JAMES WARREN & Associates Pty Ltd

ECOLOGICAL CONSULTANTS

ECOLOGICAL ASSESSMENT

Lot 112 DP 1073791
Lyons Road, Sawtell

JANUARY 2011

A REPORT PREPARED FOR
UTILA PTY LTD

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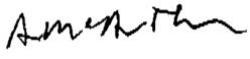
Signature	

1. INTRODUCTION

1.1 Background

James Warren and Associates (JWA) have been engaged by Utila Pty Ltd to complete an Ecological Assessment of land formally described as Lot 112 DP 1073791, Lyons Road, Sawtell **(FIGURE 1).**

A project application for the proposed development was lodged with the Department of Planning (DoP) – Application No. 08_0080 and Director General's Requirement (DGRs) issued. The DGRs require the consideration of the existing aquatic and riparian environment and proposed water courses.

The assessment has involved the following:

- Mapping and ground truthing vegetation units and determining their conservation status with reference to the Comprehensive Regional Assessment completed for NSW Forest and Non-forest ecosystems as part of the Regional Forestry Agreement (RFA) process (CRA Unit 1999), and with reference to the Coffs Harbour Vegetation Management Strategy (Ecograph 2002);
- Searching for and recording Threatened (*TSC Act 1995*) plant species and assessing the occurrence of Endangered Ecological Communities (EECs);
- Determining the suite of Threatened fauna (*TSC Act 1995*) that occurs in the locality and assessing their potential occurrence in the Study area;
- Assessing habitat provided by the site in relation to adjacent habitat and making an assessment of the corridor value of the site;
- Addressing statutory requirements including *State Environmental Planning Policy No. 44* (SEPP 44 – Koala Habitat Protection), Section 5A of the *Environmental Planning & Assessment Act (1979)* (EPA Act) and the Commonwealth *Environment Protection and Biodiversity Act 1999* (EPBC Act).

1.2 The Subject Site

1.2.1 Description and Location

The subject site, Lot 112 DP 1073791, is situated on the outskirts of Sawtell on the NSW mid-north coast. The site covers an area of approximately 38.5 ha **(FIGURE 2)**. Forested wetland covers the eastern third of the site (approximately 13 ha) and partially vegetated wetland extends along drainage lines running from the north-west and south-west. The remainder of the site is cleared land currently used for grazing (approximately 25 ha). The site adjoins Bongil Bongil National Park.

1.2.2 Land Use Zones

The site covers the following land use zones:

- 2(a) Residential – Low Density;
- 6(a) Open space – Public Recreation; and

SOURCE: Google Maps SCALE: 1 : 15 000 @ A4 JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants	CLIENT Utila Pty Ltd PROJECT Ecological Assessment Lot 112 on DP1073791 Lyons Road, North Bonville, NSW Coffs Harbour City Council LGA	**FIGURE 1** PREPARED: BW DATE: 20 May 2010 FILE: N08022_Locality.cdr	TITLE **LOCALITY PLAN**

N

Legend

Subject Site

0 50m 100m

1 : 4000

SOURCE: Google Earth 2008 Aerial Photograph

SCALE: 1 : 4000 @ A3

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FIGURE 2

PREPARED: BW
DATE: 20 May 2010
FILE: N08022_Aerial.cdr

TITLE

AERIAL PHOTOGRAPH

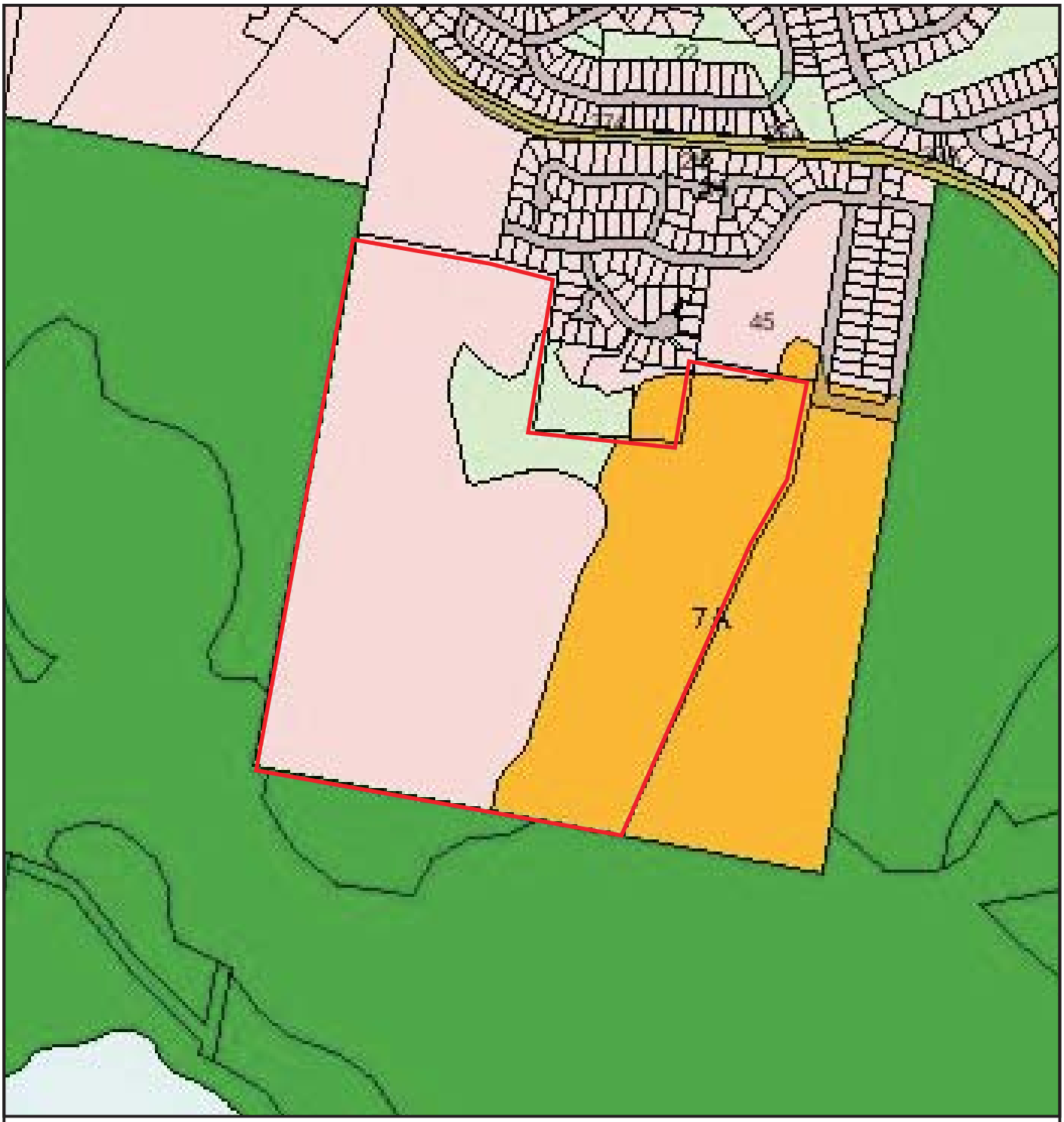
- 7(a) Environmental Protection – Habitat & Catchment.

Land zones are shown in **FIGURE 3.**

1.3 The Proposed Development

The proposed development is for a residential subdivision comprising of 151 low density lots and three land parcels for medium density housing with the potential to accommodate 42 medium density lots. The development will also include associated roads, infrastructure, public open space areas and a residential public reserve. The proposed development layout is shown in **FIGURE 4**.

The proposal also includes the implementation of a Vegetation Management Plan (JWA 2011) roughly covering the Freshwater Wetlands, the north-west and south-west drainage lines, and a portion of the Swamp Sclerophyll Forest in the east of the site.



Legend

- 2a Residential - Low Density
- 6a Open Space - Public Recreation
- 7a Environmental Protection - Habitat & Catchment
- 8 National Park & Reserves
- Subject Site

N

0 100m 200m

SOURCE: Coffs Harbour City Council - LEP Maps Online

SCALE: 1 : 8000 @ A4

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FIGURE 3

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FILE: N08022_Zoning.cdr

TITLE

ZONING PLAN

FUTURE APPROVED DEVELOPMENT

BONGIL BONGIL NATIONAL PARK

740.74

FIRE TRAIL

PROPOSED PUBLIC RESERVE

PROPOSED PUBLIC RESERVE

PROPOSED PUBLIC RESERVE

BONGIL BONGIL NATIONAL PARK

509.01

MIMIVALI CLOSE

EXISTING DEVELOPMENT

EXISTING DEVELOPMENT
NO ACCESS TO LYONS ROAD

EXISTING AS CONSTRUCTED INTERSECTION

BAMBARA DRIVE

194.37

88.25

EXISTING DEVELOPMENT

LETITIA PLACE

TROND CLOSE

RUTLAND STREET

CELESTE PLACE

LYONS ROAD

DANIEL COURT

212.98

117.3

202.775

85.3

115.91

166.95

137.0

101.31

431.67

PROPOSED ADDITIONS TO BONGIL BONGIL NATIONAL PARK
LAND TRANSFER TO BE BY ARRANGEMENT WITH NATIONAL
PARKS AND WILDLIFE SERVE

47.0 125.0 26.5 78.0 61.6 31.0 34.7 39.1 11.8 23.4 13.4 43.5 35.3

POST AND RAIL GATE AT FIRE TRAILTO
COFFS HARBOUR CITY COUNCIL DETAIL
TYPICAL EACH END

Legend
Subject Site

0 100m
1 : 3000

SOURCE: JWA Site Investigations; Worley Parsons; Geoff Slattery & Partners SCALE: 1 : 3000 @ A3 *JAMES WARREN & ASSOCIATES PTY LIMITED* *Environmental Consultants*	CLIENT Utila Pty Ltd PROJECT Ecological Assessment Lot 112 on DP1073791 Lyons Road, North Bonville, NSW Coffs Harbour City Council LGA	**FIGURE 4** PREPARED: BW DATE: 17 January 2011 FILE: N08022_Layout.cdr	TITLE **PROPOSED DEVELOPMENT LAYOUT**

2. FLORA ASSESSMENT

2.1 Introduction

This section discusses the methods used in the vegetation assessment and presents the results of the assessment.

2.2 Methods

2.2.1 Database searches

Searches of the NPWS and DEWHA databases were completed (27th October 2008) to find records of State and Commonwealth Threatened species[1] within 10km of the Subject site.

2.2.2 Site survey

A site survey was completed at the Subject site between the 4th & 8th November 2008 by two (2) scientists utilising random meander searches (Cropper 1993) and a general plant species list was compiled. A total of over fifteen (15) hours flora survey was undertaken.

Mapping of vegetation communities was achieved using 1:1000 (2004) aerial photography, GPS and cadastral bases with relevant survey points.

During a subsequent site survey (October 2009) all areas of vegetation on the site were traversed and previous vegetation mapping verified. Approximately four (4) hours was spent verifying vegetation mapping.

2.3 Results

2.3.1 Database searches

Searches of the NPWS and DEWHA databases (27th October 2008) revealed twenty-two (22) Threatened Flora species within 10km of the Subject site. These species are shown in **TABLE 1**.

TABLE 1
DATABASE RECORDS OF THREATENED FLORA SPECIES
WITHIN 10 KM OF THE SUBJECT SITE

Common name	Botanical name	Status	
		TSC Act (1995)	EPBC Act (1999)
Scented acronychia	*Acronychia littoralis*	Endangered	Endangered
Floyd's grass	*Alexfloydia repens*	Endangered	-
Dwarf heath casuarina	*Allocasuarina defungens*	Endangered	Endangered

[1] As listed within schedules of the TSC Act (1995) and EPBC Act (1999).

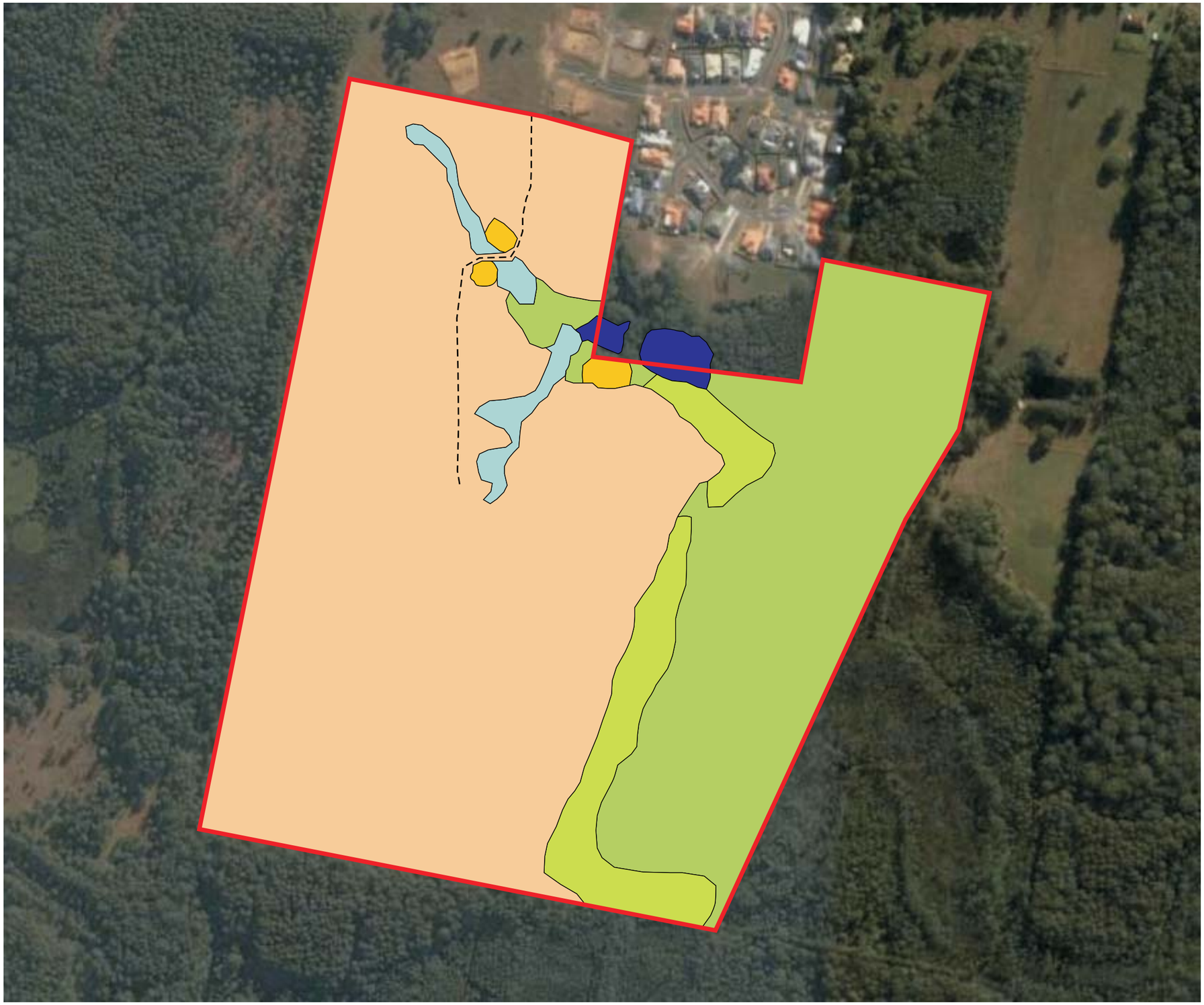
Common name	Botanical name	Status	
		TSC Act (1995)	EPBC Act (1999)
Rusty plum	*Amorphospermum whitei*	Vulnerable	-
Hairy joint-grass	*Arthraxon hispidus*	Vulnerable	Vulnerable
Stinking cryptocarya	*Cryptocarya foetida*	Vulnerable	Vulnerable
White-flowered wax plant	*Cynanchum elegans*	Endangered	Endangered
Byron Bay diuris	*Diuris sp. aff. chrysantha*	Endangered	-
Square-stemmed spike-rush	*Eleocharis tetraquetra*	Endangered	-
Slender screw fern	*Lindsaea incisa*	Endangered	-
Clear milkvine	*Marsdenia longiloba*	Endangered	Vulnerable
Red-flowered king of the fairies	*Oberonia titania*	Vulnerable	-
Milky silkpod	*Parsonsia dorrigoensis*	Vulnerable	Endangered
Knotweed	*Persicaria elatior*	Vulnerable	Vulnerable
Southern swamp orchid	*Phaius australis*	Endangered	Endangered
Coastal headland pea	*Pultenaea maritima*	Vulnerable	-
Silverbush	*Sophora tomentosa*	Endangered	-
Ribbon-root orchid	*Taeniophyllum muelleri*	-	Vulnerable
Australian toadflax	*Thesium australe*	Vulnerable	Vulnerable
Arrow-head vine	*Tinospora tinosporoides*	Vulnerable	Vulnerable
A vine	*Tylophora woollsii*	Endangered	Endangered
Headland zieria	*Zieria prostrata*	Endangered	Endangered

- Not listed

2.3.2 Site survey

Six (6) vegetation communities were identified in the Subject site (**TABLE 2**). These communities are described in detail in Section 2.3.3 and are their location and extent is shown in **FIGURE 5**.

