far from the cave entrance. The physiology of the bat suggests that it feeds primarily on small insects below the canopy. They fly relatively slowly with rapid but shallow wing beats. During autumn and early winter the males have enlarged testes. At this time, the facial glands on either side of the muzzle become swollen and show a cream colour beneath the skin. They exude a milky secretion when compressed. It is probable that these glands have a secondary sexual function. It is not known whether mating occurs in the autumn or spring; hence the duration of pregnancy is also unknown. The females give birth in November, commonly to twins, and the young are independent by late February. They leave the cave soon after and the females remain another month before abandoning the roost in late March for the winter. It is thought that during the cooler winter months the colony disperses for individual hibernation.

Miniopterus australis (Little Bentwing-bat)

This species inhabits tropical rainforest to warm-temperate wet and dry sclerophyll forest occurring along the coastal plains and adjacent ranges from Cape York to north-eastern NSW around the Hunter River. Its distribution within Australia becomes increasingly coastal towards the southern limit of its range in NSW.

It is a sub-canopy hunter with a preference for well-timbered areas but it is also known to hunt in clearings adjacent to forests. Prey items include crane flies, ants, moths and wasps. Flight characteristics include rapid movement with considerable manoeuvrability.

The species is a cave dweller that congregates in the summer months in maternity roost colonies and disperses during winter. In the southern part of their range they hibernate during winter but in the north they remain active throughout the year. Recorded roosts include caves, mines, stormwater drains, disused railway tunnels and houses. Mating, fertilisation and implantation occur in July to August, followed by a period of retarded embryonic development until mid-September. Pregnant females congregate in specified large nursery caves to rear their young. Births occur in December, when single young are born. It is often found to roost with the Large Bentwing-bat (Miniopterus schreibersii), and benefits from this larger species' ability to increase the roost temperature using metabolic heat. There is a huge nursery colony of 100,000 adult bats at Mt. Etna caves, in central Queensland.

Miniopterus schreibersii (Eastern Bentwing-bat)

The Eastern (also known as 'Large' or 'Common') Bentwing-bat may occur throughout the world. However, Parnaby (1992) notes that the Australasian populations are unlikely to be the same species that occurs outside this area. Within Australia, it is found across the coastal and near coastal areas of the north of the NT and WA and also down the east coast from Cape York to Adelaide on the coastal plains and adjacent ranges.

It is a cave (and similar man-made structures) roosting species that generally feeds above the forest canopy in wet and dry tall open forest, catching insects on the wing. However, the species has also been recorded utilising rainforest, monsoon forest, open woodland, paperbark forests and open grasslands. Moths are the main prey item. Flight is very fast and typically relatively level with swift shallow dives; the estimated flight speed is 50km per hour.

The species is known to migrate over large distances, apparently utilising different roosts for different seasonal needs. The pattern of movement varies with local climate and the dispersion of suitable roost sites. It hibernates over winter in the southern parts of its range and development of the embryo may be delayed over winter by lowering body temperature by using roosts in the cooler areas of a cave. Pregnant females roost in large colonies in nursery caves. Birth generally occurs around December. Females cluster together in a roost that generally possesses a domed roof, which allows for the retention of warm air, which may also promote faster growth. The young can fly by 7 weeks and reach adult size and are weaned by 10 weeks. The mothers then leave the cave to disperse to their winter roosts and a few weeks later, usually in March, there is a mass exodus of juveniles. The maternity colony is deserted by April.

The longevity record for an Australian bat is from a pregnant female Large Bentwing-bat that was banded and recaptured 18 years later (she was again pregnant).

Mormopterus norfolkensis (East Coast Freetail-bat)

This species is distributed along the east coast of New South Wales from south of Sydney extending north into south-eastern Queensland, near Brisbane. There are no records west of the Great Dividing Range. Although the habitat preferences are not clear (and critical or specific habitat for this species is not known), most records of this species have been reported from dry Eucalypt forest and woodland. Individuals have, however, been recorded flying low over a rocky watercourse in rainforest and foraging in clearings on the edge of forested land. It is expected that open forested areas and the cleared land adjacent to bushland, constitutes important habitat for this species, and specific foraging activity may be concentrated over small areas of open water, such as dams and creeks, in and near forests.

