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ECOLOGICAL ASSESSMENTS

NATURECALL – 2015
ECOSURE – ADDENDUM – JUNE 2016
ECOSURE – SEPTEMBER 2016

NATURECALL ENVIRONMENTAL

Statutory Ecological Assessment:

Project:

NOTE: This assessment was prepared as part of a previous DA for a residential subdivision within the same land. Data base searches and field assessments are relevant to the proposed coastal protection works located within the subject land - Lots 1 & 2 DP1209371 - No. 46 Arrawarra Beach Road, Arrawarra.

Client:

Keiley Hunter Town Planning Pty Ltd

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Executive Summary

1. BACKGROUND INFORMATION

Biodiversity Australia Pty Ltd trading as Naturecall Environmental (hereafter referred to as 'Naturecall') has been requested by Keiley Hunter Town Planning to undertake a statutory ecological assessment for a proposed subdivision of Arrawarra Beach Caravan Park/Spot X, Arrawarra. The findings of this assessment are to be submitted with the Development Application to Coffs Harbour City Council (CHCC).

The development proposal is to convert the caravan park into a 24 lot residential subdivision which will require the removal of most vegetation within Lots outside the E2 zone due to filling. Planting of native vegetation will be undertaken in the currently open E2 zones for required offsets, but it is desired to maintain views from currently open areas in the northeast.

The site has previously been surveyed by Umwelt (2004), who did not detect any Koala activity. Idyll Spaces (2014) also undertook a previous survey of vegetation which has now been partially removed under bushfire regulations, confirming it did not contain any threatened flora species or form part of an EEC listed under the EPBC Act.

Coffs Harbour City Council maps the following key constraints on site:

- CHCC Comprehensive Koala Plan of Management maps Secondary Koala Habitat along northern perimeter, with a spur in mid-southern area which has been thinned/partially cleared under the 10:50 bushfire provisions.
- Endangered Ecological Communities (TSC Act) in the same general areas.
- Regional Corridor along the riparian zone.

2. FLORA RESULTS:

2.1 Vegetation Communities

In overview, the site mostly consists of highly modified/derived swamp woodland dominated by Swamp Mahogany (*Eucalyptus robusta*), Broad-leaved Paperbark (*Melaleuca quinquenervia*), and Swamp Oak (*Casuarina glauca*); to a modified woodland of mixed eucalypts in the northwest; and exotic grassland. Virtually all of this vegetation is essentially parkland due to maintenance, and natural understorey is either absent or very localised.

2.2 EECs

The site vegetation does not appear to qualify as an EEC under the TSC Act (fails to meet geomorphological criteria) or EPBC Act.

2.3 Threatened Flora

No threatened flora species were detected on the site despite targeted searches. Due to the modified state of habitat on site and evidence history of disturbance shown in historical aerial photos, no threatened flora species were considered potential occurrences.

3. FAUNA RESULTS:

3.1 Habitat Evaluation

The site is highly modified, and hence lacks habitat features such as wetland/aquatic habitats, an understory of nectar-producing trees, no logs or similar debris, significant groundcover or leaf litter, Allocasuarinas, caves, etc.

The site has 19 hollow-bearing trees (and a number of nest boxes), mostly in the area currently mapped as Secondary Koala Habitat; a number of preferred sap species; a limited extent of edible-fruit producing trees/palms; and a limited abundance of nectar producing trees (with flowering season potentially ranging over most of the year).

3.2 Wildlife Corridors and Habitat Links

The site falls within a modelled regional corridor and under the CHCC corridor mapping, but has low value as a corridor and habitat link due to landuse and modification. Edge effects (eg dominance by common peri-urban and urban woodland species) are extreme.

A more significant corridor lies to the west over a more substantial area of intact habitat with limited barriers to movement of a broader fauna assemblage.

3.3 Survey Results

Survey specifically targeting the Squirrel Glider and Koala yielded no results. Three wide ranging threatened species were recorded: Grey-headed Flying Foxes, Hoary Bat and Osprey. The Eastern False Pipistrelle and East-coast Freetail Bat were tentative call identifications as well.

The proposal will see loss of most of the mapped Secondary Koala Habitat on site including about 10 Schedule 2 primary browse trees, which will be offset by replanting in the E2 zone at a ratio of 1:5.

4. IMPACTS OF THE DEVELOPMENT:

A comprehensive review was undertaken of the potential ecological impacts the proposal may have, with specific focus on threatened species recorded on and near the study area, or considered to have substantial potential to occur (via habitat evaluation).

Direct impacts from the proposed development would result in:

- Loss/modification of approximately 1.8ha of urban woodland and exotic grassland vegetation, including about 10 Schedule 2 primary Koala browse trees.

- Loss of foraging resources for a number of threatened and migratory species eg. Koala browse species, sap and nectar producing species.
- Loss of 15 hollow-bearing trees providing potential roosts for small to medium hollow-obligate species
- Further fragmentation of local habitat.
- Prevention of recovery of native vegetation (on-site)

5. RECOMMENDATIONS AND AMELIORATIVE MEASURES:

The following major recommendations were made to reduce impacts:

i. Vegetation management and habitat augmentation: The E2 zone is to be subject to a Vegetation Management Plan which will see removal of weeds (including exotic ornamentals), and supplementary/infill planting over an estimated 1575m^2 with Koala food trees to offset loss of trees on the remainder of the site. Nest boxes are also to be relocated/installed to offset loss of hollow-bearing trees.

ii. Clearing monitoring: An ecologist is to monitor the felling of the hollow-bearing trees to ensure fauna welfare obligations are met.

iii. E2 Zone: No fencing across the E2 zone is to be allowed, and other restrictions are to be put in place to protect habitat offset areas.

6. CHCC CKPoM:

Schedule 2 primary browse trees occurring on-site are Swamp Mahogany with a couple of Tallowwood in the northwest. The northwestern and southern portions of the site are mapped in the CHCC CKPoM as Secondary Koala Habitat. This and previous survey failed to detect Koala activity, with the nearest records 2km south-southwest near Mullaway. Koalas were considered unlikely to have a current usage of the site.

7. EPBCA 1999 – MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE.

The provisions of the EPBCA 1999 require determination of whether the proposal has, will or is likely to have a significant impact on a "*matter of national environmental significance"*. These matters are listed and addressed as follows:

1) **World Heritage Properties:** The site is not listed as a World Heritage area nor does the proposal affect any such area.
2) **National Heritage Places:** The site is not listed as a National Heritage Place nor does the proposal affect any such area.
3) **Ramsar Wetlands of International Significance**: A Ramsar wetland does not occur on the site, nor does the proposal affect a Ramsar Wetland.
4) **EPBCA listed Threatened Species and Communities**: The Grey-headed Flying Fox (Vulnerable) was recorded on site and the Koala (Vulnerable) is considered a low chance of

being a potential occurrence. These species are not considered at risk of a significant impact.

5) **Migratory Species Protected under International Agreements**: No Migratory species is likely to be significantly affected by the proposal as assessed below.
6) **The Commonwealth Marine Environment (CME):** The site is not within the CME nor does it affect such.
7) **The Great Barrier Reef Marine Park**: The proposal does not affect the Great Barrier Reef Marine Park.
8) **Nuclear Actions**: The proposal is not a nuclear action.
9) **A water resource, in relation to coal seam gas development and large coal mining development**: The proposal is not a mining development.

The proposal thus is not considered to require referral to Department of the Environment (DotE) for approval under the EPBCA.

8. SEVEN PART TEST ASSESSMENT

In addition to the 3 threatened species confirmed and 2 tentatively identified as having an association with the study area by this survey, a number of other threatened species have been recorded in the locality and some others have potential to occur due to suitable habitat. These were evaluated for their likelihood of occurrence on the site, the potential for impact upon them, and if the impacts were likely to be significant enough to require evaluation by the 7 Part Test. Of the species evaluated, the following were considered to require assessment under the 7 Part Test in addition to the species confirmed and tentatively recorded:

- Square-tailed Kite
- Little Lorikeet
- Black Bittern
- Black-necked Stork
- Sooty Oystercatcher and Pied Oystercatcher
- Koala
- Squirrel Glider
- Common Blossom Bat
- Yellow-bellied Sheathtail Bat
- Greater Broad-nosed Bat
- Eastern and Little Bent-Wing Bats
- Southern Myotis

These species were recorded on site or considered to be potential occurrences in the study area due to proximate records or records in similar regional habitat, and presence of potential foraging and/or roosting habitat in the study area. Due to their ecology and habitat limitations, the site and study area habitats could provide only part to a small fraction of the home range requirements of the local population of any of these species.

Overall, the proposal will have a number of detrimental impacts of various orders of magnitude on the known or potential occurrence of these species on the site by a reduction of the locally available potential habitat in the study area, resulting in reduced carrying capacity and increased threat levels and edge effects. From a species recovery point of view, these are acknowledged as negative effects

and will incrementally and cumulatively contribute to known threatening processes to the species. However, it is considered that the potential impacts associated with the proposal are unlikely to be of sufficient magnitude to result in the extinction of any local population of these threatened species.

9. CONCLUSION:

Based on the assessment in this report, it is considered that while the proposal will have a range of negative effects and incrementally and cumulatively contribute to threatening processes: these impacts are of insufficient order of magnitude to place a local population or occurrence of a threatened species, EEC or threatened population at likely risk of extinction at this time.

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1.0 Introduction

Biodiversity Australia Pty Ltd trading as Naturecall Environmental (hereafter referred to as 'Naturecall') has been requested by Keiley Hunter Town Planning to undertake a statutory ecological assessment for a proposed subdivision of Arrawarra Beach Caravan Park/Spot X, Arrawarra (Figure 1). The findings of this assessment are to be submitted with the Development Application (DA) to Coffs Harbour City Council (CHCC).

The development proposal is to convert the caravan park into a residential subdivision which will require the removal of vegetation within residential Lots outside the E2 zones.

The assessment for this development proposal was undertaken in accordance with the *Environmental Planning and Assessment Act 1979*, as amended by the *Threatened Species Conservation* (TSCA) *Act 1995* which in turn has been amended by the *Threatened Species Conservation Legislation Amendments Act 2002* (Seven Part Test for Significance); NSW SEPP 44 - *Koala Habitat Protection* (CHCC CKPoM assessment); and the Commonwealth *Environment Protection and Biodiversity Conservation* (EPBCA) *Act 1999* - Matters of National Environmental Significance (MNES).

The survey and assessment was performed in consideration of the draft *Threatened Species Survey and Assessment – Guidelines for Developments and Activities* (DEC 2004), and the *Threatened Species Assessment Guidelines – Assessment of Significance* (DECC 2007). The assessment has also been undertaken in accordance with the Ecological Consultants Association of NSW – *Code of Ethics* (2002) available at www.ecansw.org.au.

2.0 Background Information

2.1. Location of the Study Site and Key Definitions

The approximately 2.54ha subject site is located on Arrawarra Beach Road in the village of Arrawarra (Figure 1), which is divided by Arrawarra Creek. Arrawarra Beach Road runs along park of its west-southwestern boundary, with Yarrawarra Creek and Arrawarra Creeks to the north and east respectively, and rural land to the south.

The **site** is defined as the current entirety of Lot 12 DP835612, Lot 1 DP 26125 and Lot 1 DP789002, located at 46 Arrawarra Beach Road, Arrawarra. The development footprint is defined as the area subject to the subdivision (ie lots and access roads).

The **study area** is land within 100m of the site, and the **locality** is land within a 10km radius of the site.

2.2. Development Proposal

As shown in Figure 2, the development proposal is to convert the camping ground into a 24 Lot residential subdivision. Access will be provided via the existing connection to Arrawarra Beach Road onto a cul-de-sac within the new estate. The proposal will form an eastern extension of the western part of Arrawarra village.

The land is zoned R2 Low Density Residential and E2 Environmental Conservation under the Coffs Harbour City Local Environmental Plan 2013 (see Figure 2).

The establishment of future dwellings will require the removal of vegetation within building envelopes and the roads. Some trees will be retained (eg at the southern end) in the residential area, and not trees are to be removed in the E2 zones. Planting of native vegetation will be undertaken in selected parts of E2 zones to address the required offset provisions (see section 5), but otherwise the proponent desires to maintain views from currently open areas in the northeast.

2.3. Soils, Topography and Geology

Refer to the topographic map in Figure 1 and geological map in Figure 3 below.

2.3.1. Topography

The site is largely flat with no distinctive topographic features. Elevation ranges from RL 4m in the north to RL 2m AHD in the south (de Groot and Benson 2006).

The banks adjacent to the watercourses have seen historical erosion, with contraction east from Arrawarra Creek, and very steep banks adjacent to Yarrawarra Creek. A retaining wall has recently been installed in the upper northeast of the site to arrest erosion along Arrawarra Creek.

Both Arrawarra Creek and Yarrawarra Creek are very shallow due at least in part to historical erosion and widening of the estuary but also due to its hydrology. Yarrawarra Creek is prone to seasonal closure by sandbanks, and tidal exchange is limited for Arrawarra Creek. The lower sections of both are characterised by extensive sandbanks with very shallow braided channels.

2.3.2. Soils and Geology

Figure 3 shows that the majority of the site occurs on Pleistocene Undifferentiated beds comprising clayey sandy silt most likely derived by marine derived materials with a high degree of chemical weathering (Troedson and Hashimoto 2008). The eastern margin of the site is part of an estuarine plain comprised of marine sand, shell and sediments associated with the in-channel bar and beach to the east and north.

Figure 1: Location of the study site

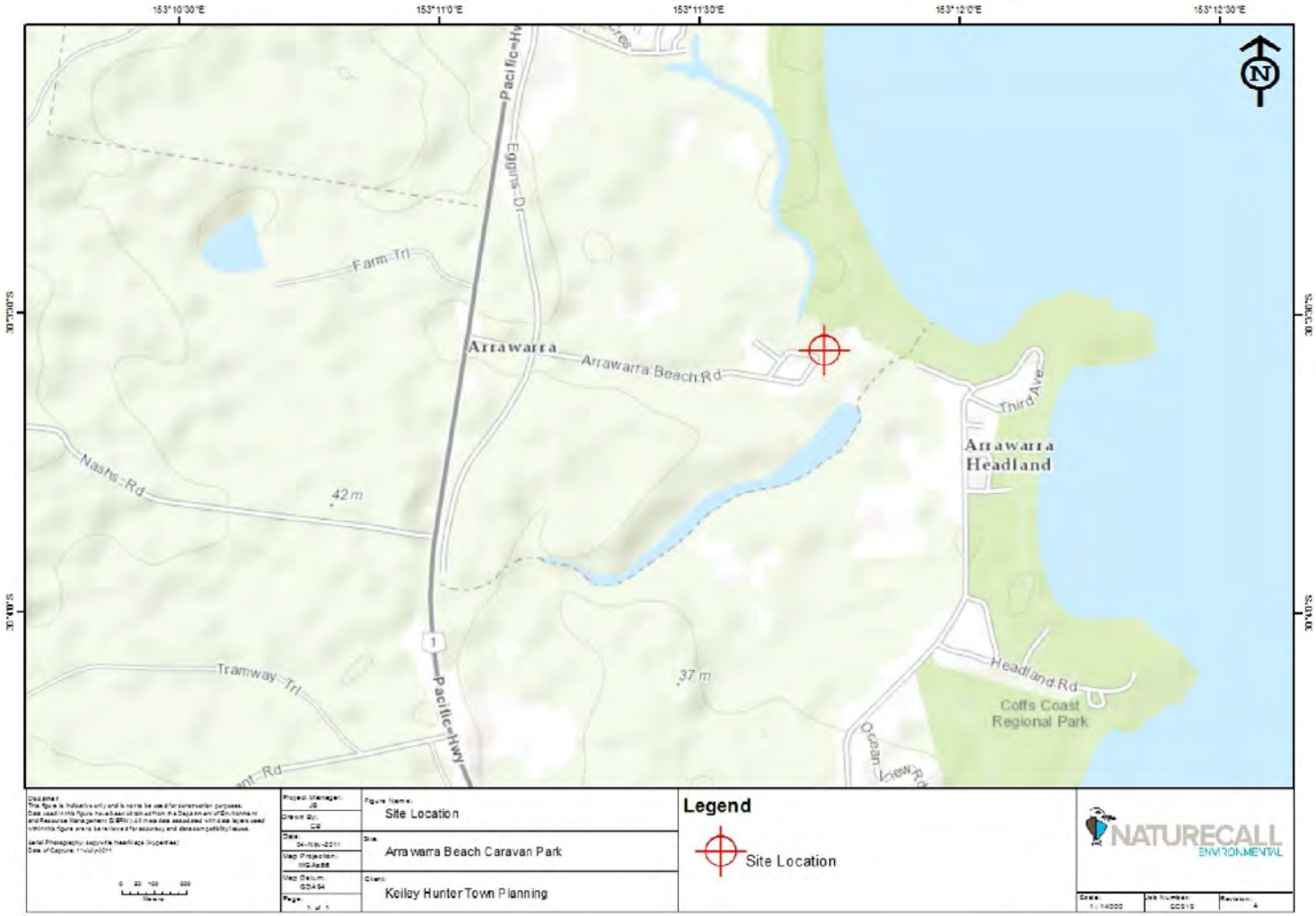
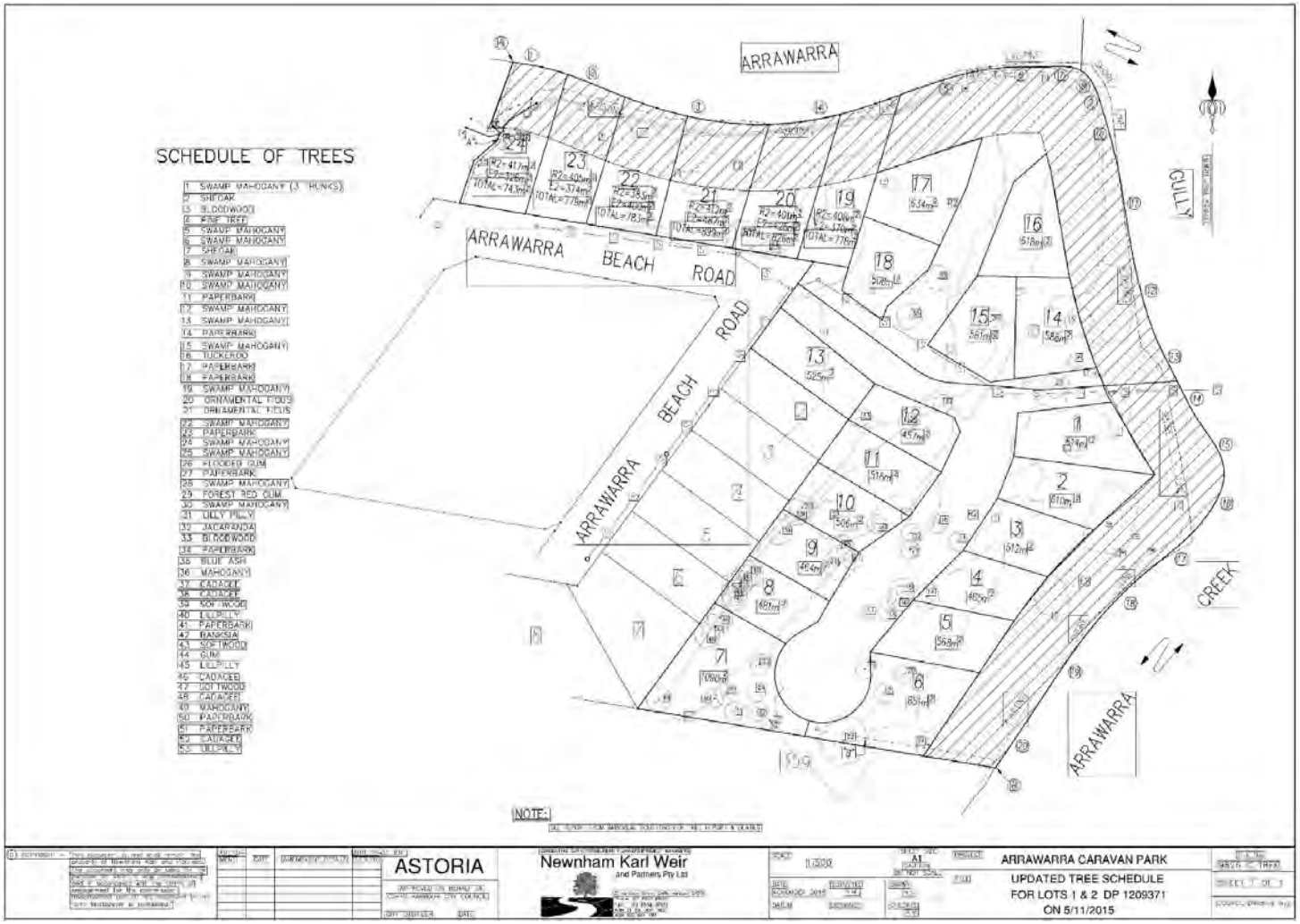


Figure 2: Concept development layout of site



2.4. Landuse and Disturbance History

2.4.1. Site and Surrounding Land Uses

The site is surrounded by existing residential land to the west; Arrawarra Creek to the east and Yarrawarra Creek to the north. The Pacific Ocean lies within 250m northeast. A powerline easement runs adjacent to the southern boundary. The recently upgraded Pacific Highway occurs 1km to the west of the site. East across Arrawarra Creek lies the other part of Arrawarra village and the headland. Extensive forest on private land occurs to the west and Crown land to the south, with Garb Nature Reserve to the south and southeast across the creek; and Wedding Bells State Forest west of the Pacific Highway. A patch of SEPP 26 Littoral Rainforest occurs north of Arrawarra Gully.

Permanent dwellings, fixed and temporary campsites associated with Arrawarra Holiday Park/Spot X currently occupy almost the entire site. A detailed history of the site has not been obtained however the state of the vegetation present indicates that it has been in its current state for several decades ie modified into parkland and used as a camping ground.

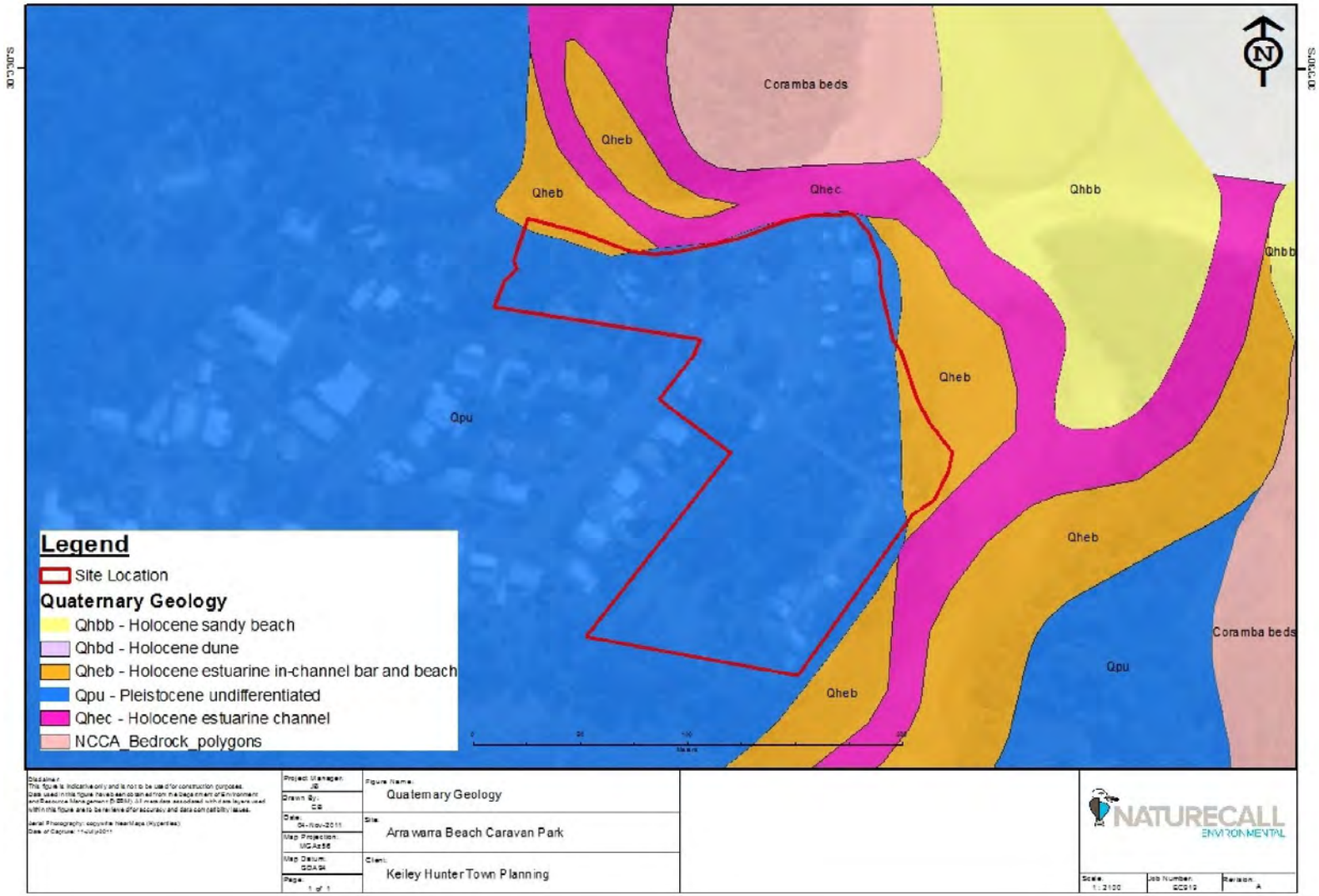
In recent years, most of a former clump of trees in the mid-south and part of the woodland in the northwest have been removed under the *10/50 Vegetation Clearing Code of Conduct for NSW* to protect cabins and safari tents (Hunter 2014). Two tree removal events have occurred to date under this legislation.

2.4.2. Fire History and Weed Invasion

The previous fire history of the site was not obtained, but the vegetation showed no signs of recent bushfires, hence any previous fires likely would have likely exceeded >20 years.

Weed infestations on the site are limited to the understorey and groundcover with exotic pasture grasses such as Paspalum, Whisky Grass, Lovegrass and Carpet Grass being the main weeds in addition to common exotic herbs. Exotic shrub species mainly comprise ornamental plantings around the main buildings and cabins. Coastal Morning Glory has a scattered occurrence along the exposed southern boundary.

Figure 3: Quaternary geology



3.0 Flora Survey

3.1. Survey and Assessment Methodology

The flora survey methodology was developed in reference to the Comprehensive Ecological Assessments Information Sheet published by Coffs Harbour City Council, with methods and effort in proportion to the state of habitat on site and considering previous investigations (Umwelt 2004, Elk 2014).

This consisted of three main components:

- Identification, description and mapping of the major vegetation communities on site.
- Identification, mapping and condition assessment of any Endangered Ecological Communities listed under the *Threatened Species Conservation Act 1995* (TSC Act), *and Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on the site.
- Searches for and (if found) mapping of threatened species listed under the *Threatened Species Conservation Act 1995* (TSCA), and *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA). This was limited to the site.

3.1.1. Vegetation Community Description and Mapping

3.1.1.1. Review of Existing Data

Existing vegetation mapping of the site produced by CHCC and vegetation layers on SIX Maps NSW were initially reviewed. These were used to identify broad vegetation types present on the site to assist with site stratification and survey design.

3.1.1.2. Methodology

Due to the limited extent and relatively uniform vegetation characteristics, the site was intensively searched for a dedicated day via undertaking random meanders throughout the entire site, as opposed to stratification and associated quadrat and transect sampling. This was deemed to be the most appropriate method given the limited number of species, highly modified vegetation, and the small extent of the site.

Species identification was made with the assistance of Williams, Harden and McDonald (2009), Brooker and Kleinig (2006), Watsford (2008), Elliot (2008) and PlantNET (2014). Plant species were identified to species or subspecies level and nomenclature conforms to that currently recognized by the Royal Botanic Gardens and follows Harden and PlantNET for changes since Harden.

The vegetation communities were described from data collected during transect studies. Classification was based on the NSW Biometric classification and the classifications proposed by Beadle and Costin (1952) and Keith (2004) eg '*Dry Sclerophyll Forest'* to assist the fauna habitat evaluation. Structural classification was as per Walker and Hopkins (1990) with crown cover classes defined by the following:

- Closed or dense: crowns touching to overlapping (crown separation ratio <0).
- Mid-dense: crowns touching or slightly separated (crown separation ratio 0– 0.25).
- Sparse: crowns clearly separated (crown separation 0.25–1).
- Very Sparse: crowns well separated (crown separation 1–20).
- Isolated plants: trees greater than 100 m apart, shrubs about 25m apart (crown separation >20).
- Isolated clumps: clump of two to five woody plants 200 metres apart (crown separation >20)

3.1.2. Conservation Status Assessment

Identification of possible Threatened Ecological Communities (TECs) was based on the data collected by the survey and review of the relevant listings on the OEH website (www.environment.nsw.gov.au) and Department of Environment – MNES SPRAT website (DotE 2014a).

3.1.3. Threatened Flora Species Searches and Occurrence Assessment

3.1.3.1. Searches

Searches for the locally recorded threatened flora recorded in the LGA and regionally (OEH 2015a, DotE 2015b) in similar habitats to those occurring on the site (see Appendix 1), were carried out over the survey period.

The site was intensively searched during the flora survey, consisting of undertaking random meanders throughout all habitats on site with targeted searches of potential habitat for locally and regionally recorded threatened species.

3.1.3.2. Potential Occurrence Assessment:

Potential occurrence assessment of threatened flora species is provided in Appendix 1. This section assesses all considered threatened species listed under the TSCA 1995 and EPBCA 1999 for their potential to occur on site based on the following factors (DEC 2004, Forest Fauna Surveys 1997, DECC 2007):

- Presence/absence of suitable habitat.
- Condition and disturbance history of habitat.
- Local and regional records.
- Location of site within known distribution of the species.
- Connectivity with habitat where species is known to occur.

3.1.4. Survey Limitations

The study site was intensively traversed by foot during specific flora surveys and during other survey activities during the survey period.

The survey was undertaken in late summer when most plants are not generally dormant. This led to a very high level in confidence that any threatened species potentially present would have been detected.