Eighty-five (85) flora species were recorded at the Subject site. No threatened species were recorded. A full list of species recorded at the site is included as **APPENDIX 1**.



Legend

- Community 1: Tall open swamp sclerophyll forest (*Eucalyptus robusta*)
- Community 2: Tall open / closed swamp sclerophyll forest (*Melaleuca quinquenervia*)
- Community 3: Tall open dry sclerophyll forest (Mixed species)
- Community 4: Low closed sedgeland / wet pasture (*Juncus usitatus* +/- *Chorizandra cymbaria* / *Philydrum lanuginosum*)
- Community 5: Low closed grassland with scattered trees
- Community 6: Dams
- Existing Track
- Subject Site

0 50m 100m

1 : 4000

SOURCE: JWA Site Investigations; Google Earth 2008 Aerial Photograph

SCALE: 1 : 4000 @ A3

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FIGURE 5

PREPARED: BW
DATE: 20 May 2010
FILE: N08022_Vegetation.cdr

TITLE

VEGETATION COMMUNITIES

TABLE 2
VEGETATION COMMUNITIES PRESENT ON THE SUBJECT SITE

1	Tall open swamp sclerophyll forest *(Eucalyptus robusta)*
2	Tall open/closed swamp sclerophyll forest *(Melaluca quinquenervia)*
3	Tall open dry sclerophyll forest (Mixed species)
4	Low closed sedgeland/wet pasture *(Juncus usitatus +/- Chorizandra cymbaria / Philydrum lanuginosum)*
5	Low closed grassland with scattered trees
6	Dams

2.3.3 Vegetation community descriptions

2.3.3.1. Background

Six (6) vegetation communities were identified in the Subject site. The conservation status of these communities is discussed at a local level with reference to the following documents:

- Fisher, Body and Gill (1996) The vegetation of the Coffs Harbour City Council LGA;
- Ecograph (2002) Coffs Harbour Vegetation Management Strategy; and
- Hager and Benson (1994) Review of the Conservation Status of Vegetation Communities in New South Wales.

2.3.3.2. Community 1 - Tall open swamp sclerophyll forest (*Eucalyptus robusta*)

Location and area

This community occurs in the low-lying eastern portion of the subject site fringing the paperbark swamp and also as a small patch adjacent to the constructed dams **(FIGURE 5).**

Description

The canopy of this community is generally comprised of mature Swamp mahogany (*Eucalyptus robusta*) up to 25m in height. There are also scattered occurrences of mature Broad-leaved paperbark (*Melaleuca quinquenervia*) and Blackbutt (*E. pilularis*), particularly adjacent to the constructed dams.

The midstorey in this community is generally comprised of a mixture of Blueberry ash (*Elaeocarpus reticulatus*); Willow bottlebrush (*Callistemon salignus*) and Black wattle (*Callicoma serratifolia*) and is quite dense in some areas. Blackwood wattle (*Acacia melanoxylon*) is common along the interface of this community and adjacent cleared land.

The groundcover is generally dominated by a mixture of Red-fruited saw-sedge (*Gahnia sieberana*) and Curly sedge (*Restio tetraphyllus*). Other species present include Blady grass (*Imperata cylindrica*), Bracken (*Pteridium esculentum*), Kangaroo grass (*Themeda triandra*), Long-leaved matrush (*Lomandra longifolia*), and Wiry panic (*Entolasia stricta*) in drier areas, as well as Bristle rush (*Chorizandra cymbaria*) and *Blechnum camfieldii* in wetter areas.

Conservation status

The closest description of this community under the Fisher, Body & Gill (1996) classification system for vegetation in the Coffs Harbour LGA is Map Unit N52 – Swamp Mahogany, which is not considered to be locally or regionally significant. It is noted however that this is a community which comprises tree species utilised by Koalas and is therefore **Ecologically significant**.

The Coffs Harbour Vegetation Management Strategy (CHVMS) (Ecograph 2002) notes that there are 142 hectares of this community within the Coffs Harbour area which amounts to 0.28% of the total area. Hager and Benson (1994) note that this community is **adequately conserved** the central zone.

This vegetation community is representative of the **Endangered Ecological Community (EEC)** Swamp sclerophyll forest on the floodplain as gazetted by the NSW Scientific Committee on 17th December 2004.

This community is therefore considered to have **high conservation significance** on the subject site.

2.3.3.3. Community 2 - Tall open/closed swamp sclerophyll forest (*Melaleuca quinquenervia*)

Location and area

This community occurs in the low-lying eastern portion of the subject site and also fringing the constructed dams **(FIGURE 5)**.

Description

The canopy of this community is comprised entirely of Broad-leaved paperbark (*Melaleuca quinquenervia*) up to 20m in height. The midstorey in this community is generally absent and restricted to scattered occurrences of Melastoma (*Melastoma affine*), Cheese tree (*Glochidion ferdinandi*) and Blueberry ash.

The groundcover is also generally absent due to the presence of standing water however Common reed (*Phragmites australis*) occurs in some areas. There are also scattered occurrences of Red-fruited saw-sedge, Curly sedge, Bristle rush, *Blechnum camfieldii* and Swamp millet (*Isachne globosa*). Slender knotweed (*Persicaria decipiens*) is common fringing the constructed dams.

Conservation status

The closest description of this community under the Fisher, Body & Gill (1996) classification system for vegetation in the Coffs Harbour LGA is Map Unit N20 – Paperbark, which is not considered to be locally or regionally significant. It is noted

however that this is a community which comprises tree species utilised by Koalas and is therefore **ecologically significant**.

The Coffs Harbour Vegetation Management Strategy (CHVMS) (Ecograph 2002) notes that there are 485 hectares of this community within the Coffs Harbour area which amounts to 0.91% of the total area. Hager and Benson (1994) note that this community is **adequately conserved** the central zone.

This vegetation community is representative of the **Endangered Ecological Community (EEC)** Swamp sclerophyll forest on the floodplain as gazetted by the NSW Scientific Committee on 17th December 2004.

This community is therefore considered to have **high conservation significance** on the subject site.

2.3.3.4. Community 3 - Tall open dry sclerophyll forest (Mixed species)

Location and area

This community occurs as scattered patches of mature trees retained within the grassland community and adjacent to the constructed dams **(FIGURE 5)**.

Description

The canopy of this community is comprised of a mixture of species including Tallowwood (*E. microcorys*), Blackbutt, Red mahogany (*E. resinifera*), Pink bloodwood (*Corymbia intermedia*), Swamp mahogany, Smooth-barked apple (*Angophora costata*) and Turpentine (*Syncarpia glomulifera*).

The midstorey in this community is absent due to past clearing activities and continued grazing of cattle. The groundcover is comprised of a mixture of introduced grasses and common agricultural weeds.

Conservation status

The closest description of this community under the Fisher, Body & Gill (1996) classification system for vegetation in the Coffs Harbour LGA is Map Unit N20 – Paperbark, which is not considered to be locally or regionally significant. It is noted however that this is a community which comprises tree species utilised by Koalas and is therefore **Ecologically significant**.

The Coffs Harbour Vegetation Management Strategy (CHVMS) (Ecograph 2002) notes that there are 485 hectares of this community within the Coffs Harbour area which amounts to 0.91% of the total area. Hager and Benson (1994) note that this community is **adequately conserved** the central zone.

This vegetation community is considered to have **low-moderate conservation significance** as it is small and isolated, and is highly disturbed by grazing cattle.

2.3.3.5. Community 4 - Low closed sedgeland/wet pasture (*Juncus usitatus +/- Chorizandra cymbaria / Philydrum lanuginosum*)

Location and area

This community occurs in the low-lying drainage lines in the central and northern portions of the subject site **(FIGURE 5)**.

Description

This community is comprised of a mixture of hydrophytic plant species the most common of which include Common rush (*Juncus usitatus*), Swamp buttercup (*Ranunculus inundatus*), Bristle rush and Frogsmouth (*Philydrum lanuginosum*), and introduced pasture grasses. There are also occurrences of Swamp water fern (*Blechnum indicum*), Slender knotweed, Jointed twig-rush (*Baumea articulata*) and Tall sedge (*Carex appressa*).

Regenerating Broad-leaved paperbarks also occur sporadically within this community.

Conservation status

The closest description of this community under the Fisher, Body & Gill (1996) classification system for vegetation in the Coffs Harbour LGA is Map Unit SG6502 – Sedgeland/Rushland, which is considered to be **locally significant**.

The Coffs Harbour Vegetation Management Strategy (CHVMS) (Ecograph 2002) notes that there are 55 hectares of this community within the Coffs Harbour area which amounts to 0.1% of the total area.

This vegetation community is representative of the **Endangered Ecological Community (EEC)** Freshwater wetlands on coastal floodplain as gazetted by the NSW Scientific Committee on 17th December 2004. However, continued disturbance by grazing cattle, and the presence of introduced grasses and agricultural weeds have significantly reduced the conservation value of this area. This community is therefore considered to have **moderate conservation significance** on the subject site.

2.3.3.6. Community 5 - Low closed grassland with scattered trees

Location and area

The majority of the subject site is comprised of grassland with scattered trees having been substantially cleared for grazing purposes **(FIGURE 5)**.

Description

This community is comprised of a mixture of native and introduced grasses as well as commonly occurring agricultural weeds, and is heavily grazed by cattle.

Conservation status

This community is considered to have **low conservation significance** on the subject site.

2.3.3.7. Community 6 - Dams

Location and area

Two (2) constructed dams occur on the northern boundary of the subject site **(FIGURE 5)**.

Description

Fringing vegetation is comprised of a mixture of Eucalyptus species (Community 3) and Broad-leaved paperbarks (Community 2).

Vegetation within the dams includes Slender knotweed, Grey sedge (*Lepironia articulata*), Common rush, Water lilies (*Nymphaea sp.*), Java pondweed (*Potamogeton javanicus*) and Cumbungi (*Typha orientalis*). Water primrose (*Ludwigia peploides*) also occurs and forms dense floating mats in some areas.

Conservation status

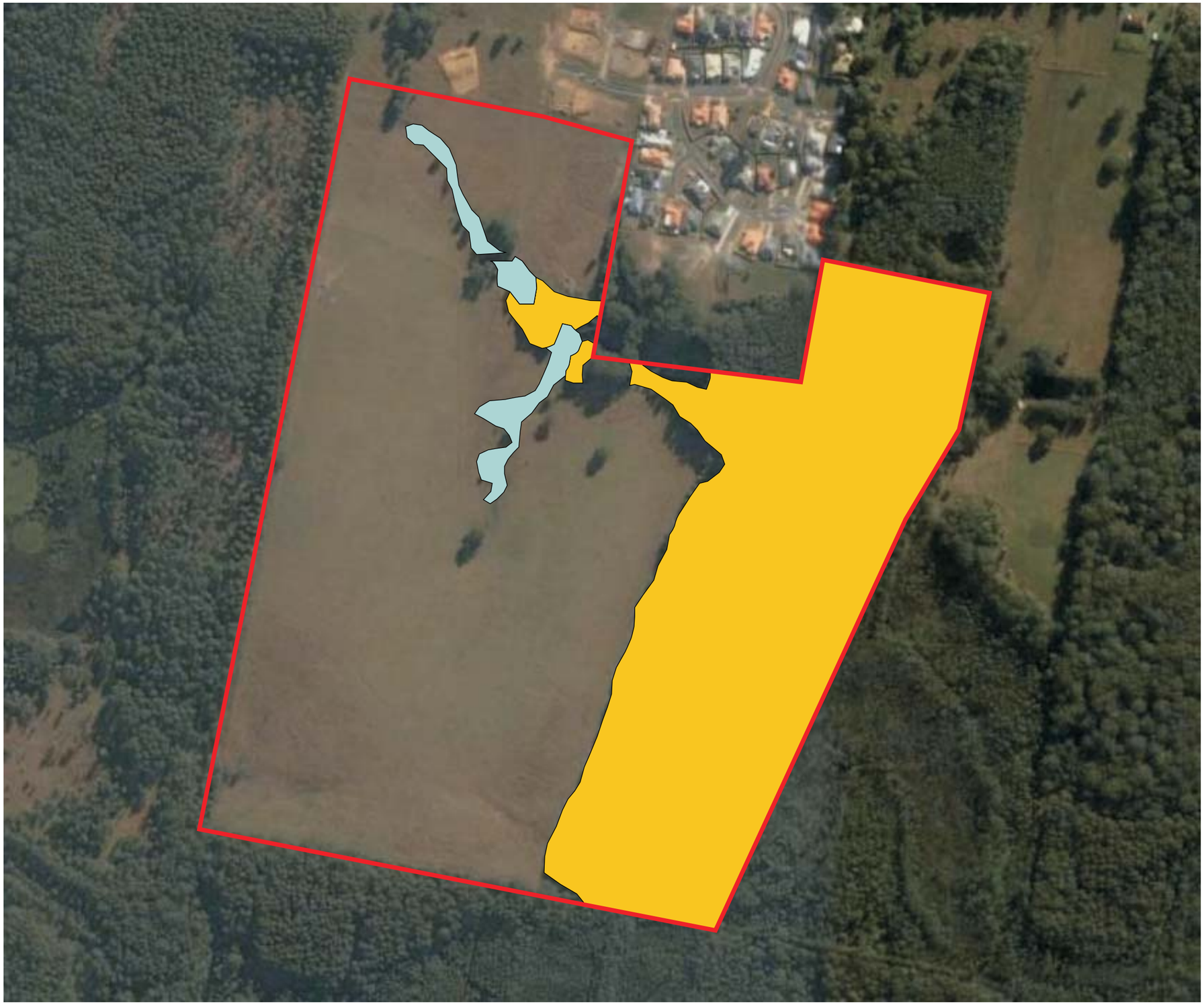
This community is considered to have **low-moderate conservation significance** on the subject site.

2.3.4 Endangered Ecological Communities

There are two EECs on the subject site:

- Swamp sclerophyll forest on the floodplain (i.e. Vegetation communities 1 & 2); and
- Freshwater wetlands on coastal floodplain (i.e. Vegetation community 4).

The location and extent of these EECs on the subject site are shown in **FIGURE 6.**



Legend

- Swamp Sclerophyll Forest on Coastal Floodplain
- Freshwater Wetland on Coastal Floodplain (Degraded)
- Subject Site

N

0 50m 100m

1 : 4000

SOURCE: JWA Site Investigations; Google Earth 2008 Aerial Photograph

SCALE: 1 : 4000 @ A3

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FIGURE 6

PREPARED: BW
DATE: 20 May 2010
FILE: N08022_EEC.cdr

TITLE

ENDANGERED ECOLOGICAL COMMUNITIES

3. FAUNA ASSESSMENT

3.1 Introduction

This section includes a description of the methods used in determining which fauna species use, or are likely to use, the Study area and a discussion of the results of the Fauna assessment. The fauna assessment involved a full fauna survey (i.e. specialised bird, bat and amphibian survey, spotlighting, hair sampling and trapping).

3.2 Methods

3.2.1 Database searches

Searches of the NPWS and DEWHA databases were conducted to find records of State and Commonwealth Threatened[2] fauna species within 10km of the Subject site.

3.2.2 Fauna survey

3.2.2.1. Introduction

A detailed fauna survey was carried out between the between the 4th & 8th November 2008. The weather was generally fine and warm during the survey period with a number of showers.