It is a predominantly tree-dwelling species (roosting in hollows or behind loose bark in mature Eucalypts), but one individual was recorded roosting in the roof of a hut, together with a number of Gould's Wattled Bats and an Eastern Broad-nosed Bat (Allison & Hoye 1995). The diet is thought to consist of small insects including leafhoppers, chafers, weevils and other beetles. Foraging is apparently undertaken above the tree canopy or in clearings on forest edges (AMBS 1995). Examination of wing morphology indicates that the bat has a direct and fast flight more suited for foraging in open habitats, above the canopy and along watercourses.

Saccolaimus flaviventris (Yellow-bellied Sheathtail bat)

This species is widespread across Australia and its apparent rarity is probably due to its flying so high and fast that it is seldom collected. It has been reported from a wide variety of habitats. Hunting height appears to vary depending upon the height of the dominant vegetation in Eucalypt forests it feeds above the canopy, but in mallee or open country it comes lower to the ground. Prey species include beetles, long-horned grasshoppers, shield bugs and flying ants.

Usually solitary, but occasionally occurring in colonies of less than ten individuals, the Yellow-bellied Sheathtail-bat roosts in tree hollows, animal burrows, dry clay cracks, under rock slabs, abandoned Sugar Glider nests, and has been found resting on the walls of buildings in broad daylight, and one such individual, caught at Queanbeyan, NSW, appeared to be so exhausted that it made no effort to escape. Similar reports suggest that it is migratory in southern Australia and that individuals found resting in the open are in the course of a winter migration from the cooler to warmer areas. They have been reported from southern Australia only between January and June.

Males have a prominent throat-pouch which is devoid of glandular tissue but a subcutaneous gland lies behind it. The throat-pouch is represented by a rudimentary fold of skin in the female. There is no seasonal difference in testicular size in males and there is no relationship between reproductive condition in males and the size of the throat pouch. Pregnancy is always restricted to the right uterine horn. Single young are born between December and mid-March. Sub-adults have only been collected in January and February.

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,

No microbats were detected within the study area during targeted surveys. The proposal will result in the loss of approximately 4.04 hectares of highly disturbed remnant native vegetation, which includes marginal foraging habitat. The trees occurring within the study area contribute to a canopy stratum that is highly fragmented and discontinuous across the locality. As a result, the trees proposed to be removed do not comprise a significant area of canopy within the locality and consequently do not comprise a significant area of foraging habitat within the locality.

Three of the five microbat species are cave-dwelling species; the study area does not support caves. The East Coast Freetail-bat and Yellow-bellied Sheathtail-bat may roost under the bark of eucalypts. However, eucalypts to be cleared generally comprise smooth-barked species and so do not support potential roosting habitat. One tree hollow will be lost and one will be retained (in proximity to Freshwater Creek wetland). The hollow to be retained may however be occupied by birds or arboreal mammals.

Due to the small amount of habitat to be altered / modified due to the proposal with the removal of vegetation unlikely to impact this species, it is unlikely that the proposal will have any impact on this species that will cause a local 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;

The TSC Act defines an 'endangered population' as 'a population specified in Part 2 of Schedule 1' of the Act. These microbat species are not an 'endangered population', as defined under the TSC Act.

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 of the ecological community such that its local occurrence is likely to be placed at risk of extinction;

The TSC Act defines an 'endangered ecological community' as an 'ecological community specified in Part 3 of Schedule 1' of the Act. These microbat species are not an 'endangered ecological community', as defined under the TSC Act.

d) In relation to the habitat of a threatened species, population or ecological community:

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

The proposed development is expected to remove approximately 4.04 hectares of highly disturbed remnant native vegetation, offering marginal foraging habitat to microbats. The study area does not support preferred roosting habitat to these species of microbats. The trees occurring within the study area contribute to a canopy stratum that is highly fragmented and discontinuous across the locality. The proposed action is highly unlikely to have an adverse effect on the foraging activities of these microbats.