Regardless, any short-term survey will only provide a list of plants detected during a brief interval of time (DEC 2004). The total species list of an area is usually much greater than can be detected in such a short time and it can be influenced by factors such as: size of the property, fire history, time since disturbance, flowering season (particularly orchids), and presence of reproductive material (DEC 2004).

3.2. Flora Survey Results

3.2.1. Site Vegetation Communities

Refer to the vegetation maps in Figure 5 and following site photos.

The woodland-dominated part of the site is mostly highly modified/derived swamp sclerophyll woodland dominated by Swamp Mahogany (*Eucalyptus robusta*), Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Swamp Oak (*Casuarina glauca*); with a patch of highly modified wet sclerophyll containing an eclectic mix of trees including Tallowwood (*E. microcorys*), Flooded Gum (*E. grandis*) and Pink Bloodwood (*Corymbia intermedia*) in the northwest. Areas outside these patches of remnant vegetation are largely open with exotic grasses and ornamental plantings eg palms and various exotic shrubs.

Table 1: Modified swamp woodland

Vegetation Community	Highly Modified (Swamp) Woodland
Biometric Vegetation Class	Swamp Mahogany swamp forest of the coastal lowlands of the North Coast
Keith (2000) Vegetation Formation	Forested Wetlands
Location and Area	Southern half of site
Description	**(a) Canopy:** *Structure and Species*: Ranges from clumps on mid-east and southern fringes (generally all or partly within E2 zones where occurs on site), to partly scattered trees and a thinned clump in the central south. Height ranges from about 12-20m, with trunk diameter at breast height 20-120cm.

Vegetation Community	Highly Modified (Swamp) Woodland
	Main clump is dominated by Swamp Mahogany (*Eucalyptus robusta*) and Broad-leaved Paperbark (*Melaleuca quinquenervia*), with one very large Flooded Gum (*E. grandis*). Swamp Oak (*Casuarina glauca*) occur in the northeast end of this community, with a break then a single Moreton Bay Fig (*Ficus macrophylla*) occurs within a small patch of Swamp Oak with scattered Broad-leaved Paperbark and Coral Trees on the mid-east, grading to paperbark with a few Swamp Mahogany to the southeast. **(b) Understorey:** *Structure and Species*: Absent in main clump. Small clump on southern boundary has an understory of Coral Trees with some rainforest species including young *Ficus* spp, Cheese Tree (*Glochidion ferdinandi*), and a number of exotic ornamentals. In other areas, limited to a few younger or suppressed canopy species, and a number of rainforest species such as Twin-leaved Tuckeroo (*Rhysotoechia bifoliolata*), Tuckeroo (*Cupaniopsis anacardioides*), Lily Pilly (*Syzygium* spp), Weeping Bottlebrush and Bangalow Palm (*Archontophoenix cunninghamiana*). A number of ornamentals have also been planted around cabins. Height ranges from 4-10m. **(c) Shrub Layer:** *Structure and Species*: Absent apart from scattered ornamental exotics (eg Weeping Fig) and native cultivars, to well-developed around permanent cabins in the southeast. Height ranges from 0.5-3m. **(d) Ground Layer:** *Structure and Species*: Sparse to open. Dominated by introduced grasses, primarily Couch (**Cynodon dactylon*) and Lovegrass (**Eragrostis* spp), and a suite of native and mostly exotic herbs eg Dandelion. Range of exotic ornamentals planted around cabins. **(e) Lianas, scramblers, epiphytes, mistletoe etc.:** A few Austral Smilax along the creek bank. Southern end dominated by **Ipomoea* spp.
Condition	Poor condition given modification and maintenance suppressing regeneration, and dominance of weed species within ground stratum.
Threatened plants recorded or potential habitat	No
Threatened Ecological Community or Endangered Population	No

Table 2: Modified wet sclerophyll forest/woodland

Vegetation Community	Highly Modified Tall Open Wet Sclerophyll Forest/Woodland
Biometric Vegetation Class	n/a
Keith (2000) Vegetation Formation	Wet Sclerophyll Forests (Shrubby Formation)
Location and Area	Northwest portion of site.
Description	**(a) Canopy:** *Structure and Species*: Modified open forest about 15-20m high with trunk DBH 20-50cm. Eclectic mix of species consisting of Swamp Oak, Tallowwood, Pink Bloodwood, Brushbox (*Lophostemon confertus*), and Flooded Gum. **(b) Understorey:** *Structure and Species*: Limited to a few younger or suppressed canopy species and a number of rainforest species such as Twin-leaved Tuckeroo, Brushbox, Tuckeroo, Red Ash (*Alphitonia excelsa*) and Turpentine. A number of ornamentals have also been planted around cabins. **(c) Shrub Layer:** *Structure and Species*: Absent apart from a range of rainforest shrubs with Bitou Bush on creek bank and planted ornamentals. **(d) Ground Layer:** *Structure and Species*: Very open to sparse, and overall low. Dominated by introduced grasses, primarily Kikuyu, Couch Lovegrass, and a suite of native and mostly exotic herbs eg Dandelion. Range of exotic ornamentals planted along creek bank eg **Sansevieria spp.* **(e) Lianas, scramblers, epiphytes, mistletoe etc.:** Absent apart from some dense **Ipomoea cairica* and some Twining Lily and Austral Smilax along creek bank.
Condition	Poor condition given modification and maintenance suppressing regeneration, and dominance of weed species within ground stratum. About 50% of this community was later removed under the 10/50 regulation.
Threatened plants recorded or potential habitat	No
Threatened Ecological Community or Endangered Population	No

Table 3: Exotic Grassland

Vegetation Community	Exotic Grassland
Biometric Vegetation Class	n/a
Keith (2000) Vegetation Formation	n/a
Location and Area	Northeast portion of site and parts of southern end.
Description	**(a) Canopy:** *Structure and Species*: Few scattered remnant Swamp Mahogany 8-12m high, with trunk DBH 60-120cm. **(b) Understorey:** *Structure and Species*: Limited to a range of exotic and horticultural natives mostly planted around cabins. Kentia Palm is the most common, with Cabbage Palm (*Livistona australis*), Lasiandra and **Strelitzia nicolai*. Height ranges from 4-6m. **(c) Shrub Layer:** *Structure and Species*: Absent apart from ornamental around cabins, camp kitchen and administration buildings. **(d) Ground Layer:** *Structure and Species*: Dominated by introduced grasses, primarily Kikuyu (**Pennisetum clandestinum*) and Couch (**Cynodon dactylon*), Lovegrass (**Eragrostis* spp), and a suite of native and mostly exotic herbs eg Dandelion.
Condition	Poor condition given modification and maintenance suppressing regeneration, and dominance of weed species within ground stratum.
Threatened plants recorded or potential habitat	No
Threatened Ecological Community or Endangered Population	No

Photo 1: Example of exotic grassland and palms



Photo 2: Clump of weed infested denser forest on southern boundary



Photo 3: Denser plantings of ornamental natives and exotics in southeast corner in E2 zone



Photo 4: Forest in E2 zone in mid-east



Photo 5: Modified swamp forest (Secondary Koala Habitat) in R2 zone



Photo 6: Modified wet sclerophyll in northwest corner in E2 zone



Figure 4: Site vegetation communities



3.2.2. CHCC Fine Scale (Class 5) Vegetation Mapping Review

Figure 5 shows that the CHCC Fine scale vegetation mapping maps dry sclerophyll forest across the northwestern portion of the site, and over the central southern area. These areas are categorised as CH_DOF06 (Lowlands Swamp Box - Paperbark - Red Gum Dry Forest).

CH_FrW10 (Swamp Oak Forested Wetland) is also mapped within the mid-eastern side of the site (see Photo 5). The following table compares the Class 5 vegetation mapping to the site-scale vegetation mapping.

Table 4: CHCC Fine Scale (Class 5) Vegetation Mapping

Key Criteria	Attribute	Site attributes/evaluation
CH_DOF06: Lowlands Swamp Box - Paperbark - Red Gum Dry Forest		**Modified Open Woodland (Swamp Forest and Wet Sclerophyll)**
General	A dry open forest which mostly occurs on coastal and hinterland lowlands on alluvial and colluvial flats and drainage depressions on clay and sand loams subject to infrequent inundation; often an ecotone between swamp forest and dry sclerophyll.	Structure observed on site does not match CH_DOF06.
Key Indicator Species	Varied dominance in the canopy usually of Swamp Box (*Lophostemon suaveolens*), Broad-leaved Paperbark (*Melaleuca quinquenervia*), Pink Bloodwood (*Corymbia intermedia*), Red Mahogany (*Eucalyptus resinifera* subsp. *hemilampra*), Willow Bottlebrush (*Callistemon salignus*) and Forest Red Gum (*Eucalyptus tereticornis*). Other canopy species may include Swamp Mahogany (*Eucalyptus robusta*), Coastal Blackbutt (*Eucalyptus pilularis*) and Scribbly Gum (*Eucalyptus signata*). Black She-oak (*Allocasuarina littoralis*) and Cheese Tree (*Glochidion ferdinandi* var. *ferdinandi*) are sometimes present as a small tree layer. Large-leaf Hop Bush (*Dodonaea triquetra*), Geebung (*Persoonia stradbrokensis*), Notched Bush-pea (*Pultenaea retusa*) and Coffee Bush (*Breynia oblongifolia*) dominate the lower layer. The ground layer is distinctive and consists of Kangaroo Grass (*Themeda australis*), Wiry Panic (*Entolasia stricta*), Matrushes (*Lomandra longifolia*, *Lomandra confertifolia*), Guinea Flower (*Hibbertia aspera*),	Swamp Mahogany and Broad-leaved paperbark dominant central south area; and Pink Bloodwood with Tallowwood with Brushbox in northwest. Willow Bottlebrush also present with Cheese Trees in some areas. Could have possibly once been this community as suggested by occurrence of this community around Arrawarra village to west and south.

Key Criteria	Attribute	Site attributes/evaluation
	Blue Flax-lily (*Dianella caerulea*), White Root (*Pratia purpurascens*) and Bracken Fern (*Pteridium esculentum*).	
Extent on site	Two patches are mapped on site.	Covers actual extent of all open woodland on site aside from Swamp Oak-dominated area.
CH_FrW10 (Swamp Oak Forested Wetland)		**Modified Open Woodland/Swamp Forest**
General	Saline swamp forested wetland adjacent to tidal creek and rivers.	Occurs on old estuarine soils adjacent to estuarine creek.
Key Indicator Species	Dominated by Swamp Oak with rare if any paperbarks. Monkey Rope (*Parsonsia straminea*) often present. Key defining feature is dense groundcover of usually salt tolerant sedges and grasses.	Swamp Oak is dominant with remnant rainforest species and Broad-leaved Paperbark. Groundcover is not a match and height above tide and watertable strongly suggests never matched floristic specification.
Extent on site	One patch mapped on site on mid-east boundary adjacent to creek.	Covers actual extent of Swamp Oak on site.

Figure 5: CHCC vegetation mapping of the site



3.3. Threatened Ecological Communities

3.3.1. CHCC EEC mapping

The CHCC EEC mapping layer shows that the northwestern boundary of the site, and a portion of the southern boundary of the site are mapped as the EEC -*Subtropical Coastal Floodplain Forest* (SCFF), with a minute area of the EEC - *Swamp Oak Floodplain Forest* also mapped (see Figure 8 below).

To qualify as an EEC, the vegetation community must match both the floristic and geomorphological criteria listed in the Final Determination. In the previous sections, this mapping was reviewed in reference to:

i. The Final Determination criteria for Coastal Floodplain EECs

ii. Coastal Quaternary Geology mapping by Troedson and Hashimoto (2008)

iii. Contour and 1:100 ARI data for the site provided by the client; and

iv. The vegetation survey undertaken on the site

The potential occurrence of these EECs is reviewed in the following section.

3.3.2. Site Evaluation

The following sections review the potential presence of the EECs mapped by CHCC by assessing geomorphological and floristic data against the Final Determination criteria for Coastal Floodplain EECs.

3.3.2.1. Assessment for *Swamp Oak Floodplain Forest* EEC

As shown in the following table, the patch of Swamp Oak meets some of the Final Determination criteria, but does not appear to clearly match the critical soils and landform criteria. The latter refers to the fact that the soil landscape does not appear to be derived from the processes specified in the Final Determination. As evaluated in *Gales Holdings Pty Limited v Tweed Shire Council [2008] NSWLEC 209* by Justice Preston:

> "*The soils are "in" the topographical features identified, which are in turn "associated" with the coastal floodplain, as defined by the Scientific Committee. This suggests that these topographical features are formed by the fluvial processes referred to in the definition of floodplains, namely, "active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less". So too the soils which are in such topographical features will be formed by such fluvial processes*."

Troedson and Hashimoto's (2008) state (as follows) that the depositional processes responsible for the Qpu soil landscape can be highly variable (and mixed over the local topographic range of the landscape), ranging from estuarine, fluvio-deltaic, alluvial, or backbarrier origin:

> "*At surface may form low terraces and well-drained or swampy plains; occurs in subsurface of a variety of Holocene environments; common in backbarrier settings and in marginal parts of estuarine and estuarine-deltaic depositional systems. Generally grades upstream into Pleistocene alluvium (Qpa and Qpat); may grade seaward into Pleistocene tidal delta and backbarrier flat deposits (Qpef, Qpbf); commonly overlain by Holocene freshwater swamp, alluvial, or estuarine deposits*."

Given no major watercourses capable of significant erosion and aggradation occur in the local area; and the proximity to the ocean and dune systems (see Figure 3): it is logical to deduce that estuarine and backbarrier deposition processes are likely to be the dominant geomorphological processes in this area, and hence it does not satisfy the Final Determination's criteria to qualify as a coastal floodplain due to lack of dominance by alluvial processes over the root zone (as per *Gales Holdings Pty Limited v Tweed Shire Council [2008] NSWLEC 209*).

Table 5: Review of potential occurrence of *Swamp Oak Floodplain Forest* EEC

Key Criteria	Attribute	Site attributes/evaluation	Attribute Met?
Final Determination Criteria		**Swamp Oak Woodland**	
Soils	Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline.	Generally met as soils are sandy loams, however these appear to have been formed by a mix of estuarine and marine processes with alluvial processes possibly more influential in the western side of the Qpu soil landscape which is well off site. Given proximity to ocean and dune system, marine and estuarine processes likely to be more dominant physiognomic influences on vegetation. Community is adjunct to an estuarine creek, hence expect saline influence on watertable.	N
Landform	It generally occupies low-lying parts of floodplains, alluvial flats, drainage lines, lake margins and fringes of estuaries; habitats where flooding is periodic and soils show some influence of saline ground water.	Does not appear to occur on an alluvial landform; does occur on an estuarine fringe, but occurs at the junction with marine processes, hence alluvial processes not likely to be dominant.	N

Key Criteria	Attribute	Site attributes/evaluation	Attribute Met?
Below 1:100 ARI	Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990)	Northern margins and most of eastern part of property shown as below 1:100.	Y
Latitudinal range	Generally occurs below 20 m (rarely above 10 m) elevation	Site elevation ranges from 2-4m	Y
Structure	May vary from open forests to low woodlands, scrubs or reedlands with scattered trees. Typically these forests, woodlands, scrubs and reedlands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water.	Highly modified but bears resemblance to the natural community. Forms ecotone to swamp forest and presumably originally mangroves.	Y
Dominant canopy species and other indicator species	Dense to sparse tree layer in which *Casuarina glauca* (swamp oak) is the dominant species northwards from Bermagui. Other trees including *Acmena smithii* (lilly pilly), *Glochidion* spp. (cheese trees) and *Melaleuca* spp. (paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. The understorey is characterised by frequent occurrences of vines, *Parsonsia straminea* (common silkpod), *Geitonoplesium cymosum* (scrambling lily) and *Stephania japonica* var. *discolor* (snake vine), a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter. The composition of the ground stratum varies depending on levels of salinity in the groundwater.	Highly modified but pre-disturbance, possibly could have met criteria.	Y

3.3.2.2. Assessment for *Subtropical Coastal Floodplain Forest* EEC

The following table determines that this EEC does not occur on site due to:

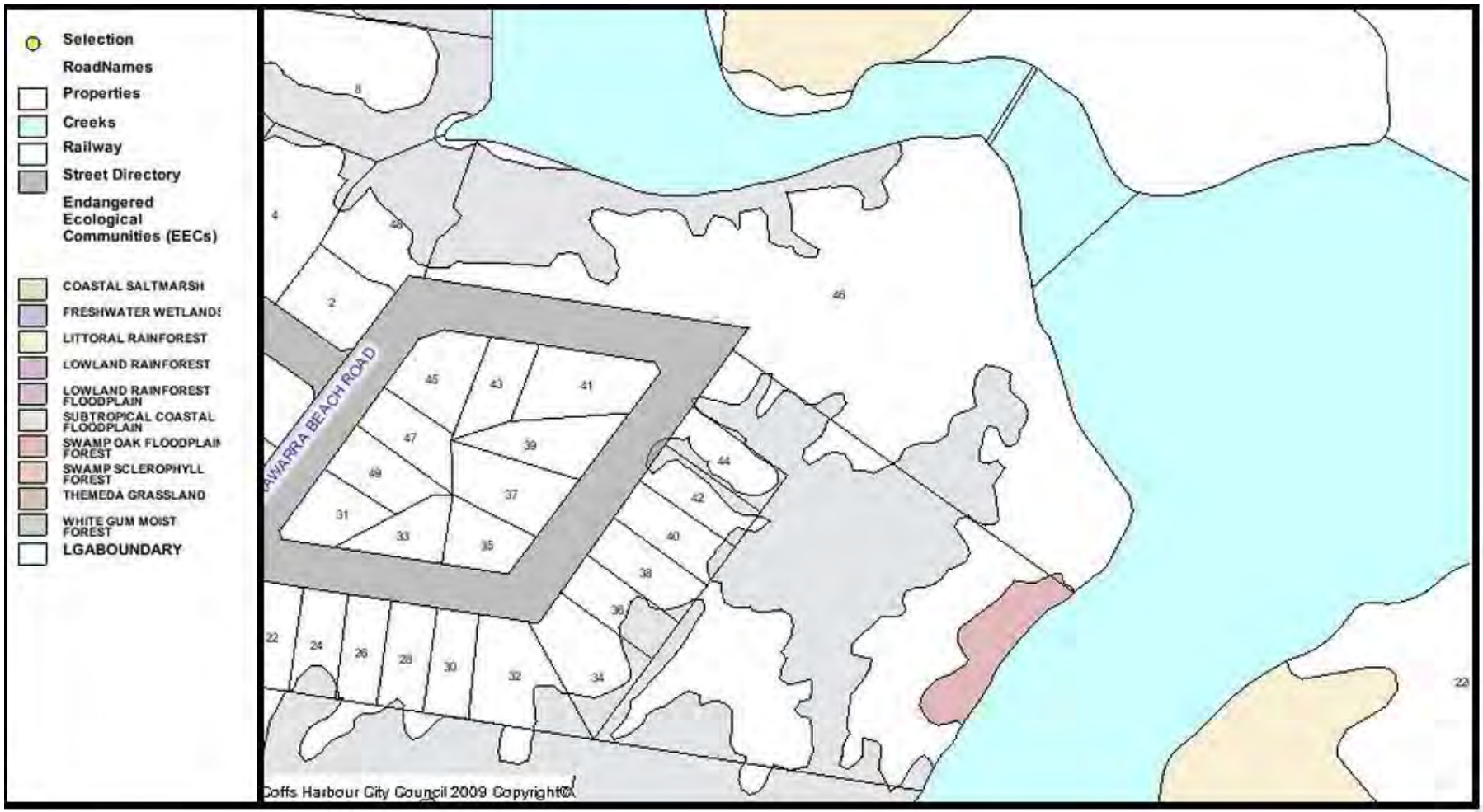
- Does not meet geomorphological requirements ie not alluvial soil landscape.
- Does not meet floristic criteria.

Table 6: Review of potential occurrence of *Subtropical Coastal Floodplain Forest* EEC

Key Criteria	Attribute	Site attributes/evaluation	Attribute Met?
Final Determination Criteria		**Highly Modified Woodland (swamp forest and wet sclerophyll)**	**Y/N**
Soils	Associated with associated with clay-loams and sandy loams.	Marginally met as soils are sandy loams, however these appear to have been formed by a mix of estuarine and marine processes and not adjunct to an alluvial landscape.	N
Landform	Periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains	Does not occur on an alluvial landform.	N
Below 1:100 ARI	Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990)	Northern margins and most of eastern part of property shown as below 1:100.	Yes for most of vegetation extent
Latitudinal range	Generally occurs below 50m, but may occur on localised river flats up to 250 m elevation	Site elevation ranges from 2-4m	Y
Structure	Has a tall open tree layer of eucalypts, which may exceed 40 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality.	Highly modified but bears generic resemblance to the natural community.	Y

Key Criteria	Attribute	Site attributes/evaluation	Attribute Met?
Dominant canopy species and other indicator species	Most widespread and abundant dominant trees include *Eucalyptus tereticornis* (Forest Red Gum), *E. siderophloia* (Grey Ironbark), *Corymbia intermedia* (Pink Bloodwood) and, north of the Macleay floodplain, *Lophostemon suaveolens* (Swamp Turpentine). Other trees may be scattered throughout at low abundance or locally common at few sites, particularly where there is an influence from lithic substrates upslope. These include *Eucalyptus moluccana* (Grey Box), *E. propinqua* (grey gum), *E. seeana* (Narrow-Leaved Red Gum), *Angophora subvelutina* (Broad-Leaved Apple), *E. robusta* (Swamp Mahogany), *Eucalyptus resinifera* subsp. *hemilampra* (Red Mahogany), *E. acmenoides* (White Mahogany), *Angophora woodsiana, A. paludosa* and rainforest trees such as *Ficus* spp. (figs) and *Cupaniopsis* spp (tuckeroos).	Highly modified but does not match the recognised association in the modified wet sclerophyll. Modified swamp forest association more closely matches the EEC – *Swamp Sclerophyll Forest on Coastal Floodplains*.	N

Figure 6: CHCC EEC mapping of the site



3.4. Other listed Threatened Ecological Communities and Populations

A summary review of TECs and Endangered Populations listed under the TSC Act 1995 and EPBC Act 1999 which occur in the North Coast Bioregion (OEH 2015b, DotE 2015a) and their potential for occurrence on site or in the study area, is provided in the following table.

Table 7: Review of TECs and Endangered Populations

Act	Literature Review	Significance
TSC Act	"***River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions***" is an EEC associated with silts, clay-loams and sandy loams on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. *River-flat Eucalypt Forest on Coastal Floodplains* (RfEF) generally occurs below 50m elevations, but may occur on localised river flats up to 250m above sea level. In the North Coast, the most widespread and abundant dominant trees include *Eucalyptus tereticornis, E. amplifolia, Angophora floribunda, A. subvelutina*, *E. saligna* and *E. grandis.*	Vegetation meeting the floristic criteria of this EEC does not occur on the site or study area.
TSC Act	***"Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions"*** is a characteristic ecological community listed as Endangered under the TSC Act 2004. This EEC is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF) generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sandplains. The structure of the community is typically open forest (but may be reduced to scattered trees via disturbance), and in some areas the tree stratum is low and dense ie a scrub. The community also includes some areas of fernland and tall reedland or sedgeland where trees are very sparse or absent. The most widespread and abundant dominant trees include Eucalyptus robusta and Melaleuca quinquenervia.	Vegetation meeting the floristic criteria of this EEC does occur, however the soil landscape is not considered to meet the geomorphological criteria.

Act	Literature Review	Significance
TSC Act	***"Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions***" has been listed as an Endangered Ecological Community under the TSC Act 2004. This EEC is associated with periodic or semi-permanent inundation by freshwater, (including areas with minor saline influence). They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains ie habitats where flooding is periodic and standing fresh water persists for at least part of the year in most years. *Freshwater Wetlands on Coastal Floodplains* (FWCF) generally occur below 20m elevations, and the structure of the community varies from sedgelands and reedlands to herbfields. Woody species of plants are generally scarce. The structure and composition of the community varies both spatially and temporally depending on the water regime (Yen and Myerscough 1989, Boulton and Brock 1999).	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on the site or study area. The aquatic vegetation in the dam does not qualify floristically and this habitat has been artificially created.
TSC Act	***"Lowland Rainforest on Floodplains on the NSW North Coast Bioregion"*** generally occupies riverine corridors and alluvial flats with rich, moist silts often in sub-catchments dominated by basic volcanic substrates. Small, scattered remnants remain on the floodplains of the Tweed, Richmond, Clarence, Bellinger, Macleay, Hastings, Manning, and Hunter Rivers. In its natural state, this community supports a rich diversity of flora and fauna. Tree species often present include Figs, (*Ficus* spp.), Palms (*Archontophoenix cunninghamiana, Livistona australis*), Lilly Pillys (*Syzygium* spp.) and vines (*Cissus* spp., *Pandorea pandorana, Flagellaria indica*).	Vegetation meeting the floristic criteria of this EEC does not occur on the site or study area.

Act	Literature Review	Significance
TSC Act	***"Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregion"*** has been listed as an Endangered Ecological Community since December 2006 on Schedule 1 – Part 3 of the TSC Act 1995. Lowland Rainforest, in a relatively undisturbed state, has a closed canopy, characterised by a high diversity of trees whose leaves may be mesophyllous and encompass a wide variety of shapes and sizes. Typically, the trees form three major strata: emergents, canopy and sub-canopy which, combined with variations in crown shapes and sizes, give the canopy an irregular appearance (Floyd 1990). The trees are taxonomically diverse at the genus and family levels, and some may have buttressed roots. A range of plant growth forms are present in Lowland Rainforest, including palms, vines and vascular epiphytes. Scattered eucalypt emergents may occasionally be present. In disturbed stands the canopy continuity may be broken, or the canopy may be smothered by exotic vines.	Vegetation meeting the floristic criteria of this EEC does not occur on the site or study area.
EPBC Act	***"Lowland Rainforest of Subtropical Australia"*** is found from Maryborough to the Hunter. Predominantly occurs on basalt and alluvial soils, or enriched rhyolitic and metasediments. Generally occurs <300m above sea level but may occur >300m on north-facing slopes, and only in areas with annual rainfall >1300mm. May intergrade with Littoral Rainforest and Coastal Vine Thickets but usually occurs >2km from ocean. Typically tall (20-30m) closed forest often with multiple tree layers dominated by diversity of rainforest species with emergent non-rainforest species constituting <30%. Emergents are typically figs, Hoop Pine and Brushbox.	Vegetation meeting the floristic criteria of this EEC does not occur on the site or study area.
TSC Act	***"Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions"*** is typically a closed forest, the structure and composition of which is strongly influenced by its proximity to the ocean. The plant species of this community are predominantly rainforest species while emergent Eucalypts or Lophostemons are present in some stands. This community grows only in coastal areas within maritime influence on sand dunes and soil derived from underlying rocks.	Vegetation meeting the floristic criteria of this EEC does not occur on the site. A patch of littoral rainforest occurs within 100m, but the proposal has nil impact.
EPBC Act	***"Littoral Rainforest and Coastal Vine Thickets of Eastern Australia"*** is a Critically Endangered Ecological Community listed under the EPBC Act 1999, which is generally identical to the TSC Act listing.	Vegetation meeting the floristic criteria of this EEC does not occur on the site. A patch of littoral rainforest occurs within 100m, but the proposal has nil impact.

Act	Literature Review	Significance
TSC Act	A localised population of a distinctive variation of *Glycine clandestina*, identified as *Glycine* sp. "Scotts Head", has been listed as an Endangered Population. This population is restricted to part of the headland complex at Scotts Head.	The site is well beyond the range of this population.
TSC Act	***"Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregion"*** has been listed as an Endangered Ecological Community under the TSC Act 1995. Coastal Saltmarsh is the ecological community occurring in the intertidal zone on the shores of estuaries and lagoons along the NSW coast. Characteristic species include: *Baumea juncea, Juncus kraussii, Sarcocornia quinqueflora, Sporobolus virginicus, Triglochin striata, Isolepis nodosa, Samolus repens, Selliera radicans, Suaeda australis, Zoysia macrantha.*	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on site or in the study area.
TSC Act	***"White Box Yellow Box Blakely's Red Gum Woodland"*** is an EEC predicted to occur in Macksville, Dorrigo, Grafton, Kempsey, Korogoro Part, Nambucca, Coffs Harbour and Bare Part Atlas of Wildlife databases. This community is generally restricted to the tablelands and western slopes.	The site/study area does not meet the floristic requirements of this EEC, hence it does not occur.
TSC Act	***"Hunter Lowland Red Gum Forest in the Sydney Basin and North Coast Bioregions"*** is an EEC found on gentle slopes arising from depressions and drainage flats on Permian sediments of the Hunter Valley floor in the Sydney Basin and NSW North Coast Bioregions.	Vegetation meeting the floristic criteria of this EEC does not occur on the site or study area.
TSC Act	The ***"Population of Eucalyptus seeana in the Greater Taree Local Government Area"*** has been listed as an Endangered Population.	The site/study area does not meet the floristic requirements of this EEC, hence it does not occur.

Act	Literature Review	Significance
TSC Act	***"White Gum Moist Forest in the NSW North Coast Bioregion"*** is an ECC characteristically dominated by White Gum (*Eucalyptus dunnii*) either in pure stands or with *E. saligna, E. microcorys* and/or *Lophostemon confertus* (NSWSC 2008a).White Gum Moist Forest typically occurs on the escarpment slopes and foothills of the north-east NSW, most commonly between 400 and 650 m elevation, where mean annual rainfall exceeds approximately 1000 mm and has a summer maximum (DECC 2007) on fertile soils. It is currently known from the local government areas of Clarence Valley, Coffs Harbour, Kyogle and Tenterfield.	White Gum does not occur on the site or study area thus the EEC does not occur.
TSC Act	***"Hunter Valley Vine Thicket in the NSW North Coast and Sydney Basin Bioregions***" is a Critically Endangered Ecological Community (CEEC). This CEEC occurs on Carboniferous sediments (often on limestone) mainly on rocky slopes. The community typically forms a low closed forest dominated by low trees, shrubs and vines. The canopy is dominated by both varieties of *Elaeodendron australe* (Red Olive Plum), *Geijera parviflora* (Wilga), *Notelaea microcarpa* var. *microcarpa* (Native olive), and *Alectryon oleifolius* subsp. *elongatus* (Western Rosewood). Emergent eucalypts are common and include *Eucalyptus albens* (White Box), *E. dawsonii* (Slaty Box), and *E. crebra* (Narrow-leaved Ironbark). Hunter Valley Vine Thicket has been recorded from the local government areas of Muswellbrook, Singleton, and Upper Hunter (NSWSC 2007b).	This community does not occur on the site/study area which is located outside the prescribed range, thus the EEC does not occur.
TSC Act	***"Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions"*** is an EEC which occurs on Carboniferous sediments of the Barrington footslopes along the northern rim of the Hunter Valley Floor, where it occupies gullies and steep hill slopes with south facing aspects. The community usually forms a closed forest 15-20m high with emergent trees 20-30m high. Vines are abundant and there is a dense shrub and ground layer (NSWSC 2007c).	This community does not occur on the site/study area which is located outside the prescribed range, thus the EEC does not occur.
TSC Act	***"Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions***" is an that belongs to the Maritime Grasslands vegetation class of Keith (2004) and its structure is typically closed tussock grassland, but may be open shrubland or open heath with a grassy matrix between the shrubs.	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on site/study area.