3.2.2.2. Survey Techniques

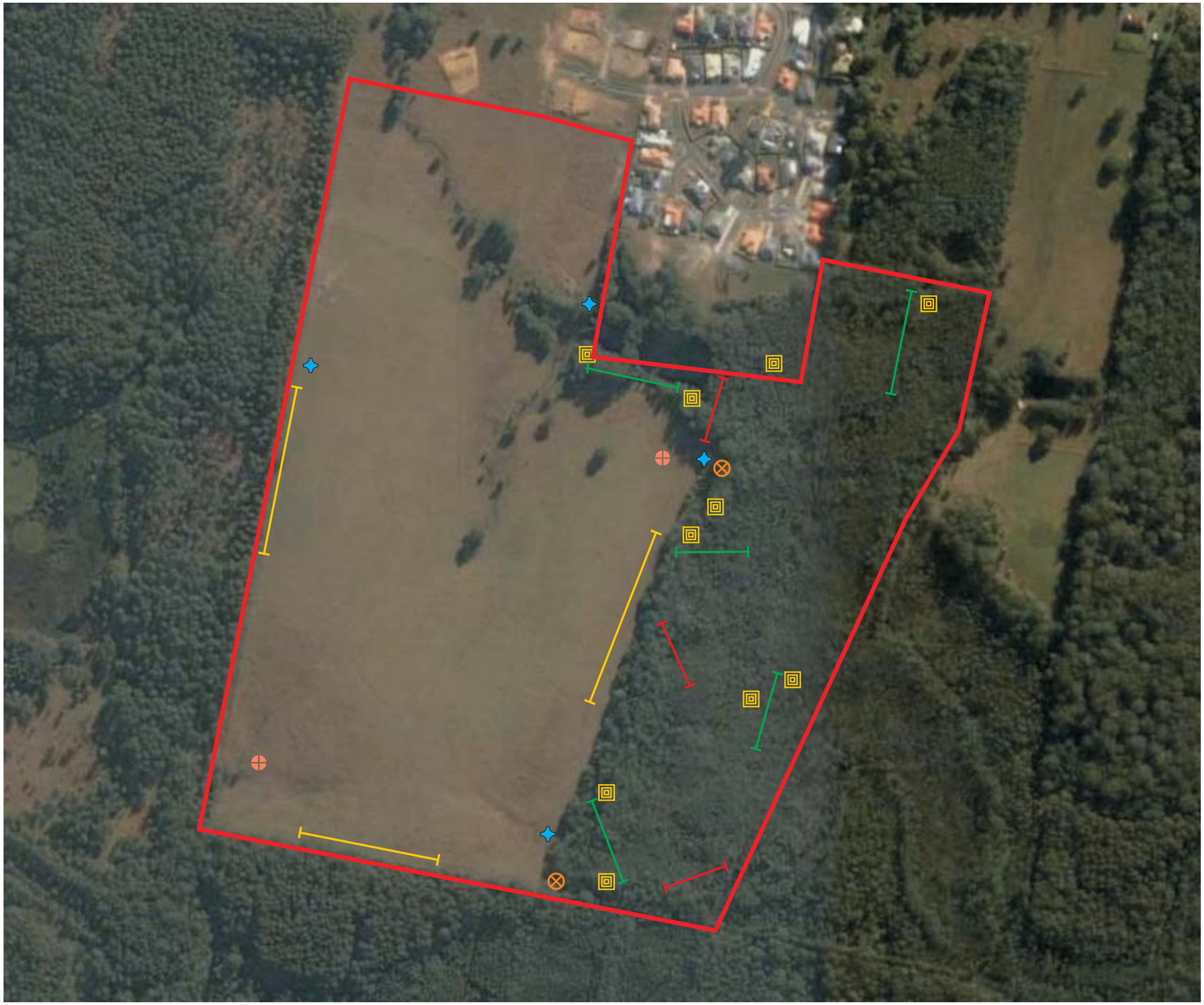
Detailed fauna surveys were designed to target threatened species identified as occurring in the Study area. The following survey techniques were utilised in this assessment. **FIGURE 7** shows the location of trap sites. **TABLE 3** provides a summary of the trapping effort.

Opportunistic Sightings
The 'random meander' technique (Cropper 1993) was used to traverse the site. All incidental records of fauna utilising the study area were recorded.

Active Searching
Logs, sheets of tin, cardboard, bark and leaves were overturned in search of reptiles and amphibians while incidentally traversing the site. Diggings and signs of droppings were searched for. The site was actively searched for scats and bones. Active observation of bird activity was undertaken during the site visit.

Type 'A' Elliott Box Traps and Cage Traps
This methodology provides an insight into the size and density of populations of ground fauna which may form a component of the diet of raptors such as the Eastern grass owl and the Masked owl. It also indicates the extent of invasion by exotic species such as the Black rat and the House mouse which allows an assessment of the 'naturalness' of the area to be made.

[2] As listed within schedules of the TSC Act (1995) and EPBC Act (1999).



Legend

- Elliott Traps
- Cage Traps
- Pitfall Traps
- Hair Tubes
- Call Playback Locations
- Harp Traps
- ANABAT Locations
- Subject Site

N

0 50m 100m

1 : 4000

SOURCE: JWA Site Investigations; Google Earth 2008 Aerial Photograph

SCALE: 1 : 4000 @ A3

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FIGURE 7

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TITLE

SURVEY SITES

Five (5) lines of Type 'A' Elliot traps with ten (10) traps in each line were set for a period of four (4) nights for a total of two hundred (200) trap nights. Ten (10) cage traps were also deployed for four (4) nights for a total of forty (40) trap nights. Both the Elliot traps and the Cage traps were baited with a mixture of rolled oats, honey, peanut butter and vanilla essence. The cage traps were also baited with fruit.

Pitfall traps
Three (3) pitfall lines of five (5) buckets (10 litre) spaced five (5) metres apart (incorporating drift fencing) were set for a period of four (4) nights. A total of sixty (60) bucket nights were achieved during this component of the Study.

Hair Tubes
Four (4) lines of five (5) hair tubes each were laid on the site. Each Hair Tube was baited with rolled oats, honey, peanut butter and vanilla essence and then set for a period of fourteen (14) nights for a total of two hundred and eighty (280) trap nights. Hair tube records were analysed by Barbara Triggs.

Call playback techniques
Call playback was carried out over four (4) nights at various locations throughout the site for a period of one (1) hour. Target species included:

- Barking Owl;
- Koala;
- Masked owl;
- Powerful owl;
- Squirrel glider;
- Wallum froglet; and
- Yellow-bellied glider.

Calls were broadcast, and then followed by a five (5) minute listening period.

Diurnal bird surveys
Diurnal birds were surveyed visually and aurally by habitat search for an hour before dusk on the 4th November, an hour after dawn and an hour before dusk on the 5th November, an hour after dawn and an hour before dusk on the 6th November, an hour after dawn and an hour before dusk on the 7th November, and an hour after dawn on the 8th November, for a total of eight (8) hours.

Harp Netting
Two (2) Harp traps were set in potential flyways over four (4) nights. Flyways were chosen on the basis of adequate cover on both sides of the trap, and screening was incorporated to enhance capture success. An overall total of eight (8) trap nights was achieved in this component of the Study.

Anabat Recording
An Anabat II sonar detector (Titley Electronics, Ballina) was used to down-load the ultrasonic calls of Microchiropteran bats. Recording was undertaken for twelve (12) hours per night over four (4) nights. A total of forty-eight (48) hours of recording was undertaken. Recording times commenced from slightly before dusk. Recording was undertaken by positioning the Anabat II sonar detector facing across possible bat flyways. Anabat records were identified by Dr. Greg Ford.

Spotlighting
Spotlighting was undertaken by one (1) person for two and a half (2.5) hours on four (4) consecutive nights for a total of ten (10) hours spotlighting. The weather for the spotlighting survey was generally fine and warm, with a few showers on the night of the 7th.

All vegetated areas were traversed on foot and spotlighting was carried out using a 50W spotlight powered by a 12V battery. The observer walked at approximately 1km/h allowing intensive listening as an adjunct to visual detection.

TABLE 3
SUMMARY OF TRAPPING EFFORT

Elliott trapping	200 trap nights
Cage traps	40 trap nights
Pitfall traps	60 trap nights
Hair tubes	280 trap nights
Call playback	4 nights (4hrs)
Bird survey	Targeted diurnal surveys, 5 days opportunistic records
Harp traps	8 trap nights
Anabat (bat calls)	4 nights (48 hours)
Spotlighting	10 hours

3.2.3 Habitat suitability assessment

Site habitats were assessed to determine their value for native fauna species. This assessment was completed in conjunction with the flora survey. The assessment focused on identifying habitat features typically associated with Threatened species as well as other native fauna groups. Particular attention was paid to habitat features such as:

- The presence of mature trees with hollows, fissures and/or other suitable roosting/nesting places;
- The presence of Koala food trees;
- The presence of preferred Glossy black cockatoo feed trees (Forest oak and/or Black she-oak);
- The presence of characteristic signs of foraging (e.g. Yellow-bellied glider feeding scars);
- Condition, flow and water quality of drainage lines and bodies of water;
- Areas of dense vegetation;
- Presence of hollow logs/debris and areas of dense leaf litter;
- Presence of fruiting flora species;
- Presence of blossoming flora species, particularly winter-flowering species;

- Vegetation connectivity and proximity to neighbouring areas of intact vegetation; and
- Presence of caves and man-made structures suitable as microchiropteran bat roost sites.

Each Threatened species known from the locality was regarded as *Likely, Possible* or *Unlikely* to occur on the Subject site based on the occurrence of suitable habitat characteristics (Section 3.3.3). A rating of *Likely* was given for those species where breeding or high quality habitat is present on the site; a rating of *Possible* was given for those species where suitable foraging or roosting habitat is present on the site; and a rating of *Unlikely* was given for species where no suitable habitat occurs on the site.

3.3 Results and Discussion

3.3.1 NPWS Database search

The NPWS database revealed records of thirty (30) Threatened fauna species within 10km of the subject site. The EPBC Protected Matter Search Tool revealed the potential occurrence of thirteen (13) Commonwealth Threatened fauna species within 10km of the subject site based on records and/or the availability of suitable habitat.

These species are shown in **TABLE 4**. Oceanic and shore-line species will not occur on the subject site and have not been included in the table.

TABLE 4
DATABASE RECORDS OF THREATENED FAUNA SPECIES
WITHIN 10 KM OF THE SUBJECT SITE

Scientific Name	Common Name	Status	
		TSC Act (1995)	EPBC Act (1999)
Ninox connivens	Barking owl	Vulnerable	-
Coracina lineata	Barred cuckoo-shrike	Vulnerable	-
Ixobrychus flavicollis	Black bittern	Vulnerable	-
Xenorhychus asiatius	Black-necked stork	Endangered	-
Litoria booroolongensis	Booroolong frog	Endangered	Endangered
Phascogale tapoatafa	Brush-tailed phascogale	Vulnerable	-
Petrogale penicillata	Brush-tailed rock-wallaby	Endangered	Vulnerable
Irediparra gallinacea	Comb-crested jacana	Vulnerable	-
Syconycteris australis	Common blossom bat	Vulnerable	-
Planigale maculata	Common planigale	Vulnerable	-
Miniopterus schreibersii oceanensis	Eastern bent-wing bat	Vulnerable	-
Mormopterus norfolkensis	Eastern free-tail bat	Vulnerable	-
Mixophyes iteratus	Giant barred frog	Endangered	Endangered

Scientific Name	Common Name	Status	
		TSC Act (1995)	EPBC Act (1999)
Calyptorhynchus lathami	Glossy black-cockatoo	Vulnerable	-
Tyto capensis	Grass owl	Vulnerable	-
Scoteanax rueppellii	Greater broad-nosed bat	Vulnerable	-
Litoria aurea	Green and golden bell frog	Endangered	Vulnerable
Pteropus poliocephalus	Grey-headed flying-fox	Vulnerable	Vulnerable
Phascolarctos cinereus	Koala	Vulnerable	-
Chalinolobus dwyeri	Large-eared pied bat	Vulnerable	Vulnerable
Myotis macropus	Large-footed myotis	Vulnerable	-
Miniopterus australis	Little bent-wing bat	Vulnerable	-
Potorous tridactylus	Long-nosed potoroo	Vulnerable	Vulnerable
Tyto novaehollandiae	Masked owl	Vulnerable	-
Pandion haliaetus	Osprey	Vulnerable	-
Ninox strenua	Powerful owl	Vulnerable	-
Xanthomyza phrygia	Regent honeyeater	Endangered	Endangered
Ptilinopus regina	Rose-crowned fruit dove	Vulnerable	-
Tyto tenebricosa	Sooty owl	Vulnerable	-
Dasyurus maculatus	Spotted-tail quoll	Vulnerable	Endangered
Lophoictinia isura	Square-tailed kite	Vulnerable	-
Petaurus norfolkensis	Squirrel glider	Vulnerable	-
Mixophyes balbus	Stuttering frog	Endangered	Vulnerable
Crinia tinnula	Wallum froglet	Vulnerable	-
Ptilinopus magnificus	Wompoo fruit-dove	Vulnerable	-
Petaurus australis	Yellow-bellied glider	Vulnerable	-

- Not listed

3.3.2 Results of fauna survey

3.3.2.1. Amphibians

Seven (7) species of amphibian were recorded during site surveys (**TABLE 5**). No Threatened species were recorded. The survey was completed in summer and during a period of moderate rainfall. Amphibian activity could be expected to be high.

TABLE 5
AMPHIBIAN SPECIES RECORDED ON THE SUBJECT SITE

Common name	Scientific name	Method of identification
Bleating tree frog	*Litoria dentata*	Call recognition
Cane toad*	*Bufo marinus*	Call recognition, capture
Common eastern froglet	*Crinia signifera*	Call recognition, capture
Eastern dwarf tree frog	*Litoria fallax*	Call recognition
Green tree frog	*Litoria caerulea*	Call recognition
Striped marsh frog	*Limnodynastes peronii*	Capture
Tusked frog	*Adelotus brevis*	Call recognition

* Introduced species

3.3.2.2. Reptiles

Seven (7) reptile species were recorded during the fauna survey (**TABLE 6**). No Threatened species were recorded. The survey was completed in summer and during a period of moderate rainfall. Reptile activity could be expected to be moderate-high.

TABLE 6
REPTILE SPECIES RECORDED ON THE SUBJECT SITE

Common name	Scientific name	Method of identification
Carpet python	*Morelia spilota*	Sighting
Common garden skink	*Lampropholis delicata*	Capture
Dark flecked sun skink	*Lampropholis guichenoti*	Capture
Eastern blue-tongue lizard	*Tiliqua scincoides*	Capture
Eastern water dragon	*Physignathus lesuerii*	Sighting
Lace monitor	*Varanus varius*	Capture
Red-bellied black snake	*Pseudechis porphyriacus*	Sighting

3.3.2.3. Birds

Sixty (60) bird species were recorded from the subject site. No Threatened species were recorded. **TABLE 7** lists the bird species recorded during the survey.

TABLE 7
BIRD SPECIES RECORDED DURING THE SURVEY

Scientific name	Common name
Geopelia humeralis	Bar-shouldered dove
Coracina novaehollandiae	Black-faced cuckoo-shrike
Macropygia amboinensis	Brown cuckoo-dove
Gerygone mouki	Brown gerygone
Lichmera indistincta	Brown honeyeater
Acanthiza pusilla	Brown thornbill
Ardea ibis	Cattle egret
Ocyphaps lophotes	Crested pigeon
Eurystomus orientalis	Dollarbird
Platycercus eximius	Eastern rosella
Acanthorhynchus tenuirostris	Eastern spinebill
Psophodes olivaceus	Eastern whipbird

Scientific name	Common name
Eopsaltria australis	Eastern yellow robin
Cacomantis flabelliformis	Fan-tailed cuckoo
Sphecotheres viridis	Figbird
Todiramphus macleayii	Forest kingfisher
Eolophus roseicapillus	Galah
Rhipidura fuliginosa	Grey fantail
Accipiter novaehollandiae	Grey goshawk
Colluricincla harmonica	Grey shrike-thrush
Dacelo novaeguineae	Laughing kookaburra
Meliphaga lewinii	Lewin's honeyeater
Phalacrocorax melanoleucos	Little pied cormorant
Anthochaera chrysoptera	Little wattlebird
Gymnorhina tibicen	Magpie
Grallina cyanoleuca	Magpie-lark
Vanellus miles	Masked lapwing
Dicaeum hirundinaceum	Mistletoe bird
Philemon corniculatus	Noisy friarbird
Manorina melanocephala	Noisy miner
Oriolus sagittatus	Olive-backed oriole
Anas superciliosa	Pacific black duck
Centropus phasianinus	Pheasant coucal
Cracticus nigrogularis	Pied butcherbird
Strepera graculina	Pied currawong
Trichoglossus haematodus	Rainbow lorikeet
Malurus melanocephalus	Red-backed fairy-wren
Neochmia temporalis	Red-browed finch
Rhipidura rufifrons	Rufous fantail
Trichoglossus chlorolepidotus	Scaly-breasted lorikeet
Myzomela sanguinolenta	Scarlet honeyeater
Zosterops lateralis	Silvereye
Dicrurus bracteatus	Spangled drongo
Pardalotus punctatus	Spotted pardalote
Threskiornis spinicollis	Straw-necked ibis
Malurus cyaneus	Superb fairy-wren
Podargus strigoides	Tawny frogmouth
Corvus orru	Torresian crow
Malurus lamberti	Variegated fairy-wren
Haliastur sphenurus	Whistling kite
Threskiornis molucca	White ibis
Sericornis frontalis	White-browed scrubwren
Phylidonyris nigra	White-cheeked honeyeater
Egretta novaehollandiae	White-faced heron
Hirundapus caudacutus	White-throated needle-tail
Cormobates leucophaeus	White-throated treecreeper
Rhipidura leucophrys	Willie wagtail
Chenonetta jubata	Wood duck
Lichenostomus chrysops	Yellow-faced honeyeater
Calyptorhynchus funereus	Yellow-tailed black-cockatoo

3.3.2.4. Mammals

Sixteen (16) mammal species were recorded form the subject site (**TABLE 8**). No Threatened species were recorded.