(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

The study area is located within a semi-rural residential landscape which has been subject to extensive vegetation clearing. Canopy trees in the study provide marginal canopy connectivity to habitat contained within Tingira Heights Nature Reserve, which adjoins the neighbouring property to the south. Microbats may foraging along this tenuous vegetated link of canopy trees. The proposed development is unlikely to further fragment or isolate any areas of habitat from other areas of habitat as a result of the proposed action.

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

The removal of scattered trees from the study area that offer marginal foraging habitat will not remove, modify, fragment or isolate a significant area of potential foraging or roosting habitat for the five microbat species in the locality. One tree hollow will be lost; this does not comprise a significant area of roosting habitat for any hollow-roosting microbat species, in the locality. As a result, the long-term survival of these microbats in the locality is unlikely to be affected as a result of the proposed action.

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

Critical habitat for this species has not been gazetted. Therefore the action proposed will not have an adverse effect on any critical habitat (either directly or indirectly).

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

A Recovery Plan or threat abatement Plan has not been produced for these species. However, it is considered that the proposed action will not contravene any strategies or plans to manage this species or its habitats apart from the removal of a small area of sub-optimal habitat which has been disturbed.

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 action proposed is likely to result in the operation of several Key Threatening Processes such as:

- Removal of Native Vegetation,
- Invasion and establishment of exotic vines and scramblers,
- Invasion, establishment and spread of *Lantana camara,*
- Invasion of native plant communities by *Chrysanthemoides monilifera* (Bitou bush and boneseed), and
- Removal of dead wood and dead trees

As mentioned previously, the proposed action includes the removal of 4.04 hectares of vegetation (comprising scattered canopy trees). The removal of these three trees is unlikely to result in habitat

degradation or loss, population fragmentation or habitat disturbance for these microbats.

The proposal is likely to contribute to the Key Threatening Process "Removal of dead wood and dead trees" as a result of clearing vegetation and modification of the environment. Clearing of vegetation at this scale represents a small cumulative impact due to the small size of the area to be cleared. As such it is unlikely to significantly contribute to this process on a regional scale. There is also the opportunity to install some of this dead wood if appropriate, in the eastern section of the site.

Conclusion

The study area offers potential marginal foraging habitat to the species. One tree hollow will be lost and one will be retained (in proximity to Freshwater Creek wetland). The hollow to be retained may however be occupied by birds or microbats. As a result, it is considered unlikely that the proposal represents a significant impact to these microbat species, particularly if the mitigation measures listed in Section 5 are implemented.

Appendix 5

EPBC Significant Impact Assessment

Ardea ibis (Cattle Egret)

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

Within the study area, the Cattle Egret may follow horses within the Exotic Grassland with Scattered Tree vegetation community, and forage for invertebrates disturbed during horse grazing activities. The study area does not support a breeding colony due to an absence of preferred breeding habitat (wooded swamp).

The removal of Exotic Grassland with Scattered Trees will result in the loss of potential foraging habitat for the species. However, this foraging habitat of the study area does not comprise a significant area of habitat within the wider locality. Similar foraging habitat occurs throughout the locality within other semi-rural residential properties and public parks and reserves. As a result, the proposed action will not substantially modify, destroy or isolate an area of important habitat for the Cattle Egret.

Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species

The action is highly unlikely to introduce disease or result in the establishment of a new invasive species becoming established in an area of important habitat for the species. The study area supports foraging habitat for the species; no breeding habitat was identified from the study area.

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

The removal of Exotic Grassland with Scattered Trees will result in the loss of potential foraging habitat for the species. However, the study area does not support a breeding colony due to an absence of preferred breeding habitat (wooded swamp). As a result, the removal of a small area of foraging habitat will not seriously disrupt the lifecycle of an ecologically significant proportion of the population.

Pteropus poliocephalus (Grey-headed Flying Fox)

Habitat features of the study area which may support the Grey-Headed Flying-Fox include foraging habitat provided by a number of flowering exotic and native trees, predominantly eucalypts, located within the study area. A list of Grey-headed Flying Fox feed trees was compiled by Eby and Law (2008), comprising 59 species that provide a source of blossom and 46 species that provide a source of fruit. In accordance with the species listed by Eby and Law (2008), flora species that offer a blossom or fruit resource to the Grey-headed Flying Fox that occur in the study area include *Angophora costata (*Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus piperita* (Sydney Peppermint), *Eucalyptus punctata* (Grey Gum), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus saligna* (Sydney Blue Gum), *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Grevillea robusta (*Silky Oak).