Act	Literature Review	Significance
TSC Act	***"Carex Sedgelands of the New England Tableland, Nandewar, Brigalow Belt South and NSW North Coast Bioregions"*** is a preliminarily listed EEC in marshy regions dominated by sedges, grasses and semi-aquatic herbs. The species dominants are *Carex appressa, Stellaria angustifolia, Scirpus polystachyus, Carex gaudichaudiana, Carex sp. Bendemeer, Carex tereticaulis* and *Isachne globosa*, either as single species or in combinations. Other common species include *Geranium solanderi var. solanderi, Haloragis heterophylla, Lythrum salicaria, Epilobium billardierianum subsp. Hydrophilum and Persicaria hydropiper* (Hunter and Bell 2009).	Vegetation meeting the floristic and location criteria of this EEC does not occur on site/study area.
TSC Act	***'Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions'*** is an EEC that generally occurs on floodplains and on floodplains and associated floodplain rises along the Hunter River and tributaries.	This community does not occur on the site/study area, which is located outside the prescribed range, thus the EEC does not occur.
TSC Act	***'Coastal Cypress Pine Forest in the NSW North Coast Bioregion'*** is a distinctive vegetation community dominated by Coastal Cypress Pine (Callitris columellaris) and is typically found on coastal sand plains, north from the Angourie area on the far north coast of NSW.	The site/study area is far beyond the known range of this EEC and the Coastal Pine does not occur, thus the EEC does not occur.

3.5. Over-Cleared Vegetation Types

As shown below, the patch of Swamp Oak on the mid-east boundary is mapped as an over-cleared vegetation type.

Figure 7: Over-cleared vegetation types mapping of the site



3.6. Threatened Flora

3.6.1. Survey Results

No threatened plants were recorded on the study site during the survey. This confirmed the results of the earlier survey by Umwelt (2004).

3.6.2. Potential Occurrence Assessment

Searches of relevant literature and databases (OEH 2015a, Umwelt 2004) found records of 11 threatened flora species in the locality.

Table 8: Threatened flora species recorded in the locality

Common Name	Species	Legal Status	Distance from Study Site
Dwarf Heath Casuarina	*Allocasuarina defungens*	E-TSCA	Mullaway
Orara Boronia	*Boronia umbellata*	V-TSCA, V-EPBCA	Conglomerate State Forest, northwest of Woolgoolga
Rough-shelled Bush Nut	*Macadamia tetraphylla*	V-TSCA, V-EPBCA	Wedding Bells State Forest
Slender Marsdenia	*Marsdenia longiloba*	E-TSCA, V-EPBCA	Houp Gully, western Woolgoolga
Rusty Plum	*Niemeyera whitei*	V-TSCA	Numerous records eg Woolgoolga, Wedding Bells State Forest.
Milky Silkpod	*Parsonsia dorrigoensis*	V-TSCA, E-EPBCA	Wedding Bells State Forest
Southern Swamp Orchid	*Phaius australis*	E-TSCA, E-EPBCA	Northwest of Woolgoolga
Coast Headland Pea	*Pultenaea maritima*	V-TSCA	Mullaway, Woolgoolga Headland, Arrawarra
Silverbush	*Sophora tomentosa*	E-TSCA	North of Woolgoolga
-	*Maundia triglochinoides*	V-TSCA	North-west of Corindi Beach
Scented Acronychia	*Acronychia littoralis*	E-TSCA, E-EPBCA	Red Rock Road north of Corindi Beach

It was considered that the site and most of the study area's significant disturbance history (eg clearing, underscrubbing, slashing, weed invasion) have resulted in major habitat changes (eg to dispersal of propagules, microclimates, soil characteristics, etc) that have likely excluded any threatened species from occurring on the site/study area.

Given this and that no threatened flora species were detected during this survey despite extensive targeted searches, it is considered highly unlikely that any such species would occur on the study site. Thus no threatened flora species are considered in the subsequent statutory assessments.

4.0 Fauna and Habitat Survey and Assessment

4.1. Survey Methods

In consideration of the threatened species recorded in the locality, available habitats on site, and potentially occurring species: the following survey methods were employed:

- Qualitative and quantitative habitat assessment
- Spotlighting and stag watching
- Call playback
- Yangochiropteran bat call detection
- Diurnal reptile and bird survey
- PIR camera trap survey
- Koala survey
- Habitat tree survey
- Physical searches of habitat e.g. leaf litter, dense vines, hollow inspections, etc.
- Opportunistic sightings, scratches and scats.

In addition to the above, a Naturecall ecologist supervised removal of trees under the 10:50 bushfire provisions. This involved a pre-clear survey every morning over 4 days before works commenced, and inspecting all hollows for fauna, and rescuing as necessary.

All field surveying was conducted as per the conditions of the consultant's Animal Research Authority and Section 120 Scientific License.

4.1.1. Habitat Evaluation

The site was surveyed to determine the available potential habitats, and the support value of these habitats for threatened species. Habitats were defined according to parameters such as:

- Structural and floristic characteristics of the vegetation e.g. understorey type and development, crown depth, groundcover density, etc.
- Degree and extent of disturbance e.g. fire, logging, weed invasion, modification to structure and diversity, etc.
- Soil type and suitability e.g. for digging and burrowing.
- Presence of water in any form e.g. dams, creeks, drainage lines, soaks.
- Size and abundance of hollows and fallen timber.
- Availability of shelter e.g. rocks, logs, hollows, undergrowth.
- Wildlife corridors, refuges and proximate habitat types.

- Presence of mistletoe, nectar, gum, seed, sap, etc. sources.

Species identification was assisted by Morcombe and Stewart (2010), Pizzey and Knight (2003), Tyler and Knight (2009), Wilson and Knowles (1992), Strahan (2008), Triggs (1996), Robinson (1996), Swan *et al* (2004) and Schodde and Tideman (1990).

4.1.2. Spotlighting and Stag Watches

Spotlighting was conducted for 1.5 hours from dusk over 4 nights. The procedure involved walking with a hand held spotlight over the entire site, targeting the trunks and branches of canopy trees and understorey.

Stag watching was undertaken for 3 nights. This considered of a stationary observer maintaining a fixed position where several hollow-bearing trees could be silhouetted against the sky, and observing for signs of emergent fauna eg bats and arboreal mammals. Survey commenced 30mins before dusk and 30-45mins after. Stag watching was undertaken in the localised concentration of hollows in the modified swamp woodland.

Torch searches were routinely undertaken around the site for frogs and small reptiles, despite lack of aquatic habitat, logs and dense leaf litter. A total of 1.5 hours was spent on this activity.

Conditions varied from partially overcast nights to overcast with light rain. Wind ranged from light to moderate. The moon phase ranged from new moon to first quarter.

4.1.3. Yangochiropteran Bat Call Detection

Anabat call detection was undertaken with 2 Anabats fitted with ZCAIMs for approximately 2 hours per night during call playbacks and spotlighting. The units were either stationary or carried around (eg. during spotlighting). The units were not left out overnight due to risk of theft.

The recordings were forwarded to Dr Anna McConville of Echo Ecology, a bat call identification consultant, for identification of the bat species. Her report is provided in Appendix 4.

4.1.4. Active Listening Survey

Call playback was not conducted as it was deemed too disruptive to the local residents and campers. Active listening of all fauna calls was conducted at pre-dusk and during spotlighting and other nocturnal activities for over a period >12 hours.

4.1.5. Diurnal Bird Survey

Birds were surveyed by detecting calls and searching by binoculars at dawn and dusk (when call chorus and peak activity occurs) during 6 specific census periods of 0.5 hours each. Birds were also surveyed opportunistically during other activities eg flora survey and spotlighting.

Diurnal species such as the Varied Sittella, raptors and Little Lorikeet were the main species routinely searched for.

This information provided short-term data on bird occurrences in the area for the particular season (DEC 2004).

4.1.6. Herpetofauna and Secondary Evidence Searches

Physical habitat searches of the site were undertaken each day during the survey in February. Survey involved:

- Lifting up of debris to search for reptiles and frogs.
- Inspection of dense vegetation for bird nests.
- Raking of leaf litter for frogs and reptiles.
- Observation of likely basking sites (ie reptiles and frogs).
- Searches for scats, tracks, digging and scratches (eg Koala, gliders, etc) over the site.
- Searches for scats, owl regurgitation pellets and guano deposits under every tree.
- Census and binocular inspection of tree hollows within the study area for signs of use eg worn edges.

A total of 2hrs was specifically spent on general habitat searches.

4.1.7. Koala Survey and Coffs Harbour City Council CKPoM Assessment

Survey for Koalas over the site consisted of diurnal searches, scat surveys (with the intention of applying the Spot Assessment Technique) and spotlighting over 3 non-consecutive nights.

Every eucalypt on site was checked for signs of Koala usage eg scratches and scats. The objective of this survey was to determine if the proposal would affect known Koala habitat.

4.1.8. Habitat Tree Survey

All hollow-bearing trees on site were located and recorded using an Ipad with GIS Kit Pro (Garafa Inc). Each tree was quantified (number of hollows, location in tree and aperture diameter).

This collated information is provided in Appendix 3 and location is shown in Figure 12.

4.1.9. PIR Camera Survey and Hair Tubes

Four PIR cameras were mounted in trees at least 3m above ground and set for a total of 14 days of continuous monitoring. Two cameras were Reconyx HC600, and two were Scoutguard 670.

All cameras were set facing a mounted bait station (a hair tube) which was baited with a mixture of rolled oats, peanut butter, honey and vanilla essence. Two camera traps were set in the modified swamp forest in the central south where hollows were most common. The others were set in the northwest. The target species were the Squirrel Glider and Brushtailed Phascogale. Weather conditions ranged from fine, hot days, to a few days of heavy rain followed by fine weather.

4.2. Survey Limitations

4.2.1. Flora

The study site was intensively traversed by foot during a specific flora survey and during other survey activities during the survey period. The survey was undertaken in summer when many plants are in a high growth or flowering phase. This, and the extremely high accessibility of the site and limited diversity resulted in a very high detection rate of plants present.

Regardless, any short-term survey will only provide a list of plants detected during a brief interval of time (DEC 2004). The total species list of an area is usually much greater than can be detected in such a short time and it can be influenced by factors such as: size of the property, fire history, time since disturbance, flowering season (particularly orchids), and presence of reproductive material (DEC 2004).

4.2.2. Fauna

Fauna detectability is limited by seasonal, behavioural or lifecycle characteristics of each species, and even by habitat variations (e.g. flowering periods), which can occur within a year, between years, decades, etc (DEC 2004).

To counter these limitations, qualitative and quantitative habitat evaluation was used as well as a suite of standard ecological field survey techniques to assess the site's significance to threatened species. Habitat evaluation conservatively assesses the potential occurrence of threatened species based on potentially suitable habitat and local records, providing a prediction of the likelihood of a particular threatened species occurring in the study area (DEC 2004, DECC 2007, Forest Fauna Surveys 1997). It relies on the ecologist's knowledge, literature review and observation skills, and hence any assessment must be objective and justified.

4.3. High Value Arboreal Habitat

No high-value arboreal habitat has been mapped on the site or on adjoining land.

Figure 8: CHCC High Value Arboreal Habitat mapping of the local area



4.4. Corridors and Key Habitats

See Figure 10 showing the following:

4.4.1. Regional and Sub-regional Corridors

Regional corridors are typically >500m wide and provide a link between major and/or significant areas of habitat in the region. Ideally they are of sufficient size to provide habitat in their own right and at least twice the width of the average home range area of fauna species identified as likely to use the corridor (OEH 2015c, Scotts 2002).

Sub-regional corridors connect larger landscaped features and are of sufficient width to allow movement and dispersal (generally >300m), but may not provide substantial species habitat (OEH 2015c, Scotts 2002).

As seen in Figure 10, a regional corridor is mapped over the site. As the site is highly modified with no intact understory or shrub layer present, the site's vegetation would provide limited connectivity but may provide habitat for highly mobile bird species. This, along with other mapped corridors connect coastal habitats from Coffs Harbour to Yuraygir National Park

4.4.2. Local Corridors and Habitat Links

Local corridors provide connections between remnant patches of habitat and landscape features. Due to their relatively small area and width (they may be <50m), these corridors are subject to edge effects (OEH 2015c, Scotts 2002). Habitat links are evaluated in this report as links from habitat on-site directly to similar habitat on adjacent land. These would be used by fauna, which depend solely or at least partially on the site for all of their lifecycle requirements, and/or dispersal (Lindenmayer and Fisher 2006).

Figure 10 shows that the site and Arrawarra village fragment part of the eastern fringe of a relatively intact area of forest that extends north to Corindi Beach with limited fragmentation, becoming progressively fragmented south to Safety Beach. Connectivity west to Wedding Bells State Forest is broken by the upgrade of the Pacific Highway and the Arrawarra interchange, and the resulting gap poses a major biodiversity barrier (Lindenmayer and Fisher 2006). Hence the most significant local corridor is between the village and the highway.

Habitat links occur on site and interlink to adjacent habitat, but are degraded. The open woodland on site can be accessed from intact forest to the south, except that the cleared overhead powerline poses a barrier to gliders and a predation risk for small to medium terrestrials moving north from extensive habitat to the south. The canopy gap in the middle of the site then limits movement north for all but birds and bats.

The woodland in the northwest is limited by residential development in the intervening distance between intact habitat and the site, but trees are close enough for gliders and passerine birds. Less mobile fauna accessing this area would at most be using this as the southern limit of their range due to poor connectivity to extensive habitat to the south via the site.

4.4.3. Key Habitat

Key Habitats are areas of predicted high conservation value for forest faunal assemblages, endemic forest vertebrates or endemic invertebrates; spatially depicted as a merging of mapped assemblage hubs, assemblage hot spots and centres of endemism (OEH 2015c, Scotts 2002).

The site is not mapped as Key Habitat.

4.4.4. CHCC Landscape Corridors

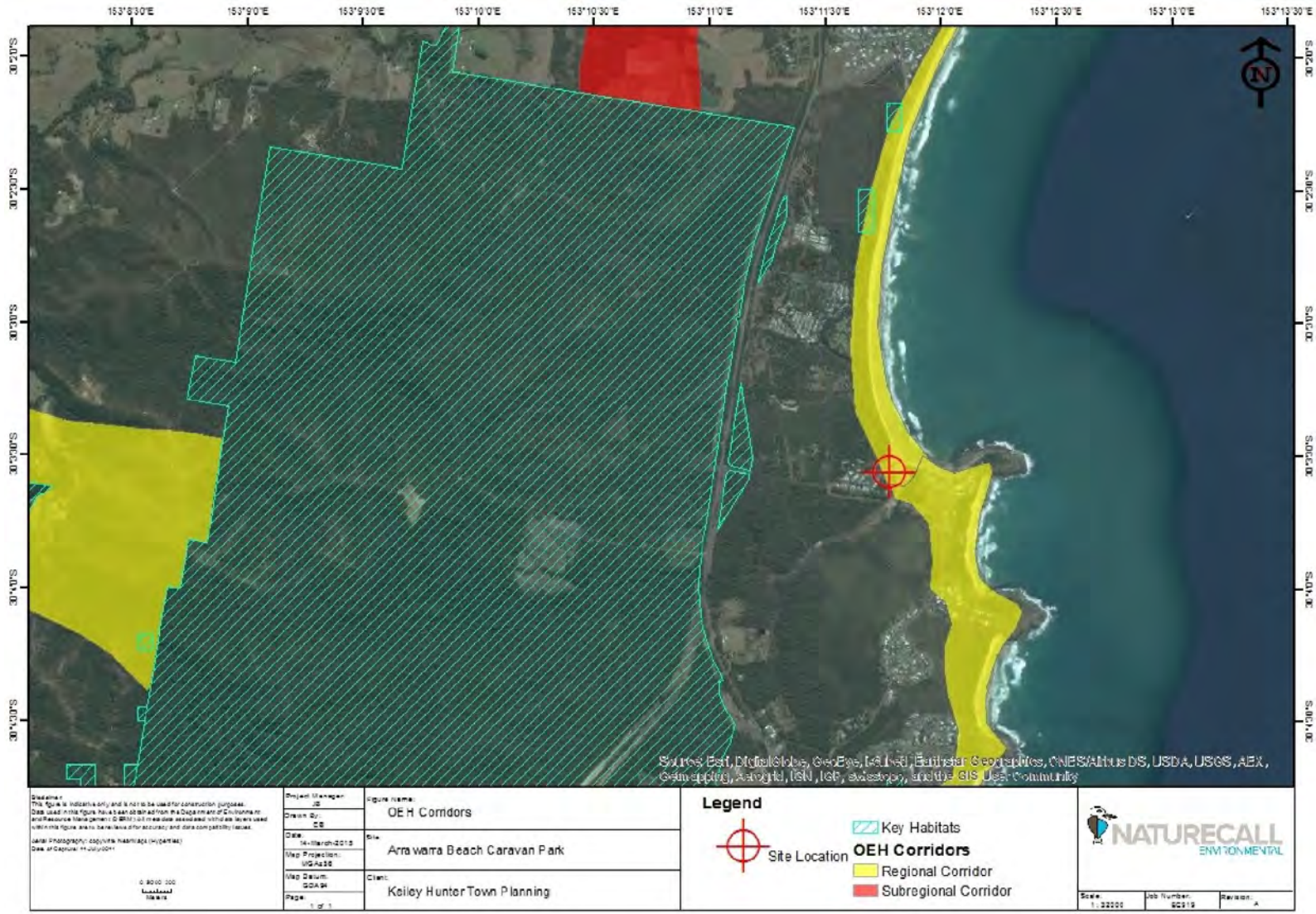
As seen in Figure 9 below, a CHCC landscape corridor is mapped over most of the site. Compared to the linkage west of the village, the mapped linkage on site is poor due to historical clearing and fragmentation. There is minimal vegetation in the northeast, and combined with the seasonally very high human presence, this would limit use of this corridor to common species tolerant of peri-urban to urban areas eg medium sized woodland birds, bats and common possums.

The lack of dense groundcover, logs, or substantial leaf litter as well as very high human presence would also be a key constraint on reptiles and small mammal diversity, and their use of the mapped local linkage.

Figure 9: CHCC landscape corridors



Figure 10: OEH Corridors and Key Habitats



4.5. Fauna Survey Results

4.5.1. Habitat Evaluation

The following table summarises the results of the habitat evaluation survey:

Table 9: Habitat evaluation summary

Habitat Attribute/Type	Site/Study Area	Potential Values to Threatened Species Occurrence
Groundcover	Mown or absent due to maintenance and camping.	Nil.
Leaf litter	Absent to sparse. Only present in small clump of forest at southern end which has been used for storing green wastes.	Nil
Logs and debris	Absent apart from wood chip pile on edge of clump of forest at southern end.	Nil
Hollows	Very common with 19 hollow-bearing trees currently on site and 2 other which appears just off the southern boundary (see Figure 11 for location). Size ranges from small (<10cm diameter) to large (>15cm). Most are small to medium (<10-15cm). Common lorikeets, galahs and Brushtail Possums noted to dominate the hollows. Largest hollows occur in the senescent Flooded Gum in the mid-southwest, and most hollows occur in the clump of Swamp Mahogany and paperbarks in the central-south clump.	Potentially suitable in terms of opening size for broad range of common and threatened species eg Yangochiropteran bats, Squirrel Glider and Yellow-bellied Glider. However, usage is limited by poor connectivity to adjacent habitat; competition with urban woodland generalists; and an opening does not directly indicate habitable internal dimensions (Gibbons and Lindenmayer 2002).
Nectar Sources	Dominance by Swamp Mahogany and paperbark provides good autumn-winter nectar source with some spring-summer flowering resources. Local forest dominated by Red Mahogany hence expect more spring-flowering.	Potential flowering during key seasons but limited abundance and accessibility for gliders. Dominated by common conspecifics. Forage for flying foxes as minute part of local range.
Wattles, Melaleucas, Callistemons and Banksias (shrub layer)	Absent.	Nil

Habitat Attribute/Type	Site/Study Area	Potential Values to Threatened Species Occurrence
Sap and gum sources	Pink Bloodwood and Flooded Gum are preferred sap species for Sugar, Squirrel and Yellow-bellied Gliders. No preferred wattles on site.	No active incisions noted. No gliders recorded.
Primary preferred Koala browse trees	16 primary preferred Koala food trees present in the R2 section of the site comprising mostly Swamp Mahogany with a few Tallowwood. Several more in the E2 zone in the north and southeast, and along southern boundary.	Potential Koala Habitat but no evidence of use in this or previous survey.
Allocasuarinas	Absent	No forage for Glossy Black Cockatoo
Aquatic	Absent	Nil
Fruiting species	Limited to palms and a few rainforest species.	Insufficient abundance to attract threatened frugivorous birds.
Passerine bird habitat	Very poor – most of site very open with little cover. Noisy Miner and other medium sized woodland birds noted to be dominant.	Low prey diversity. Unlikely to support threatened passerines due to nest predation and harassment.
Caves, cliffs, overhangs, culverts, bridges	Absent	No roosts for obligate bats.
Terrestrial prey	Minimal prey habitat – small clump of dense vegetation in southern end and semi-permanent cabins offer refuge for exotic rodents and common reptiles.	Poor prey diversity.
Wader Habitats	Site adjoins narrow and very shallow estuarine creeks, as well as open beach with very high human presence. Upper beach and creek offers good habitat for various waders, which may use these areas in low abundance as part of non-breeding range.	Upstream creeks on fringe of study area offer potential habitat for Black Bittern and Black-necked Stork. Wider area contains some habitat which may be used by EPBCA migratory species in low abundance.

Figure 11: Location of hollow-bearing trees



4.5.2. Direct Observation and Habitat Searches

Birds

A limited diversity of common birds were detected by call identification and direct sighting (see table below). These were all medium-sized woodland species. A Brush Turkey was noted foraging amongst the caravans, and a butcherbird nest were observed in a Swamp Mahogany.

No waders were observed in the adjacent creeks within the study area at any time. Pacific Silver Gulls were commonly observed in the estuarine zone. An Osprey (Vulnerable - TSCA) was observed flying over the beach on one occasion.

Frogs

No frogs were heard calling in the vicinity of the site during the survey. A single Striped Marsh Frog was detected during torch searches.

Reptiles

Garden Skinks were the only reptile observed in low abundance, mainly in the southern end.

4.5.3. Bat Call Identification

Yangochiropteran bat calls recorded during the survey were sent Echo Ecology, a recognised Yangochiropteran bat ecologist for identification. The results are shown in the table below and the report is provided in Appendix 3.

Table 10: Yangochiropteran bat call identification

Note: **#** indicates species listed as Vulnerable on Schedule 2 of the TSCA Act 1995

Scientific Name	Common Species Names	Definite Passes	Possible Passes
Chalinolobus gouldii	Gould's Wattled Bat	X	
#Chalinolobus nigrogriseus	Hoary Wattled Bat	X	
Vespadelus darlingtoni	Large Forest Bat	X	
Vespadelus pumilus	Eastern Forest Bat	X	
Chalinolobus morio	Chocolate Wattled Bat		X
#Falsistrellus tasmaniensis	Eastern False Pipistrelle		X
#Mormopterus norfolkensis	East Coast Freetail Bat)		X
Mormopterus (Ozimops) ridei	Eastern Freetail Bat		X
Scotorepens orion	Eastern Broad-nosed Bat		X
Vespadelus troughtoni	Eastern Cave Bat		X

Those species listed as "*definite*" are most likely to be the species actually recorded, and these results are very similar to Umwelt (2004), including recording the Hoary Wattled Bat (V-TSCA).

Two other threatened species were tentatively considered possible call identifications due to call identification limitations (McConville 2015).

4.5.3.1. Spotlighting, Stag Watches and Torch Searches

Spotlighting and stag watches were highly productive, with the resident family group of Brushtail Possums quickly becoming evident at dusk and at all times during spotlighting. Several of the possums commonly emerged out of the large Flooded Gum on the mid-west boundary which contained several large hollows, and foraged widely over the site.

Sleeping Kookaburras were also noted each night. Several Grey Headed Flying Foxes and a Little Red Flying Fox were also observed. Grey Headed Flying Foxes are listed as Vulnerable under the TSCA and EPBCA.

No fauna were observed flying out of the dense clump of vegetation in the southern end, but a major flying fox roost was active >1km southeast at the time, with thousands of bats flying over the site at dusk each night.

Torch searches encountered only a single Striped Marsh Frog near the southern clump of forest.

4.5.3.2. Secondary Evidence

Searches under all primary preferred Koala food trees and most of the other browse species failed to detect Koala scats. No confirmed Koala scratches were identified.

No scats of any other mammal were found. No bones were detected.

4.5.3.3. PIR Cameras and Hair Funnels

PIR cameras and the associated hair funnels were a hive of activity, with a plethora of photos recorded of the resident Brushtail Possums, including a female bearing pouch young as shown in subsequent photos.

The Kookaburra, Noisy Miner and Blue-faced Honeyeater were also recorded.

Photo 7: PIR photo of Brushtail Possum with pouch young



4.5.3.4. Clearing Monitoring

Pre-clearing surveys for recent removal of trees under the 10:50 bushfire provisions recorded only common species. A single Brushtail Possum and a Green-tree Snake were the only fauna recorded in hollows, and a rotten lorikeet egg.

4.5.3.5. Total Fauna Observed

The following table lists all fauna recorded by this survey and by Umwelt (2004), excluding microbats.

Table 11: Fauna recorded on and adjacent to the site

Group	Common Name	Species	Detection Method
Mammals	**Grey-headed Flying Fox**[+]	*Pteropus poliocephalus*	S, HC, O
	Brushtail Possum	*Trichosurus vulpecula*	S, O
Birds	Australian Raven	*Corvus coronoides*	HC
	Channel-billed Cuckoo	*Scythrops novaehollandiae*	U
	Eastern Osprey[#]	*Pandion cristatus*	O
	Masked Lapwing	*Vanellus miles*	HC
	White-throated Needletail[#]	*Hirundapus caudacutus*	U

Group	Common Name	Species	Detection Method
	Welcome Swallow	*Hirundo neoxena*	O
	Little Black Cormorant	*Phalacrocorax sulcirostris*	O
	Wood Duck	*Chenonetta jubata*	O
	Brush Turkey	*Alectura lathami*	O
	Australian Magpie	*Cracticus tibicen*	HC
	Noisy Miner	*Manorina melanocephala*	O, HC
	Crested Pigeon	*Ocyphaps lophotes*	O
	Rainbow Lorikeet	*Trichoglossus haematodus*	O, HC
	Eastern Rosella	*Platycercus eximius*	O
	Laughing Kookaburra	*Dacelo novaeguineae*	O, HC, P
	Willie Wagtail	*Rhipidura leucophrys*	O
	Australian White Ibis	*Threskiornis molucca*	O
	Tawny Frogmouth	*Podargus strigoides*	U
	Australasian Figbird	*Sphecotheres vieilloti*	O
	Pacific Black Duck	*Anas superciliosa*	O
	Little Pied Cormorant	*Microcarbo melanoleucos*	U
	Little Egret	*Egretta garzetta*	U
	White-faced Heron	*Egretta novaehollandiae*	U
	White-cheeked Honeyeater	*Phylidonyris niger*	HC
	Black-faced Cuckoo Shrike	*Coracina novaehollandiae*	O
	Silver Gull	*Chroicocephalus novaehollandiae*	O, HC
	Pied Currawong	*Strepera graculina*	HC
	Rainbow Lorikeet	*Trichoglossus haematodus*	O, HC
	Crested Tern	*Sterna bergii*	U
	Forest Kingfisher	*Todiramphus macleayii*	O
	Rainbow Bee-eater	*Merops ornatus*	U

Group	Common Name	Species	Detection Method
	Magpie Lark	*Grallina cyanoleuca*	O
	Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*	HC
	Lewin's Honeyeater	*Meliphaga lewinii*	HC
	Little Wattlebird	*Anthochaera chrysoptera*	HC
	Eastern Whipbird	*Psophodes olivaceus*	U
	Noisy Friarbird	*Philemon corniculatus*	O
	Superb Fairy Wren	*Malurus cyaneus*	U
	Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	O, HC
Reptiles	Garden Sun-skink	*Lampropholis delicata*	O
	Green Tree Snake	*Dendrelaphis punctulata*	O
Amphibians	Striped Marsh Frog	*Limnodynastes peronii*	O

Key:

Bold: Vulnerable under TSCA

+ Vulnerable under EPBCA

Migratory under EPBCA

* Indicates introduced species.

Observation Key: Obs – Observation; HC – heard calling, S – Spotlighting/torch searches, P – PIR camera, U - Umwelt

4.5.4. Locally Recorded Threatened Fauna

The following table lists threatened species known to occur in the locality (OEH 2015a, Connell Wagner 2007a, 2007b, Lewis Ecological Surveys 2006, Darkheart 2013), excluding marine species due to lack of affected habitat.