TABLE 8
MAMMALS RECORDED DURING THE FIELD SURVEY

Scientific Name	Common Name	Method of Identification
Rattus rattus	Black rat*	Capture
Antechinus stuartii	Brown antechinus	Capture
Rattus fuscipes	Bush rat	Capture
Felis catus	Cat*	Sighting
Trichosurus vulpecula	Common brushtail possum	Sighting
Bos taurus	Cow*	Sighting
Canis familiaris	Dog*	Tracks, Scats, Sighting
Vespadelus pumilus	Eastern forest bat	ANABAT
Vulpes vulpes	Fox*	Sighting
Nyctophilus gouldi	Gould's long-eared bat	ANABAT
Chalinolobus gouldii	Gould's wattled bat	ANABAT
Mus musculus	House mouse*	Capture
Isoodon macrourus	Northern brown bandicoot	Capture
Rattus lutreolus	Swamp rat	Capture
Wallabia bicolor	Swamp wallaby	Scats, Sighting
Tadarida australis	White-striped freetail bat	ANABAT

* Introduced species

3.3.3 Likelihood of Threatened fauna species occurrence

Based on the assessment of habitats in the Study area, Threatened fauna species known from the locality have been assessed for the likelihood of their occurrence in the Study area. Each Threatened species known from the locality is regarded as *Likely, Possible* or *Unlikely* to occur on the Subject site based on the occurrence of suitable habitat characteristics (**TABLE 9**).

A rating of *Likely* was given for those species where breeding or high quality habitat is present on the site; a rating of *Possible* was given for those species where suitable foraging or roosting habitat is present on the site; and a rating of *Unlikely* was given for species where no suitable habitat occurs on the site.

TABLE 9
LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES IN THE STUDY AREA

Species	Likelihood of occurrence in the Study area	Notes
Barking owl (*Ninox connivens*)	**Possible**	The Barking owl is distributed thinly throughout NSW. It occurs in eucalypt woodland, open forest, swamp woodlands and timber along watercourses. Territories range from 30 to over 1000 hectares. Suitable forage habitat is considered to occur on the subject site. No suitable nest sites were located.
Barred cuckoo-shrike (*Coracina lineata*)	**Possible**	The Barred cuckoo-shrike is generally uncommon and is rare in NSW. This species lives in rainforest, eucalypt forests and woodland, swamp woodlands and timber along watercourses, and wanders nomadically in search of fruit. Suitable forage habitat is considered to occur on the subject site.
Black bittern (*Ixobrychus flavicollis*)	**Possible**	This species occurs in coastal and sub-coastal areas of south-western, northern and eastern Australia. It is usually found in dense vegetation fringing and in streams, swamps, tidal creeks and mudflats, particularly amongst swamp she-oaks and mangroves. Suitable habitat is considered to occur within the swamp sclerophyll communities on the subject site.
Black-necked stork (*Ephippiorhynchus asiaticus*)	**Possible**	This species is widespread in northern Australia and sparse in coastal eastern Australia from Qld to southern NSW. It inhabits swamps, mangroves, mudflats, dry floodplains and irrigated land. It occasionally forages in open grassy woodland. The subject site represents potential forage habitat for this species.
Booroolong frog (*Litoria booroolongensis*)	Unlikely	This species is restricted to the tablelands and slopes from 200 to 1300 m above sea level in NSW and north-eastern Victoria. The species is predominantly found along the western-flowing streams and their headwaters of the Great Dividing Range, although a small number of animals have been recorded in eastern-flowing streams. Suitable habitat is not considered to occur on the subject site.

Species	Likelihood of occurrence in the Study area	Notes
Brush-tailed phascogale (*Phascogale tapoatafa*)	Unlikely	This species is patchily distributed along the eastern seaboard to the western slopes of the Great Divide. It inhabits dry sclerophyll open forest as well as heathlands, swamps, rainforest and wet sclerophyll forest and is reliant on hollow-bearing trees. There is a relatively low abundance of hollow-bearing trees on the subject site.
Brush-tailed rock-wallaby (*Petrogale penicillata*)	Unlikely	This species occurs in isolated populations in rocky ranges of inland and coastal south-east Australia. It typically occupies north-facing cliffs in dry eucalypt forest and woodland. Preferred habitat features (i.e. cliffs & rocky outcrops) are absent from the subject site.
Comb-crested jacana (*Irediparra gallinacea*)	Unlikely	This species is found in coastal and sub-coastal northern and eastern Australia. In NSW populations are localised and scattered. It lives amongst vegetation floating on the surface of slow-moving rivers and permanent lagoons, swamps, lakes and dams. Constructed dams on and adjacent to the subject site do not contain suitable habitat (i.e. floating vegetation).
Common blossom bat (*Syconycteris australis*)	**Possible**	Common blossom bats occur in coastal areas of north-east NSW and eastern Qld. They often roost in littoral rainforest and feed on flowers in adjacent heathland and paperbark swamps. Suitable forage habitat occurs within the swamp sclerophyll forest areas of the subject site. Suitable roost habitat is not present.
Common planigale (*Planigale maculata*)	**Possible**	This species occurs in coastal north-east NSW. It occupies a wide range of habitats from rainforest, sclerophyll forest, grasslands, marshlands, rocky areas and even some suburban areas, and usually occurs close to water. Suitable habitat occurs within the forested areas of the site.

Species	Likelihood of occurrence in the Study area	Notes
Eastern bent-wing bat (*Miniopterus schreibersii oceanensis*)	**Possible**	This species occurs throughout eastern Australia. It generally occupies caves and tunnels during the day, but may occasionally roost singularly or in small collectives under the bark of mature paperbark trees. Suitable forage habitat and potential roost habitat occurs on the subject site.
Eastern free-tail bat (*Mormopterus norfolkensis*)	**Possible**	This species is found only from south-east Qld to mid-coastal NSW. It occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures. Suitable forage habitat and potential roost habitat occurs on the subject site.
Giant barred frog (*Mixophyes iteratus*)	Unlikely	This species occurs on the coast and ranges from south-east Qld to the Hawkesbury River in NSW. It inhabits rainforests, moist eucalypt forest and nearby dry eucalypt forest near flowing rocky streams. Suitable habitat does not occur on the subject site.
Glossy black cockatoo (*Calyptorhynchus lathami*)	Unlikely	Found in coastal forests and open inland woodland in eastern Australia. The Glossy black-cockatoos distribution is limited to habitat which contains sufficient seed reserves of their three favoured species of food trees: *Allocasuarina littoralis*, *A. torulosa* and *A. verticillata* (Forshaw 1981) and suitable large hollow bearing trees for nesting. Preferred food trees occur in only low abundances on the subject site.
Grass owl (*Tyto capensis*)	Unlikely	The Grass owl occupies coastal heath and grassland across northern Australia (Reader's Digest 1993). In NSW they are more likely to be found in the north-east. Suitable habitat is not considered to occur on the subject site.

Species	Likelihood of occurrence in the Study area	Notes
Greater broad-nosed bat (*Scoteanax rueppellii*)	Unlikely	This species occurs on the coast and ranges from Qld to southern NSW. It occurs in a variety of habitats from woodland through moist and dry eucalypt forest to rainforest and roosts in tree hollows. Suitable habitat is not considered to occur on the subject site.
Green and golden bell frog (*Litoria aurea*)	Unlikely	This species occurs in isolated populations along the coast of NSW. It is found amongst vegetation in and around permanent swamps, lagoons and farm dams, and on flood-prone river flats, particularly where there are bulrushes and spikerushes. The constructed dams on the subject site do not contain preferred habitat features.
Grey-headed flying fox (*Pteropus poliocephalus*)	**Possible**	This species occurs from central eastern Qld south to Vic. In NSW they mainly occur in coastal areas and along river valleys. They typically roost in conspicuous camps in lowland rainforest and swamp forest, often in isolated remnants or on islands in rivers. They forage on fruit, nectar and pollen in rainforests and eucalypt forests. The subject site provides suitable forage and roost opportunities.
Koala (*Phascolarctos cinereus*)	**Possible**	The Koala occurs in eucalypt woodlands and forests throughout eastern Australia. They inhabit areas where there are appropriate food trees. Preferred Koala food trees are present on the subject site (i.e. Swamp mahogany and Tallowwood).
Large-eared pied bat (*Chalinolobus dwyeri*)	Unlikely	This species is generally rare with a very patchy distribution in NSW, with records from the Richmond and Nightcap Ranges. It roosts in caves in dry open forest and woodland. Preferred habitat features (i.e. caves) are not present on the subject site.
Large-footed myotis (*Myotis macropus*)	Unlikely	This species is distributed throughout eastern Australia. It forages over bodies of water ranging from rainforest streams to large lakes and reservoirs. It roosts during the day in caves, mines, tunnels, tree hollows and under bridges. Constructed dams on the subject site are not considered to provide significant habitat for this species.

Species	Likelihood of occurrence in the Study area	Notes
Little bent-wing bat (*Miniopterus australis*)	**Possible**	This species occurs in coastal north-east NSW and eastern Qld. It inhabits moist eucalypt forest, rainforest and dense coastal scrub. It generally occupies caves and tunnels during the day, and may occasionally roost singularly or in small collectives under the bark of mature paperbark trees. Suitable forage habitat and potential roost habitat occurs on the subject site.
Long-nosed potoroo (*Potorous tridactylus*)	Unlikely	This species occurs in coastal areas from the Gladstone area in Qld to south-west Vic and are regarded as uncommon north of Sydney. They inhabit a range of vegetation communities including rainforest, moist and dry forests, and heathlands. This species is reliant on dense groundcovers and pliable soils. Suitable habitat is not considered to occur on the subject site.
Masked owl (*Tyto novaehollandiae*)	**Possible**	In NSW this species is recorded sporadically in the north-east along the coast and tablelands. It inhabits dry eucalypt forest and woodlands. It has a large home range of 500 – 1000 hectares covering forested and partly open country. Suitable forage habitat occurs on the subject site. Suitable nest sites are not present.
Osprey (*Pandion haliaetus*)	Unlikely	This raptor is thinly distributed in coastal Australia. It nests in singularly overtopping, generally dead trees. The Osprey hunts in coastal rivers, estuaries and streams and may gather nesting material from nearby forests. Suitable habitat does not occur on the subject site.
Powerful owl (*Ninox strenua*)	**Possible**	The Powerful owl is found throughout south-eastern Australia but is uncommon. They have large home ranges (more than 1000 hectares) and occur in a variety of habitats, from woodland and open forest to tall moist forests and rainforests. Suitable forage habitat occurs on the subject site. No suitable nest sites occur.

Species	Likelihood of occurrence in the Study area	Notes
Regent honeyeater (*Xanthomyza phrygia*)	**Possible**	In NSW this species if found predominately along the western slopes of the Great divide, and less commonly along the coast. It occupies dry open forest and woodland with an abundance of nectar-producing eucalypts, particularly box-ironbark woodland in the west and Swamp mahogany forests on the coast. Suitable forage habitat occurs on the subject site.
Rose-crowned fruit-dove (*Ptilinopus regina*)	Unlikely	The Rose-crowned fruit-dove occurs along the coast and the ranges of Qld and eastern NSW. It occurs mainly in subtropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. Suitable habitat is not considered to occur on the subject site.
Sooty owl (*Tyto tenebricosa*)	Unlikely	In NSW, the Sooty owl occurs throughout the coastal area and adjacent ranges. It inhabits rainforests, particularly rainforest gullies overtopped by eucalypts. Suitable habitat is not considered to occur on the subject site.
Spotted-tailed quoll (*Dasyurus maculatus*)	Unlikely	The Spotted-tailed quoll occurs along the escarpments, tablelands and coast of the eastern seaboard. It inhabits a range of habitats including dry and moist sclerophyll forests, woodlands, coastal heathlands and rainforests. It prefers large tracts of intact forest. Suitable habitat is not considered to occur on the habitat
Square-tailed kite (*Lophoictinia isura*)	**Possible**	This species is uncommon, yet widespread. It is thinly distributed through open forests, woodland and sandplains, both coastal and subcoastal, and shows a particular preference for timbered watercourses. Suitable forage habitat occurs on the subject site.
Squirrel glider (*Petaurus norfolcensis*)	Unlikely	The Squirrel glider is distributed widely in eastern Australia. It occupies wet and dry sclerophyll forests, with open dry sclerophyll forests regarded as optimum habitat, and is reliant on hollow-bearing trees. There is a relatively low abundance of hollow-bearing trees on the subject site.

Species	Likelihood of occurrence in the Study area	Notes
Stuttering frog (*Mixophyes balbus*)	Unlikely	This species is found in far northern NSW, along the Great Divide, to north-east Vic. It lives in cool rainforest, moist eucalypt forest and occasionally along creeks in dry eucalypt forest. Suitable habitat is not considered to occur on the subject site.
Wallum froglet (*Crinia tinnula*)	**Possible**	The Wallum froglet is found in coastal areas from south-east Qld to the central coast of NSW. It is found only in acid Paperbark swamps and sedge swamps of the coastal 'wallum' country. Potential habitat is considered to occur within swamp sclerophyll forest on the subject site.
Wompoo fruit-dove (*Ptilinopus magnificus*)	Unlikely	This species is found along the coast and coastal ranges from Cape York to the Hunter River in NSW. It occurs in rainforests, low-elevation moist eucalypt forest and brushbox forests. They most often occur in mature forests, but are also found in remnant and regenerating forest. Suitable habitat does not occur on the subject site.
Yellow-bellied glider (*Petaurus australis*)	Unlikely	This species is found along the eastern seaboard to the western slopes of the Great Divide. Preferred habitats are tall open mature sclerophyll forests with a range of eucalypt species in areas of high rainfall. This species is reliant on hollow-bearing trees. There is a relatively low abundance of hollow-bearing trees on the subject site.

4. IMPACTS AND AMELIORATION

4.1 Impacts of the Proposed Development

4.1.1 Introduction

This section examines the likely impacts of the Proposed development. The possible direct and indirect impacts of the proposal are outlined and amelioration measures to minimise impacts on flora and fauna are suggested.

4.1.2 Plant communities

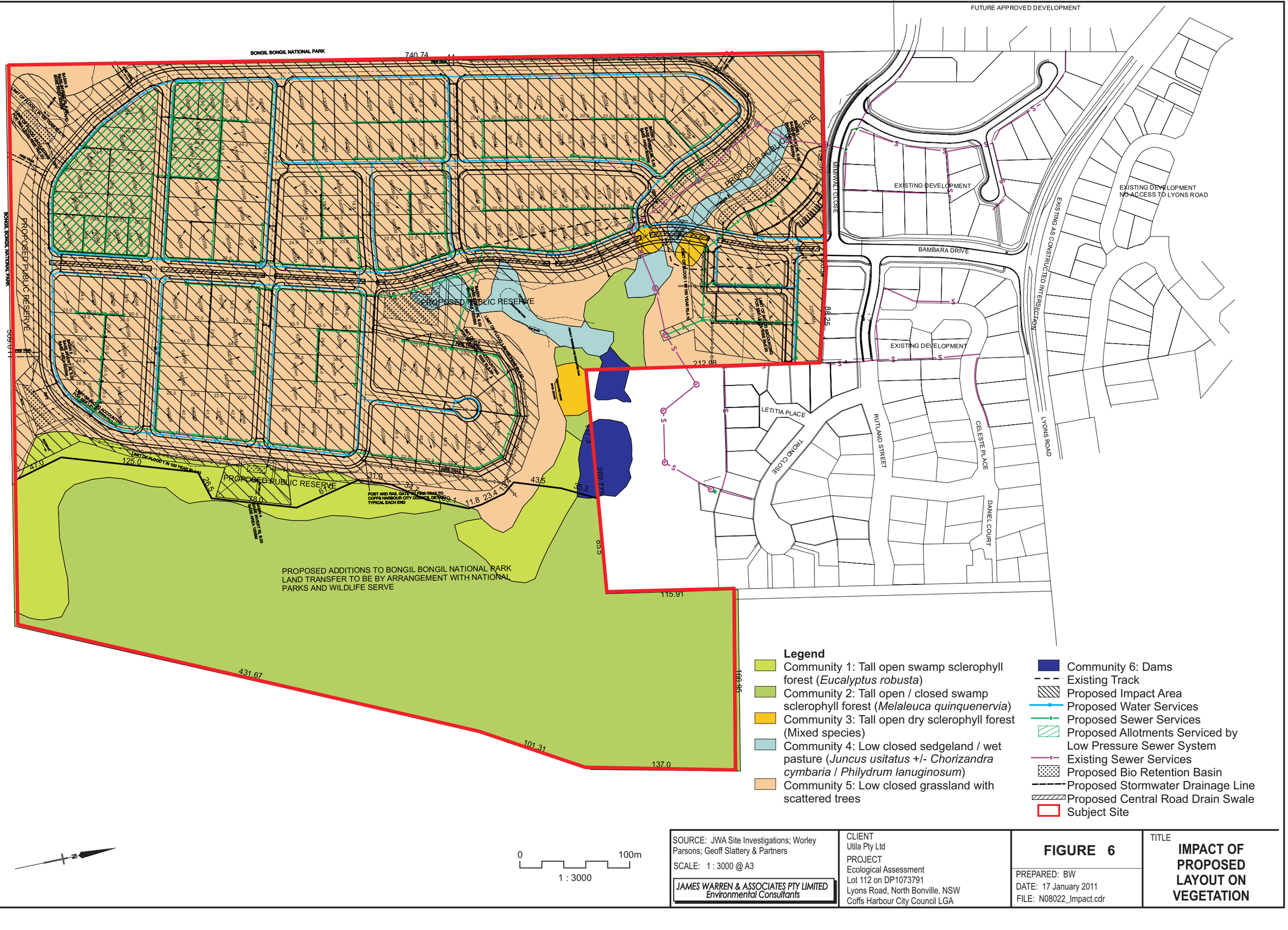
4.1.2.1. Impacts

The proposed development will result in the loss of vegetation for the construction of buildings, access roads, driveways and associated infrastructure. The majority of this loss however is from Community 5 – Low closed grassland with scattered trees. The impact of the proposed development on vegetation communities on the site is shown in **FIGURE 8**.