The study area does not contain roosting habitat (a camp) for this species. The closest camp to the study area is located in Blackbutt Reserve, approximately 6 kilometres to the north-east.

Lead to a long-term decrease in the size of an important population of a species

The removal of known feed trees from the study area that offer a seasonal foraging resource is unlikely to a long-term decrease in the size of an important population. An abundance of foraging habitat is widely available to the species and is distributed across Tingira Heights Nature Reserve, parks and other areas of open space in the locality, including conservation areas, public parks and private property.

Reduce the area of occupancy of an important population

The removal of known feed trees from the study area that offer a seasonal foraging resource is unlikely to significantly reduce the area of occupancy available for an important population of the species.

Fragment an existing important population into two or more populations

Due to the highly mobile nature of this species, the Proposal is unlikely to result in the fragmentation of the population of the Grey Headed Flying Fox.

Adversely affect habitat critical to the survival of a species

To date, no critical habitat has been declared for the Grey-Headed Flying-fox under the EPBC Register of Critical Habitat. In accordance with the criteria listed in the *Draft National Recovery Plan* (DECCW 2009), the study area meets four of the five criteria of foraging habitat that is critical to the survival of the species. The study area does not support roosting habitat that is critical to the survival of the species.

Clearing of winter foraging habitat is a particular concern of the *Draft National Recovery Plan* for the species. Few feed trees flower in winter, and those that flower reliably occur on coastal lowlands in northern New South Wales. Winter-flowering *species* in the study area include *Eucalyptus robusta* (Swamp Mahogany) and *Melaleuca quinquenervia* (Five-veined Paperbark). The extent of seasonal foraging habitat that will be removed as a result of the proposal does not comprise a significant area of foraging habitat within the locality for the Grey-Headed Flying Fox, considering that Tingira Heights Nature Reserve, parks, reserves and street and garden trees in the locality contain an abundance and diversity of potential foraging habitat for the Grey-Headed Flying-Fox

Disrupt the breeding cycle of an important population

The nearest known maternity colony of the species is 6 kilometres north-east of the study area in Blackbutt Reserve. The removal of feed trees from the study area is unlikely to disrupt the breeding cycle of a local, regional or other population by impacts on potential roosting and maternity camp habitat or foraging habitat

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

The removal of known feed trees from the study area that offer a seasonal foraging resource is unlikely to modify, destroy, remove or isolate or decrease the availability of foraging habitat, to the extent that the Grey-Headed Flying-fox is likely to decline. Due to the nomadic nature and large nightly dispersal distances of the species, coupled with the presence of quality regional habitats, the removal of known feed trees from the study area is unlikely to result in a decline of this species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The action is highly unlikely to result in the establishment of an invasive species that is harmful to the Grey-Headed Flying-fox or that may cause the Grey-Headed Flying-fox to decline. Mitigation measures to minimise impacts on fauna species in the study area are detailed in Section 5.

Introduce disease that may cause the species to decline

The action is highly unlikely to introduce disease that is harmful to the Grey-Headed Flying-fox or that may cause the Grey-Headed Flying-fox to decline. Mitigation measures to minimise impacts on fauna species in the study area are detailed in Section 5.

Interfere substantially with the recovery of the species.

The Draft National Recovery Plan for the Grey Headed Flying Fox (*Pteropus poliocephalus*; Department of Environment, Climate Change and Water NSW 2009) has the overall objectives to:

- To reduce the impact of threatening processes on Grey-headed Flying-foxes and arrest decline throughout the species' range;
- To conserve the functional roles of Grey-headed Flying-foxes in seed dispersal and pollination; and
- To improve the standard of information available to guide recovery of the Grey-headed Flying-fox, in order to increase community knowledge of the species and reduce the impact of negative public attitudes on the species.