Table 12: Threatened species recorded in the locality

Group	Common Name	Species	Legal Status	Distance From Study Site/General Location
Mammals	Koala	*Phascolarctos cinereus*	V-TSCA	Wedding Bells State Forest, South of Mullaway, north of Woolgoolga
	Spotted-tailed Quoll	*Dasyurus maculatus*	V-TSCA, E-EPBCA	Northwest of Woolgoolga, Wedding Bells State Forest, Garby Nature Reserve

Group	Common Name	Species	Legal Status	Distance From Study Site/General Location
	Rufous Bettong	*Aepyprymnus rufescens*	V-TSCA	Sherwood Forest Road, Wedding Bells State Forest
	Squirrel Glider	*Petaurus norfolcensis*	V-TSCA	Arrawarra area, Mullaway
	Yellow-bellied Glider	*Petaurus australis*	V-TSCA	Wedding Bells State Forest, west Arrawarra
	Golden-tipped Bat	*Kerivoula papuensis*	V-TSCA	Northwest of Woolgoolga
	Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V-TSCA	
	Hoary Wattled Bat	*Chalinolobus nigrogriseus*	V-TSCA	West of Hearns Lake, Mullaway, Arrawarra, Wedding Bells State Forest
	Greater Broad-nosed Bat	*Scoteanax rueppellii*	V-TSCA	Mullaway, west Arrawarra
	Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V-TSCA	Mullaway
	Little Bent-wing Bat	*Miniopterus australis*	V-TSCA	Mullaway, Wedding Bells State Forest, west Arrawarra, Corindi
	Eastern Bent-wing Bat	*M. orianae oceanensis*	V-TSCA	Mullaway, west Arrawarra
	Southern Myotis	*Myotis macropus*	V-TSCA	West of Corindi Beach
	Grey-headed Flying Fox	*Pteropus poliocephalus*	V-TSCA, V-EPBCA	Woolgoolga, Arrawarra, Mullaway, Wedding Bells State Forest, west of Corindi Beach
Birds	Glossy Black-cockatoo	*Calyptorhynchus lathamii*	V-TSCA	Woolgoolga, west Arrawarra
	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area		EP-TSCA	Between Red Rock and Corindi Beach
	Powerful Owl	*Ninox strenua*	V-TSCA	Arrawarra, Woolgoolga, Wedding Bells State Forest, west Arrawarra

Group	Common Name	Species	Legal Status	Distance From Study Site/General Location
	Masked Owl	*Tyto novaehollandiae*	V-TSCA	Wedding Bells State Forest, Corindi Beach
	Sooty Owl	*Tyto tenebricosa*	V-TSCA	Wedding Bells State Forest
	Swift Parrot	*Lathamus discolor*	E-EPBCA, E-TSCA	Woolgoolga
	Rose-crowned Fruit Dove	*Ptilinopus regina*	V-TSCA	Wedding Bells State Forest
	Superb Fruit-dove	*Ptilinopus superbus*	V-TSCA	Wedding Bells State Forest
	Wompoo Fruit-dove	*Ptilinopus magnificus*	V-TSCA	Woolgoolga, Wedding Bells State Forest
	Barred Cuckoo-shrike	*Coracina lineata*	V-TSCA	Wedding Bells State Forest
	Eastern Ground Parrot	*Pezoporus wallicus wallicus*	V-TSC	Between Red Rock and Corindi Beach
	Little Lorikeet	*Glossopsitta pusilla*	V-TSCA	Arrawarra, Wedding Bells State Forest
	Little Eagle	*Hieraaetus morphnoides*	V-TSCA	Corindi Beach
	Square Tailed Kite	*Lophoictinia isura*	V-TSCA	Pacific Highway Arrawarra, Garby Nature Reserve, Wedding Bells State Forest, Corindi
	Varied Sittella	*Daphoenositta chrysoptera*	V-TSCA	Woolgoolga, Wedding Bells State Forest
	Collared Kingfisher	*Todiramphus chloris*	V-TSCA	Lakes Road Woolgoolga (1991)
	Brown Treecreeper	*Climacteris picumnus picumnus*	V-TSCA	Wedding Bells State Forest
	Grey-crowned Babbler	*Pomatostomus temporalis temporalis*	V-TSCA	Wedding Bells SF
	Painted Honeyeater	*Grantiella picta*	V-TSCA	Woolgoolga Headland (1991)
	Bush-stone Curlew	*Burhinus grallarius*	E-TSCA	Wedding Bells State Forest

Group	Common Name	Species	Legal Status	Distance From Study Site/General Location
	Jabiru/Black Necked Stork	*Ephippiorhynchus asiaticus*	E-TSCA	Arrawarra, Safety Beach, west Woolgoolga, Corindi Beach, Mullaway
	Brolga	*Grus rubicunda*	V-TSCA	Darkum Creek Woolgoolga
	Black Bittern	*Ixobrychus flavicollis*	V-TSCA	Woolgoolga Lake, Poundyard Lake Woolgoolga
	Comb-crested Jacana	*Irediparra gallinacean*	V-TSCA	West Woolgoolga
	Freckled Duck	*Stictonetta naevosa*	V-TSCA	Woolgoolga
	Eastern Osprey	*Pandion cristatus*	V-TSCA, EPBCA-Migratory	Arrawarra Headland, Mullaway, Woolgoolga, Hearns Lake, Corindi Beach, Garby Nature Reserve.
	Sooty Oystercatcher	*Haematopus fuliginosus*	V-TSCA	Arrawarra, Mullaway, Woolgoolga Headland and back beach, Flat Top Point, Hearns Lake, Corindi Beach
	Pied Oystercatcher	*Haematopus longirostris*	E-TSCA	Arrawarra Headland, Woolgoolga back beach, Corindi Beach,
	Little Tern	*Sterna albifrons*	E-TSCA	Arrawarra Headland, Woolgoolga Creek Woolgoolga, Corindi Beach,
	Great Knot	*Calidris tenuirostris*	V-TSCA	Woolgoolga Headland
	Black-tailed Godwit	*Limosa limosa*	V-TSCA	Arrawarra Headland
Frogs	Giant Barred Frog	*Mixophyes iteratus*	E-TSCA	Woolgoolga Creek north of Woolgoolga, Corindi River north of Corindi.
	Wallum Froglet	*Crinia tinnula*	V-TSCA	South of Corindi Beach, Corindi Beach, Red Rock Road, Arrawarra, Corindi
Reptiles	Stephens' Banded Snake	*Hoplocephalus stephensii*	V-TSCA	Wedding Bells State Forest

The study area is located on land and does not encompass any ocean or beach, thus sea birds/mammals/reptiles are not considered in this assessment.

The following species are considered likely to occur in the locality (excluding sea birds, etc.) due to suitable habitat and regional records in similar habitat (some have been recorded within 20km).

Table 13: Threatened fauna potentially occurring in the locality

Bold indicates listed under the EPBC Act 1999.

Animal Group	Potentially Occurring Species
Mammals	**Long-nosed Potoroo**, Eastern Chestnut Mouse, **Dwyer's Bat**, Beccari's Freetail Bat, Eastern Cave Bat, **New Holland Mouse**.
Birds	Barking Owl, Grass Owl, Spotted Harrier, Flame Robin, Diamond Firetail, Hooded Robin, Speckled Warbler, White-eared Monarch, **Red Goshawk, Painted Snipe,** White-fronted Chat, Magpie Goose, Blue-billed Duck, **Eastern Curlew, Curlew Sandpiper**
Reptiles	**Three-toed Snake-toothed Skink**, White-crowned Snake, Pale-headed Snake
Frogs	**Stuttering Frog, Olongburra Frog, Green and Golden Bell Frog**

4.6. Potential Occurrence Assessment

Each of the species listed in the above two tables above have been evaluated for their potential to occur on the study site/area, as well as for the likely significance of the proposal and thus their eligibility for Seven Part Test assessment, in Appendix 1.

From this assessment, threatened species considered to potentially use the site (at best as a small part of a wider foraging range) are listed in the following table:

4.6.1. New South Wales

Each of the species listed above have been evaluated in Appendix 1 for their potential to occur on the site, as well as their potential to occur in the study area and hence be affected by the proposal (and thus require Seven Part Test assessment).

From this assessment, the following species listed under the NSW *Threatened Species Conservation Act* are considered to potentially occur:

Table 14: Threatened species potentially occurring on the site/study area

Species	Occurrence Type	Occurrence Likelihood (See Appendix 1)
Square-tailed Kite	Minute portion of large area of potential foraging territory, with generic potential nesting trees.	Considered a fair chance of occurrence using site as part of wider foraging range. Generic nesting potential.
Little Lorikeet	Small portion of foraging and possibly breeding habitat falling within a wider local foraging range. Limited foraging habitat and likely extreme competition for hollows strongly suggests unlikely to breed on site.	Low chance of seasonal foraging occurrence with presence and abundance concentrating during local major flowering instances. Highly unlikely to breed on site.
Pied Oystercatcher	Seasonal forager in adjacent estuarine, beach and nearby rocky foreshore.	Bionet records show previous records in study area. Low chance of rare occurrence depending on human and dog activity.
Sooty Oystercatcher	Seasonal forager in adjacent estuarine, beach and nearby rocky foreshore.	Bionet records show previous records in study area. Low chance of rare occurrence depending on human and dog activity.
Black-necked Stork	Seasonal forager in more remote sections of Arrawarra creek.	Bionet records show previous records in study area. Low chance of rare occurrence depending on human and dog activity.
Black Bittern	Seasonal forager and potentially roosting in upper sections of adjacent creeks.	Low chance of rare occurrence depending on human and dog activity.
Koala	No evidence during survey and no proximate records, hence considered at best may occur as very rare transient dispersing from Core Koala Habitat in locality.	No evidence found despite targeted survey and no proximate records. At best low potential to occur as rare transient.
Squirrel Glider	Low quality potential habitat over-dominated by conspecifics, and competition for hollows with lorikeets.	Low chance that may occur in low density population in study area or more likely in intact habitat on fringe of study area, but not occurring regularly on site.
Common Blossom Bat	Marginal potential foraging habitat on fringe of larger area of higher quality habitat. Site unlikely to be used for roosting.	Low chance foraging on site. Unlikely potential to roost.

Species	Occurrence Type	Occurrence Likelihood (See Appendix 1)
Yellow-bellied Sheathtail Bat	Generic potential foraging habitat as part of wider area of such habitat. Site would comprise minor portion of large seasonally variable foraging range. Tree hollows offer potential roost sites but subject to high competition and risk of predation.	Low chance of foraging within forest canopy on the site. Low potential to roost
Greater Broad-nosed Bat	Generic potential foraging habitat as part of wider area of such habitat. Site would comprise minor portion of large seasonally variable foraging range. Tree hollows offer potential roost sites but subject to high competition and risk of predation.	Low chance of foraging within forest canopy on the site. Low potential to roost
Southern Myotis	Estuarine habitat upstream of site offers potential foraging resource. Potential roosts in hollows but subject to high competition.	Low chance of occurrence foraging over aquatic habitat in study area at some time.

4.6.2. Commonwealth

The following species are considered by the DotE Matters of National Environmental Significance search tool as potential occurrences in the locality. Marine birds, mammals and reptiles and all fish listed in the search are irrelevant as the site/study area does not contain habitat and the proposal has no potential to impact these species.

4.6.2.1. Threatened Species

The following table summarises the species predicted by the search tool as potential occurrences, and other species with potential to occur in the locality, for their potential to occur on site, in the study area or on the property. The potential for these species to occur on the site is also reviewed in Appendix 1.

Table 15: EPBC Act threatened fauna species potential occurrence assessment

Note: Likelihood of occurrence derived from opinions of consultants in consideration of known ecology of each species (see Appendix 1); and quality of habitat on-site. * indicates listed on DotE website search.

Group	Common Name	Scientific Name	Listing Status	Recorded In Locality (10km Radius)	Suitable Habitat On Site/Study Area	Likelihood Of Occurrence
Birds	*Regent Honeyeater	*Xanthomyza phrygia*	CE	Y	Site offers small area of foraging habitat with preferred eucalypt species.	Unlikely to occur as not numerous local records indicating key area, and high competition with Noisy Miner.
	*Eastern Curlew	*Numenius madagascariensis*	CE	N	Potential habitat along Arrawarra Gully and Creek, but shy to human presence.	Low of adjacent estuaries where limited human presence. Unlikely to occur in exposed areas adjacent to site.
	*Curlew Sandpiper	*Calidris ferruginea*	CE	N	Potential habitat along beach and mouth of Arrawarra Creek	Unlikely within at least 500m due to high human presence and unleashed dogs. May occur at best for short periods on the upper margins of beach at dawn/dusk.
	*Australian Painted Snipe	*Rostratula australis*	V	N	No preferred habitats.	Unlikely to occur.
	*Red Goshawk	*Erythrotriorchis radiatus*	E	N	Generic potential habitat forming minute fraction of such habitat.	Unlikely as not seen south of Clarence River.

Group	Common Name	Scientific Name	Listing Status	Recorded In Locality (10km Radius)	Suitable Habitat On Site/Study Area	Likelihood Of Occurrence
	*Eastern Bristlebird	*Dasyornis brachypterus*	E	N	No suitable habitat.	Unlikely to occur.
	*Black-breasted Button-quail	*Turnix melanogaster*	V	N	No suitable habitat.	Unlikely to occur.
	*Australasian Bittern	*Botaurus poiciloptilus*	E	N	No suitable habitat.	Unlikely to occur.
	*Swift Parrot	*Lathumus discolor*	E	Y	Swamp Mahogany on site are a potential foraging resource for non-breeding transients.	Site forms minute part of local extent of potential habitat – competition with con-specifics suggests very unlikely to occur.
Mammals	*Long-nosed Potoroo	*Potorous tridactylus*	V	N	No suitable habitat.	Unlikely potential to occur – no local records and patchy coastal records throughout its distribution.
	*Koala	*Phascolarctos cinereus*	V	Y	Site has preferred forage species but no proximate records occur.	Low chance as transient.
	*Spotted-tail Quoll	*Dasyurus maculatus*	E	Y	Site too open and exposed and limited potential denning habitat.	Unlikely to occur
	*Grey-headed Flying-fox	*Pteropus poliocephalus*	V	Y	Seasonally suitable for nectar foraging.	**Recorded on site.**
	*Dwyer's/Large Pied Bat	*Chalinolobus dwyeri*	V	N	Generic forage habitat over forest. No potential roosts in study area.	Unlikely to occur

Group	Common Name	Scientific Name	Listing Status	Recorded In Locality (10km Radius)	Suitable Habitat On Site/Study Area	Likelihood Of Occurrence
	*Brushtailed Rock Wallaby	*Petrogale penicillata*	V	N	No suitable habitat in locality.	Unlikely to occur
	*New Holland Mouse	*Pseudomys novaehollandiae*	E	N	No suitable habitat.	Unlikely to occur
Frogs	*Green and Golden Bell Frog	*Litoria aurea*	V	N	No suitable habitat.	Unlikely to occur
	*Stuttering Frog	*Mixophyes balbus*	V	N	No suitable habitat on site or study area.	Unlikely to occur.
	Wallum Sedge Frog	*Litoria olongburensis*	V	N	No suitable habitat on site or study area.	Unlikely to occur.
	*Giant Barred Frog	*M. iteratus*	E	Y	No suitable habitat on site or study area.	Unlikely to occur.
Reptiles	Three-toed Snake-tooth Skink	*Coeranoscincus reticulatus*	V	N	No suitable habitat on site.	Unlikely to occur.

4.6.3. Migratory Species

Two EPBC Act 1999 migratory species were recorded on the site by the survey, the Eastern Osprey and Rainbow Bee-eater.

A significant number of EPBC Act 1999 listed migratory bird species are known (OEH 2015a) or considered potential occurrences in the locality (DotE 2015a). A search of the MNES website and literature review (Readers Digest 1990, DotE 2015b) also produced a list of likely occurrences. All of these species plus

some considered by the consultant as potential occurrences in the LGA in similar habitat to that on the property are also shown in the following table, with an evaluation made on likelihood of occurrence based on cited ecology. Note this list excludes seabirds, etc as detailed above.

Table 16: EPBC Act migratory species potential occurrence assessment

Common Name	Scientific Name	Predicted Type of Occurrence	Recorded In Locality (10km Radius)	Suitable Habitat On Site/Study Area/Property	Likelihood Of Occurrence
*White-Bellied Sea-Eagle	*Haliaetus benghalensis*	Species and/or habitat likely to occur within area	Y	Upstream sections of adjacent creeks offers suitable habitat as small part of territory	High
Osprey	*Pandion cristatus*	-	Y	Upstream sections of adjacent creeks offers suitable habitat as small part of territory	High
Eastern Curlew	*Numenius madagascariensis*	CE	N	Potential habitat along Arrawarra Gully and Creek, but shy to human presence.	Low chance to occur in upper portions of adjacent estuaries where limited human presence. Unlikely to occur in exposed areas adjacent to site.
Curlew Sandpiper	*Calidris ferruginea*	CE	N	Potential habitat along beach and mouth of Arrawarra Creek	Unlikely within at least 500m due to high human presence and unleashed dogs. May occur at best for short periods on the upper margins of beach at dawn/dusk.
Latham's Snipe	*Gallinago hardwickii*	Species or habitat may occur in area	Y	Upstream edges of creeks may offer some potential foraging habitat.	Low chance of occurrence

Common Name	Scientific Name	Predicted Type of Occurrence	Recorded In Locality (10km Radius)	Suitable Habitat On Site/Study Area/Property	Likelihood Of Occurrence
Australian Painted Snipe	*Rostratula benghalensis (australis)*	Species and/or habitat may occur in area	N	No suitable habitat in study area	Unlikely to occur.
Cattle Egret	*Ardea ibis*	Species/habitat may occur in area	Y	Upstream sections of creeks may offer potential roost sites.	Unlikely to occur.
Eastern Great Egret	*Ardea modesta*	Species/habitat may occur in area	Y	Potential foraging habitat along upstream sections of creek	Moderate
Rainbow Bee-eater	*Merops ornatus*	Species/habitat may occur in area	Y	Suitable foraging habitat over most of site and study area.	**Recorded** by Umwelt
Regent Honeyeater	*Xanthomyza phrygia*	Species/habitat may occur in area	Y	Swamp Mahogany on site are a potential foraging resource for non-breeding transients.	Site forms minute part of local extent of potential habitat – competition with con-specifics suggests very unlikely to occur.
Swift Parrot	*Lathumus discolor*	Species/habitat may occur in area	Y	Swamp Mahogany on site are a potential foraging resource for non-breeding transients.	Site forms minute part of local extent of potential habitat – competition with con-specifics suggests very unlikely to occur.
Rufous Fantail	*Rhipidura rufifrons*	Breeding or breeding habitat may occur in area	Y	Small areas of marginal habitat in south of site.	Very low to low
Satin Flycatcher	*Myiagra cyanoleuca*	Breeding or breeding habitat likely in area	Y	Small areas of marginal habitat in south of site.	Very low to low

Common Name	Scientific Name	Predicted Type of Occurrence	Recorded In Locality (10km Radius)	Suitable Habitat On Site/Study Area/Property	Likelihood Of Occurrence
Black Faced Monarch	*Monarcha melanopsis*	Breeding or breeding habitat may occur in area	Y	Small areas of marginal habitat in south of site.	Very low to low
Spectacled Monarch	*M. trivirgatus*	Breeding or breeding habitat likely in area	Y	Small areas of marginal habitat in south of site.	Very low to low
White-throated Needletail	*Hirundapus caudacutus*	Species/habitat likely to occur in area	N	Yes as part of a broader area	**Recorded** by Umwelt
Fork-tailed Swift	*Apus pacificus*	Species/habitat may occur in area	N	Yes as part of a broader area	Fair potential, as transient, between Oct-April

5.0 SEPP 44 - CHCC CKPoM Assessment

As noted previously, the site falls under jurisdiction of the *Coffs Harbour City Comprehensive Koala Plan of Management* (CHCC 1999).

Assessment under the planning controls of the CHCC CKPoM (CHCC 1999, 2008) is undertaken to demonstrate if the proposal can be consistent with the CKPoM.

5.1. CKPoM Classification

As shown in Figure 12 (sourced from Coffs City Council website) (http//gis.coffsharbour.nsw.gov.au) the CHCC CKPoM has patches of vegetation occurring in the northwest and south of the site mapped as Secondary Koala Habitat. Most of the remaining vegetation east of the Pacific Highway from Corindi Beach south is also mapped as this class.

The proposed subdivision will see removal of most of the currently mapped area, however the mapped extent exceeds the actual extent of habitat on site, and much of the southern area has been removed under the 10/50 *Vegetation Clearing Code of Conduct for NSW*.

Figure 13 shows that there are 15 Schedule 2 primary browse species in the R2 portion of the site (including a possible *E. patentinervis*), with 11 CHCC primary and supplementary browse species (eg Broad-leaved Paperbark). Several Schedule 2 species also occur in the E2 zone (only 1 in northwest is shown) with many supplementary browse species.

5.2. Secondary Habitat CKPoM Controls

For Development Applications (DA) which affect Secondary Koala Habitat, the objectives, heads of consideration and controls are as follows (Lunney *et al* 1999a, CHCC 2008):

> **Objective**: To minimise further loss, fragmentation or isolation of existing Koala habitat and the creation of barriers to Koala movement and, where appropriate, to encourage restoration of Koala habitat.
>
> The consent authority shall not grant consent for development in areas of Secondary Koala Habitat unless it can be shown that the activity will not destroy, damage or compromise the values of the land as Koala habitat in the locality, and remove the following tree species: Tallowwood, Flooded Gum (except when part of a plantation), Swamp Mahogany (*E. robusta*), Forest Red Gum (*E. tereticornis*) or Small-Fruited Grey Gum (*E. propinqua*).
>
> In assessing an application the consent authority shall take into consideration:
>
> a) That there will be minimal loss of Secondary Koala Habitat;
>
> b) The level of significance to Koalas of trees proposed to be removed.
>
> c) The number of trees proposed to be removed in relationship to the extent and quality of adjacent or nearby Primary and/or Secondary Koala Habitat.
>
> d) The threats to Koalas which may result from the development.

e) All other options for protecting Koala trees as listed above; and,

f) The impacts to existing or potential Koala movement corridors; and,

The consent authority shall not grant consent for development in areas identified as Secondary Koala Habitat unless it is satisfied that:

g) The proposal will not result in significant barriers to Koala movement;

h) Boundary fences does not prevent the free movement of Koalas;

i) Lighting and Koala exclusion fencing is provided where appropriate on roadways adjacent to Koala habitat;

j) Tree species listed under Secondary Koala Habitat are retained, where possible;

k) New local roads are designed to reduce traffic speed to 40kph in potential Koala blackspots;

l) Preferred Koala trees are used in landscaping where suitable;

m) Minimise threats to Koalas by dogs ie banning of dogs or confining of dogs to Koala proof yards;

n) Fire protection zones, including fuel reduced zones and radiation zones, are provided generally outside of Secondary Koala Habitat.

The following section evaluates how these points are to be met by the proposal.

Figure 12: CHCC CKPoM mapping of the site



Figure 13: Location of current Schedule 2 Koala Food Trees identified on site

Note only 1 Schedule 2 tree in E2 zone shown in red. Others occur in northern E2 zone.



5.3. Development Control Considerations

5.3.1. Secondary Koala Habitat

a) That there will be minimal loss of Secondary Koala Habitat;

The proposal requires the removal/modification of most of the mapped Secondary Koala Habitat within the R2 Low Density Residential zone to establish the subdivision due to filling requirements.

This will see loss of up to 21 Koala food trees (as listed in the CHCC CKPoM) comprising 11 primary preferred species (1 Flooded Gum and 10 Swamp Mahogany/E. patentinervis), as well as 10 other species listed as secondary and supplementary forage species eg Weeping Bottlebrush, Swamp Oak, Broad-leaved Paperbark, etc. A number of Schedule 2 species will be retained along the southern boundary, with many more other browse species in the E2 zone, adjacent to remnant habitat on the adjoining land to the south.

Under the CKPoM, offset planting is required at a ratio of 1:5. This will see the need for around 105 replacement Koala food trees to be planted. These are nominated to be planted in the E2 zones in the north, and in the east-southeast to infill existing vegetation. Based on the CHCC guidelines, the offset will be planted at a maximum density of 1 tree per 15m^2, hence a maximum of 1575m^2 of E2 zone will be planted out, with associated understorey to establish a self-sustaining native vegetation community as per CHCC's guidelines.

b) The level of significance to Koalas of trees proposed to be removed;

As detailed in Section 4.5.3.2, a thorough survey for Koalas failed to detect any evidence, nor have previous surveys detected the Koala. This was confirmed by querying of long term residents and database searches, with the latter showing the nearest records are southwest of Mullaway and local records are sparse.

Consequently, the trees to be removed in the development envelope are clearly not significant (ie used) by the Koala now or in the near future.

c) The number of trees proposed to be removed in relationship to the extent and quality of adjacent or nearby Primary and/or Secondary Koala Habitat.

The CHCC CKPoM maps most of the native vegetation east of the highway from Corindi Beach to south of Mullaway as Secondary Koala Habitat.

In this landscape context, the locality is generally not a key area for the Koala, and the extant population appears to be localised and possibly low density (possibly due to soil landscapes and historical factors).

In this and a study area context, the loss of 21 trees comprising most of the actual Secondary Koala Habitat on site is of very low significance in terms of both extent of available habitat and value to the survival of the local population (given neither habitat on site or nearby appears to be currently used).

The required replacement plantings will maintain the potential value of the site in a protected area.

d) The threats to Koalas which may result from the development;

The main potential threats to Koalas from any residential subdivision are assessed in the following table:

Table 17: Identification and assessment of threats to the Koala by the proposal

Threat	Assessment	Mitigation Measures
Habitat loss/modification	Loss of about 21 primary, secondary and supplementary species as listed in the CHCC CKPoM.	Replanting of around 105 trees in the E2 zone. The E2 zone will retain effective long term protection of these trees.
Vehicle collision	New roads on site will be low speed as cul-de-sacs are used, hence unlikely to increase risk of road strike.	No specific measures deemed required.
Dog attack	Dogs may wish to be kept by future residents on the site, however dog attack is an existing threat as dogs currently occur adjacent to the site.	No specific measures deemed required as no resident Koala population.
Barriers to movement	New roads proposed are unlikely to act as a barrier to Koala movement as no site or local Koala population. Fencing of individual Lots as a result of the subdivision could create barriers to movement and injury risks.	It is recommended that no fence capable of inflicting injury is (e.g., barb wired fence) to be erected at any time. E2 zone will not be fenced with any kind of barrier fencing – hence Koalas and other fauna will be able to circumnavigate the residential area via the habitat in the E2 zone.
Bushfire	Low risk of fire at present. This will be further reduced post development due to less fuel on site.	No specific provisions required.
Injury during clearing	Minimal if any given lack of evidence of Koala activity.	Ecologist to be on site during vegetation removal for other fauna, hence will undertake pre-clearing survey to ensure Koala food trees not impacted.

e) All other options for protecting Koala trees as listed above; and,

As noted above, all remaining habitat and the plantings will be protected by E2 zoning under the CHCC LEP.

f) The impacts to existing or potential Koala movement corridors; and,

g) The proposal will not result in significant barriers to Koala movement;

h) Boundary fencing does not prevent the free movement of Koalas;

As discussed in section 4.4, the site's value as a corridor is limited by fragmentation, and a better north-south link occurs west of Arrawarra village via extensive forest. However, if Koalas were present in the study area, they have a demonstrated ability to cross urban woodlands (DECC 2008, AKF 2007, etc) and hence would be able to traverse the site.

Post-development, the E2 zone will have additional vegetation with at least parkland-state vegetation in the thinnest area. As no fences will cross the E2 zone, this will provide an effective long term corridor for Koalas.

i) Lighting and Koala exclusion fencing is provided where appropriate on roadways adjacent to Koala habitat.

Adequate street lighting along the approved new cul-de-sacs will be provided as per Council requirements. This should ensure good driver visibility and reduce risk of wildlife road kills along these short cul-de-sacs.

Exclusion fencing is not considered relevant given the very low risk.

j) Tree species listed under Secondary Koala Habitat are retained, where possible;

As noted previously, most of potential Koala browse species within the R2 zone are expected to be removed, which is estimated to be 21 trees. These will be replaced at 1:5 in the E2 zone where existing habitat will also be retained. Weeds will also be removed under a project Vegetation Management Plan (VMP) which will manage and monitor the plantings.

k) New local roads are designed to reduce traffic speed to 40kph in potential Koala blackspots;

Not applicable.

l) Provide preferred Koala trees in landscaping where suitable.

It is recommended that potential Koala food trees not be planted in the landscaping provisions, unless there is insufficient space to plant the offset requirements in the E2 zone. This is considered preferable as it reduces the need to expose wildlife to threats such as vehicles, adverse interactions with the public, and potential clashes between infrastructure and plantings in the long term.

m) Minimise threats to Koalas by dogs ie banning of dogs or confining of dogs to Koala proof yards.

As the Arrawarra area does not appear to support a current population of Koalas, and no existing controls exist in the current residential area to the west, implementing a ban on dogs is considered impractical to implement and unjustified in this instance.

n) **Avoid removal or disturbance of Secondary Koala Habitat by locating fire protection zones, including fuel reduced zones and radiation zones, outside areas of Secondary Koala Habitat.**

As Secondary Koala Habitat in the E2 zones is to be expanded via the offset plantings to the loss of Secondary Koala Habitat in the R2 zone, any bushfire provisions will have to be retained within the R2 zones. If required, dwellings will have to have a higher construction code to enable a reduced APZ.

5.4. Offset Planting and VMP

5.4.1. Identification and Calculation of Replacements

To achieve the CKPoM's primary objectives, no net loss of carrying capacity will be achieved via the offset planting in the E2 zone.

The CHCC CKPoM guidelines (2008) requires offset replanting at a ratio of 1:5 for the Secondary and Supplementary Food Resources. It is estimated that including primary and supplementary tree species, 21 of these trees will be removed. Hence a minimum of 105 trees will need replanting.

5.4.2. Locations for Re-plantings

Plantings will be located in current canopy gaps in the E2 zone, excluding the existing open area in the northeast which will be maintained for public beach access as parkland.

These plantings and the associated weed removal will be detailed and managed under the Vegetation Management Plan (see section 7.1.2), which are to be prepared prior to issuing of the Construction Certificate for any development on the site (CHCC 2009a).

6.0 Impact Identification and Assessment

6.1. Direct Impacts

6.1.1. Establishment of the Subdivision

As mentioned previously, the proposal is a residential subdivision of the site, with the creation of 24 Lots along with a new access road within the site. The total footprint for the development is approximately 1.8ha.