A summary of vegetation types to be lost and their respective areas is shown in **TABLE 10**.

TABLE 10
VEGETATION TO BE LOST AS A RESULT OF THE PROPOSED DEVELOPMENT

Vegetation Community	Total area (ha)	Area to be removed (ha)	Percentage of area lost
Community 1: Tall open swamp sclerophyll forest *(Eucalyptus robusta)*	2.4747	0.3977	16.1%
Community 2: Tall open/closed swamp sclerophyll forest *(Melaluca quinquenervia)*	10.8040	-	0%
Community 3: Tall open dry sclerophyll forest (Mixed species)	0.2392	0.1065	44.5%
Community 4: Low closed sedgeland/wet pasture *(Juncus usitatus +/- Chorizandra cymbaria / Philydrum lanuginosum)*	O.7477	0.3554	47.53%
Community 5: Low closed grassland with scattered trees	24.2164	22.2930	92.1%
Community 6: Dams	0.1160	-	0%
TOTAL	**38.5980**	**23.1526**	**60%**



SOURCE: JWA Site Investigations; Worley Parsons; Geoff Slattery & Partners

SCALE: 1 : 3000 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Utila Pty Ltd

PROJECT
Ecological Assessment
Lot 112 on DP1073791
Lyons Road, North Bonville, NSW
Coffs Harbour City Council LGA

FIGURE 6

PREPARED: BW
DATE: 17 January 2011
FILE: N08022_Impact.cdr

TITLE
IMPACT OF PROPOSED LAYOUT ON VEGETATION

In total 23.1526 hectares of vegetation will be lost from the subject site, the majority of which (over 95%) will be the loss of Low closed grassland with scattered trees. Approximately 40% of the subject site is proposed to be retained as open space and/or environmental protection.

Apart from the direct impact of vegetation clearing, potential additional impacts on vegetation communities include:

- Clearance of areas of the Subject site represents a loss of habitat available for dispersal for plants and will reduce visits by pollination and dispersal vectors;
- Disturbance to the Subject site creates opportunities for weeds to colonise. Weeds may be introduced to the Study site in construction materials or by vehicles. Occupation of the Subject site creates opportunities for weeds to become established. Landscape species may escape to retained areas of vegetation;
- The removal of vegetation from the Subject site represents the loss of organic material from the site;
- Residents may create walking tracks through bushland areas to gain access to the adjoining Bongil Bongil National Park. This may result in direct loss of vegetation, change in vegetation structure and increased opportunities for weeds and disturbance adapted animal species; and
- Occupation of the site may increase the risk of fire release into the surrounding bushland.

4.1.2.2. Amelioration

The proposed development has been designed to utilise cleared portions of the subject site. Around 40% of the subject site is proposed to be retained as open space and/or environmental protection. A Vegetation Management Plan (JWA 2011) has been prepared for the proposed development and should be read in conjunction with this Ecological Assessment. In total, approximately 4.22ha of revegetation works are proposed to offset the removal of 0.3554 hectares of degraded Freshwater wetland EEC. Details of the revegetation/regeneration works are contained within the Vegetation Management Plan (JWA 2011). The VMP provides guidelines for the restoration and management of the native vegetation to be retained and rehabilitated the subject site.

Other amelioration measures include:

- Weeds should be controlled during construction;
- Vegetation removed during construction should be mulched for use on the site. This will prevent the introduction of weeds from seeds in mulch brought in from elsewhere;
- Weeds should be controlled in landscaped areas and areas of retained vegetation;
- Known environmental weeds (e.g. Umbrella tree) should be avoided;

- Landscape plantings should include a majority of native species that will provide forage habitat for nectarivorous and frugivorous birds and bats; and
- Landscaping trees should be situated where possible to reduce the amount of disturbance to retained areas of habitat.

4.1.3 Threatened flora

No Threatened flora species were recorded from the subject site.

4.1.4 Endangered Ecological Ecosystems

4.1.4.1. Impacts

Approximately, 0.35 hectares on the EEC Freshwater wetland will be lost to the proposed development. This area is however highly degraded as is subject to continued disturbance by grazing cattle.

4.1.4.2. Amelioration

The implementation of the VMP (JWA 2010) will result in the rehabilitation of the Core Riparian Zone in the north of the site. This will significantly improve and extend areas of Freshwater Wetland.

4.1.5 Fauna

4.1.5.1. Impacts

The proposed development will result in some minor loss of foraging, sheltering and breeding habitat for native fauna occurring in the locality. This loss may have a range of impacts including:

- Loss of forage habitat for nectarivorous and insectivorous fauna species, including the loss of autumn/winter flowering plants;
- Minor decrease in the size of local fauna populations and increased susceptibility to threatening processes acting in the locality;
- Minor decrease in the size of the prey base for carnivorous species;
- Loss of sheltering and breeding habitat for native fauna;
- Reduction in opportunities for movement through the site;
- Loss of sub-mature eucalypts represents a decrease in the future recruitment of hollows;
- Loss of eucalypts, paperbarks, banksias and flowering shrubs decrease the food supply for nectarivores;
- Animals may be killed or injured during the clearance of vegetation;
- Domestic dogs and cats prey on native fauna and may have significant impacts on the populations of native species;
- Development of the Subject site may favour native and introduced disturbance adapted competitors. For example, Cane toads may out-compete other Amphibians and Reptiles, aggressive open country birds species (eg Noisy miner,

Crow, Pied currawong) may out-compete other Birds, and non-native mammals (Black rat and House mouse) may out-compete other native small mammals);

- Increased light, noise and activity may cause reclusive species to move away from habitat edges;
- The Proposed development will result in an increase in traffic on and to the Subject site. This increases the likelihood of animals being killed or injured by vehicles; and
- Alterations to site hydrology and land use may alter the water quality or hydrological regime in Paperbark Communities.

4.1.5.2. Amelioration

The following amelioration measures apply:

- Landowners should control dogs and cats. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure. Consideration should be given to banning cats to reduce likely impacts on local fauna;
- Appropriate disposal of rubbish and food scraps reduces opportunities for non-native predators and disturbance adapted competitors;
- Landscape and landfill materials should be sourced from a supplier where Cane toads do not occur;
- Mature habitat trees should be retained where possible;
- A qualified fauna handler should be on site when clearing occurs; and
- 40 km/hr speed limit to be imposed on internal access roads.

4.1.6 Threatened fauna

No Threatened fauna species have been recorded from the subject site. The impact of the proposed development on Threatened fauna species considered a possible occurrence on the subject site over time is discussed in accordance with Section 5A of the *Environmental Planning & Assessment Act (1979)* in Section 5.2.4.

4.1.7 Bongil Bongil National Park

4.1.7.1. Impacts

The proposed development has the potential to impact on Bongil Bongil National Park in the following ways:

- Residents from the proposed development may create walking tracks through the National Park, resulting in direct loss of vegetation, reduced visitation by pollinators and dispersal vectors, changes in vegetation structure, and increased opportunities for weeds and disturbance-adapted pest species.

- Occupation of the subject site may increase the risk of fire release into the National Park.
- Occupation of the proposed development may cause an increase in local populations of invasive pest species (e.g. rats, cane-toads, foxes) and invasive weeds. Residents of the proposed development may dump rubbish and garden wastes into or near the National Park encouraging pest species and allowing the release of weed species, parasites and diseases into the National Park.
- Domestic animals may predate on or disturb fauna within the National Park if they are allowed to roam.
- Increased light and noise from the proposed development may disturb the more reclusive species, in effect increasing the penetration of edge effects into the National Park.

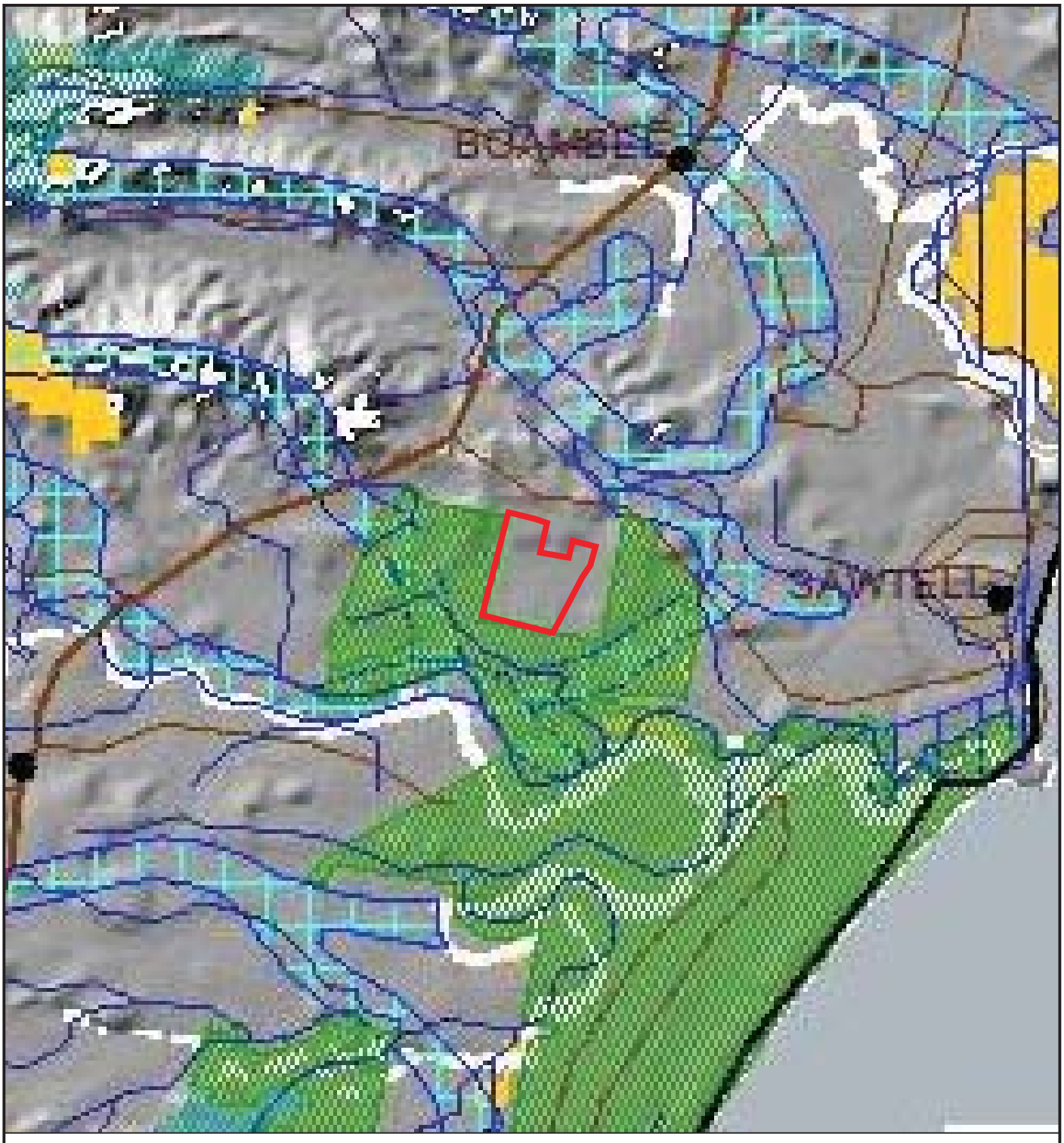
4.1.7.2. Amelioration

The following measures will implemented to ameliorate potential impacts on the Bongil Bongil National Park:

- Formal walking tracks should be provided to established access to Bongil Bongil National Park. Assess points could be adjacent to the locked gates at the fire trail access points. This will prevent the formation of a larger number of informal tracks;
- A koala proof fence will be constructed on the western and southern boundaries of the proposed development site adjacent to the National Park;
- Restrictions should be placed on the use of fires, within the residential development site, during extended dry weather periods;
- Regulation should be formulated regarding domestic dogs, within the residential development site (i.e. dogs should be contained within fenced yards and/or leashed at all times; and
- A buffer ranging between the 20-50m is provided to the National Park, comprising of the outer road, along the west and south of the residential lots.

4.1.8 Wildlife Corridor

The NPWS Key Habitats and Corridors database shows several regional habitat corridors within the locality of the site. However, the subject site itself does not occur within any of the mapped corridors (**FIGURE 9**). The proposed development will utilise cleared portion of the subject site and will retain all intact areas of vegetation.



Legend

- Regional Corridor
- Subregional Corridor
- Key Habitat
- Nature Reserve
- Regional Park
- State Forest
- Rivers
- Main Roads
- Minor Roads
- Wooded Vegetation
- Subject Site

N

0 1km

SOURCE: NPWS Key Habitats & Corridors (website accessed 04.12.08)

SCALE: 1 : 40 000 @ A4

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FIGURE 9

PREPARED: BW
DATE: 20 May 2010
FILE: N08022_Corridors.cdr

TITLE

NPWS KEY HABITATS & CORRIDORS

5. STATUTORY CONSIDERATIONS

5.1 Introduction

This section includes assessments of the impacts of the Proposed development with regard to:

- Section 5A of the *Environment Protection & Assessment Act (1979)*;
- *Coffs Harbour City Council Koala Plan of Management (KPoM) (1999)*; and
- *Commonwealth Environment Protection and Biodiversity Conservation Act (1999).*

5.2 Assessment of Significance (Seven Part Test)

5.2.1 Background

Under the *Threatened Species Conservation Amendment Act 2002*, the factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species, populations or ecological communities, or their habitats (known previously as the "8-part test"), have been revised. This affects s5A EP&A Act, s94 *Threatened Species Conservation Act 1995* (TSC Act) and s220ZZ *Fisheries Management Act 1994* (FM Act).

The revised factors maintain the same intent but focus consideration of likely impacts in the context of the local rather than the regional environment as the long-term loss of biodiversity at all levels arises primarily from the accumulation of losses and depletions of populations at a local level. This is the broad principle underpinning the TSC Act, State and Federal biodiversity strategies and international agreements. The consideration of impacts at a local level is designed to make it easier for local government to assess, and easier for applicants and consultants to undertake the Assessment of Significance because there is no longer a need to research regional and statewide information. The Assessment of Significance is only the first step in considering potential impacts. Further consideration is required when a significant effect is likely and is more appropriately considered when preparing a Species Impact Statement.

The Assessment of Significance should not be considered a "pass or fail" test as such, but a system allowing proponents to undertake a qualitative analysis of the likely impacts and ultimately whether further assessment needs to be undertaken via a Species Impact Statement. All factors must be considered and an overall conclusion must be drawn from all factors in combination. Where there is any doubt regarding the likely impacts, or where detailed information is not available, a Species Impact Statement should be prepared.

Mitigating, ameliorative or compensatory measures proposed as part of the action, development or activity should not be considered in determining the degree of the effect on threatened species, populations or ecological communities, unless the measure has been proven successful for that species in a similar situation. In many cases where complex mitigating, ameliorative or compensatory measures are required, such as translocation, bush restoration, purchase of land, further assessment through the Species Impact Statement process is likely to be required.

In determining the nature and magnitude of an impact, it is important to consider matters such as:

- Pre-construction, construction and occupation/maintenance phases;
- All on-site and offsite impacts, including location, installation, operation and maintenance of auxiliary infrastructure and fire management zones;
- All direct and indirect impacts;
- The frequency and duration of each known or likely impact/action;
- The total impact which can be attributed to that action over the entire geographic area affected, and over time;
- The sensitivity of the receiving environment; and
- The degree of confidence with which the impacts of the action are known and understood.

Recovery and threat abatement plans, priorities action statements and threatened species profiles may provide further guidance on whether an action/activity is likely to be significant.