The following actions have been proposed in the Draft National Recovery Plan to assist in the conservation of the Grey Headed Flying Fox:

Action 1: Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range

Action 2: Enhance winter and spring foraging habitat for Grey-headed Flying Foxes

Action 3: Identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes

Action 4: Significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture

Action 5: Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps

Action 6: Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions

Action 7: Monitor population trends for the Grey-headed Flying Fox

Action 8: Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts

Action 9: Oversee a program of research to improve knowledge of demographics and population structure of the Grey-headed Flying Fox

Action 10: Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan. With regard to the proposed action the following applies to the above points:

Appendix 6

Staff CVs

RPS

Curriculum Vitae

LAURA WORTHINGTON

Ecologist

Sydney, NSW

Bachelor of Science (Honours), University of New South Wales, 2007

AREAS OF EXPERTISE:

Laura has over five years of experience in ecological consulting and GI.S. Laura's consulting experience includes undertaking ecological surveys and preparing assessments and management plans in accordance with relevant State and Commonwealth government legislative frameworks. Laura also possesses skills in G.I.S implemented across a variety of projects, utilising ArcGIS to undertake spatial analysis and field verification of ecological data; data management; mapping of ecological values; and analysis and mapping of environmental constraints. Laura has worked with a range of clients including resource and energy companies, property developers, and state and federal government agencies such as NSW Roads and Maritime Services, Australian Rail Track Corporation, Transport Construction Authority and Sydney Water.

SELECTED PROJECT EXPERIENCE:

- **Pacific Highway Upgrade-Oxley Highway to Kempsey (NSW Roads and Maritime Services)**

  Implementation of the Microchiropteran Bat Management Plan prepared for the 37km upgrade of the Pacific Highway between the Oxley Highway and Kempsey on the NSW Mid-north coast. Project tasks included a desktop analysis of potential roost box locations, on-ground habitat assessment to determine the suitability of proposed installation sites, the installation of 158 bat roost boxes and the provision of GIS data to inform future monitoring activities.

  Preparation of post-approval ecological assessments for the 37km upgrade of the Pacific Highway between the Oxley Highway and Kempsey on the NSW Mid-north coast, including a Fauna Fencing Strategy, Fauna Crossing Strategy , which required worked closely with a multi-disciplinary team and playeing an integral part in the identification of fauna mitigation measures for the project, including dedicated fauna culverts, rope bridges, glider poles and fauna fencing.

  Preparation of an Ecological Monitoring Program in accordance with Conditions of Approval issued for the project. The Ecological Monitoring Program will monitor the effectiveness of the mitigation measures for threatened species directly impacted by the project. Project tasks included identification of mitigation measures for monitoring, development of survey and monitoring methodology and identification of targets against which to measure effectiveness.

- **Westfield Warringah Mall Project Ecologist (Westfield Design and Construction)**- Acted in the role of Project Ecologist for stormwater augmentation at Westfield Warringah Mall and remediation works of Brookvale Creek (the Project). Project tasks involved the providion of specialist ecological advice during the planning and project approval period, and supervising construction works to ensure that mitigation measures and other management strategies required to minimise ecological impacts are implemented on site.

- **Residential Subdivision at Bolwarra (Avalon Rural Holdings)**- Preparation of a Flora and Fauna Assessment for a residential subdivision in the Maitland LGA. Project tasks included preliminary desktop assessment, interpretation of legislative requirements, targeted field survey, assessment of fauna habitat quality and value to threatened species, identification of project impacts and measures to avoid or mitigate potential impacts.

- **Residential Subdivision at Mount Hutton** (EJE Architecture)- Preparation of a Flora and Fauna Assessment for a residential subdivision in the Lake Macquarie LGA. Project tasks included preliminary desktop assessment, interpretation of legislative requirements, targeted field survey, assessment of fauna habitat quality and value to threatened species, identification of project impacts and measures to avoid or mitigate potential impacts.