The new Lots are to be located in the R2 zoned portion of the site, and most of the remaining parkland vegetation is expected to be removed only in this area. This is expected to see the removal of about 30 native trees, plus planted and native understory species (native and exotic). A total of up to 15 hollow-bearing trees and up to 10 Schedule 2 primary browse species may also be removed.

Habitat remaining in the E2 zone will be augmented with offset plantings and weed management as an offset to this loss.

6.2. Indirect Impacts

The following indirect impacts are generally associated with residential to rural development. The following table evaluates the likelihood of occurrence and potential significance:

Table 18: Indirect impacts associated with the proposal

Threat	Literature Review	Assessment Of Proposal
Direct mortality via clearing and habitat destruction	Animals within hollows and fallen logs, as well as dense vegetation and leaf litter may be killed during clearing of these structures. This risk increases during breeding seasons (generally spring to late autumn), and cooler season when mammals and reptiles enter torpor.	As detailed above, up to 15 hollow-bearing tree are likely to be removed for the development. Given this and current state of the site, direct mortality is considered a minimal risk other than for common woodland species.
Fragmentation and Landscape change	Fragmentation and the associated landscape changes at all scales is major factor in the decline of biodiversity, the modification of ecosystems, and alteration of ecosystem processes. Its effects vary with factors such as distance of fragments from similar habitat, their position in the landscape, the forms of habitat modification of isolates that occurs (e.g. due to edge effects), and types of surrounding land uses in the matrix, the ecology of the species affected, and how these factors influence the movement of organisms between the isolates and larger areas of habitat (Lindenmayer and Fisher 2006, OEH 2015b).	The proposal will increase local fragmentation via removing most of the modified/urban woodland on site. This will reduce linkage across the site, but augmentation of habitat within the E2 zone will retain connectivity for urban woodland species. The more significant local corridor is west of Arrawarra, and hence dispersal movements will not be disrupted.
Erosion and Sedimentation	Sedimentation and erosion impacts can occur at both the construction and establishment phases. Erosion/sedimentation may occur via erosion of fill material and disturbed soils, scouring of exposed soil, earthen banks and habitats adjacent to the development area via directed flow (e.g. stormwater), or where runoff is concentrated.	Standard mechanisms and controls should ensure the prevention of erosion and sedimentation during construction and post-development and such impacts do not extend beyond the development footprint.

Fencing	Fences have potential to obstruct the movement of threatened fauna across the site. Some threatened fauna can be injured by collision with wire fences, particularly barbed wire e.g. the Yellow-bellied Glider, owls and Squirrel Glider have been recorded being injured by barbed wire fences (Lindenmayer 2002, Berrigan 2001c, Woodford 1999).	Fencing of individual Lots as a result of the subdivision could create barriers to movement and injury risks to species such as Koalas, gliders and possums across the site. It is recommended that no fence capable of inflicting injury is (e.g., barb wired fence) to be erected. No Koala impermeable fencing will be allowed to cross the E2 zone.
Noise, Vibration and Anthropogenic Disturbances	Noise effects on fauna in Australia are relatively poorly studied (Clancy 2001, Berrigan 2001d). Most evidence presented is anecdotal, but suggests most fauna have at least a fair degree of tolerance and adaptation at least to residential noise depending on species, situation, habitat/lifecycle stage affected, habitat significance, etc.	Currently, noise is derived from traffic on Arrawarra Beach Road and entertainment activities in the caravan park. During the development's establishment, noise will be highest during construction, but limited to day time hence will only impact diurnal birds and mammals. Post-development, noise will be typical of a residential areas which is generally low to nil at night, but periodically moderate via mowers, which may potentially peak on weekends. Noise generated by the proposal is unlikely to disturb fauna occurring on the site, with species expected to have a substantial tolerance to the current level of anthropogenic noise in the area.
Weed Invasion	Disturbance of soil provides the opportunity for weed invasion. Weeds may also be transported to the site from vehicle, people (e.g. on clothing), etc., who visit the development area, and via introduced fill material.	Soil disturbance during construction may provide an opportunity for weed invasion, but this will only occur within the development envelope where the groundcover will be intensively managed.

Introduction of feral/introduced species	Urban, industrial and rural developments are often associated with the introduction of non-native species i.e. rodents, cats and dogs accidentally and intentionally e.g. via creating habitat for such species (e.g. rats, Indian Myna) or as pets. Feral cats and foxes are significant predators of native species (NSWSC 2000a, Dickman 1996, May and Norton 1996, OEH 2014b), and domestic dogs are significant threats to species such as the Koala (Wilkes and Snowden 1998, Port Stephens Council 2001, Connell Wagner 2000b, OEH 2012b). The mere presence of these predators has also been shown to affect fauna behaviour e.g. avoidance and range contraction. Rodents compete with native species but also form component of native species prey (OEH 2015b, Debus 1993).	The conversion of the site to a residential land use may result in the introduction of non-native pet species such as dogs and cats to the study area. The introduction of dogs on the site has the potential to increase the risk of attack on Koalas. However given that Koalas have not been found to have a significant association with the site, this risk is unlikely to be significantly increased. The introduction of cats poses a predation risk to native fauna and could potentially elevate mortality rates. However given that cats would already be present within the area, this will be an incremental and cumulative impact.

7.0 Recommendations

7.1. Primary Recommendations

The following are recommended to be included as conditions of consent if the proposal is approved in order to mitigate the major potential ecological impacts of the proposal. The conclusions of this assessment assume these measures are implemented and effective in mitigating impacts.

7.1.1. Protection of E2 Zone During Clearing

The E2 zone is to be clearly marked and fenced off (eg with paramesh or bunting) prior to clearing if any construction activity occurs in close proximity.

Site induction is to specify that no vegetation modification via any means is to occur beyond the nominated area, and no storage or dumping of any building material is to occur under the drip line of any retained trees.

Any clearing and earthworks associated with the development is to avoid damage to root zones of retained trees e.g. no parking of vehicles or storage of materials or excavated fill under retained trees.

7.1.2. Vegetation Management and Habitat Augmentation

The E2 zone will be subject to a Vegetation Management Plan which will be prepared prior to construction. The primary conservation measures to be included in the VMP are:

- Supplementary/infill planting with Koala food trees (primarily Tallowwood and Swamp Mahogany) to offset the loss of trees on the remainder of the site.
- Installation/relocation of nest boxes to offset loss of hollow-bearing trees. One nest box per hollow removed is to be erected, with target species matching the aperture size. The boxes are to be sourced by a reputable supplier and installed by an ecologist on retained mature trees in the E2 zone prior to commencement of clearing. Existing boxes are to be relocated to the E2 zone. The final number of boxes will be subject to the physical availability of trees to mount boxes and ecology of target species eg exclusive home ranges.
- Ongoing weed removal under the life of the VMP in the E2 zone.

7.1.3. Hollow-bearing Tree Removal Protocol and Animal Welfare Protocol

The hollow-bearing trees proposed to be removed may contain fauna at the time of clearing. Such fauna may be placed under stress, injured or killed during tree felling via:

- Being nocturnal or in torpor, and unable to escape prior to the tree falling.
- Collapse of the hollow when it impacts the ground.
- Collision with internal walls or via being thrown out when the tree falls.
- Being present as young eg. eggs.

In general, any hollow bearing tree removal must be undertaken via a method that will minimise the risk of injury/mortality of potentially denning/roosting fauna within the limitations of Occupational Health and Safety (OH&S) Guidelines. Undertaken with due care, this practice can demonstrably avoid mortality of common and threatened species during felling of hollow-bearing trees, thereby substantially reducing the potential significance of development impacts. The following general guidelines are recommended:

1) Hollow-bearing trees should be removed via a method that does not require traditional tree felling methods i.e. clear-drop chainsaw cut or bulldozer/excavator “rip and push” methods undesirable due to the violence of tree-ground impact and associated high risk of injury/mortality to fauna (e.g. via hollow collapse, collision with walls, etc). Options include:
    - The use of an excavator or similar machine with a harvester head attachment, which can hold the trunk while the tree base is sawn, and then the lowers the tree to the ground for inspection (limited in practicality to small to medium sized trees).
    - Use of a crane to hold the tree while the base is sawn, and then lower the tree to the ground for inspection (limited in practicality to small to medium sized trees).
    - An arborist and an ecologist in a man-box on a crane inspect and then lop each hollow until all hollows are cleared and fauna captured and relocated (limited practicality for trunk hollows unless an inspection camera can be effectively used).

- An arborist in combination with a crane to progressively section hollow-bearing limbs/trunks, and lower to the ground to allow inspection (effective for broadest range of situations).

2) An ecologist must be present during felling of the hollow bearing trees to monitor clearing, capture any resident animals injured or not evacuating, and undertake appropriate emergency actions if required e.g. euthanasia or transport animal to veterinary treatment (care at proponent's cost) or care by FAWNA (with a donation by proponent to cover all carer and treatment costs). An ecologist must also be present during the removal of the old hall where the Squirrel Glider was recorded denning.
3) Hollows are to be immediately inspected once the tree is felled (within OH&S guidelines) for injured individuals or abandoned offspring, and appropriate measures undertaken. All rehabilitated animals are to be released in the retained habitat directly on/or adjacent to the site.
4) If hollows cannot be cleared of fauna, the fallen tree must either be allowed to sit overnight, or may be sectioned by chainsaw to clear hollows of fauna. It may then be destroyed/stacked for destruction.

Clearing outside spring-summer is also highly recommended to minimise the risk of many hollow-obligate birds nesting and Yangochiropteran bat breeding season.

Any feral species (including bees) detected during tree felling are to be euthanised.

7.1.4. Sedimentation and Erosion Control

Standard soil and sedimentation control measures will be required by Council in the construction stage of the proposal to ensure that habitats on the site and in the study area, as well as subsequent wetlands/aquatic habitats nearby are not substantially affected by the proposed development.

Proposed drainage systems need to be adequately designed and effectively established to prevent the risk of any substantial impacts (e.g. erosion and sedimentation) as per statutory obligations.

7.1.5. Restrictions to Use of E2 Zone

No fencing is to be erected by any resident across the E2 zone at any time.

Furthermore, outside the designated public beach access area in the northeast, no mowing, vegetation modification (including conversion into parkland or yard extensions), storage of caravans, trailers, etc, or green waste dumping is allowed in the E2 zone.

If required to ensure exclusion of these activities, the E2 boundary may need to be formally fenced eg colorbond fencing along the R2 boundary.

7.2. Secondary Recommendations

7.2.1. Pets and Feral Predator Management

Pets are to be formally banned from the E2 zone, with appropriate signage installed. Residents should report all stray cats and dogs to Council as applicable under the provisions of the *Companion Animals Act 1997*, and that pet attacks on fauna is an offence under the Act. Residents should also report sightings of foxes and feral cats to the OEH or CHCC for control actions.

Cats should be confined indoors between sunset and sunrise. This is essential to avoid pet predation of the Phascogale and Squirrel Glider, which are particularly sensitive (NSWSC 2000a, Dickman 1996, Grayson and Galver 2004, May 1997, Smith and Murray 2003, Smith 2002a, Faulding and Smith 2008, Barratt 1997).

7.2.2. Specifications for Landscape Plantings

Any landscaping proposed as part of the development should give due consideration to the establishment of native plants as ornamental species to maintain and/or increase biodiversity, provide replacement habitat, and maximise water efficiency.

Where possible, plantings should preferably not be in parkland style or isolated trees as this minimises their effectiveness to provide habitat to all but common medium sized species (e.g. Currawongs and Indian Mynahs) and may become detrimental to the presence of other species (Catterall 2004). Rather, plantings should be planned to recreate a natural structure (i.e. layered). Such plantings thus would consist of at least one or two canopy trees, underlain by a few understorey trees, and finally a number of shrubby species. This multi-layered planting can provide effective aesthetics while supporting passerine birds (who depend on the lower stratums and structural complexity), Yangochiropteran bats, and canopy species such as birds, arboreal mammals and Yinpterochiropteran bats (Catterall 2004).

7.2.3. Artificial Lighting

To ensure anthropogenic impacts are minimised, it is recommended that artificial lighting be kept to a minimum and be of a localised and low luminosity, with light directed to the ground and not onto retained trees/adjacent vegetation.

8.0 Seven Parts Test Assessment

8.1. General Overview

The 7 Part Tests are used to determine whether a proposed development is likely to have a significant effect on threatened species, Endangered Ecological Communities, Endangered Populations and Critical Habitat listed under schedules of the *Threatened Species Conservation Act 1995* known or considered reasonably likely to occur in the area influenced by a development proposal. Considerations must be given to the possible significant impacts a proposed development may have on threatened species, populations, ecological communities, and their habitats (DECC 2007).

The content of the 7 Parts are specified by Section 5A of the *Environmental Planning and Assessment Act 1979,* as amended by the *Threatened Species Act 1995*, which in turn has been amended by the *Threatened Species Conservation Amendments Act 2002*.

8.1.1. Entities to be assessed

No threatened flora species were detected during the survey in the study area, and none are considered potential occurrences.

Similarly, as detailed in section 3.3, no EECs are considered to occur on site. *Littoral Rainforest* occurs within 100m north, but the proposal clearly has no potential to directly or indirectly impact this EEC, but it is assessed as per the Precautionary Principle and DECC (2007).

Three threatened fauna species, the Osprey, Hoary Bat and Grey-headed Flying fox were detected during the site survey. Umwelt (2004) also recorded Hoary Bat and Grey-headed Flying fox on the site. The East-coast Freetail Bat and Eastern False Pipistrelle were also tentative call identifications. These species automatically require assessment.

The following species (see Appendix 1) are also subject to the 7 Part Tests as they are considered to have at least a low potential to use some habitat in the study area at some time (e.g. now or if they were to potentially recover and expand):

- **Mammals:** Koala, Squirrel Glider, Yellow-bellied Sheathtail Bat, Common Blossom Bat, Eastern Bent-wing Bat, Little Bent-wing Bat, Greater Broad-nosed Bat, Southern Myotis.
- **Birds:** Square-tailed Kite, Eastern Osprey, Little Lorikeet, Varied Sittella, Black Bittern, Black-necked Stork, Pied Oystercatcher, Sooty Oystercatcher.

Brief ecological profiles are provided in Appendix 1 for these species. More complete profiles can be found online (DotE 2015b, OEH 2015b), and these and the references listed in this assessment were used in combination with personal knowledge when undertaking the impact assessment.

8.1.2. Local Populations Occurrence

The guidelines associated with the revised factors have provided definitions for key terms with the most significant being that of the "*local population*" and "*local occurrence*" as follows (DECC 2007):

"Local population: the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions.

- The *local population* of a threatened *plant* species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.
- The *local population* of *resident fauna* species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.
- The *local population* of *migratory or nomadic fauna* species comprises those individuals that are likely to occur in the study area from time to time…."

The local population of the potentially occurring threatened species is thus defined as follows:

Table 19: Definition of local population

Species	Local Population
Square-tailed Kite	Any individuals known or potentially using habitat within site/study area depending on prey abundance as part of larger range. Local population requires much more habitat that found within study area to meet lifecycle requirements.
Squirrel Glider	Colonies potentially occurring within the study area, and using both adjacent habitat and the study area. Lack of evidence on site, high competition with other common species and lack of close proximity records suggests site is not core part of home range of a local population.
Little Lorikeet	Any individuals potentially using habitat within the study area depending on flowering incidences. Given ecology, site limitations and competition with common species, local population requires much more habitat that found within study area to meet lifecycle requirements.
Varied Sittella	The family group/s which use the site and adjoining habitat in the study area for foraging and breeding.
Black Bittern	Most likely to be a single bird at times using the more secluded portions of Arrawarra Creek and Yarrawarra Creek as part of its local foraging and roosting requirements. Ecology of the species and limited habitat in study area indicates the local population extends well beyond the study area.

Species	Local Population
Black-necked Stork	Most likely to be a single bird at times using the more secluded portions of Arrawarra Creek and Yarrawarra Creek as part of its local foraging requirements. Ecology of the species and limited habitat in study area indicates the local population extends well beyond the study area.
Pied Oystercatcher Sooty Oystercatcher	Any birds which use the adjacent creeks or beach as part of non-breeding range. Ecology of the species and limited habitat in study area indicates the local populations extend well beyond the study area.
Eastern Osprey	Local pair of birds which may include study area as small portion of large foraging territory. Local population thus requires much more habitat that found within study area to meet lifecycle requirements.
Koala	Any individuals potentially using habitat in the study area as part of a larger home range. Lack of use on site and records in study area indicates study area may at best only be very rarely used by transients, hence range of local population extends beyond study area.
Grey-headed Flying-fox	Any individuals known to be using habitat in the study area depending on seasonal flowering incidences. Local population thus requires much more habitat that found within study area to meet lifecycle requirements.
Bent-wing Bats, Hoary Bat, East-coast Freetail Bat, Greater Broad-nosed Bat, Yellow-bellied Sheathtail Bat, Southern Myotis	Any individuals/colonies known or which may use forest in the site/study area for foraging and roosting at some stage of their lifecycle which will see them ranging over a far wider range. Due to ecology of these species and extent of study area, local population requires much more habitat that found within study area to meet lifecycle requirements.
Common Blossom Bat	Any individuals using the study area for seasonal foraging. Due to limited preferred resources on site and seasonal availability of the food resource, local population and individuals would extend well beyond property to meet lifecycle requirements eg roosting habitat.

8.2. Seven Part Test Assessment

8.2.1. Seven Part Test Structure

To minimise repetition and superfluous information, the responses to the 7 Part Tests are structured as follows:

- In Part (a), species are grouped together based on broadly common ecology (i.e. mobile bird species such as the owls or species with similar habitats such as the Yangochiropteran bats) or similar impacts, and subject to a common 7 Part Test response to part (a).
- Parts (d) and (f) are collectively depending. Part (b) deals with Endangered Populations of which none are relevant to the proposed development. Part (c) applies specifically to EECs, and the two recorded EECs on site is assessed here. Part (e) deals with Critical Habitat, which is not relevant to the subject proposed development.

8.2.2. Seven Part Test Responses

(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,

As detailed in section 6.1, the proposal is the establishment of a residential subdivision over the 2.54ha study site. This will result in the loss of most of the remaining vegetation in the R2 zone on the site, with existing habitat in the E2 zone on the periphery to be augmented with offset plantings, and protected in perpetuity.

The loss of vegetation on the site as a result of the proposal will incrementally and cumulatively reduce the study area's carrying capacity for some of the subject species via removal of potential foraging sources (e.g. sap sources and flowering canopy species) and/or potential prey habitat (e.g. Yangochiropteran bats insect prey habitat) and up to 15 hollow-bearing trees.

The impact of the proposal will vary in significance and context per species/species groups as follows:

Koala

The Koala was not detected on site during the survey, and has not been recorded by long term residents or a survey in 2004 (Umwelt 2004). The Bionet database (OEH 2015a) shows the nearest Koala records are down past Mullaway to the south. Records are much more common in the southwest of the locality in Wedding Bells State Forest, but these latter records are separated by the recent widening of the Pacific Highway. There are no Koala records in the Arrawarra area, and the woodland on site and most of the remnant forest in the locality is only mapped as Secondary Koala Habitat in the CHCC CKPoM.

The lack of Koala activity in the study area or proximate records indicates the study area is unlikely to be significant to the Koala ie not part of a local aggregate's home range. At best, the Koala may occur in the remnant habitat from Corindi to south of Mullaway in low density, and potentially (if the population were to recover), expand over time into remaining habitat. At present, it is likely only to occur within the study area as a very rare dispersing transient.

The proposal will reduce the current habitat values of the site for the Koala via loss of up to 10 Schedule 2 species (ie Swamp Mahogany), as well as 11 trees of other species listed in the CHCC CKPoM (mostly as secondary or supplementary browse). These will be replaced via replanting in the E2 zone, thereby retaining linkages, increasing carrying capacity and maintaining the long term potential for the Koala to colonise the study area.

The new roads on the site are only cul-de-sacs hence are not considered a significant threat of vehicle strike, and given current use of the site as a caravan park, local traffic volumes are expected to largely remain the same. Hence no specific mitigation measures are proposed.

Dog attack may also pose a risk due to the increased number of pet dogs that may eventuate, however dogs already exist on adjacent land; and the site is not Core Koala Habitat. The proposal will thus incrementally add to this existing threat.

No significant change to the current bushfire regime is expected to occur as a direct result of the proposal.

Overall, the proposal will remove some potential foraging habitat and to some extent increase local fragmentation, and will generally see an incremental increase in other threats which currently occur in the wider area. Given neither Core Koala Habitat or an area of major activity is impacted; connectivity is not effectively prevented between proximate potential habitat; other threats will not be significantly increased: the proposal is considered unlikely to result in impacts of sufficient order of magnitude to place a local viable population at risk of extinction due to loss of viability.

Squirrel Glider

The Squirrel Glider was not recorded on site despite specifically targeted via the combination of a range of methods over nearly 3 weeks, or by previous survey (Umwelt 2004). Bionet (OEH 2015a) showed 2 records within 1km, hence it is possible that at least one colony occurs within or uses habitat within the study area at least.

The proposal will see loss of potential denning hollows and foraging resources for the Squirrel Glider. The Squirrel Glider has been recorded in caravan parks (eg Darkheart 2005a) and in urban remnants (Smith and Murray 2003, Darkheart 2005b, 2005c, 2005d, 2005e, 2004a, 2004b, 2004c, Berrigan 2003a, etc), hence could potentially forage and den in the study area. However, the resources on site, particularly the tree hollows, are subject to very high competition with Brushtailed Possums and common birds eg Rainbow and Scaly-breasted Lorikeets. Given this and failure to detect by this survey and Umwelt (2004), is appears very unlikely that the site forms a core part of the species' range.

The loss of about 30 native trees (plus a similar number of exotic and native ornamentals, mostly constituted by palms) including 15 hollow-bearing trees on site is a negative impact on the potential occurrence of this species, incrementally contributing to the cumulative loss of habitat in the locality and across the species range. Perusal of adjacent vegetation suggests adjacent vegetation has a low to very low density of hollows in comparison to the site, hence the proposal will see increased competition in the study area for this key habitat component.

This loss will be offset by the replanting of around 105 trees in the E2 zone, and mounting of a number of nest boxes specifically suitable for this species. Acknowledging that nest boxes have a limited lifespan, while foraging capacity is likely to be maintained and potentially increased, the number of potential dens will take a long time to be naturally replaced (ie >100 years). While this is a negative impact, the lack of evidence indicating a local colony is dependent on hollows on site suggests this is not likely to be a significant impact.

Artificial lighting and keeping of cats also add to the net negative impact, but as the species has been recorded in similar situations and given current dwellings (likely to have cats) and artificial lighting in the study area: these threats are unlikely to prevent the species from potentially occurring in the study area.

Overall, given the site has been demonstrated to not currently support a resident colony; foraging capacity will be eventually be restored; much of the same current linkage values will remain; and that the site is evidently not a critical part of the local population's home range and it would be more

likely to depend on habitat within the largely unaffected study area to meet most if not all of its lifecycle needs: the proposal is unlikely to have an impact of sufficient order of magnitude to place a local viable population at risk of extinction.

Grey-headed Flying Fox

A small number of Grey-headed Flying Fox were observed foraging on the site, while many more were observed flying overhead. These bats form a minute part of a large colony which to the south (pers. obs.).

This bat traverses over a very large range according to seasonal flowering and fruiting, and lifecycle stage e.g. maternity season (OEH 2015b, Eby 2002, 2000a, 2000b). Hence the site/study area would only form a small to minute part of a local breeding colony's seasonal range, and consequently, a local population of either species needs to fulfil the majority of its lifecycle requirements well beyond the site/study area.

Around 30 potential food trees (plus some palms) will be removed, some of which flower in seasons where nectar is in short supply ie late autumn-winter. While a negative impact, this represents a relatively very minor foraging resource for the Grey-headed Flying Fox, and is not roosting habitat. Given the ecology of the species, extent of local habitat, and extent of habitat removed, the loss of this modified woodland is clearly not capable of disrupting the lifecycle of a local population of these bat species. This loss will be offset by the required 1:5 offset plantings, hence carrying capacity should largely be retained in the medium to long term.

Common Blossom Bat:

This small bat has been locally recorded (OEH 2015a), and could potentially forage during flowering events on trees such as *Melaleuca* and Swamp Mahogany on site. This is however at best a low potential given competition with flying foxes (eg Little Red Flying Fox), and the extent of high quality habitat in the study area eg Banksia woodland and swamp forest. Roosting is at best only a marginal possibility in the dense clump of regrowth in and adjacent to the southern end. It is more likely to occur locally in better wet sclerophyll or littoral rainforest eg the SEPP 26 area to the north.

This species has been recorded in peri-urban habitats, even falling prey to cats. Replanting of the E2 zone with more potential food trees will increase potential carrying capacity for this species, but the likely keeping of cats will add incrementally to the current threat posed by adjacent dwellings which may allow cats to roam the study area.

Overall, given the low potential significance of the site to this species (ie highly modified potential foraging habitat) and no likely roosting habitat to be removed, the proposal is considered unlikely to have an impact of sufficient order of magnitude to place a local viable population at risk of extinction.

Yangochiropteran Bats: East-coast Freetail Bat, Eastern Bent-wing Bat, Little Bent-wing Bat, Greater Broad-nosed Bat, Eastern False Pipistrelle Yellow-bellied Sheathtail Bat, Southern Myotis, Hoary Bat.

Of these species, only the Hoary Bat was confidently recorded during the survey and by Umwelt (2004) via call detection. The East-coast Freetail Bat and Eastern False Pipistrelle were tentative call identifications.

For the remaining species, the study area is considered to provide some suitable foraging habitat. The presence of hollow-bearing trees provide potential roosts but are subject to high competition with common species eg Lorikeets. During the survey, only 2-3 bats were observed, and activity was concentrated in the southern end of the site.

All of these bats require home ranges or seasonably variable ranges that far exceed the site/study area at least seasonally depending on lifecycle stage or due to their ecology e.g. summer migrants in the south of the bioregion e.g. Dwyer 1966, 1968, OEH 2015b, ABS 2015, Smith *et al* 1995, Churchill 2009, etc. Hence ecologically, while an individual/s may use the site/study area for foraging or roosting in tree hollows at some time, any known/potentially occurring local population of these species would extend well beyond the site/study area to meet all their full lifecycle requirements.

Considering the relatively minor amount of habitat loss relative to the extent of habitat in the study area and within their seasonal range, the retention and augmentation of the habitat in the E2 zone, no significant change to the estuarine habitat adjacent, and that a local population of these bats would extend well beyond the site: the order of magnitude of impacts associated with the proposal is not considered likely to be sufficient to be considered likely to place a local population of the subject bats at risk of extinction.

Osprey

The Osprey was observed as a fly-over. A local pair would use the adjacent creeks and ocean as part of its territory. No nests were observed on or near the site.

The proposal will have no direct impact on this species given no nests will be removed, or significant changes to the estuarine ecosystems. The loss of trees will see a relatively minute loss of potential nesting materials, but no likely nesting sites will be removed.

Given this and the demonstrated tolerance of this species to residential areas, the proposal clearly has no capacity to significantly impact this species, and hence will not place a local viable population at risk of extinction.

Square-tailed Kite

The Square-tailed Kite was not recorded by the survey, however it been recorded in the locality (OEH 2015a). The species requires very large territories or seasonably variable ranges that far exceed the site/study area (OEH 2015b, Debus 2012, NSWSC 2009). Hence the site/study area only has potential to form a small to minute part of a local pair's range, and consequently, a local population needs to fulfil its lifecycle requirements well beyond the site/study area.

The site/study area overall offers some generic potential foraging opportunities, although due to the extent of modification, prey abundance and diversity would be low. The proposal will impact the Square-tailed Kite via a relatively minute but incremental and cumulative loss of potential foraging habitat within its territory. As the territories of the species is measured in terms of square kilometres (Debus 2012), the relatively minute loss of carrying capacity to their territory, while a negative impact, is not sufficient to undermine the local pair's ability to obtain sufficient forage to raise young to fledging.

No known nest sites will be removed, hence there is negligible risk of direct mortality. The species have been recorded building nests in urban remnants and along busy roads, hence its current potential to nest on site will be retained.

Given this; that no barrier to connectivity for this species will be created; that they are also known to forage in retained and urban woodland habitat within or adjacent to rural-residential and urban areas (hence are likely to occur in the study area post-development), and that the local population of the subject species would extend well beyond the confines of the study area to meet the majority of their life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct or indirect decline (i.e. reduce viability) of the local populations.

Little Lorikeet

This bird traverses over a very large range according to seasonal flowering (OEH 2015b, NSWSC 2009). Hence the site/study area only has potential to form a small to minute part of a local pair's seasonal range, and consequently, a local population needs to fulfil its lifecycle requirements well beyond the study area.

Due to the site's significant disturbance history, it currently has a number of habitat limitations for this bird. It is also dominated by both conspecifics and species known to harass the species ie Noisy Miner. Consequently, the site is only considered to offer a small area of generic potential seasonal foraging habitat with a locality with a large amount of potential habitat.

The proposal will result in the loss of about 30 trees which offer potential foraging habitat for this bird, and about 15 hollow-bearing which would be very unlikely to be used as nest site due to the high level of competition from other species, particularly conspecific lorikeets; and risk of predation. Given the seasonal range of this bird and extent of other higher quality habitat remaining locally: this is not considered likely to directly affect breeding success.

In consideration of the above; the ecology of the subject species; that no barrier to connectivity for this species will be created; that the species is known to forage in retained habitat within or adjacent to rural-residential and urban areas (hence likely to occur in the study area post-development); and that the local populations of the species would extend well beyond the confines of the site/study area to meet life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline of a local population of the Little Lorikeet.

Black Bittern and Black-necked Stork:

The shy Black Bittern and the less wary Black-necked Stork are not considered potential occurrences foraging or roosting in the creeks directly adjacent to the site, but could occur in the study area further upstream. People were noted to frequently utilise the adjacent creeks, including with dogs. Usage further upstream is hampered by diminishing access, and this is where the Bittern and Stork are more likely to occur.

The proposal will not significantly increase or decrease human presence, nor will it alter habitat or introduce new threats (eg cats and dogs are already present). Given the status quo will largely remain post-development for these species, and no nesting habitat is impacted, the proposal is

considered incapable of having an impact of sufficient order of magnitude to place a local viable population at risk of extinction.