Application of the precautionary principle requires that a lack of scientific certainty about the potential impacts of an action does not itself justify a decision that the action is not likely to have a significant impact. If information is not available to conclusively determine that there will not be a significant impact on a threatened species, population or ecological community, or its habitat, then it should be assumed that a significant impact is likely.

5.2.2 Flora

No Threatened flora species were recorded from the Subject site.

5.2.3 Endangered Ecological Communities (EECs)

5.2.3.1. Background

There are two EECs on the subject site:

- Swamp sclerophyll forest on coastal floodplain (i.e. Vegetation communities 1 & 2);
- Freshwater wetlands on coastal floodplain (i.e. Vegetation community 4).

The location and extent of these EECs on the subject site are shown in **FIGURE 6.** An Assessment of Significance has been completed for these EECs in accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* prepared by DECC (2007).

5.2.3.2. Factors for consideration

(a) In the case of a Threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable for EEC's.

(b) In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

Not applicable for EEC's.

(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

A plan showing the locations of EEC's in relation to the proposed development is shown in **FIGURE 10**. A summary of impacts on EEC's recorded on the site is provided in **TABLE 11.** It should be noted that the local occurrence of EEC's includes adjacent contiguous areas which maintain the movement of individuals and exchange of genetic material, however the calculation below were available for the subject site only.

TABLE 11
POTENTIAL LOSS OF EEC's FROM THE SUBJECT SITE

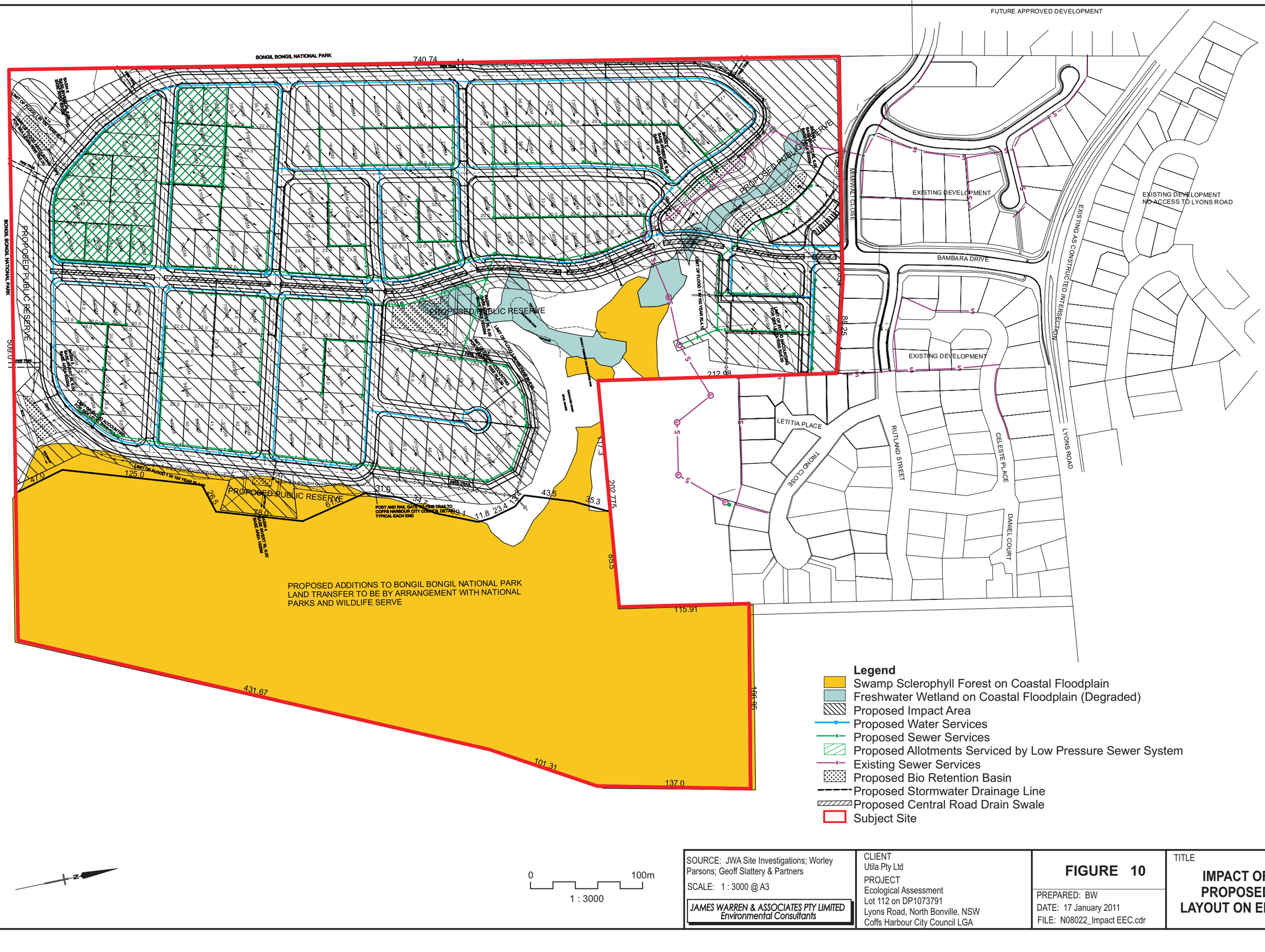
EEC Description	Area of existing EEC	Area of EEC to be removed/ modified by proposed development
Swamp sclerophyll forest	13.2787ha	0.3977ha (3%)
Freshwater wetlands	0.7477ha	0.3554ha (47.5%)

The risk of extinction of an EEC relates to the likelihood that the local occurrence of EEC will become extinct either in the short term or the long term as a result of direct or indirect impacts.

Swamp sclerophyll forest

This EEC occurs in the eastern portion of the subject site and will not be directly impacted in a significant way by the proposed development. A Stormwater Management Plan (Moon 2010) has been prepared which aims to achieve no significant net change in runoff or water quality entering this EEC.

The proposed development is not considered to represent a significant impact in relation to the local distribution of this community.



SOURCE: JWA Site Investigations; Worley Parsons; Geoff Slattery & Partners

SCALE: 1 : 3000 @ A3

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FIGURE 10

PREPARED: BW
DATE: 17 January 2011
FILE: N08022_Impact EEC.cdr

TITLE

IMPACT OF PROPOSED LAYOUT ON EEC'S

Freshwater wetlands

In total 0.3554 hectares of Freshwater wetland (47.5%) will be lost from the subject site as a direct result of the proposed development (**FIGURE 10**).

JWA (2011) have prepared a Vegetation Management Plan (VMP) for the proposed development. The VMP proposes revegetation/rehabilitation measures aimed at addressing a number of vegetation/habitat management issues, including the management, rehabilitation and protection of EEC's. This Plan identifies areas where active restoration and rehabilitation measures are proposed to offset any removal of EEC's and to enhance retained vegetation communities on the site. Proposed Assisted Natural Regeneration Areas and Revegetation Areas are depicted in **FIGURE 11**.

The removal of an area of this degraded EEC from the subject site is not considered to represent a significant impact in relation to local occurrence. It is considered that, with the adoption of recommended management practices, the proposed development is highly unlikely to result in the local extinction of any of the EEC's identified on the subject site.

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

The composition of an EEC refers to both the plant and animal species present, and the physical structure of the EEC. The major amelioration strategy for EEC's on the subject site is the retention and long-term protection of these vegetation communities within Environmental Protection Areas.

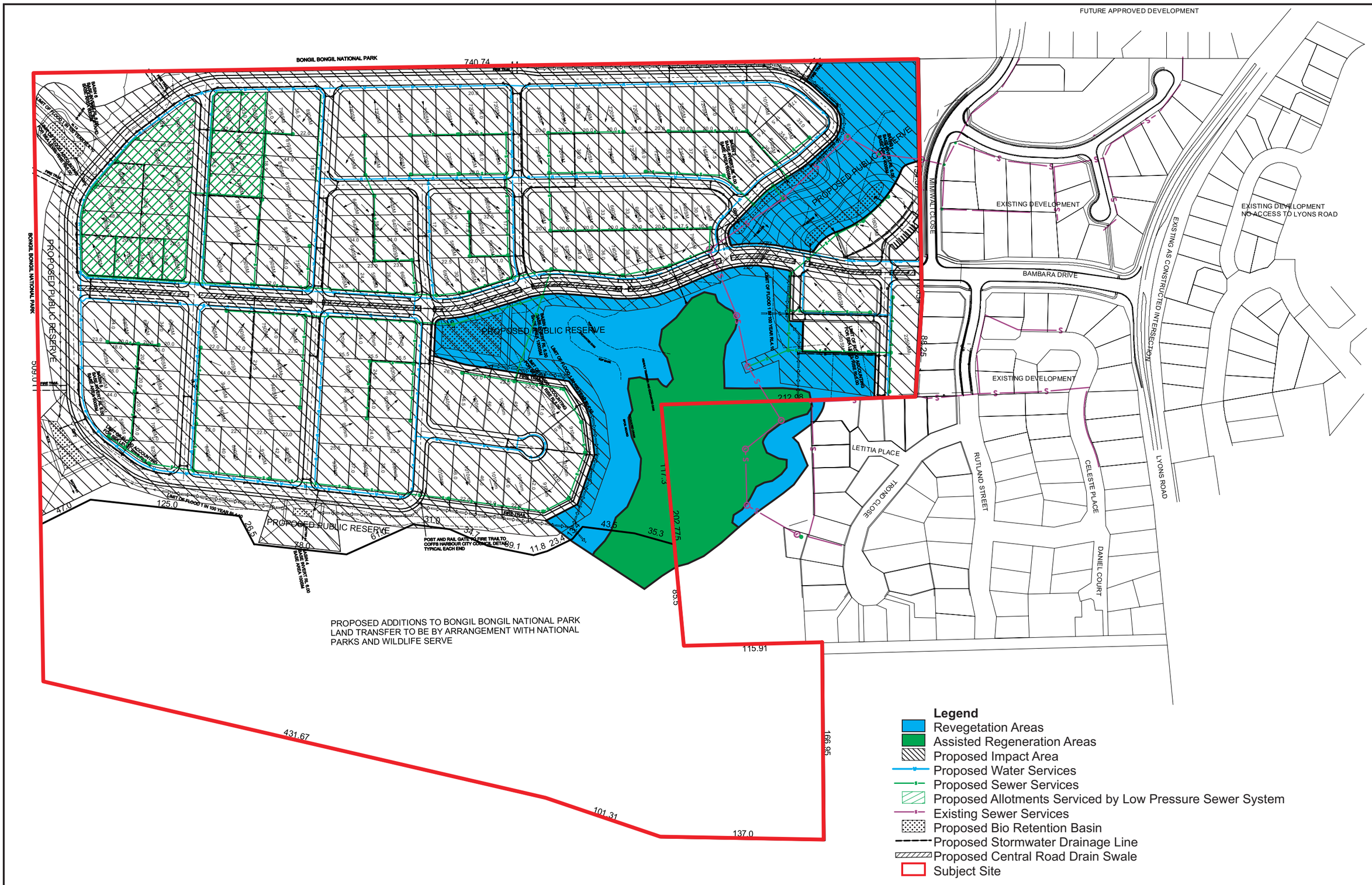
The VMP (JWA 2011) outlines the various measures to ensure that the retained EEC's are adequately managed. Revegetation/regeneration will be completed in accordance with this plan to offset any loss of EEC's (**FIGURE 11**).

In total, approximately 4.22ha of revegetation works are proposed to offset the removal of 0.3554 hectares of degraded Freshwater wetland EEC. Details of the revegetation/regeneration works are contained within the Vegetation Management Plan (JWA 2011).

With the adoption of recommended amelioration measures contained within the VMP, it is considered that the proposed development will not have an adverse affect on the extent, or substantially modify the composition of any EEC such that the local occurrence is likely to be put at risk of extinction. Conversely, proposed rehabilitation works at the subject site are likely to improve habitat diversity and connectivity across the subject site.

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

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



SOURCE: JWA Site Investigations; Worley Parsons; Geoff Slattery & Partners

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FIGURE 11

PREPARED: BW
DATE: 17 January 2011
FILE: N08022_Regen Reveg.cdr

TITLE
REVEGETATION & ASSISTED REGENERATION AREAS

A summary of impacts on EEC's recorded on the subject has been provided in **TABLE 11** above**.** The proposed development will result in the removal of 0.3554 hectares of Freshwater wetland EEC.

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

The Proposed development has been designed to utilise disturbed areas of the subject site and is unlikely to contribute significantly to an increase in the fragmentation of native vegetation communities. Retained habitat linkages will ensure existing movement opportunities are maintained for all native flora and fauna species.

(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.

Most of the vegetation to be removed consists of highly disturbed vegetation. The importance of this vegetation is minor when compared to the areas of suitable habitat proposed to be retained, protected and rehabilitated. The assessment of the importance of the habitat to be removed has taken into consideration the stages of relevant flora and fauna life cycles and how reproductive success may be affected. It is considered that, with the adoption of recommended amelioration and management measures, the proposed development will not significantly affect the life cycle or reproductive success of native flora and fauna species.

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

Critical habitat areas listed under the *Threatened Species Conservation Act (1995)* currently consist of habitat for Mitchell's rainforest snail in Stott's Island Nature Reserve, habitat for the Little penguin population in Sydney's North Harbour, habitat for Gould's Petrel and habitat for Wollemi Pine.

There will be no adverse effects on any critical habitat listed, in the Register of critical habitat in NSW, from the action proposed.

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

No Recovery plans or relevant Threat Abatement Plans have been prepared for the EEC's occurring on the subject site.

(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.

A "threatening process" means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes have been listed in Schedule 3 of the *TSC Act (1995)*.

Key Threatening Processes (Schedule 3):

- Invasion and establishment of exotic vines and scramblers
- Invasion of native plant communities by bitou bush & boneseed
- Invasion of native plant communities by exotic perennial grasses
- Invasion, establishment and spread of *Lantana camara*
- Competition and grazing by the feral European rabbit
- Competition and habitat degradation by feral goats
- Competition from feral honeybees
- Herbivory and environmental degradation caused by feral deer
- Importation of red imported fire ants into NSW
- Introduction of the large earth bumblebee (*Bombus terrestris*)
- Invasion and establishment of the Cane Toad
- Invasion of the yellow crazy ant (*Anoplolepis gracilipes*)
- Predation by feral cats
- Predation by the European Red Fox
- Predation by the Plague Minnow (*Gambusia holbrooki*)
- Predation by the ship rat (*Rattus rattus*) on Lord Howe Island
- Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands
- Bushrock Removal
- Clearing of native vegetation
- Alteration of habitat following subsidence due to longwall mining
- Ecological consequences of high frequency fires
- Human-caused Climate Change
- Loss and/or degradation of sites used for hill-topping by butterflies
- Loss of Hollow-bearing Trees
- Removal of dead wood and dead trees
- Infection by Psittacine circoviral (beak & feather) disease affecting endangered psittacine species
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis
- Infection of native plants by *Phytophthora cinnamomi*
- Death or injury to marine species following capture in shark control programs on ocean beaches
- Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments

The proposed development has the potential to result in an increase in the **'Invasion and establishment of exotic vines and scramblers'**, **'Invasion of native plant communities by exotic perennial grasses'** and **'Invasion, establishment and spread of *Lantana camara*'**. A VMP (JWA 2010) has been prepared for the development and will ensure that these key threatening processes are not exacerbated.

The proposed development has the potential to result in an increase in the **'Invasion and establishment of the Cane Toad'**, **'Predation by feral cats'** and **'Predation by the European Red Fox'**. It is recommended that a Fauna Management Plan should be prepared or included as a condition of consent for the development to ensure that these key threatening processes are not exacerbated.

The proposed development has the potential to result in an increase in the **'Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands'.** A Stormwater Management Plan has been prepared (Moon 2010) to ensure that this key threatening process is not exacerbated.

The proposed development will contribute towards the **'Clearing of native vegetation'**, a key threatening process listed on Schedule 3 of the *TSC Act (1995)*. The final determination of the NSW Scientific Committee notes that clearing of native vegetation is recognised as a major factor contributing to loss of biological diversity, with impacts such as: destruction of habitat; fragmentation of habitat; riparian zone degradation; increased greenhouse gas emissions; increased habitat for invasive species; loss of leaf litter layer; loss or disruption of ecological function (*e.g.* loss of populations of pollinators or seed dispersers) and changes to soil biota.

Habitat loss is the main threatening process affecting all subject species. The Proposed development will make a minor contribution towards the loss of habitat in the region. However, as previously discussed, the majority of vegetation to be lost has been highly disturbed by past landuse activities.

The proposed development has the potential to result in an increase in the **'Ecological consequences of high frequency fires'.** A Bushfire Management Plan has been prepared by a suitably qualified firm to ensure that this key threatening processes is not exacerbated.