- **Subdivision and Urban Devleopment at Catherine Hill Bay and Gwandalan (Rose Group)-** Preparation of Preliminary Documentation to assist in the assessment of potential impacts of the project under the EPBC Act, and preparation of management plans for the project including Flora and Fauna Management Plan, Weed Management Plan and Wildlife Management Strategy.
- **Airly Coal Mine Flora and Fauna Baseline Survey Report (Centennial Coal)-** Preparation of a baseline ecological report to inform future impact assessments. The baseline report was informed by desktop research and extensive flora and fauna field surveys conducted over over 10 months, and described flora and fauna species, vegetation communities and fauna habitat types and connectivity.
- **Refurbishment of Jetty and King Stree Wharf 10 (Brookfield Mulitplex on behalf of NSW Roads and Maritime Services)-** Preparation of a Microbat Impact Assessment Report, informed by nocturnal surveys and diurnal inspection of the jetty, to identify the presence of microbats and potential roosting habitat, determining the presence or probability of microbats to roost in the jetty, and determie whether refurbishment of the jetty is likely to have an impact on microbats.
- **Muswellbrook-Ulan Passing Loops (Australian Rail Track Corporation)-** Ecological assessments of numerous passing loops on the Ulan Line across the Muswellbrook and Mid-Western Regional LGAs, including Bengalla, Wilpingjong, Bylong, Murrumbo , Widden Creek and Muswellbrook Junction. Laura's involvement in the Ulan+ Alliance included identifying ecological contraints and opportunities, conducting flora and fauna surveys, and pre-clearing surveys and preparing Flora and Fauna Assessments, Review of Environmental Factors and Preliminary Environmental Assessments.
- **SIMTA Moorebank Intermodal Terminal Facility (QUBE)** - Preparation of a Flora and Fauna Assessment for the development of the SIMTA Moorebank Intermodal Terminal Facility, comprising an intermodal terminal, rail link and warehouse/distribution facility. The assessment addressed both the Commonwealth EIS guidelines as issued under the Environment Protection and Biodiversity Conservation Act 1999 and State provided Environmental Assessment Requirements (EARs), as issued under the Environmental Planning and Assessment Act 1979 to support a State Significant Development (SSD) environment impact statement (EIS).
- **Flora and Fauna Assessment: Campbelltown Road Upgrade (NSW Roads and Maritime Services)-** Flora and Fauna Assessment of proposed upgrade of Campbelltown Road, between Edmondson Park and Denham Court. Project tasks included preliminary desktop assessment, interpretation of legislative requirements, targeted field survey, assessment of fauna habitat quality and value to threatened species, identification of project impacts and measures to avoid or mitigate potential impacts.
- **Devils Pulpit Pacific Highway Upgrade (NSW Roads and Maritime Services)-** Laura was involved throughout the ecological assessment process for the upgrade of the Devils Pulpit section of the Pacific Highway, south of Ballina on the NSW mid-north coast. Laura undertook flora and fauna surveys of proposed extensions of the upgrade, in addition to targeted threatened species searches and habitat tree mapping and surveyed and assessed a proposed compensatory offset site. Laura also developed an Ecological Monitoring Program to be implemented upon completion of the upgrade
- **Blaxland Commuter Car Park Upgrade (Transport Construction Authority)-** Ecological Impact Assessment for of proposed commuter car park upgrade at Blaxland Railway Station. Project tasks included preliminary desktop assessment, legislative framework, field survey including targeted threatened species survey, mapping and report preparation.
- **Flora & Fauna Assessment and Property Environmental Management Plans (Sydney Water) –** Preparation of an assessment of several Sydney Water-owner properties across northern and western Sydney, including Warriewood Wastewater Treatment Plant and Prospect Reservoir. Project tasks included diurnal and nocturnal flora and fauna surveys, targeted searches for threatened flora, fauna and ecological communities, the identification of constraints to inform property maintenance and recommendations for management of threatened and non-threatened biodiversity focusing on threatened flora.
- **Weed Mapping, Risk Management Assessment and Management Plan (Wyong Shire Council)-** Aerial, vehicle and ground surveys of environmental and noxious weeds across the Porter Creek Catchment. Data capture of weed locations and attributes, digitisation of results, spatial analysis and production of maps for

the catchment.Production of a weed risk assessment in accordance with the NSW Weed Risk Management System. A qualitative risk assessment was undertaken to inform the Weed Management Plan, involving weed control, monitoring, targets, indicators and cost estimates.