Sooty Oystercatcher and Pied Oystercatcher:

These birds have been previously recorded in Arrawarra Creek and at Arrawarra Headland. Both will tolerate human presence to a point (periodically seen in Moonee Creek estuary adjacent to the caravan park), and may even be found in estuarine canal estates (pers. obs.). Breeding habitat is usually in more secluded locations. Occurrence would depend on seasonal life cycle stages, and also daily human and dog activity.

The proposal will not significantly increase or decrease human presence, nor will it alter habitat or introduce new threats (eg cats and dogs are already present). Given the status quo will largely remain post-development for these species, and no nesting habitat is impacted, the proposal is considered incapable of having an impact of sufficient order of magnitude to place a local viable population 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 "*Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area"* is the only locally recorded Endangered Population in the study area.

No emu records occur in close proximity to Arrawarra, and the proposal will have nil impact on this Endangered Population given no potential habitat is impacted, no barrier introduced, and no significant change to current traffic volumes on local roads.

(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,

As mentioned previously, the site is not considered to contain an EEC as the soils do not appear to match the Final Determination for Coastal Floodplains. *Littoral Rainforest* occurs within 100m north within a mapped SEPP 26 area, but the proposal has nil impact on this EEC eg no change to hydrology, fire regime, fragmentation, maritime stresses, etc.

(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,

The proposal will remove an estimated 1.8ha of modified woodland and exotic grassland on site. This includes about 10 Schedule 2 primary Koala browse species and 15 hollow-bearing trees. The

residual of the site is zoned E2 and will be maintained in the northeast, with offset plantings in the remainder.

(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,

The site is mapped as a falling within regional corridor and a local corridor. Review of aerial photos show the site is part of the main fragmentation of the eastern fringe of a largely intact body of forest running north and south of Arrawarra.

The site itself offers poor connectivity due to the level of modification (ie parkland vegetation), canopy gaps (eg open space in the northeast providing an effective barrier for gliders). The proposal will further increase this fragmentation via loss of most of the current woodland on site, but this will be offset via replanting in the E2 zone. With at least scattered trees in the northeast part of the E2 zone, and forest in most of the remainder, this will maintain if not enhance connectivity via formalising it around the periphery of the residential area.

(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,

As noted in part (a), the study site generally offers some mostly low quality potential foraging and refuge (denning, roosting, etc.) habitat for a number of threatened fauna species. However, due to habitat limitations of the site and to meet all lifecycle and routine foraging requirements, the range of all the species must extend off the site and for many beyond the study area due to key habitat constraints (e.g. competition for hollow-bearing trees, seasonally variable foraging resources) and their ecology. Hence the habitat to be removed is not of any key significance to any threatened species, thus no habitat of critical importance to the survival of any species in the locality is to be removed.

For the nearby *Littoral Rainforest* EEC, the habitat to be removed has no value and its removal and offsetting will have no implications for its long term survival.

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

No relevant areas of critical habitat have been declared, as yet, under Part 3 of the TSCA.

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

Draft/final recovery plans have only been prepared for the Grey-headed Flying-fox and Koala (DECCW 2009, DECC 2008). Priority actions have been identified for all of the other species, and the EEC (OEH 2015b).

The *Recovery Plan for Koalas* (DECC 2008) specifies actions considered to be key threats to Koalas. This plan specifies habitat loss, fragmentation and degradation as the most important threats to Koalas throughout their range. The proposal is not strictly consistent with this Plan as it will remove and modify potential habitat, however given that the Koala does not have an association with the

site, the proposal is not capable of significantly affecting the recovery of the Koala. This habitat loss will also be offset by a net gain in habitat in the medium to long term, hence the objectives of the Recovery Plan are met.

The proposal is slightly inconsistent with the draft Recovery Plan for the Grey-headed Flying-fox as it will see some minor loss of generic potential habitat, however as this habitat is not of any specific importance, and no barriers to movement created, it is not capable of significantly affecting the objectives of the Plan. Furthermore, this habitat loss will be restored in the medium to long term.

For all other species, the proposal to remove vegetation from the site by strict interpretation could be considered as adding to the main threatening process affecting these species (habitat loss), and hence is inconsistent with the recovery of these species. However, given the relatively marginal quality of the habitat to be affected, the minor area of habitat to be removed, the extent of habitat retained and to be re-created on the site, current maintenance regime in the absence of the development, and the abundance of similar habitat on adjacent land and in the locality; the loss is considered to be insignificant to the long term recovery of these species or the *Littoral Rainforest* EEC.

(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 TSCA 1995 defines a "*threatening process*" as "*a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities"*. Loss and fragmentation of habitat due to urban, residential and rural development is a recognised threat to these species (Smith *et al* 1995, Lindenmayer and Fisher 2006, Johnson *et al* 2007, Smith *et al* 1995, Gibbons and Lindenmayer 2002, OEH 2015b, NPWS 1999b, Watson *et al* 2003, Gilmore and Parnaby 1994, NPWS 2003b, etc.). The proposal thus generically qualifies as a class of activity that is considered a threatening process.

For all of the subject species and the EEC, the proposal will or may contribute (to varying extents) to the following Key Threatening Processes:

Table 20: Key threatening processes

KTP	Extent/Manner Which Proposal Affects KTP	Mitigable?
Clearing of native vegetation (NSWSC 2001c).	Removal of native trees over portions of the site	Tree loss to be offset at 1:5 replacement planting in E2 zone under VMP.
Loss of hollow-bearing trees (NSWSC 2007)	Potential loss of 15 hollow-bearing trees	Replacement nest boxes recommended but limited life span, and limited vegetation on site to erect.

KTP	Extent/Manner Which Proposal Affects KTP	Mitigable?
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants (NSWSC 2011)	New residents may dump garden clippings which would have the potential to invade the retained swamp forest on site	Yes – weed control will be undertaken, managed under a VMP.
Human caused climate change (NSWSC 2000d).	As above and generation of greenhouse gasses by machinery during construction.	As above.

9.0 EPBC Act - MNES Assessment

9.1. General Assessment Overview

The provisions of the EPBCA 1999 require determination of whether the proposal has, will or is likely to have a significant impact on a "*matter of national environmental significance"*. These matters are listed and addressed in summary as follows:

1) **World Heritage Properties**: The site is not listed as a World Heritage area nor does the proposal affect any such area.
2) **National Heritage Places**: The site is not listed as a National Heritage Place nor does the proposal affect any such area
3) **Ramsar Wetlands of International Significance**: A Ramsar wetland does not occur on the site, nor does the proposal affect a Ramsar Wetland.
4) **EPBCA listed Threatened Species and Communities**: The Grey-Headed Flying Fox (Vulnerable) and Koala (Vulnerable) are considered potential occurrences on the site. As detailed in section 9.2, these species are not considered at risk of a significant impact.
5) **Migratory Species Protected under International Agreements**: No Migratory species is likely to be significantly affected by the proposal as assessed below.
6) **The Commonwealth Marine Environment (CME)**: The site is not within the CME nor does it affect such
7) **The Great Barrier Reef Marine Park:** The proposal does not affect the Great barrier Reef Marine Park.
8) **Nuclear Actions**: The proposal is not a nuclear action.
9) **A water resource, in relation to coal seam gas development and large coal mining development**: The proposal is not a mining development.

The proposal thus is not considered to require referral to Department of Environment (DotE) for approval under the EPBCA.

9.2. Koala Referral Assessment

The DotE have prepared the *EPBC Act Referral Guidelines For The Vulnerable Koala* (DotE 2014). These guidelines are intended to provide tools to objectively assess the likelihood of a proposal having a significant effect and hence requiring referral.

The habitat on site has been assessed using the Koala habitat assessment tool from the Referral Guidelines (DotE 2014) for Koalas in the coastal zone. To qualify as critical habitat, it must score 5 or more. As shown in the following table, the site just qualifies as critical habitat:

Table 21: Critical Koala habitat identification assessment

Attribute	Criteria	Assessment	Score
Koala occurrence	**High (2):** Evidence of one or more Koalas within the last 2 years. **Medium (1):** Evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years. **Low (0):** None of the above.	**Desktop**: OEH Bionet does not show any records of the Koala within 2km of the site. Not recorded on adjacent land by previous surveys. **On-ground**: Scat searches, call detection and spotlighting were carried out during recent and previous surveys. No sightings or evidence of Koalas were found on site.	0
Vegetation structure and composition	**High (2):** Has forest or woodland with 2 or more known Koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata. **Medium (1):** Has forest or woodland with only 1 species of known Koala food tree present. **Low (0):** None of the above.	**Desktop**: CHCC vegetation mapping of site and adjacent forest as mainly dry sclerophyll forest dominated by Pink Bloodwood, Brushbox, Blackbutt and Broad-leaved Paperbark. **On-ground**: Swamp Mahogany is one of the most common species on site. Tallowwood less common.	2
Habitat connectivity	**High (2):** Area is part of a contiguous landscape ≥ 500ha. **Medium (1):** Area is part of a contiguous landscape <500ha, but ≥300ha. **Low (0):** None of the above.	Site is part of a localised modified landscape that is relatively connected to larger remnant patches of vegetation north and south which is separated from Wedding Bells State Forest by the Pacific Highway to the west. The Pacific Highway is a major barrier but underpasses are provided for the Koala, hence including State Forest to west, this qualifies as “high”	2

Attribute	Criteria	Assessment	Score
Key existing threats	**High (2):** Little or no evidence of Koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for Koala occurrence. Areas which score 0 for Koala occurrence and have no dog or vehicle threat present	Lack of Koala records within 2km, however risk of dog attack and vehicle strike due to keeping of dogs by adjacent residents and Arrawarra Beach Rd bisects a local corridor.	1
	Medium (1): Evidence of infrequent or irregular Koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for Koala occurrence, **OR** Areas which score 0 for Koala occurrence and are likely to have some degree dog or vehicle threat present.		
	Low (0): Evidence of frequent or regular Koala mortality from vehicle strike or dog attack in the study area at present, **OR** Areas which score 0 for Koala occurrence and have a significant dog or vehicle threat present.		
Recovery value	**High (2):** Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	Site is a relatively small area of highly modified urban woodland with no existing Koala population and no significant value as a corridor.	0
	Medium (1): Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.		
	Low (0): Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.		

Attribute	Criteria	Assessment	Score
		Total:	5

As the site qualifies as critical habitat, the next step is to determine if the proposal is likely adversely affect this habitat and/or interfere substantially with the recovery of the Koala and require referral to the Minister.

The following table derived from the Koala Referral Guidelines (DotE 2014) assesses whether the proposal is likely to adversely affect habitat critical to the survival of the Koala and hence requires referral to the DotE.

Table 22: Critical habitat impact assessment

Factor	Y/N	Reason
Does impact area contain habitat critical to the survival of the Koala	Y	Site scores 5 as per the Koala habitat assessment tool
Do the areas proposed to be cleared contain known Koala food trees	Y	Habitat to be removed contains known Koala food tree species which are not used.
Are you proposing to clear<2ha of habitat containing known Koala food trees in an area with a habitat score of ≤5	Y	Proposal will remove 1.8ha of habitat containing up to 10 Schedule 2 primary browse species.
Are you proposing to clear >20ha of habitat containing known Koala food trees in an area with a habitat score of ≥8	N	Proposal will remove 1.8ha of habitat containing 11 primary browse species.
Outcome	**Referral is not recommended** under the DotE (2014) Referral Guidelines as it does not reach the specified threshold.	

This assessment has determined that the proposal is unlikely to lead to a significant impact. Thus a referral to DotE for the Koala is not required.

9.2.1. Protected Species Assessments

The following EPBCA threatened species are considered potential occurrences and require assessment:

- Grey-headed Flying-fox (Vulnerable)
- Eastern Curlew (Critically Endangered)

9.2.1.1. Factors to be Considered for a Vulnerable/Endangered Species:

The guidelines to assessment of significance to this Matter, define an action is as likely to have a significant impact on a Vulnerable or Endangered species, if it will:

a) Lead to a long-term decrease in the size of an important population (Vulnerable) or population (Endangered) of a species, or:

b) Reduce the area of occupancy of an important population (Vulnerable) or population (Endangered), or:

c) Fragment an existing important population (Vulnerable) or population (Endangered) into two or more populations, or:

d) Adversely affect habitat critical to the survival of a species, or:

e) Disrupt the breeding cycle of an important population (Vulnerable) or population (Endangered), or:

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

g) Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to a Vulnerable or Endangered species, becoming established in the Vulnerable and/or Endangered species' habitat, or:

h) Introduce a disease that may cause a species to decline, or:

i) Interferes substantially with the recovery of the species.

An *important population* is one that is necessary for a species' long-term recovery. This includes such populations as:

- Key populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity, and or:
- Populations that are near the limit of the species range:

9.2.1.2. Assessment of Significance

This section addresses each of the previous points listed.

For the purposes of discussion, the "*important population*" of Grey-headed Flying-foxes is defined as that population of the species likely to depend on colonial roosts in the locality (e.g. Woolgoolga), or within foraging range of the site/study area.

The population of the migratory Eastern Curlew would be those birds potentially foraging within mangrove habitats within the study area.

a) Lead to a long-term decrease in the size of an important population (Vulnerable) or population (Endangered) of a species, or:

Grey-headed Flying-fox:

In the context of the species ecology, the site provides an extremely minute area of foraging habitat. It is not known nor considered suitable as roosting habitat for the species, thus no such areas are affected by the proposal.

The proposal will require the removal of an estimated 30 trees which relative to the requirements of the important population, provides only an extremely small fraction of their nectar resource. While in very strict terms a negative effect, this loss will have a very low impact on the local Grey-headed Flying Fox population as the site in total would only form a very minute fraction of this species wider

opportunistic/seasonally variable foraging range. The site is also not known or considered suitable as a roost (Eby 2000) and better quality alternative foraging habitat in the locality is evidently extensive. The proposal will thus not lead to a long-term decrease in the size of an important population.

Eastern Curlew:

The Eastern Curlew is only likely to occur in less visited and more sheltered portions of the adjacent estuaries due to its shyness and to avoid dogs. Habitat use would only be as foraging by 1-2 birds as part of seasonal occurrence in the local area.

The proposal will not directly impact potential habitat, nor see a significant change in human and dog activity given current levels. No physical or behaviour barrier will be created to access the nearby habitats; nor will the proposal affect prey abundance or diversity. Hence the proposal has no potential to impact the size of any population of this species.

b) Reduce the area of occupancy of an important population (Vulnerable) or population (Endangered), or:

Grey-headed Flying-fox:

The area of occupancy of the local population of the Grey-headed Flying-fox would extend well beyond the confines of the site (as their ecology indicates an area of occupancy is likely to be tens if not hundreds of thousands of hectares – Eby 2000a, 2000b, Eby and Lunney 2002, Eby 2002).

As mentioned previously, establishment of the proposal may require the removal of an estimated 50 potential food trees within a modified woodland, which offer generic potential forage for the Grey-headed Flying-fox. This loss is only a minor fraction of the potential habitat remaining in the study area. In this context, and in the context of the species' area of occupancy as discussed above, the proposal will reduce only a very small portion of the habitat available to an important population. Furthermore, the species is known to readily use habitat within urban areas indicating usage of highly modified habitat and adjustment to high levels of human presence (e.g. Smith 2002, Eby 2002, Parry-Jones 2006).

Eastern Curlew:

As noted in (a), the potential for this species to occur in the study area will remain as current, hence the proposal will not impact the area of occupancy.

c) Fragment an existing important population (Vulnerable) or population (Endangered) into two or more populations, or:

The Grey-headed Flying Fox are highly mobile and known to be capable of crossing human-modified habitat (personal observations, Eby 2002, Parry-Jones 2006, Smith 2002). The proposal will thus offer no barrier to movement and hence will not fragment an existing important population of this species.

Similarly, the Eastern Curlew is an international migratory bird. The proposal will not risk fragmentation of an existing population of this species.

d) Adversely affect habitat critical to the survival of a species, or:

According to the MNES guidelines, "*critical habitat*" refers to areas critical to the survival of a species or ecological community and may include areas that are necessary for/to:

- Activities such as foraging, breeding, roosting or dispersal.
- Succession.
- Maintain genetic diversity and long term evolutionary development, or
- Reintroduction of populations or recovery of the species/community.

As mentioned previously, the study site/area is not known roosting habitat for the Grey-headed Flying Fox, nor is any significant extent of potential or known foraging habitat affected by the proposal. Post-development in the medium to long term, the site will retain its essential capacity to support foraging by the Grey-headed Flying Fox as part of the important population's range due to the habitat offset requirements. Hence the proposal is not considered likely to affect the viability of an important population.

As noted in (a), the potential for this species to occur in the study area will remain as current as its habitat will remain in its current extent and condition, under a similar disturbance regime, hence the proposal will not affect critical habitat above the current levels of impact.

e) Disrupt the breeding cycle of an important population, or:

The proposal will not disrupt the breeding cycle of an important population/population given that:

- The site/study area do not represent potential or known breeding habitat for the subject species;
- The potential for these species to occur on the site/in the study area will be retained post development;
- The site/study area potentially only forms a minute part of their local range, and hence lifecycle requirements.
- Alternative potential habitat in the locality is extensive.

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

As detailed previously, the degree of possible vegetation loss imposed by the proposed development is not significant enough to affect the local population of the subject species to the point that it could cause a decline of the Grey-headed Flying Fox.

As noted in (a), the potential for this species to occur in the study area will remain as current, hence the proposal will not lead to loss of habitat for this species.

g) Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to an Endangered species, becoming established in the Vulnerable and/or Endangered species' habitat, or:

No new species that affects the subject species is likely to be introduced as a direct result of the proposed works.

h) Introduce disease that may cause a species to decline, or:

No disease that poses a potential risk to the species is likely to be introduced to the site.

i) Interferes substantially with the recovery of the species.

Ideally, the goal in threatened species recovery is to increase the number and extent of the threatened species, so that it is not in risk of becoming extinct.

As detailed previously, the proposal will result in the modification of a relatively minute area of potential foraging habitat that is not significant enough to interfere with the recovery of the Grey-headed Flying Fox.

Similarly, as the potential for this species to occur in the study area will remain as current, hence the proposal will not interfere substantially with the recovery of the species.

9.2.2. Conclusion

The proposal is not considered likely to have a significant impact on the Grey-headed Flying-fox.

9.3. Migratory Species

Three migratory species have been recorded in the study area to date (Umwelt 2004): White-throated Needletail, Osprey and Rainbow Bee-eater. The site/study area also offers potential habitat for a number of species such as the Great Egret and Satin Flycatcher. These species are collectively assessed below.

9.3.1. Factors To Be Considered

The guidelines to assessment of significance to this Matter, define an action as likely to have a significant impact on a migratory species, if it will:

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

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

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

An important area of habitat is:

1. Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or:
2. Habitat utilised by a migratory species which is at the limit of the species range, or;
3. Habitat within an area where the species is declining.

9.3.2. Assessment of Significance

This section addresses each of the previous points listed.

The site and study area is not considered likely to constitute an important area of habitat on the basis of the following:

1. The site and study area site is not of sufficient extent to support an ecologically significant proportion of any of the above listed species (at most, only a small group or transient individuals). This value of the habitat is as a fraction of a significant extent of similar habitat not only in the LGA, but the North Coast Bioregion.
2. While some migratory species occurring in the locality may be at the limits of their range, no such species were recorded in the survey area.
3. If the site and study area was located at the limits of a species whose abundance and range is declining, it would not be considered significant as such habitat is locally abundant in the area, and habitat with greater capability occurs within 10km e.g. State Forest, conservation reserves, etc.

In regards to point (**a**): The proposal does not affect important habitat (as detailed above). Occurrence of the subject species on site/study area is considered most likely to be as a short term seasonal forager with the site constituting a small part of their large seasonal nomadic range. The value of habitat on the site/study area is as a minor fraction of the significant area of potential habitat in the LGA and the North Coast Bioregion.

In regards to point (**b**): An invasive species is one that may become established in the habitat, and harm the migratory species by direct competition, modification of habitat, or predation. The proposal will not introduce any such invasive species.

In regards to point (**c**): No disruption of the lifecycle of any migratory bird is likely as:

- Habitat affected is either only marginally suitable, and/or locally abundant i.e. pasture and open woodland.
- No significant nesting/breeding habitat is affected.
- No significant extent of potential or known foraging habitat will be affected.

In view of the above, no migratory bird is considered likely to be significantly affected by the proposal.

10.0 Conclusion

The study site overall has evidently been subject to a significant disturbance history, which has seen original vegetation modified into an urban woodland with maintenance and landuse effectively preventing regeneration and progressively reducing habitat support values.

Surveys detected the Grey-headed Flying Fox and Hoary Bat on site, and the Osprey flying by; and tentative call identification of the East-coast Freetail Bat and Eastern False Pipistrelle. In consideration of the habitat types present and local records, 14 other NSW listed threatened species were considered at least low potential occurrences using habitat in the study area as part of a wider range.

The development proposal, which involves a residential subdivision over the site, will have a range of negative impacts on the capacity of the study area to support the recorded and potential threatened species, as it will remove known and potential foraging habitat and key habitat components including tree hollows. While these are negative impacts, no threatened species is known or considered likely to depend on the site for critical stages of its lifecycle.

Overall, the proposal will have a net negative impact due to incremental and cumulative loss of habitat associated with the development. However due to the ecology of the subject species; habitat limitations of the site; extent of adjacent habitat present; and that all the subject species are likely to depend on adjacent habitat for their viability: the proposal is not considered likely to result in impacts of sufficient order of magnitude to place a local viable population at risk of extinction.

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12.0 Appendix 1: TSC Act – Seven Part Test Eligibility

A1.0 Potential Occurrence Assessment

The following tables are used as a summary to address threatened species (as detailed below) in terms of potential occurrence, and likelihood of being significantly affected by the proposal, and hence requiring formal 7 Part Test assessments. Threatened species have been assessed if it is:

a) Recorded on-site;

b) Not recorded on site, but recorded within a 10km radius (the locality), and may occur to some degree on-site or in the study area (land within 100m of site) due to potential habitat, key habitat component, etc.;

c) Not recorded in the locality as yet, but recorded in the bioregion, and thus may occur in the locality, and possibly to some extent, may occur on the site, due to potential habitat.

The "*habitat requirements*" column is derived from the previously listed references. Likelihood of occurrence is based on the probability of occurrence in terms of:

- Habitat extent (e.g. sufficient to support an individual or the local population; comprises all of home range; forms part of larger territory, etc.); quality (i.e. condition, including an assessment of threats, historical land uses on and off-site, and future pressures); interconnectivity to other habitat; and ability to provide all the species life-cycle requirements (either the site alone, or other habitat within its range);
- Occurrence frequency (i.e. on-site resident; portion of larger territory; seasonal migrant or transitory opportunist and thus when and how often, etc.)
- Usage ie breeding or non-breeding; opportunistic foraging (e.g. seasonal, migratory or opportunistic); marginal fringe of core range; refuge; roosts; etc.

An indicative 1-5 scale used by the author to indicate the likelihood of the species to potentially occur in the habitat on the study sites (if they have not been recorded in the locality) is as follows:

- 0: *Unlikely* (<1% probability) - no potentially suitable habitat; too disturbed; or habitat is very poor. No or few records in region or records/site very isolated eg by pastoral land, urbanisation, etc.
- 1: *Low* (1-10%)- few minor areas of potential habitat; highly modified site/habitat; or few habitat parameters present, but others absent or relatively insignificant (sub-optimum habitat). Usually very few records in locality.
- 2: *Fair* (11-25%) - some significant areas of potential habitat, but some habitat parameters limited. Potential for occasional foraging eg from nearby more optimal areas or known habitat. Records at least within 10-15km radius of site.
- 3: *Good* (26-50%) - significant abundance of habitat parameters/areas of habitat, and more locally e.g. adjacent. Potential part of larger territory, but probably unable to support breeding in isolation. Recorded within 10km in similar habitat/environs.

- 4: *Moderate* (51-75%) - quite good potentially suitable habitat on and adjacent to the site, and/or good quality and abundance of some vital habitat parameters. Records within <10km, or adjacent to site, or adjacent to high quality habitat where species likely to occur.
- 5: *High* (>75%) - very good to optimum habitat occurring on or adjacent to the site (support breeding pair or population). Recorded within 5-10km of site in same or similar habitat.

The "*Assessment of Significance*" column is based on consideration of the habitat on-site, likelihood of occurrence, and consideration of the DECC guidelines for assessment under the 7 Part Tests (DECC 2007). Recognising that some species with very large ranges or varying tolerances to habitat modification, some species which may have low potential to occur in the study area and will obviously not be significantly affected by the proposal will not be formally assessed to avoid production of superfluous information. Rather these species are assessed in the final column with justification for this assessment. However, recognising that significance is open to interpretation, the decision on whether a species is formally assessed or not by the 7 Part Tests in this assessment is based on the following rules:

a) If there is *any* justifiable risk, based on consideration, of a significant impact as a result of direct or indirect impacts, a 7 Part Test is required (ie the Principle of Uncertainty is applied).

b) Any threatened species recorded on-site or in the study area, or of at least fair chance of occurrence on-site in terms of potential habitat, is **automatically** selected for the 7 part Tests, unless the proposal has no effect (justification provided).

A1.1 Flora

Searches of relevant literature and databases (OEH/Bionet 2015a) found records of the following threatened flora species in the locality.

Table 23: Eligibility for Seven Part Test Assessment - Flora

Species	Legal Status	Habitat Requirement	No. of records	Likelihood of Occurrence and Impact Significance	7 Part Test Required?
Scented Acronychia (*Acronychia littoralis*)	E-TSCA, E-EPBCA	An understorey tree found in littoral rainforest on sand. Recorded on Bare Point, Hastings, Kempsey, Nambucca, Macksville, Ballina, Tweed, Byron, Bellingen and Coffs Harbour databases.	1	Highly modified habitat – not found by targeted survey. Unlikely to occur.	Unlikely to occur – no risk of significant impact hence 7 Part Test not required.
Dwarf Heath Casuarina (*Allocasuarina defungens*)	E-TSCA E-EPBCA	A straggly oak about 2m high with blue-green foliage found in heath on sand (sometimes clay and sandstone soils), and swamp sclerophyll forest margins.	1	No suitable habitat – unlikely to occur.	No impact on known population or likely habitat. 7 Part Test not required.
Hairy-joint Grass *(Arthraxon hispidus)*	V-TSCA V-EPBCA	A grass found in (or is likely to occur in) rainforest, wet sclerophyll forest, some dry sclerophyll forest and swamp paperbark forests and at no particular altitude. May occur in pasture adjacent to such habitats usually in shaded areas, often near creeks and swamps. Variable geology and various, mainly richer loams soils are favoured. Range extends from south of Gold Coast to Kempsey coastally and in northern tablelands.	1	No suitable habitat – unlikely to occur.	Unlikely to occur and unsuitable habitat, hence no risk of significant impact. No Seven Part Test required.
Orara Boronia (*Boronia umbellata*)	V-TSCA V-EPBCA	A shrub recorded in “scrub” in the Coffs Harbour locality. It grows as an understorey shrub in and around gullies in wet open forest.	2	No suitable habitat – unlikely to occur.	No impact on known population or likely habitat. 7 Part Test not required.

Species	Legal Status	Habitat Requirement	No. of records	Likelihood of Occurrence and Impact Significance	7 Part Test Required?
Lindsaea incisa	V-TSCA	A ground fern found in damp sandy places and open forest. Light green fronds are up to 30cm long. Preferred habitat is dry eucalypt forest on sandstone and moist shrubby eucalypt forest on metasediments. Usually found in waterlogged or poorly drained sites along creeks, where ferns, sedges and shrubs grow thickly	10	No suitable habitat – unlikely to occur.	No impact on known population or likely habitat. 7 Part Test not required.
Rough-shelled Bush Nut (*Macadamia tetraphylla*)	V-TSCA V-EPBCA	Small to medium-sized tree growing up to 18m tall found in subtropical rainforest and notophyll vine forest; often on steep slopes on the ecotone, usually near the coast. Confined chiefly to the Richmond and Tweed Rivers, and southeast Qld. Recorded in Lismore, Tweed, Ballina and Byron LGAs	1	No suitable habitat – unlikely to occur.	No impact on known population or likely habitat. 7 Part Test not required.
Maundia triglochinoides	V-TSCA	An aquatic herbaceous plant found in swamps or shallow fresh water on heavy clay on the north and central NSW coast. Recorded on Hastings, Port Stephens, Richmond Valley and Kempsey databases.	13	No suitable habitat – unlikely to occur.	No impact on known population or likely habitat. 7 Part Test not required.
Southern Swamp Orchid (*Phaius australis*)	E-TSCA, E-EPBCA	Are orchids that generally grows in *Melaleuca quinquenervia* swamps on the coast or at sea level, as well as littoral rainforest, dunes (including stabilised dunes), riparian forests (including gallery rainforests), swamp forests, swamps (including marshes and intermittent wetlands), mainly at low altitudes. Sandy alluvium is the favoured geology and sandy, damp to humic soils are favoured. Both recorded in Byron LGA, Richmond Valley LGA, Tweed LGA, and Ballina LGA.	1	No suitable habitat – unlikely to occur.	No impact on known population or likely habitat. 7 Part Test not required.

Species	Legal Status	Habitat Requirement	No. of records	Likelihood of Occurrence and Impact Significance	7 Part Test Required?
Coastal Headland Pea (*Pultenaea maritima*)	V-TSCA	A prostrate, mat-forming shrub, which occurs in grasslands, shrublands and heath on exposed coastal headlands. Only recently described and was previously considered a prostrate maritime form of Pultenaea villosa. Occurs in New South Wales and Queensland and has been recorded from Newcastle north to Byron Bay on 16 headlands. Recorded at Lake Macquarie, Coffs Harbour, Evans Head and Byron Bay. Recorded in the Tweed Heads and Richmond Valley LGA.	8	No suitable habitat – unlikely to occur.	No impact on known population or likely habitat. 7 Part Test not required.
Rusty Plum (*Niemeyera whitei*)	V-TSCA	Small to medium sized tree with leaves 5-15cm long and 2-5cm wide. Found in littoral and warm-temperate rainforest, as well as riparian and gully vegetation. Generally found on less fertile soils derived from metasediments or rhyolite. Recorded on coast up to at least 700m AS:in the Nambucca LGA, Lismore LGA, Clarence Valley LGA, Byron LGA, Bellingen LGA, Tweed LGA, Ballina LGA and Coffs Harbour LGA.	8	No suitable habitat – unlikely to occur.	No impact on known population or likely habitat. 7 Part Test not required.
Silverbush (*Sophora tomentosa*)	E-TSCA	A coastal shrub that occurs on recent sands on frontal coastal dunes northwards from Port Stephens. Port Macquarie has the largest known population eg Shelley and Nobby's Beaches. Recorded on Kempsey, Hastings LGA, Coffs Harbour LGA, Clarence Valley LGA, Tweed LGA and Bare Point databases.	1	No suitable habitat – unlikely to occur.	No impact on known population or likely habitat. 7 Part Test not required.