5.2.3.3. Results of Assessment of Significance

On the basis of this assessment, it is considered that the proposed road construction will not result in any significant impacts on EEC's recorded within the construction area.

5.2.4 Fauna

5.2.4.1. Background

Sixteen (16) Threatened fauna species are considered potential occurrences on the subject site based on the results of the habitat assessment (Section 3.3.3):

- Barking owl;
- Barred cuckoo-shrike;
- Black bittern;
- Black-necked stork;
- Common blossom bat;
- Common planigale;
- Eastern bent-wing bat;
- Eastern free-tail bat;
- Grey-headed flying-fox;

- Koala;
- Little bent-wing bat;
- Masked owl;
- Powerful owl;
- Regent honeyeater;
- Square-tailed kite; and
- Wallum froglet.

An Assessment of Significance has been completed for each of these Threatened fauna species in accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* prepared by DECC (2007).

5.2.4.2. Factors for consideration

(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.

Barking owl (*Ninox connivens*)

Extent of the local population

The NPWS database contains one (1) record of this species within 10 km of the subject site and a total of four (4) records within the Coffs Harbour LGA. No records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site however suitable habitat is considered to occur. Approximately 13.5 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha);
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha); and
- 3 – Tall open dry sclerophyll forest (0.24ha).

No suitable nest sites were observed on the subject site.

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

The Barking owl is widespread and quite common in parts of northern Australia. It occupies eucalypt woodland, open forest, swamp woodlands and timber along watercourses. Occasionally it roosts in denser habitat but hunts over more open country. Nests are in hollows of large, old eucalypt trees (NPWS 2002).

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding sites for the Barking owl as consisting of large hollows in large, live trees near or on floodplains. Breeding sites are associated with

red gum forest types with sparse groundcover, dry forest woodland with dense thickets of eucalypt, paperbark or viney scrub and cypress pine. This owl typically shelters in thickets. The Barking owl has a diverse diet that includes rabbits, insects, a variety of birds, bats, arboreal mammals and some ground mammals.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Barking owl, with the following results:

1st order disturbances	Clearing for agriculture
2nd order disturbances	High frequency fire Grazing
3rd order disturbances	Firewood collecting that results in loss of nests
5th order disturbances	Drainage of swamps

Potential threats to the species from development of the site include:

- Human disturbance to areas of forage habitat; and
- Disturbance from straying domestic pets.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3.7%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation, with the exception of the western and southern site boundaries, are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
-
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010);
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Barred cuckoo-shrike (*Coracina lineata*)

Extent of the local population

The NPWS database contains six (6) records of this species within 10 km of the subject site and a total of eight (8) records within the Coffs Harbour LGA. One (1) record exists from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site however suitable habitat is considered to occur. Approximately 13.27 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha); and
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha).

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and identified breeding and sheltering sites for the Barred cuckoo shrike as consisting of low elevation subtropical and littoral rainforest and coastal wet sclerophyll forest close to fruiting figs with the preferred habitat being a mature canopy. The Barred cuckoo-shrike forages in mature canopy and feeds on fruit and large insects including cicadas and phasmids with other small fruited figs as their preferred food.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Barred cuckoo-shrike, with the following results:

1st order disturbances	Urban development Weed invasion Loss of habitat trees (fig trees) in agricultural land Intensive horticulture

Potential threats to the species from development of the site include:

- Human disturbance to areas of forage habitat; and
- Disturbance from straying domestic pets.

The proposed development will result in the removal or modification of a total of 0.3977 hectares (3%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010); and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Black bittern (*Ixobrychus flavicollis*)

Extent of the local population

The NPWS database contains four (4) records of this species within 10 km of the subject site and a total of fifteen (15) records within the Coffs Harbour LGA. Three (3) records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site however suitable habitat is considered to occur. Approximately 13.27 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha); and
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha).

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

The Black bittern is usually found in dense vegetation fringing and in streams, swamps, tidal creeks and mudflats, particularly amongst swamp she-oaks and mangroves (NPWS 2002). Black bittern forage secretively and in a mostly crepuscular manner along closely forested streams and wetlands on fish, molluscs and insects (Marchant and Higgins 1990). Required streams are small to moderate, rarely broad in size and have a mix of clear pools and clear running water well sheltered and protected by partly or wholly overhanging tree canopy (CSIRO 1995).

Breeding occurs during summer in secluded places in densely vegetated wetlands. Nests are constructed of sticks on a sheltered branch that overhangs the water (NPWS 2002b).

The NPWS Threatened Species Unit (DECC 2005) discusses the following threats for the Black bittern:

- Loss of habitat from clearing and grazing;
- Reduced water quality from saltation and pollution;
- Predation by foxes and feral cats; and
- Disturbance of nesting birds by watercraft.

Potential threats to the species from development of the site include:

- Human disturbance to areas of forage habitat; and
- Disturbance from straying domestic pets.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010); and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Black-necked stork (*Ephippiorhynchus asiaticus*)

Extent of local population

The NPWS database contains seventeen (17) records of this species within 10 km of the subject site and a total of one hundred and thirty-four (134) records within the Coffs Harbour LGA. Five (5) records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site however suitable habitat is considered to occur. Approximately 14.57 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha);
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha);
- 4 – Low closed sedgeland/wet pasture (0.75ha); and
- 6 – Dams (0.12ha).

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

The Black-necked stork inhabits swamps, mangroves, mudflats, dry floodplains, and irrigated land. It occasionally forages in open grassy woodland (Environment Australia 1999). An abundant supply of frogs and fish is required, together with suitable roost and nest trees, usually overhanging rivers and swamps (SFNSW 1995). It strides through the water probing for prey with its bill and may chase fish. The nest is a large flat pile of sticks, grass and rushes in a tree, usually near water (NPWS 2002).

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. This analysis was based on local expert knowledge and ranked the significance of various forms of disturbance for the Black-necked stork, with the following results:

1st order disturbances	Drainage of wetlands Dams
2nd order disturbances	Power lines Intensive horticulture (tea trees)
3rd order disturbances	Pesticide contamination of wetlands Urban development Loss of nest trees
4th order disturbances	Shooting

Potential threats to the species from development of the site include:

- Minor loss of habitat within low-lying pasture;
- Human disturbance to areas of forage habitat; and
- Disturbance from straying domestic dogs.

The proposed development will result in the removal or modification of a total of 0.7531 hectares (5%) of potential forage habitat for this species.

Likelihood of local extinction

The removal of a small area of potential forage habitat from the subject site (5%) is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010); and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Common blossom bat (*Syconycteris australis*)

Extent of the local population

The NPWS database contains six (6) records of this species within 10 km of the subject site and a total of seventeen (17) records within the Coffs Harbour LGA. Two (2) records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site however suitable habitat is considered to occur. Approximately 13.27 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha); and
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha).

No potential roost habitat is considered to occur on the subject site.

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and identified breeding and sheltering sites for Common blossom bat as consisting of subtropical and littoral rainforest. This species breeds twice, in the coastal complex and riverine rainforest in spring and in the coastal complex in autumn. It needs a diverse array of nectivorous plant communities nearby. The Common blossom bat forages in a diverse range of nectar producing plant communities year round; occasionally eating some rainforest fruits.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Common blossom bat, with the following results:

- Clearing – habitat loss - resulting in fragmentation, increasing predation and decreasing food availability
- Wildfire;
- Management and illegal burns;
- Apiary;
- Weed invasion;
- Drainage of swamps;
- Sand mining;
- Logging of coastal sclerophyll forests with Banksia understorey;
- Aerial spraying of Bitou bush;
- Sand dune disturbance from recreational 4WDs;
- Barbed wire fences; and
- Introduced predators.

The most likely impacts to the Common blossom bat from the proposed development would be from urban disturbance (light spill, noise, and vehicle movements) adjacent to foraging areas.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- Lighting is designed to minimise spill;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010); and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Common planigale (*Planigale maculata*)

Extent of the local population

The NPWS database contains one (1) record of this species within 10 km of the subject site and a total of five (5) records within the Coffs Harbour LGA. No records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site however suitable habitat is considered to occur. Approximately 13.27 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha); and
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha).

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and identified breeding and sheltering sites for Planigales as consisting of nests of eucalypt leaves in logs or under bark, in cracks in the soil or in grass tussocks. Nests were also located in building debris. The Common planigale forages in dry sclerophyll, swamp sclerophyll, heathland and grassland at the ecotone with rainforest in areas with dense leaf litter or ground cover.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Common planigale, with the following results:

- Predation by cats;
- Loss of habitat;
- Altered fire regimes;
- Baiting for dingoes;
- Exotic competitors; and
- Predation by cane toads.

The most likely threats to the Common Planigale from development of the subject site are mortality from vehicles and domestic cats.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- A range of measures to reduce vehicle impacts on fauna including: traffic calming features (e.g. speed humps), reduced traffic speeds, lighting;
- Lighting is designed to minimise spill;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010); and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Eastern bent-wing bat (*Miniopterus schreibersii oceanensis*)

Extent of the local population

The NPWS database contains nine (9) records of this species within 10 km of the subject site and a total of one hundred and thirty-nine (139) records within the Coffs Harbour LGA. Two (2) records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site however suitable habitat is considered to occur. This species is likely to forage widely throughout the locality including within urban and rural areas, however better quality forage habitat is likely to be within and adjacent to intact vegetation.

Approximately 13.27 hectares of potential forage and roost habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha); and
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha).

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and identified breeding sites for Eastern bent-wing bat as consisting of limestone caves, where it usually occurs in association with the Common bent-wing bat. It congregates in high numbers in maternity roost (in 1000's). It also shelters in a range of artificial structures including culverts, drains, mines etc. The Eastern bent-wing bat forages on flying insects in

forested areas, predominantly swamp forest, moist eucalypt forest, rainforest and some dry forests.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Eastern bent-wing bat, with the following results:

1st order disturbances	Clearing – habitat loss
2nd order disturbances	Disturbance to camps/caves by limestone mining (cave collapse, altered air flow, noise, dust etc) and recreational activities.
3rd order disturbances	Clearing – fragmentation Logging – loss of foraging habitat Frequent burning Altered hydrology/microclimate – old growth-regrowth
4th order disturbances	Grazing Wildfire Pesticides
5th order disturbances	Introduced predators

The Eastern bent-wing bat is likely to forage widely over the locality. The most likely impacts to bats from the proposed development would be from urban disturbance (light spill, noise, and vehicle movements) adjacent to foraging areas. However, it is expected these impacts would be relatively low as some species of micro-bat are known to adapt to urban environments where street lighting provides greater opportunities for the capture of prey. Micro-bats will have large areas of foraging habitat retained on the subject site. Potential roost habitat is best represented by consolidated vegetation to be retained, and development of urban zoned land is likely to have little impact on available roost sites.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- Lighting is designed to minimise spill;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);

- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.; and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Eastern free-tail bat (*Mormopterus norfolkensis*)

Extent of local population

The NPWS database contains one (1) record of this species within 10 km of the subject site and a total of eleven (11) records within the Coffs Harbour LGA. No records exist from the adjacent Bongil Bongil National Park.

This species has not previously been recorded from the subject site however suitable habitat is considered to occur. This species is likely to forage widely throughout the locality within and adjacent to mature and structurally complex native vegetation communities.

Approximately 13.27 hectares of potential forage and roost habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha); and
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha).

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

This species is sparsely distributed in coastal eastern Australia, from approximately Sydney to Fraser Island. This is a poorly known species for which specific habitat requirements are not known. Inferences from wing morphology and echo-location call design suggest that it forages in more open environments. This species has been recorded from forest types ranging from rainforest to dry sclerophyll forest and woodland, but most records are from dry sclerophyll forest and woodland.

The Eastern free-tail bat probably forages above forest or woodland canopy and in clearings adjacent to forest. Small colonies of this species have been found in tree hollows or under loose bark. Roosting has also been reported under house eaves and the metal caps on top of telegraph poles (Hall and Richards 1979).

The most likely impacts to bats from the proposed development would be from urban disturbance (light spill, noise, and vehicle movements) adjacent to foraging areas. However, it is expected these impacts would be relatively low as some species of micro-bat are known to adapt to urban environments where street lighting provides greater opportunities for the capture of prey. Micro-bats will have large areas of foraging habitat retained on the subject site. Potential roost habitat is best

represented by consolidated vegetation to be retained, and development of urban zoned land is likely to have little impact on available roost sites.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- Lighting is designed to minimise spill;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.; and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Grey-headed flying fox (*Pteropus poliocephalus*)

Extent of the local population

The NPWS database contains forty-two (42) records of this species within 10 km of the subject site and a total of two hundred and twenty-four (224) records within the Coffs Harbour LGA. Fourteen (14) records exist from the adjacent Bongil Bongil National Park.

This species has not previously been recorded from the subject site however suitable habitat is considered to occur. This is a highly mobile species and is likely to forage widely throughout the locality in search of fruit and nectar.

Approximately 13.5 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha);
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha); and
- 3 – Tall open dry sclerophyll forest (0.24ha).

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and identified breeding and sheltering sites for the Grey-headed flying fox as consisting of mainly rainforest and moist riparian forest with a complex mosaic of rainforest, swamp and sclerophyll forest resources less than 40-50km from roost. There is high site fidelity with roosts often in riverine rainforest. The Grey-headed flying fox forages in subtropical rainforest with a mosaic of resources – rainforest fruit, nectar and pollen. The Grey-headed flying fox is less restricted to rainforest remnants than the Black flying fox.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Grey-headed flying fox, with the following results:

- Clearing – resulting in fragmentation and habitat loss;
- Direct disturbance to camps;
- Drainage of swamps;
- Powerlines;
- Logging of Sclerophyll;
- Wildfire and Management burns;
- Shooting;
- Disease – lyssavirus;
- Apiary;
- Barbed wire fences;
- Weed invasion; and
- Climate change.

Grey-headed flying-foxes will utilise the site on a seasonal basis when feed trees are flowering (Swamp Mahogany, Tallowwood, Broad-leaved Paperbark, Figs etc). This is a highly mobile species and large areas or forage resources are proposed to be retained, and the development of the site will result in a very minor reduction of resources.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3.7%) of suitable habitat for this species.

Likelihood of local extinction

Impacts on this highly mobile species are likely to be relatively low. The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- Lighting is designed to minimise spill;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;

- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Koala (*Phascolarctos cinereus*)

Extent of the local population

The NPWS database contains four hundred and thirty-one (431) records of this species within 10 km of the subject site and a total of one thousand, three hundred and ninety three (1,393) records within the Coffs Harbour LGA. Two hundred and forty-seven (247) records exist from the adjacent Bongil Bongil National Park.

This species has not previously been recorded from the subject site however suitable habitat is considered to occur. Approximately 2.47 hectares of potential forage habitat is considered to occur on the subject site and is comprised of Community 1 – Tall open swamp sclerophyll forest (2.47ha) (**FIGURE 5**).

Under the Coffs Harbour Koala Plan of Management (2009) 12.4520 hectares of primary Koala habitat occurs within the Subject site (**FIGURE 12**). However ground truthing by JWA has concluded that not all of this area offers suitable habitat for Koalas. 0.2024 (1.6%) of this area will be lost or modified as a result of the proposed development (**FIGURE 13**).