MEMBERSHIPS & ACHIEVEMENTS:

- Associate Member, Ecological Consultants Association of NSW
- Royal Zoological Society of N.S.W.

RPS

Curriculum Vitae

ZIGGY ANDERSONS

Senior Ecologist/Project Manager

Newcastle, NSW

Bachelor of Science Botany Major 2010

White Card (OH&S Induction Training)

Maritime Services Boating Licence

AREAS OF EXPERTISE:

Ziggy has a diverse range of experiences in the fields of Ecology and Natural Resource Management. He has worked in the rehabilitation, ecological assessment, environmental management and business development fields across NSW and Qld. Clients have included state government agencies, civil contractors but have predominantly been within the resource sector. Ziggy is experienced in the management of large resource projects including project inception, client liaison, project design, project management, liaising with regulatory agencies and business development.

Ziggy also has experience in ecological assessment methodologies and has a particular interest in ecosystem rehabilitation and plant ID and ecology.

SELECTED PROJECT EXPERIENCE:

Environment

- Flora and Fauna assessment project design
- Flora and fauna identification and habitat assessment
- Targeted threatened flora and fauna surveys
- Delineation and mapping of vegetation communities
- Endangered Ecological Community (EEC) assessment
- Experience with GPS/GIS for project design and mapping
- Conducting Field Surveys for Flora, Fauna and Habitat Identification
- Report Preparation including Fauna and Flora Assessments
- Ecological Monitoring and Reporting
- Vegetation Management Plan Reporting
- Understanding of environmental legislation

PREVIOUS EXPERIENCE:

Mackay Regional Manager – Kleinfelder Ecobiological **(2012)**

Ziggy was employed to establish a regional office in Mackay to service the Central and Northern Qld regions. During his employment he was responsible for the whole gamut of activities involved in ecological consultancy including; business development, client liaison, project management, negotiations with regulatory bodies, ecological assessments, report development and review, budgeting, workflow and business management.

Ecological Consultant (Business Owner) – Evergreen Vegetation Consultants **(2010-2011)**

Ziggy owned and operated his own ecological consultancy business with a significant two year contract with Callide Mine (AngloAmerican). Ziggy was responsible for developing and implementing Management Action Plans

that related to an EPBC non-compliance as well as acting in a support role to the environmental department staff. During this period Ziggy was responsible for contractor management (quote review, contract development, contractor management), community liaison, incident investigation and management, reporting and liaising with regulatory agencies, advising senior leadership team on ecological matters etc.

Botanist and Bush Regenerator – Sustainable Resource Management Group (2009-2010)

Ziggy acted as the company's botanist and was part of the Bush Regeneration Team. The company had numerous contracts with the Hunter Valley CMA as well as Landcare groups within the Hunter and Mid North Coast region. He had a range of responsibilities including ecological assessments, report writing, quoting, project management, and team supervision.

VOLUNTEER WORK

- Callide Valley Landcare Chair (October 2009 to 2011)
- Callide Valley Landcare Treasurer (August to October 2009)
- Clean up Australia Day Coordinator, Bohnock, NSW (March 2007)
- Self initiated weed management and revegetation of Charley's Island/ Farquhar Pk, Manning River NSW (2007-2008)

MEMBERSHIPS & ACHIEVEMENTS:

- Drivers Licence (C, MR (Motorcycle), and RMDL (Boat))
- RTD02 ChemCert Chemical Accreditation AQF III
- HLTFA301B Apply First Aid Certificate
- 91476NSW Course in Sustainable Private Native Forestry
    - Follow environmental care procedures
    - Operator core knowledge and skills
    - Protect coastal & tableland native forest
    - Apply biodiversity conservation principles
    - Apply silviculture principles
- Qld Black Coal Generic Induction (Surface)
- S1, S2, S3 Supervisor Training (Qld)
- G2 Risk Assessment Training (Qld)
- HLTFA301C - Apply First Aid
- Standard 11 Generic Induction Refresher (Qld)
- RIIVEH201A – Operate Light Vehicle
- RIIVEH305A – Operate and Maintain a Four-Wheel Drive Vehicle
- Qld BioCondition v2.1 Training