A number of other species (see table below) are known or considered potential occurrences within the locality. However due to a number of factors, these species were not considered potential occurrences on site. Thus the proposal is not considered to have a significant impact on the viability of any local population of the subject species and Seven Part Test evaluation was not required.

Table 24: Threatened flora unlikely to occur

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
Dry Sclerophyll Open Forest Woodland	*Acacia ruppii*	X		X
	Ancistrachne maidenii	X		X
	Angophora inopina	X		X
	Angophora robur	X		X
	Babingtonia prominens	X		X
	Banksia conferta subsp. Conferta	X		X
	Bertya sp.(Chambigne NR, M Fatemi 24)	X		X
	Bertya ingramii	X		X
	Bertya sp. Cobar-Coolabah	X		X
	Boronia hapalophylla	X		X
	Caesia parviflora var. minor	X	X	X
	Chiloglottis anaticeps	X		X
	Diuris venosa	X	X	X
	Diuris disposita	X		X
	Diuris pedunculate	X	X	X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Diuris praecox	X	X	X
	Dillwynia tenuiflora		X	X
	Eucalyptus tetrapleura	X	X	X
	Grevillea banyabba	X		X
	Grevillea beadleana	X		X
	Grevillea caleyi	X	X	X
	Grevillea quadricuada	X		X
	Hakea archaeoides	X		X
	Hakea trineura	X		X
	Hibbertia superans	X		X
	Leucopogon confertus	X		X
	Lindsaea incisa	X		X
	Macrozamia johnsonii	X		X
	Melichrus hirsutus	X		X
Rainforest Wet Sclerophyll Forest Riparian	*Olax angulata*	X		X
	Philotheca obovatifolia	X		X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Polygala linariifolia	X		X
	Corybas dowlingii	X		X
	Dracophyllum macranthum	X		X
	Acacia chrysotricha	X	X	X
	Acalypha eremorum	X	X	X
	Acronychia littoralis	X		X
	Amorphospermum whitei	X		X
	Archidendron hendersonii	X		X
	Arthraxon hispidus	X		X
	Arthropteris palisotii	X		X
	Boronia umbellata	X		X
	Calophanoides hygrophiloides	X		X
	Corynocarpus rupestris subsp. Rupestris	X		X
	Dendrocnide moroides	X		X
	Desmodium acanthocladum	X		X
	Diospyros mabacea	X		X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Diploglottis cambelli	X		X
	Eidothea hardeniana	X		X
	Endiandra floydii	X		X
	Endiandra hayesii	X		X
	Eucalyptus tetrapleura	X	X	X
	Gingidia montana	X		X
	Grammitis stenophylla	X		X
	Grevillea guthrieana	X	X	X
	Haloragis exalata subsp. velutina.	X		X
	Harnieria hygrophiloides	X		X
	Lindsaea brachypoda	X		X
	Macadamia tetraphylla	X		X
	Marsdenia longiloba	X	X	X
	Olearia flocktoniae	X	X	X
	Peristeranthus hillii	X	X	X
	Phyllanthus microcladus	X		X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Plectranthus nitidus	X		X
	Pomaderris queenslandica	X		X
	Psilotum complanatum	X		X
	Quassia sp. Moonee Creek	X		X
	Sarcochilus dilatatus	X		X
	Sarcochilus fitzgeraldii	X		X
	Sarcochilus hartmannii	X		X
	Siah's Backbone (Streblus pendulinus/brunonianus)		X	X
	Syzygium paniculatum	X		X
	Tinospora smilacina	X		X
	Tinospora tinosporoides	X		X
	Triplarina imbricata (formerly Baeckea camphorata)	X	X	X
Swamp Forest Aquatic Freshwater Wetland Estuarine	*Tylophora woolsii*	X		X
	Typhonium sp. aff. brownii	X		X
	Dendrobium melaleucaphilum	X		X
	Oberonia titania	X		X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Uromyrtus australis	X		X
	Alexfloydia repens	X		X
	Cyperus aquatilis	X		X
	Eleocharis tetraquetra	X		X
	Phaius tancarvilleae	X	X	X
	Melaleuca biconvexa			X
	Melaleuca tamariscina ssp irbyana	X		X
Heathland Shrubland Grasslands	*Allocasuarina defungens*	X		X
	Allocasuarina simulans	X		X
	Sophora tomentosa subsp. australis	X		X
	Babingtonia silvestris	X		X
	Centranthera cochinchinensis	X		X
	Chamaesyce psammogeton	X		X
	Diuris sp. aff. chrysantha	X		X
	Lindernia alsinoides	X		X
	Phaius australis	X		X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Rotala tripartita	X		X
	Elyonurus citreus	X		X
	Eucalyptus approximans	X		X
	Glycine clandestina (Broad leaf form)	X		X
	Pimelea spicata	X	X	X
	Rutidosis heterogama	X		X
	Zieria prostrata	X		X
Various Habitats, Miscellaneous, Other.	*Pultenaea maritima*	X		X
	Cryptostylis hunteriana *(Leafless Tongue Orchid)*	X	X	X
	Galium australe *(Tangled Bedstraw)*	X	X	X
	Zieria prostrata	X		X
	Zieria smithii	X		X
	Hibbertia hexandra	X	X	X
	Neoastelia spectabilis	X		X

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
	Zieria lasiocaulis	X		X
	Kennedia retrorsa	X		X
	Tetratheca juncea	X	X	X
	Prostanthera spnosa	X		X
	Senecio spathulatus	X		X
	Styphelia perileuca	X		X

A1.2 Fauna

As previously noted in section 4, a significant number of threatened fauna have been recorded in the locality, and a number of others are considered potential occurrences by the consultant. In the table below, these species are evaluated for their potential to occur on the site; significance of the proposal to this potential occurrence; and thus their eligibility/requirement for Seven Part Test assessment.

Table 25: Eligibility for Seven Part Test Assessment – Fauna

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Brown Treecreeper (*Climacteris picumnus*) eastern subspecies	1	V-TSCA	Medium-sized insectivorous bird occupying eucalypt woodlands, particularly open woodland lacking a dense understorey. Sedentary and nests in tree hollows within permanent territories, breeding in pairs or communally in small groups (Noske 1991). Birds forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae (Noske 1979). Distributed through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys, Coffs Harbour and Great Lakes Shire.	No suitable habitat. records. Unlikely to occur. No risk of impact, hence 7 Part Test not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Grey-Crowned Babbler (*Pomatostomus temporalis temporalis*) eastern subspecies	1	V-TSCA	Occupies open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. Builds conspicuous dome-shaped nests and breeds co-operatively in sedentary family groups of 2-13 birds (Davidson and Robinson 1992). Insectivorous and forage in leaf litter and on bark of trees. Occurs on the western slopes and plains but less common at the higher altitudes of the tablelands. Isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (Blakers *et al.* 1984, Schodde & Mason 1999).	No suitable habitat. records. Unlikely to occur. No risk of impact, hence 7 Part Test not required.
	Powerful Owl (*Ninox strenua*)	7	V-TSCA	Wet and dry sclerophyll forests. Nests in tree hollows. Requires high diversity and abundance of medium-sized arboreal prey. Very large territory (500-5000ha).	The site contains some marginal foraging opportunities however lacks suitable nesting hollows. Low prey abundance and diversity on the site. Very low to unlikely to occur. Proposal highly unlikely to impact given limited habitat loss and extent of higher quality habitat locally. No loss of potential nest trees. Impact insignificant. Seven Part Test not required

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Masked Owl (*Tyto novaehollandiae*)	2	V-TSCA	Eucalypt forest and woodlands with sparse understorey. Nests in tree hollows. Requires high diversity and abundance of prey 200-600g weight. Large territory.	As for Powerful Owl.
	Sooty Owl (*Tyto tenebricosa*)	1	V-TSCA	Rainforest and tall, moist eucalypt forest. Nests in tree hollows. Requires high diversity and abundance of medium-sized arboreal prey. Large territory.	Site is not suitable habitat. Recorded locally however unlikely to occur on or in close proximity to site. No risk of impact, hence 7 Part Test not required.
	Barking Owl (*Ninox connivens*)	0	V-TSCA	Well-forested hills and flats, eucalypt savannah (especially), and riverine woodland in coastal and subcoastal areas. Prefers hunting in more open country for mammals (rabbits, rats, mice, small bats and small marsupials) and birds (small up to Frogmouths and Magpies). Large territories. Nest in hollows.	No typical habitat in study area and no local records, hence unlikely to occur. No risk of impact, hence 7 Part Test not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Square-tailed Kite (*Lophoictinia isura*)	3	V-TSCA	Open forests and woodlands in coastal and sub-coastal areas. Forages low over, or in, canopy for eggs, nestlings, passerines, small vertebrates and invertebrates. Large home range (>100km^2). Observed foraging in residential areas of Port Macquarie. Large stick nest in high fork of living tree. Breeds July-December. Lays 2-3 eggs with 1-2 birds fledging after 100days. Appears to be adapting to an abundance of passerines in well-vegetated outer fringes of cities. Probably migrates to northern Australia in winter. (Debus 1998, NSW NPWS 2000)	Site offers some low quality generic potential habitat, and foraging opportunities. Considered low to fair chance of occurrence at some stage in study area. Proposal highly unlikely to detectably impact given limited habitat loss and extent of higher quality habitat locally. Impact clearly insignificant but **7 Part Test required** as fair potential to occur.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Little Eagle (*Hieraaetus morphnoides*)	1	V-TSCA	Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland, sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. It eats birds, reptiles and mammals, occasionally adding large insects and carrion (Marchant and Higgins 1993; Aumann 2001b; Debus et al. 2007). It is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment (Marchant and Higgins 1993). It occurs as a single population throughout NSW.	Low prey abundance and diversity on the site, and this bird is not recorded in such modified habitats. Very low to unlikely to occur. Proposal highly unlikely to impact given limited habitat loss and extent of higher quality habitat locally. No loss of potential nest trees. Impact insignificant. Seven Part Test not required

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
BIRDS	Eastern Osprey (*Pandion cristatus*)	23	V-TSCA	Fish (mostly Mullet) and carrion eater. Forages along coastal rivers, lakes, beaches, creeks and inlets. Tall, dead tree for staging or feeding roost. Nests on exposed tree within 2km of water, but rarely adjacent, and with access to Paperbark or Swamp Oak for nest material. Breeds April-Sept. (Clancy, 1991)	Adjacent creek offers good foraging habitat – observed fly-over. No nests or nesting opportunities on site. Recorded within 1km of site at Arrawarra Headland. Proposal highly unlikely to detectably impact given limited habitat loss and extent of higher quality habitat locally. Impact clearly insignificant **but 7 Part Test** required as observed in study area

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Spotted Harrier (*Circus assimilis*)	0	V-TSCA	Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant and Higgins 1993; Aumann 2001a). It is found mostly commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The species builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Diet includes terrestrial mammals, birds and reptiles, occasionally large insects and rarely carrion (Marchant and Higgins 1993; Aumann 2001b). Many of the remaining key prey species (e.g. terrestrial grassland birds such as quail, button-quail, pipits, larks and songlarks) require ground cover and are sensitive to habitat degradation from grazing (Marchant and Higgins 1993).	General area including site largely unsuitable with low prey abundance and no local records. Unlikely to occur. No risk of impact, hence 7 Part Test not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Regent Honeyeater (*Xanthomyza phrygia*)	0	E-TSCA, E-EPBCA	Nomadic, may move coastwards in late summer. Inhabits temperate eucalypt woodlands and open forest, including forest edges, woodland remnants on farmland and urban areas. Also uses *Casuarina cunninghamiana* gallery forests. Requires reliable and ample nectar supplies to support semi-permanent (core breeding) habitat. Favoured nectar sources are *E. sideroxylon, E. albens, E. melliodora, E. leucoxylon, E. robusta, E. planchoniana*, and heavy infestations of mistletoe. Also take insects and orchard fruits. Coastal forests of Swamp Mahogany or Spotted Gum an important drought refuge. Preference for large emergent trees. Breeds in pairs or small colonies in open woodland/forest and occasionally more disturbed woodland near housing and farmland, depending on food availability, from August-January. Breeding less likely to occur if nectar flows are low or unreliable, or heavy competition with more aggressive honeyeaters eg Noisy Miner, Red Wattlebirds and Noisy Friarbirds. (Menkhorst *et al* 1999)	Not recorded locally and considered at best very low potential to occur on site due to lack of local records, intensive competition with common species including Noisy Miner. Proposal unlikely to impact due to limited extent of habitat loss and not likely to occur, hence 7 Part Test not undertaken.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Painted Honeyeater (*Grantiella picta)*	1	V-TSCA	Strongly migratory and locally nomadic. Exploits almost exclusively mistletoe-infested (mainly Amyema genus) eucalypt forest/woodland in mainly drier areas. Leaf insects occasionally taken. May extend range or visit woodland remnants and suburban gardens during poor seasons. Breeding habitat is mistletoe-laden eucalypt forest/woodland	Lack of preferred habitat and habitat components. Lack of history of periodic sightings suggest not a key migratory area. Unlikely to occur. No risk of significant impact hence 7 Part Test not undertaken.
	Little Lorikeet (*Glossopsitta pusilla*)	2	V-TSCA	Gregarious, usually foraging in small flocks, often with other species of lorikeet feeding 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. Mostly occurs in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. In south-east Queensland (Smyth *et al*. 2002), were more likely to occupy forest sites with relatively short to intermediate logging rotations (15–23 years) and sites that have had short intervals (2.5– 4 years) between fires.	Wider study area is generic potential foraging and nesting habitat, although nesting habitat on site subject to very high competition from other species. Considered low to marginally fair chance of occurrence during peak flowering events at some stage in study area as recorded within 1km at Arrawarra. **7 Part Test required** as potential to occur.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Flame Robin (*Petroica phoenicea*)	0	V-TSCA	Found in southeastern Australia. In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter 2002). There may be two disjunct breeding populations in NSW on the Northern Tablelands and the Central–Southern Tablelands (Barrett *et al.* 2003 and the NSW Wildlife Atlas). Forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank.	Site habitat largely unsuitable and lack of potential habitat in area. No local records, unlikely to occur. No risk of impact and unlikely to occur, hence 7 Part Test not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Scarlet Robin (*Petroica boodang*)	0	V-TSCA	Found in south-eastern Australia and south-west Western Australia. In NSW it occupies open forests and woodlands from the coast to the inland slopes (Higgins and Peter 2002). Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. It 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. The robin builds an open cup nest of plant fibres and cobwebs, sited in the fork of tree (often a dead branch in a live tree, or in a dead tree or shrub) which is usually more than 2 m above the ground (Higgins and Peter 2002; Debus 2006a,b).	As for Flame Robin. Seven Part Test not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Swift Parrot (*Lathumus discolor*)	1	E-TSCA, E-EPBCA	Breeds in Tasmania and winters on mainland, from Victoria to southern Queensland. Feeds mostly on pollen and nectar of winter flowering eucalypts and banksias, but also on fruit, seeds, lerps and insect larvae (Schodde and Tideman 1990). Favoured species are *E. robusta*, *Corymbia gummifera*, *E. globulus, E. sideroxylon, E. leucoxylon, E. labens, E. ovata, E. maculata, Banksia serrata* and *B. integrifolia.* In coastal NSW, Swamp Mahogany, Spotted Gum and Bloodwood forests are important foraging habitats and larger trees may be selected. Disperse according to changing local food resources.	Only single local record and considered at best very low potential to occur on site due to lack of on-going local records indicating significant migration stop over area and intensive competition with common species including Noisy Miner. Proposal unlikely to impact due to limited extent of habitat loss and not likely to occur, hence 7 Part Test not undertaken.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Varied Sittella (*Daphoenositta chrysoptera*)	4	V-TSCA	Sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west (Higgins and Peter 2002; Barrett *et al.* 2003). It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Some marginally potentially suitable habitat on site and adjacent. Considered very low chance of occurrence on site due to harassment by Noisy Miner and no proximate records. Recorded 5km south at Woolgoolga. Proposal highly unlikely to impact given limited habitat loss and extent of higher quality habitat in adjacent forest. Impact clearly insignificant hence 7 Part Test not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Eastern Ground Parrot (*Pezoporus wallicus wallicus*)	6	V-TSCA	Found from coastal southeastern to eastern Australia, with a highly fragmented distribution. Terrestrial bird, most often found in heathland or sedgeland with dense cover and high density of preferred food plants. Found from coast to 300m ASL. Heathland usually high diversity of heath species with scattered shrubs of Banksia and She-oaks, grass trees with abundant sedges and grasses. Sometimes found in open Bansksia woodlands with heath understorey, closed fernland around shallow creeks or plains or sedges at swamp margins. Nests on ground. Appears to prefer a fire regime that promotes plant growth and hence seed production. Breeds in spring-early autumn depending on latitude (in summer in colder areas). Feeds on seeds, some green shoots, leaves, buds, flowers and fruits. Diurnal and mainly sedentary with young dispersing in autumn, with movements of 80-220km recorded. Estimated to range over 8-20ha depending on habitat condition (eg fire) and quality.	No suitable habitat on site or in study area. Unlikely to occur. Seven Part Test not required as no risk of impact.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Glossy Black Cockatoo (*Calyptorhynchus lathami*)	47	V-TSCA	Dry sclerophyll forest and woodland containing Allocasuarina and Casuarina, and large tree hollows. Preferred regional forage species are *A. littoralis* and *A. torulosa*. Requires sufficient extent of forage within home range to support breeding. Breeds Mar-Aug, takes 90 days to hatch and fledge (Lindsey 1992).	No suitable foraging species or hollows large enough to support nesting. Not recorded in close proximity to the site; nearest record 5m south at Woolgoolga. Unlikely to occur, hence 7 Part Test not required.
	Superb Fruit Dove (*Ptilinopus superbus*)	1	V-TSCA	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic.	Vegetation on site only has small fruiting resource mainly consisting of vines which would be unlikely to attract threatened fruvigores due to high human presence and dominance by common species. Unlikely to occur. No risk of impact and unlikely to occur, hence 7 Part Test not required.
	Rose-crowned Fruit Dove (*Ptilinopus regina*)	1	V-TSCA	Inhabits dense rainforest or vegetation containing fruit bearing trees, feeding on fruit. Migratory with fruiting patterns.	As for Superb Fruit Dove. Seven Part Test not required.
	Wompoo Fruit Dove (*Ptilinopus magnificus*)	4	V-TSCA	Sub-tropical, littoral, warm temperate and dry rainforest, and wet sclerophyll with rainforest understorey. Feeds on fruit. Known to feed on Camphor Laurel and Lantana.	As for Superb Fruit Dove. Seven Part Test not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Barred Cuckoo Shrike (*Coracina lineata*)	1	V-TSCA	Gregarious rainforest/moist forest (especially creek gullies) species feeding mainly on fruit on tall rainforest trees and shrubs, and insects; generally moving with fruiting patterns.	As for Superb Fruit Dove. Seven Part Test not required.
	Black Bittern (*Dupetor flavicollis*)	2	V-TSCA	Coastal waterways and rivers lined with mangroves etc; denser paperbark woodlands near coastal swamps.	Site and adjacent habitat too disturbed by high human presence – more likely to occur in less accessible upper sections of creek outside study area. Proposal poses no major change to current anthropogenic impacts in terms of type or magnitude, however as low to fair potential to occur within 100m of site, **7 Part Test undertaken**
	Great Knot (*Calidris tenuirostris*)	1	V-TSCA	Prefers sheltered coastal habitats, with large intertidal mudflats or sandflats including inlets, bays, harbours, estuaries and lagoons.	Lack of suitable habitat on site. Marginal potential in adjacent creek – not considered open or extensive enough to support this bird. Unlikely to occur. No risk of significant impact hence 7 Part Tests not undertaken.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Little Tern (*Sterna albifrons*)	6	E-TSCA	Beaches, sandy-shored bays, estuaries, exposed sand bars, mudflats, river mouths and deltas.	Proposal poses no major change to current anthropogenic impacts in terms of type or magnitude, and this bird is more likely to occur in areas not visited by dogs, hence no risk of impact as not a key roosting or nesting area affected. 7 Part Tests not required.
	Australasian Bittern (*Botaurus poiciloptilus*)	0	V-TSCA, E-EPBCA	Inhabits estuarine and freshwater wetlands, generally with permanent water and dense vegetation of sedges, rushes and reeds, particularly Bullrush and Spikerush. Solitary or groups up to 12. Usually sedentary. Roosts in reeds by day, forages in shallow water at dusk/night for frogs, fish, invertebrates, fruit, leaves. Tramples reeds, sedges to make a foraging platform. Nests in dense vegetation over water. (NSW NPWS 2000)	Site and adjacent habitat too disturbed by high human presence – more likely to occur in less accessible upper sections of creek outside study area. National rarity and lack of records however suggests unlikely to very low potential to occur. Proposal poses no major change to current anthropogenic impacts in terms of type or magnitude. 7 Part Test not undertaken
	Comb-Crested Jacana (*Irediparra gallinacea*)	4	V-TSCA	Deep, permanent freshwater with surface/floating vegetation (eg Water Lily). Sedentary or locally nomadic. Forages on surface. Nest a raft in screened, emergent vegetation. Sensitive to water level changes and to disturbance. Breeds in response to rising water level Sep-Jan (Lindsey 1992).	Lack of suitable habitat on site or in study area. Unlikely to occur. No risk of significant impact hence 7 Part Tests not undertaken.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Freckled Duck (*Stictonetta naevosa*)	1		Usually in small groups. Nomadic, breeds in densely vegetated freshwater wetlands with thickets of small trees, usually in western NSW. After breeding, disperses to open fresh or saline water, often in eastern NSW. Breeds Sept-Dec or after flooding rain. Nests in tree, low over water. (Morecombe 2000)	Lack of suitable habitat on site or in study area. Unlikely to occur. No risk of significant impact hence 7 Part Tests not undertaken.
	Black-necked Stork (*Ephippiorhynchus asiaticus*)	60	E-TSCA	Inhabits coastal and inland wetlands, shallow lakes, grassland, saltmarsh, farm and dry open land. Forages for large invertebrates, frogs, fish, seeds, green shoots and bulbs. Breeding occurs predominantly in tropical wetland and large inland swamps and irrigated grasslands at inland and central northern Australia (eg Queensland and Northern Territory), though has been recorded in the northwest and north-eastern corner of NSW and Victoria	Site and adjacent habitat too disturbed by high human presence – more likely to occur in less accessible upper sections of creek outside study area. Proposal poses no major change to current anthropogenic impacts in terms of type or magnitude, however as low to fair potential to occur within 100m of site, **7 Part Test undertaken**

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Collared Kingfisher (*Todiramphus chloris*)	1	V-TSCA	In NSW the Collared Kingfisher occurs in the northeast in the Tweed River area and occasionally further south in the Clarence catchment. Occurs in coastal habitats such as estuaries, rock walls, foreshores and tidal flats. Often perches over or near water and preys on fish, crustaceans, lizards and insects (DECCW 2011, Morcombe 2000).	Some good potential habitat for this bird occurs upstream in Arrawarra Creek, however nearest record is at Woolgoolga. Very low to unlikely chance of occurrence in study area as limited habitat and only 1 local record. Proposal will not remove potential habitat for this species nor significantly alter current anthropogenic impacts, hence unlikely to impact. Seven Part Test not required.
	Brolga (*Grus rubicunda*)	2	V-TSCA	Inhabits coastal and inland wetlands, shallow lakes, grassland, saltmarsh, farm and dry open land. Forages for large invertebrates, frogs, fish, seeds, green shoots and bulbs. Breeding occurs predominantly in tropical wetland and large inland swamps and irrigated grasslands at inland and central northern Australia (eg Queensland and Northern Territory), though has been recorded in the northwest and north-eastern corner of NSW and Victoria.	Site and adjacent habitat too disturbed by high human presence – marginal potential habitat in less accessible upper sections of creek outside study area. Proposal poses no major change to current anthropogenic impacts in terms of type or magnitude. 7 Part Test not undertaken.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Sooty Oystercatcher (*Haematopus fuliginosus*)	22	V-TSCA	Beaches, rocky foreshores, headlands, exposed reefs, sandy-shored bays, estuaries, exposed sand bars and mudflats.	Adjacent beach and rocky foreshore, and perhaps more secluded section of Arrawarra Creek offers non-breeding foraging habitat. Recorded nearby hence low to fair potential to occur. Proposal poses no major change to current anthropogenic impacts in terms of type or magnitude, however as low to fair potential to occur within 100m of site, **7 Part Test undertaken**
	Pied Oystercatcher (*Haematopus longirostris*)	14	E-TSCA	Beaches, sandy-shored bays, estuaries, exposed sand bars and mudflats.	Adjacent beach and rocky foreshore, and perhaps more secluded section of Arrawarra Creek offers non-breeding foraging habitat. Recorded nearby hence low to fair potential to occur. Proposal poses no major change to current anthropogenic impacts in terms of type or magnitude, however as low to fair potential to occur within 100m of site, **7 Part Test undertaken**

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Black-tailed Godwit (*Limosa limosa*)	1	V-TSCA	Beaches, sandy-shored bays, estuaries, exposed sand bars and mudflats.	Site and adjacent habitat too disturbed by high human presence – marginal potential habitat in less accessible upper sections of creek outside study area and more secluded sections of beach. Proposal poses no major change to current anthropogenic impacts in terms of type or magnitude. 7 Part Test not undertaken.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Eastern Curlew (*Numenius madagascariensis*)	0	CE-EPBCA M-EPBCA	International migratory wader most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. May use ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. Foraging for invertebrates among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. Roosts on sandy spits and islets (especially on dry beach sand near the high-water mark), and among coastal vegetation including low saltmarsh or mangroves. Occasionally roosts on reef-flats in the shallow water of lagoons and other near-coastal wetlands. Also recorded roosting in trees and on the upright stakes of oyster-racks. Does not breed in Australia.	Potential habitat in upper, less visited sections of adjacent estuarine habitats, but unlikely to occur in close proximity to site. Seven Part Test not required as not listed under TSC Act.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Curlew Sandpiper (*Calidris ferruginea*)	0	CE-EPBCA M-EPBCA	International migratory wader mainly found on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast; less commonly inland around including around ephemeral and permanent lakes, dams, waterholes and bore drains. Forages in shallow water and in saltmarsh, preferring mudflats. Generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh; rarely in mangroves. Does not breed in Australia.	Potential habitat in upper, less visited sections of adjacent beach and less so the estuarine habitats, but unlikely to occur in close proximity to site. Seven Part Test not required as not listed under TSC Act.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Bush-stone Curlew (*Burchinus grallaris*)	1	E-TSCA	Nocturnal, sedentary and territorial (when breeding) species generally inhabiting open grassy woodlands with few or no shrubs. Abundant leaf litter and fallen debris such as tree branches required for foraging and roosting. Nests in more open areas with very little groundcover (even recorded on mown lawns and golf courses). Coastally, often associated with Swamp Oak groves, saltmarsh, mangroves, *Melaleuca quinquenervia* woodlands and even golf courses, etc. May travel as far as 3km from roost site to foraging grounds	Not a known habitat area. Proposal poses no major change to current anthropogenic impacts in terms of type or magnitude. 7 Part Test not undertaken
	Beach Stone-Curlew (*Esacus neglectus*)	0	E-TSCA	A large wader distinguished by its strong legs, short tail and massive bill. It occupies coastlines across northern and north eastern Australia and in NSW is found south to the Manning River. Found on beaches, estuaries, intertidal flats, mangroves and sand spits where they forage for marine invertebrates. Breeding occurs from September to March and nests are made on the ground above the littoral zone behind beaches, on permanent sand bars and among mangroves.	Lack of suitable habitat on site. Marginal potential in adjacent creek – not considered open or extensive enough to support this bird. Unlikely to occur. Beach subject to high human use and dogs. No risk of significant impact hence 7 Part Tests not undertaken.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
MAMMALS	Spotted-tail Quoll (*Dasyurus maculatus*)	4	V-TSCA, E-EPBCA	Various forested habitats with preference for dense forests. Requires tree hollows, hollow logs or caves for nesting. Large home range (>500ha) and may move over several kilometres in a few days. Tends to follow drainage lines.	Lack of suitable habitat on site – too disturbed with minimal understorey cover and denning opportunities. Unlikely to occur. No risk of significant impact hence 7 Part Tests not undertaken.
	Koala (*Phascolarctos cinereus*)	12	V-TSCA, V-EPBCA	A large arboreal marsupial to 12kg for males and 8kg for females. Spends most of its time in trees and has large claws adapted for climbing. Largest populations in NSW occur on the central, mid-north and north coast with scattered populations on the south coast, tablelands and western districts. Koalas inhabit eucalypt forests and woodlands where they feed on the leaves of a wide range of eucalypts and will select preferred browse species in an area. Home range size varies depending on quality of habitat, ranging from two to several hundred hectares in size (DECCW, 2010; Van Dyck and Strahan, 2008).	Part of site mapped as Secondary Habitat, but no evidence of usage. No close proximity records, hence only very low potential for transient occurrence of dispersing Koala investigating the outermost fringe of local habitat. Loss of this habitat **requires 7 Part Test** to demonstrate not significant due to CHCC mapping.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Brushtailed Phascogale (*Phascogale tapoatafa*)	0	V-TSCA	Range of forest habitats but prefers drier sclerophyll forest with sparse ground cover. Forages on large rough-barked trees for small fauna, also utilises eucalypt nectar. Rests in tree hollows, stumps, bird nests. Requires tree hollows for nesting. (NPWS, 2000) Breeds May-July. Occupies territory of 20-100ha. Has been recorded in swamp forest.	No records in locality; marginal habitat on site and in study area. Unlikely to occur. Proposal unlikely to impact given limited habitat loss and extent of higher quality habitat locally. Unlikely to occur hence Seven Part Test not required.
	Yellow-bellied Glider (*Petaurus australis*)	10	V-TSCA	Moist and dry tall mature eucalypt forest and woodland. Requires mature hollow-bearing trees, winter-flowering eucalypts, suitable sap-feeding eucalypt species and a mosaic of forest types (NPWS 1999). Sap trees utilised include: *E. propinqua, E. tereticornis, E. microcorys, & E. resinifera* (NPWS 2000). Home range of 30-65ha (NPWS 1999).	Site and surrounding modified habitat is at best marginally suitable for this species but very high human presence. Records in area limited to large expanses of to west. Unlikely to occur on site as would be readily detected. Competition with Brushtail Possums would be very high. No risk of impact as unlikely to occur. Seven Part Test not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Squirrel Glider (*Petaurus norfolcensis*)	14	V-TSCA	Moist and dry tall mature eucalypt forest and woodland. Requires mature hollow-bearing trees, winter-flowering eucalypts, suitable sap-feeding eucalypt species and a mosaic of forest types (NPWS 1999). Sap trees utilised include: *E. propinqua, E. tereticornis, E. microcorys, & E. resinifera* (NPWS 2000). Home range of 30-65ha (NPWS 1999).	Not recorded on site, however records within 500m of study site to west and southwest in intact forest which interconnects to a significant body of habitat with good connectivity and a complex mosaic of vegetation types. Suitable hollows and sap species but site and study area highly modified with other threats eg cats. May to occur on fringes of study area. **7 Part Test required** due to loss of hollows and likely to occur in study area.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Long-Nosed Potoroo (*Potorous tridactylous*)	0	V-TSCA V-EPBCA	Coastal heath and shrublands; paperbark forest; woodland with dry heathy understorey; high elevation rainforest or moist hardwood forest; moist shrublands with dense or moderately dense understoreys and sedge-dominated groundcover; wet or dry sclerophyll forests where average annual precipitation exceeds 760mm. Requires thick groundcover for refuge, while foraging in open areas on ridges, slopes or gullies, typically on ecotones, and prefers sandy soils for digging. Eats roots, tubers, fungi, fleshy fruits, leaves, insects and other soil invertebrates. Optimum habitat generally considered a mosaic of regenerating dense understorey vegetation as result of patchwork of periodic low to medium intensity fires. Home range 2-5ha (NSW NPWS 2000).	Site and study area too disturbed and considered an unlikely occurrence due to rarity and lack of local records. No risk of significant impact hence 7 Part Tests not required.
	Rufous Bettong (*Aepyprymnus rufescens*)	2	V-TSCA	Inhabits well-grassed open woodland/forest on flat/undulating ground. Not usually in rainforest or moist forest. Typically with *Poa* and Bladey Grass cover. Nests in dense grasses or under logs. Nocturnal. Diet of grasses, sedges, herbs, tubers. Not social, but may aggregate to feed in pasture. Breeding may be continuous. (Strahan, 1995; Mt King, 1993).	Site and study area habitat largely unsuitable and disturbance history of site and surrounding area likely to have excluded species. Recorded in locality; unlikely to occur on site. No risk of significant impact hence 7 Part Tests not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Common Planigale (*Planigale maculata*)	0	V-TSCA	Wide variety of habitats. Preference for areas of dense groundcover due to heat/dehydration problems. May prefer ecotones of dry/wet habitats (Denny 1982). Preys on arthropods, small vertebrates, shelters in nest under/in fallen timber or rock (Strahan 1995). Home range about 0.5ha. Breeds Oct-Jan (NSW NPWS 2000).	Site and study area habitat largely unsuitable and disturbance history of site and surrounding area likely to have excluded species. Not recorded in locality; unlikely to occur on site or study area No risk of significant impact hence 7 Part Tests not required.
	Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*)	0	V-TSCA	Appears to prefer heathland especially dense wet heath and swampy areas usually occupied by Swamp Rat (AMBS,1996). Also recorded from mid-elevation grasslands, open dry and wet sclerophyll woodland. In the Port Macquarie area, associated with heathland with dense shrub layer of *Banksia ericifolia*, *B. serratifolia, Xanthorrhoea* spp, *Dillwynia floribunda, Boronia spp*, *Leptospermum flavescens* and *Melaleuca nodosa*. Requires specific fire regime, greatest density 3-4 years after fire. Omnivorous, seeds, fungi, green stem, arthropods. Home range <0.5ha (NSW NPWS 2000).	Site and study area habitat largely unsuitable and disturbance history of site and surrounding area likely to have excluded species. Not recorded in locality; unlikely to occur on site or study area No risk of significant impact hence 7 Part Tests not required.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Yellow-Bellied Sheathtail Bat *(Saccolaimus flaviventris)*	1	V-TSCA	Ecology poorly known. Found in almost all habitats, particularly wet and dry sclerophyll forests and woodlands below 500m altitude, and also open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts mainly in tree hollows, but also under bark, under roof eaves and in other artificial structures. Fast flying species, believed to forage above the canopy or closer to the ground in open areas. Insectivorous. May be Summer migrant.	Site may provide generic foraging habitat. At least low to fair chance foraging and roosting in study area given single record within the locality. No risk of significant impact but **7 Part Test required** due to potential to occur.
	Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	0	V-TSCA	A large vespertilionid which feeds on moths and insects. Known to roost in caves, abandoned buildings, but mostly in trees hollows higher rainfall forested areas. It is suspected that some populations migrate in Winter from higher altitudes to coastal areas, or may simply enter torpor. Prefers tall forests (>20m high) and extensive movements (eg 12km recorded between foraging and roost sites). Recently recorded in Thrumster west of Port Macquarie.	Study area habitat to south suitable due but no local records. Tentative call identification hence **7 Part Test required.**

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	East-coast Freetail Bat (*Mormopterus norfolkensis*)	1	V-TSCA	Specific habitat requirements of this species are poorly known. Has been recorded in habitats ranging from rainforest to dry sclerophyll and woodland, with most recorded in the latter (State Forests 1995, Allison 1991). Roosts in small colonies under tree hollows and under loose bark; has been found under house eaves, in roofs and metal caps on telegraph poles. Recorded roosting in roof in Hat Head village. Probably forages above forest or woodland canopy, and in clearings adjacent to forest. Most records are of single individuals, and is likely to occur at low densities over its range.	Site and study area may provide generic foraging habitat. Low to fair chance foraging and less so roosting in study area given local record to west near highway. Tentative call identification hence **7 Part Test required**.
	Little Bentwing Bat (*Miniopterus australis*)	10	V-TSCA	Forages above and below canopy of well-forested areas. Roosts in old buildings, caves, mines etc. Dependent on nursery caves and communal roosts.	Site and study area may provide generic foraging habitat. At least fair chance foraging in study area given local records. Low potential to roost in tree hollows due to not preferred and competition with birds and common bats. **7 Part Test required** due to potential to occur.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Common Blossom Bat (*Syconycteris australis*)	0	V-TSCA	Found in well timbered habitats. Roosts in rainforest and wet sclerophyll forest. Feeds in heathlands and paperbark swamps up to 4km from roost. Key food species include Banksia, Melaleucas, Callistemons and Bloodwoods.	Likely to occur in wider study area where Banksia woodland and swamp forest occurs, but only low potential to forage on site due to limited habitat and high competition. Very low potential to roost on site – dense vines in southern end offers marginal potential At least fair chance of occurring in study area, hence **7 Part Test required.**
	Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*)	0	V-TSCA	Habitat generalist - forages above well-forested areas. Roosts in old buildings, caves, mines etc. Dependant on nursery caves and communal roosts.	Site and study area may provide generic foraging habitat. At least fair chance foraging in study area given records in similar habitats in region. Low potential to roost in tree hollows due to not preferred and competition with birds and common bats. **7 Part Test required** due to potential to occur.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Eastern Long-eared Bat (*Nyctophilus bifax*)	0	V-TSCA	Found in lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest. Coastal rainforest and patches of coastal scrub are particularly favoured. Roosts in tree hollows, the hanging foliage of palms, in dense clumps of foliage of rainforest trees, under bark and in shallow depressions on trunks and branches, among epiphytes, in the roots of strangler figs, among dead fronds of tree ferns and less often in buildings. They appear to be confined to the coastal plain and nearby coastal ranges, extending south to the Clarence River area, with a few records further south around Coffs Harbour. The species can be locally common within its restricted range.	Unlikely to occur on the site given it is at limit of the species typical distribution range and modified nature of the study area. Proposal unlikely to impact and unlikely to occur hence 7 Part Test not required.
	Eastern Cave Bat (*Vespadelus troughtoni*)	0	V-TSCA	Rare and poorly known bat. Cave dwelling bat roosting in small (5-50) to large (500) groups in sandstone overhang caves, boulder piles, mines, tunnels and sometimes buildings. Tend to roost in well-lit portions of caves in avons, domes, cracks and crevices. Occasionally found along cliff lines in wet eucalypt forest and rainforest on the coast and dividing range, but extend into drier forest on western slopes.	Lack of preferred roosting habitat within range of site and no local records suggests unlikely to occur. Often a default identification in bat call analysis due to limitations of the technology but lack of local caves suggest unlikely to occur. 7 Part Tests not considered required as no risk of significant impact.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Greater Broad-nosed Bat (*Scoteanax rueppellii)*	3	V-TSCA	Forages over range of habitats including rainforests and moist forests, but prefers ecotones between riparian forest, woodland and cleared land. Requires sparse understorey and will forage over water. Roosts in tree hollows. Feeds on larger insects, small vertebrates and perhaps other bats.	Fair chance of foraging in forest canopy and cleared grassland over study area. Some hollow-bearing trees offer potential roosting habitat. **7 Part Test undertaken** as fair potential to occur.
	Golden-tipped Bat (*Kerivoula papuensis*)	1	V-TSCA	Spider eating specialist, capable of hovering and high manoeuvrability. Normally found in rainforest and along rainforest gullies within wet sclerophyll forest (often when lot of vines which suit prey species), but has been recorded in recently logged dry sclerophyll forest, and also known to forage in areas of mosaic forest (dry and wet sclerophyll). Roosts in abandoned nests of gerygones and scrubwrens, but also found in dense foliage, rooves, and caves.	Prefers natural habitats, often in large tracks of mixed forest. Lack of preferred foraging and roosting habitat suggests unlikely to occur. 7 Part Tests not considered required as no risk of significant impact.
	Southern Myotis *(Myotis macropus*)	3	V-TSCA	Tunnel, cave, bridges, old buildings, tree hollow and dense foliage roosting bat which prefers riparian habitat over 500m long with nearby roosting habitat. Key habitats are streams, rivers, creeks, lagoons, lakes and other water bodies. Feeds on aquatic insects and small fish. Has recently been observed foraging in small bodies of water.	May potentially forage over Arrawarra Creek as has been recorded in brackish to estuarine habitats, though prefers aquatic. Potential roosts in tree hollows on site, but subject to high competition. **7 Part Test undertaken** as potential to occur.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
AMPHIBIANS	Green and Golden Bell Frog (*Litoria aurea)*	0	E-TSCA V-EPBCA	Found in permanent swamps and ponds. Prefers water bodies which are: still; shallow; unshaded; ephemeral; unpolluted; generally isolated; and free of native fish species or Plague Minnow (*Gambusia holbrooki)* and little macro-algae. Requires emergent vegetation, grass tussocks or rocks for shelter. May use disturbed sites opportunistically - may depend on several stages. Eats insects and other frogs. Summer breeder. (Hero *et al* 2004).	No local records and disturbance history and lack of habitats in study area negate potential to occur. Considered unlikely to occur. 7 Part Tests not considered required as no risk of significant impact.
	Giant Barred Frog (*Mixophyes iterates*)	10	E-TSCA E-EPBCA	Moist hardwood forest, Antarctic Beech and rainforest near flowing streams. May also occur in coastal riverine rainforest and riparian vegetation. Forages in areas adjacent to riparian zones. Males call from under leaf litter or rocks by flowing streams. Eggs laid at streamside to await washing into stream by rainfall.	Disturbance history and lack of habitats in study area negate potential to occur. 7 Part Tests not considered required as no risk of significant impact.
	Green-thighed Frog (*Litoria brevipalmata*)	1	V-TSCA	Poorly known. Found in range of habitats such as warm temperate open forest, rainforest, and forestry dams in dry, open forest; breeding aggregations around oxbow lakes, ditches, flooded paddocks, overflows and grassy semi-permanent ponds. Males call only for few days after spring and early summer rains. Possibly a lowland forest ground-dweller.	No local records and disturbance history and lack of habitats in study area negate potential to occur. Considered unlikely to occur. 7 Part Tests not considered required as no risk of significant impact.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Wallum Froglet (*Crinia tinnula*)	13	V-TSCA	Predominantly associated with acidic paperbark swamps of coastal areas (Cogger 1992). Also found in wet heathland and *Melaleuca* sedgelands. Recorded breeding in flooded pasture adjacent to paperbark swamps.	Recorded <1km to the south of the property across the channel. Not recorded during site survey and no suitable habitat in study area. Unlikely to occur. 7 Part Tests not considered required as no risk of significant impact.
REPTILES	Loggerhead Turtle (*Caretta caretta*)	1	E-TSCA E-EPBCA	Pelagic in early life, settling in shallow benthic foraging habitats such as tropical tidal and sub-tidal coral and rocky reef habitat or inshore seagrass beds. Nests on specific sandy beaches.	Not known to nest on adjacent beach, but likely to occur in adjacent ocean. No impact on foraging or nesting habitat. 7 Part Tests not considered required as no risk of significant impact.

Animal Group	Common Name (Scientific Name)	Local Records	Legal Status	Habitat/Ecology Profile	Likelihood Of Occurrence? Risk of Significant Impact? Seven Part Test Required?
	Stephens Banded Snake (*Hoplocephalus stephensii*)	1	V-TSCA	Inhabits variety of habitats including dry rainforest, sub-tropical rainforest, wet and dry sclerophyll, rocky outcrops (especially granite and sandstone) - requires close proximity to variety of vegetation formations. Nocturnal and primarily arboreal - sheltering under decorticating bark, within tree scars, hollows, logs, rock crevices and slabs. Active predator of variety of vertebrates including geckos, skinks, frogs, small mammals, bats, birds	Site habitat has been significantly modified from its original character, ad located in high density urban area where conflicts likely to arise. Not recorded in interconnected habitat. Unlikely to occur. No potential or known habitat impacted or barrier to movement outside study area created, hence no risk of significant impact.
	Green Turtle (*Chelonia mydas*)	5	V-TSCA V-EPBCA	Pelagic in early life, settling in shallow benthic foraging habitats such as tropical tidal and sub-tidal coral and rocky reef habitat or inshore seagrass beds. Nests on specific sandy beaches.	Not known to nest on adjacent beach, but likely to occur in adjacent ocean. No impact on foraging or nesting habitat. 7 Part Tests not considered required as no risk of significant impact.

A number of other species (see table below) are known or considered potential occurrences within the locality. However due to a number of factors, these species were not considered potential occurrences on site. Thus the proposal is not considered to have a significant impact on the viability of any local population of the subject species and Seven Part Test evaluation was not required.

Table 26: Fauna unlikely to occur on site

Preferred Habitat	Species	Site considered unsuitable habitat	Presence of predators likely to have excluded the species	Disturbance history likely to have excluded this species	Lack of local records
Dry Sclerophyll Forest, Woodlands, Grassy Woodlands	Black-chinned Honeyeater (*Melithreptus gularis gularis*) eastern subspecies				X
	Hooded Robin (*Melanodryas cucullatacucullata*) southeastern form	X			X
	Turquoise Parrot (*Neophema pulchella*)	X			X
	Diamond Firetail (*Stagonopleura guttata*)	X			X
Rainforest/Wet Sclerophyll Forest	Olive Whistler (*Pachycephala olivacea*)	X			X
	White-eared Monarch (*Monarcha leucotis*)	X			X
	Parma Wallaby (*Macropus parma*)	X	X	X	X
	Three-Toed Snake-Tooth Skink (*Coeranoscincus reticulatus*)	X		X	X
	Pale-Headed Snake	X		X	X

Preferred Habitat	Species	Site considered unsuitable habitat	Presence of predators likely to have excluded the species	Disturbance history likely to have excluded this species	Lack of local records
	(*Hoplocephalus bitorquatus*)				
	White-Crowned Snake (*Cacophis harriettae*)	X		X	X
	Red-Legged Pademelon (*Thylogale stigmatica*)	X	X	X	X
	Stuttering Frog (*M. balbus*)	X			X
Swamp/ Aquatic/ Freshwater Wetland/ Estuarine/ Marine	Pink Underwing Moth (*Phyllodes imperialis*) southern species	X			X
	Blue-Billed Duck (*Oxyura australis*)	X			X
	Magpie Goose (*Anseranas semipalmata*)	X			X
	Painted Snipe (*Rostratula australis*)	X	X		X
	White-fronted Chat (*Epthianura albifrons*)	X			X

Preferred Habitat	Species	Site considered unsuitable habitat	Presence of predators likely to have excluded the species	Disturbance history likely to have excluded this species	Lack of local records
	Olongburra Sedge Frog (*Litoria olongburensis*)	X		X	X
Shrubland/Heathland/ Grassland	Eastern Pygmy Possum (*Certatetus nanus*)	X	X		X
	New Holland Mouse (*Pseudomys novaehollandiae*)	X	X	X	X
	Grass Owl (*Tyto capensis*)	X			X
	Ground Parrot (*Pezoporus wallicus wallicus*)	X	X	X	X

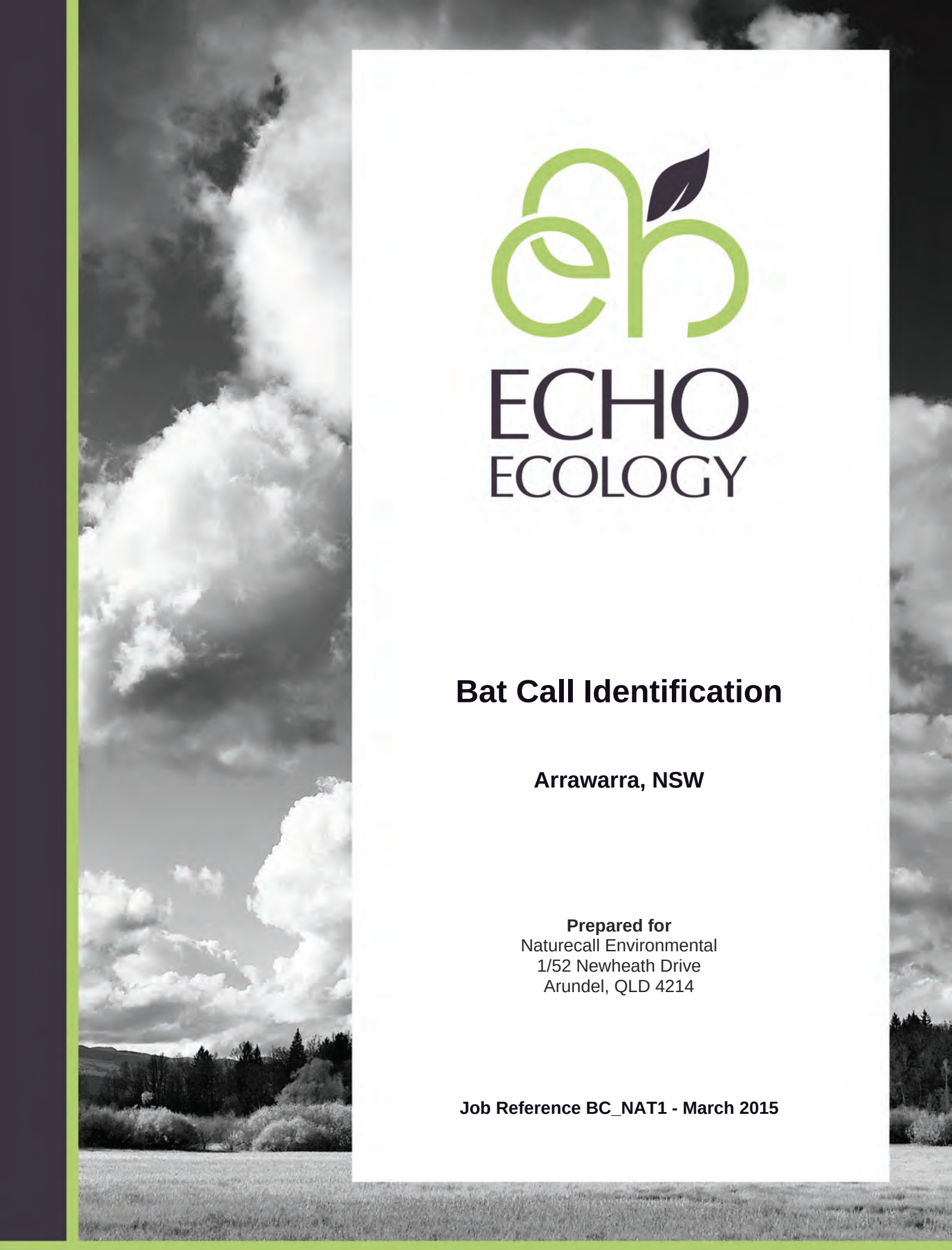
Appendix 2: Site flora species list

* Denotes an introduced species

Common Name	Scientific Name
Swamp Mahogany	*Eucalyptus robusta*
Broadleaf Paperbark	*Melaleuca quinquenervia*
Pink Bloodwood	*Corymbia intermedia*
Turpentine	*Syncarpia glomulifera*
Brushbox	*Lophostemon confertus*
Blackbutt	*Eucalyptus pilularis*
Camphor Laurel	*Cinnamonum camphora**
Moreton Bay Fig	*Ficus macrophylla*
Swamp Oak	*Casuarina glauca*
Grey Mangrove	*Avicenna marina var. australasica*
Coral Tree	*Erythrina X sykesii**
Sydney Golden Wattle	*Acacia longifolia subsp. longifolia*
-	*Senna spp.**
Coastal Banksia	*Banksia integrifolia*
Swamp Banksia	*Banksia robur*
Wild Tobacco Tree	*Solanum mauritianum**
Lantana	*Lantana camara**
Small-leafed Privet	*Ligustrum sinense**
Fishbone Fern	*Nephrolepis cordifolia*
Bracken Fern	*Pteridium esculentum*
Sand Couch	*Sporobolus virginicus*
Kikuyu	*Pennisetum clandestinum**
Couch	*Cynodon dactylon**
Bladey Grass	*Imperata cylindrica*
Mat Rush	*Lomandra longifolia*

Common Name	Scientific Name
Native Violet	*Viola hederacea*
Bitou Bush	*Chrysanthemoides monilifera**
Prickly Pear	*Opuntia spp.**
Wandering Jew	*Tradescantia albiflora*
Morning Glory	*Ipomoea indica**
Kidney Weed	*Dichondra repens*
White Clover	*Trifolium repens**
Cats Ear	*Hypochaeris radicata**
Formosan Lily	*Lilium formosanum**
Austral Smilax	*Smilax australis*

Appendix 3: Bat Call ID report



ECHO ECOLOGY

Bat Call Identification

Arrawarra, NSW

Prepared for
Naturecall Environmental
1/52 Newheath Drive
Arundel, QLD 4214

Job Reference BC_NAT1 - March 2015

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This report has been prepared to document the analysis of digital ultrasonic bat echolocation calls received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by



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1.0 INTRODUCTION

This report has been commissioned by Naturecall Environmental to analyse bat echolocation call data (Anabat, Titley Electronics) collected from Arrawarra, NSW. Data was provided electronically to the author. This report documents the methods involved in analysing bat call data and the results obtained only.

2.0 METHODS

The identification of bat echolocation calls recorded during surveys was undertaken using AnalookW (Version 4.0r) software. The identification of calls was undertaken with reference to Pennay *et al*. (2004) and through the comparison of recorded reference calls from north-eastern NSW. Reference calls were obtained from the NSW database and from the authors personal collection.

Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species
- Probable - Pass identified to species level and there is a low chance of confusion with another species
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality
- Unknown - Either background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

Call sequences that were less than three pulses in length were not analysed and were assigned to 'Unknown' and only search phase calls were analysed. Furthermore, some species are difficult to differentiate using bat call analysis due to overlapping call frequencies and similar shape of plotted calls and in these cases calls were assigned to species groups.

The total number of passes (call sequences) per unit per night was tallied to give an index of activity.

It should be noted that the activity levels recorded at different sites may not be readily able to be compared. Such comparisons are dependent on many variables which need to be carefully controlled during data collection and statistically analysed. Influential variables include wind, rain, temperature, duration of recording, season, detector and microphone sensitivity, detector placement, weather protection devices etc.

2.1 Characteristics Used to Differentiate Species

Chalinolobus gouldii was differentiated from other species by the presence of curved, alternating call pulses.

Chalinolobus nigrogriseus was differentiated from other species by the relatively long characteristic frequency section, around 2/3 of the total pulse length.

Vespadelus pumilus was differentiated from *Miniopterus australis* in call sequences which had a majority of pulses containing an up-sweeping tail.

Vespadelus darlingtoni was differentiated on the basis of characteristic frequency.

3.0 RESULTS

A total of 76 call sequences were recorded, of which 58 call sequences were able to be analysed (ie were not 'noise' files or bat calls of short length). Of the bat calls, 31 call sequences (53 %) were able to be confidently identified (those classified as either definite or probable identifications) to species level (Table 3-1). Species recorded confidently within the site include:

- *Chalinolobus gouldii* (Gould's wattled bat)
- *Chalinolobus nigrogriseus* (Hoary wattled bat)
- *Vespadelus darlingtoni* (Large forest bat)
- *Vespadelus pumilus* (Eastern forest bat)

Additionally, the following bat species potentially occurred within the site, but could not be confidently identified (those calls classified as possible or as a species group):

- *Chalinolobus morio* (Chocolate wattled bat)
- *Falsistrellus tasmaniensis* (Eastern falsistrelle)
- *Mormopterus (Micronomus) norfolkensis* (East coast free-tailed bat)
- *Mormopterus (Ozimops) ridei* (Eastern free-tailed bat)
- *Scotorepens orion* (Eastern broad-nosed bat)
- *Vespadelus troughtoni* (Eastern cave bat)
- *Vespadelus vulturnus* (Little forest bat)

It should be noted that additional bat species may be present within the site but were not recorded by the detectors and habitat assessment should be used in conjunction with these results to determine the likelihood of occurrence of other bat species.

Table 3-1 below summarises the results of the bat call analysis.

Table 3-1: Results of bat call analysis (number of passes per site per night)

IDENTIFICATION	Anabat 13/02/2015	Anabat 28/02/2015
DEFINITE		
Chalinolobus gouldii	3	-
Vespadelus pumilus	1	-
PROBABLE		
Chalinolobus gouldii	17	-
Chalinolobus nigrogriseus	1	-
Vespadelus darlingtoni	8	1
POSSIBLE		
Chalinolobus gouldii	3	-
Vespadelus darlingtoni	1	1
SPECIES GROUPS		
Chalinolobus gouldii / Mormopterus (Micronomus) norfolkensis / Mormopterus (Ozimops) ridei	6	1
Chalinolobus gouldii / Mormopterus (Ozimops) ridei	11	-
Chalinolobus morio / Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	1	-
Chalinolobus nigrogriseus / Falsistrellus tasmaniensis	1	-
Chalinolobus nigrogriseus / Falsistrellus tasmaniensis / Scotorepens orion	2	-
UNKNOWN		
'Noise' files	2	1
Unknown	7	8
TOTAL	**64**	**12**

4.0 SAMPLE CALLS

A sample of the calls actually identified from the site for each species is given below.

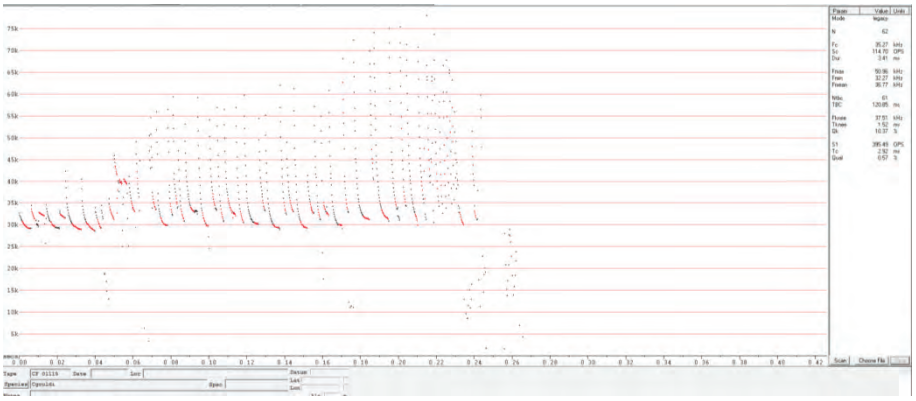


Figure 4-1: *Chalinolobus gouldii* definite call

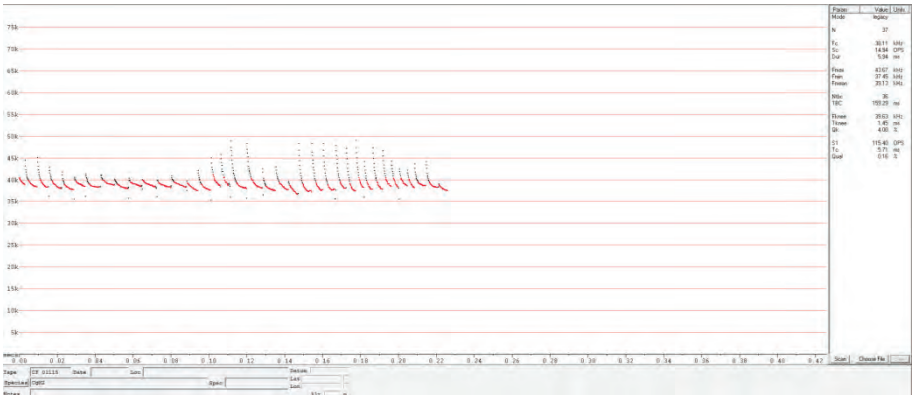


Figure 4-2: *Chalinolobus nigrogriseus* probable call



Figure 4-3: *Vespadelus darlingtoni* probable call



Figure 4-4: *Vespadelus pumilus* definite call

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