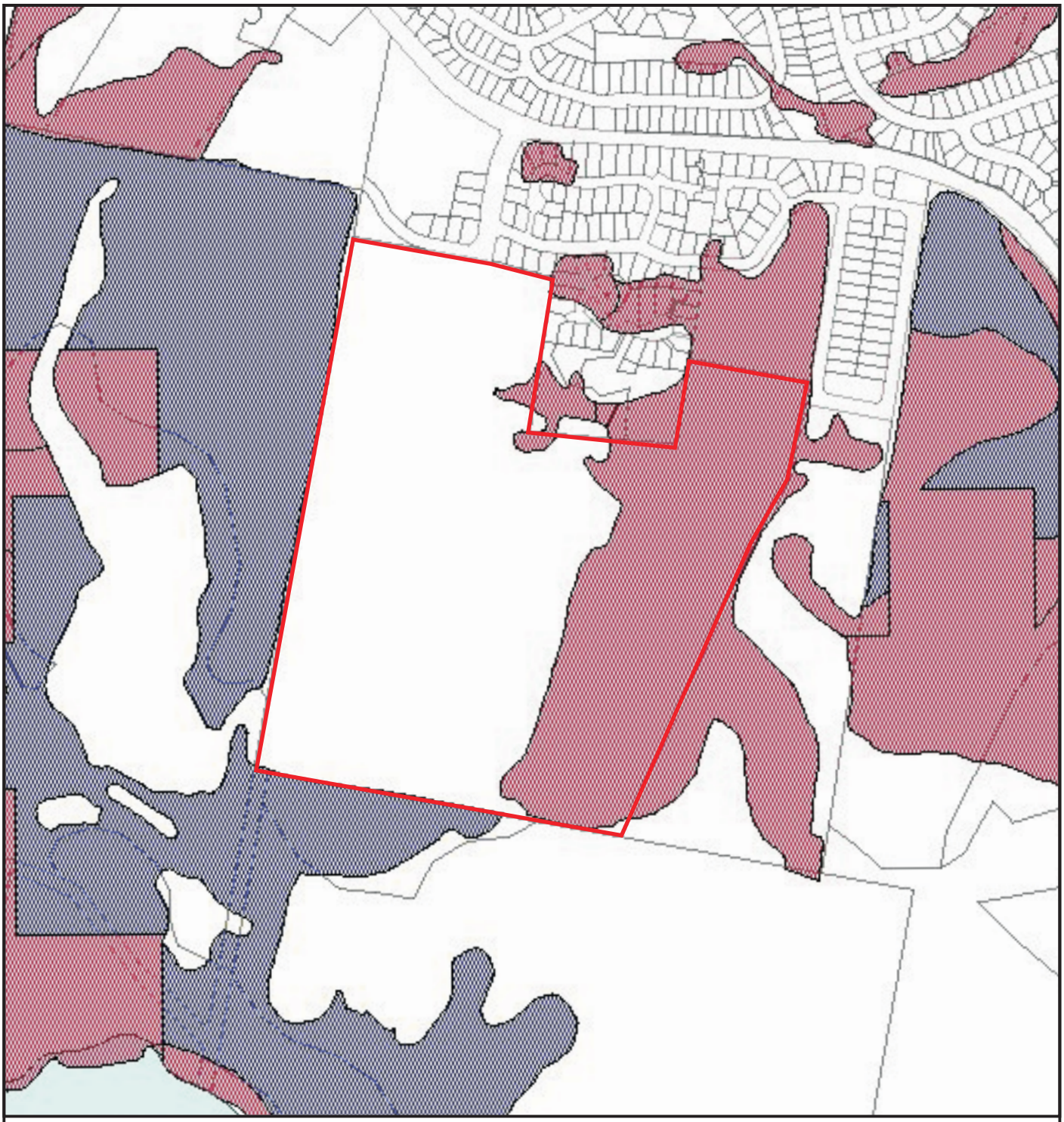
The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified feeding sites for Koalas in coastal forested environments (not woodland) as areas with stands with a high diversity of known food trees (three or more) including Tallowwood, Grey gum, Forest oak, Sydney blue gum, Swamp mahogany and Red gums. The Koala shelters in larger trees with big lateral branches (not necessarily food trees). The Koala disperses over any open habitat (including pasture and grassland) as long as scattered trees are present.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Koala, with the following results:

1st order disturbances	Habitat clearing
2nd order disturbances	Introduced predators – foxes and dogs
3rd order disturbances	Intensive logging that removes the critical tree size classes from the stand (may be frequent or single and intensive) Logging that removes stems 30-80 DBH in size.
4th order disturbances	Wildfire
5th order disturbances	Road kills
6th order disturbances	Disease



Legend
- Primary Koala Habitat
- Secondary Koala Habitat
- Tertiary Koala Habitat
- Subject Site

N

0 100m 200m

SOURCE: Coffs Harbour City Council - LEP Maps Online

SCALE: 1 : 8000 @ A4

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Utila Pty Ltd

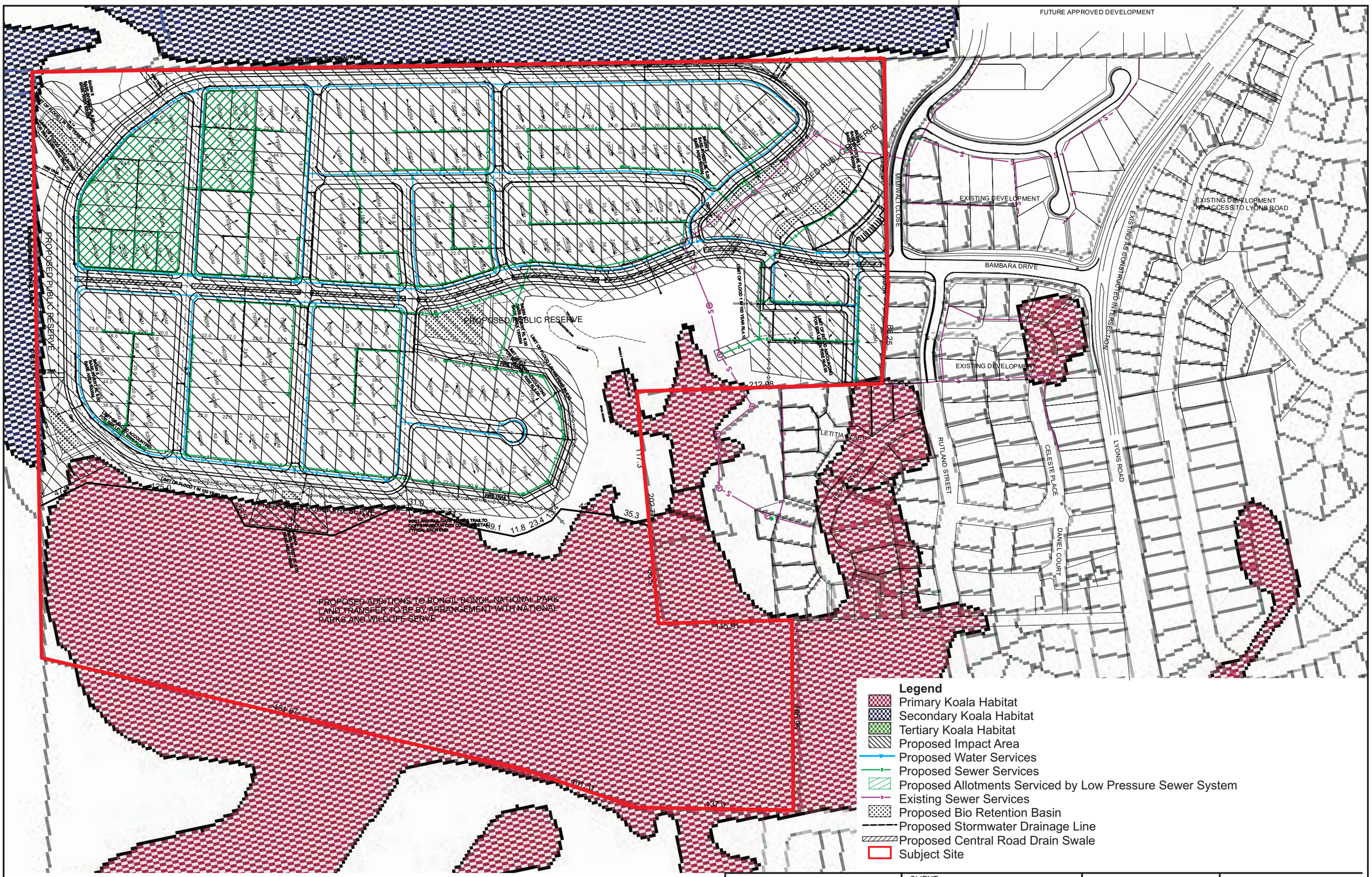
PROJECT
Ecological Assessment
Lot 112 on DP1073791
Lyons Road, North Bonville, NSW
Coffs Harbour City Council LGA

FIGURE 12

PREPARED: BW
DATE: 20 May 2010
FILE: N08022_Koala Habitat.cdr

TITLE

KOALA HABITAT



SOURCE: JWA Site Investigations; Worley Parsons; Geoff Slattery & Partners

SCALE: 1 : 3000 @ A3

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Lot 112 on DP1073791
Lyons Road, North Bonville, NSW
Coffs Harbour City Council LGA

FIGURE 13

PREPARED: BW
DATE: 17 January 2011
FILE: N08022_Impact Koala.cdr

TITLE
IMPACT OF PROPOSED LAYOUT ON KOALA HABITAT

Potential threats to the Koala from the proposed development of the site include:

- Injury/death from vehicle strike;
- Injury/death from domestic dogs;
- Bushfire; and
- Drowning in swimming pools.

The proposed development will result in the loss of a small area (0.20ha, 1.6%) of land classified as either primary, secondary or tertiary Koala habitat as defined under Coffs Harbour Koala Plan of Management (2009).

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- A range of measures to reduce vehicle impacts on fauna including: traffic calming features (e.g. speed humps), reduced traffic speeds, lighting;
- Lighting is designed to minimise spill;
- Regeneration and revegetation works on the subject site should utilise preferred Koala food trees where appropriate (i.e. within the riparian rehabilitation area mapped primary Koala habitat (JWA VMP);
- Rehabilitation works on the subject site (in accordance with the VMP) will create a fauna movement corridor from mapped Primary Koala habitat to the Bongil Bongil National Park;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010); and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Little bent-wing bat (*Miniopterus australis*)

Extent of the local population

The NPWS database contains fifteen (15) records of this species within 10 km of the subject site and a total of one hundred and forty-three (143) records within the Coffs Harbour LGA. Five (5) records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site however suitable habitat is considered to occur. This species is likely to forage widely throughout the locality including within urban and rural areas, however better quality forage habitat is likely to be within and adjacent to intact vegetation.

Approximately 13.27 hectares of potential forage and roost habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha); and
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha).

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and identified breeding sites for Little bent-wing bat as consisting of limestone caves, where it usually occurs in association with the Common bent-wing bat. It congregates in high numbers in maternity roost (in 1000's). It also shelters in a range of artificial structures including culverts, drains, mines etc. The Little bent-wing bat forages on flying insects in forested areas, predominantly swamp forest, moist eucalypt forest, rainforest and some dry forests.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Little bent-wing bat, with the following results:

- Clearing – habitat loss and fragmentation;
- Disturbance to camps/caves by limestone mining (cave collapse, altered air flow, noise, dust etc) and recreational activities;
- Logging – loss of foraging habitat;
- Wildfire and Frequent burning;
- Altered hydrology/microclimate – old growth-regrowth;
- Grazing;
- Pesticides; and
- Introduced predators.

The Little bent-wing bat is likely to forage widely over the locality. The most likely impacts to bats from the proposed development would be from urban disturbance (light spill, noise, and vehicle movements) adjacent to foraging areas and the loss of foraging areas themselves in urban-zoned land. However, it is expected these impacts would be relatively low as some species of micro-bat are known to adapt to urban environments where street lighting provides greater opportunities for the capture of prey. Micro-bats will have large areas of foraging habitat retained on the subject site. Potential roost habitat is best represented by consolidated vegetation to be retained, and development of urban zoned land is likely to have little impact on available roost sites.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- Lighting is designed to minimise spill;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.; and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Masked owl (*Tyto novaehollandiae*)

Extent of the local population

The NPWS database contains seven (7) records of this species within 10 km of the subject site and a total of ninety-two (92) records within the Coffs Harbour LGA. Three (3) records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site but is likely to forage widely over the locality including within open rural areas, however better quality forage habitat is likely to be within and adjacent to intact vegetation.

Approximately 13.5 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha);
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha); and
- 3 – Tall open dry sclerophyll forest (0.24ha).

No suitable nest sites were observed on the subject site.

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

The Masked owl feeds in sclerophyll forest with sparse, open understorey, particularly in the ecotone between wet and dry forest and non-forest habitat. It feeds on medium and small terrestrial mammals, some arboreal mammals and birds (Environment Australia 1999; Kavanagh & Murray 1996). Studies by Kavanagh & Murray (1996) suggest that the Masked owl may forage over a large area (1,000ha) containing a mosaic or relatively undisturbed and disturbed environments.

Nesting occurs at any time of year in deep hollows (usually vertical) in large, live trees (tall Eucalypts are favoured) or ledges in caves (Environment Australia 1999; Debus 1993). This owl shelters in hollows and in densely foliaged native and exotic understorey trees.

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and ranked the significance of various forms of disturbance for the Masked owl, with the following results:

1st order disturbances	Clearing for agriculture
2nd order disturbances	Logging which increases structural density of forest which effects mid to ground layer and thus affects manoeuvrability
3rd order disturbances	Fire – high frequency
4th order disturbances	Clearing for urban development
5th order disturbances	Road-kills
6th order disturbances	Nest and roost site disturbance

Masked Owls are likely to forage widely within the vicinity of the site, and the mosaic of vegetation types provides habitat for a variety of prey species. Retention of large areas of habitat will continue to provide a variety of forage environments for Masked owls.

Potential threats to the species from development of the site include:

- Human disturbance to areas of forage habitat; and
- Disturbance from straying domestic pets.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3.7%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010);
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Powerful owl (*Ninox strenua*)

Extent of local population

The NPWS database contains one (1) record of this species within 10 km of the subject site and a total of ninety-eight (98) records within the Coffs Harbour LGA. Fourteen (14) records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site but is likely to forage widely over the locality including within open rural areas, however better quality forage habitat is likely to be within and adjacent to intact vegetation.

Approximately 13.5 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha);
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha); and
- 3 – Tall open dry sclerophyll forest (0.24ha).

No suitable nest sites were observed on the subject site.

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains. Now uncommon throughout its range where it occurs at low densities. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.

NSW NPWS lists the following threats for this species:

- Historical loss and fragmentation of suitable forest and woodland habitat from land clearing for residential and agricultural development. This loss also affects the populations of arboreal prey species, particularly the Greater Glider which reduces food availability for the Powerful Owl;
- Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees. Loss of hollow-bearing trees reduces the availability of suitable nest sites and prey habitat;
- Can be extremely sensitive to disturbance around the nest site, particularly during pre-laying, laying and downy chick stages. Disturbance during the breeding period may affect breeding success;
- High frequency hazard reduction burning may also reduce the longevity of individuals by affecting prey availability;
- Road kills;

- Secondary poisoning; and
- Predation of fledglings by foxes, dogs and cats.

This species may potentially forage over the majority of the subject site however it is estimated that approximately 13.5 hectares of better quality forage habitat (i.e. more mature forest and woodland communities) occurs on the subject site. The proposed development will result in the removal or modification of a total of 0.5042 hectares (3.7%) of suitable habitat for this species.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species. This species is able to live in disturbed coastal forest (Debus 1994). The proposed retention of large areas of intact forest is likely to result in the continued foraging of this species on the subject site.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010);
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Regent honeyeater (*Xanthomyza phrygia*)

Extent of local population

The NPWS database contains three (3) records of this species within 10 km of the subject site and a total of ten (10) records within the Coffs Harbour LGA. No records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site however suitable habitat is considered to occur. Approximately 13.27 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha); and

- 2 – Tall open/closed swamp sclerophyll forest (10.8ha).

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding and sheltering sites for Regent honeyeater as consisting of Ironbark and Spotted gum forest, Whitebox and yellowbox riparian habitats with predominance of Casuarina. They tend to breed close to nectar sources (food) trees. The trees used for nectar tend to be older since they have better nectar flows. The Regent honeyeater forages in nectar trees of coastal banksia, melaleucas, winter flowering eucalypts, coastal heath and mistletoes on She-oaks and eucalypts.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Regent honeyeater, with the following results:

1st order disturbances	Clearing for agriculture
2nd order disturbances	Urban development
3rd order disturbances	Firewood collection Logging that reduces age classes Decreased nectar
4th order disturbances	Changes fire regimes Native predators
5th order disturbances	Grazing Apiary

Potential threats to the species from development of the site include:

- Human disturbance to areas of forage habitat; and
- Disturbance from straying domestic pets.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- A range of measures to reduce vehicle impacts on fauna including: traffic calming features (e.g. speed humps), reduced traffic speeds, lighting;
- Lighting is designed to minimise spill;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);

- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010); and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Square-tailed kite (*Lophoictinia isura*)

Extent of the local population

The NPWS database contains two (2) records of this species within 10 km of the subject site and a total of thirty (30) records within the Coffs Harbour LGA. No records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site but is likely to forage widely over the locality including within open rural areas, however better quality forage habitat is likely to be within and adjacent to intact vegetation.

Approximately 13.5 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha);
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha); and
- 3 – Tall open dry sclerophyll forest (0.24ha).

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

Square-tailed kites are uncommon yet widespread. They inhabit dry woodland and open forest mainly in coastal or subcoastal districts, preferring vegetation along major rivers and belts of trees in urban or semi-urban areas for hunting (NPWS 2002; Marchant & Higgins 1993).

Breeding sites for the Square-tailed kite as consist of nests in tall trees with large branches in tall, open sclerophyll forest and woodland with or adjacent to areas of high densities of passerine birds (Environment Australia 1999). The Square-tailed kite forages on a high density of passerine birds, particularly honeyeaters. It will occasionally take lorikeets, quail, pipits as well as fledglings and nestlings, lizards and insects (Environment Australia 1999; Marchant & Higgins 1993).

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and ranked the significance of various forms of disturbance for the Square-tailed kite, with the following results:

1st order disturbances	Clearing for agriculture
2nd order disturbances	Grazing and associated burning Logging which increases the structural density through reducing age classes, decreased nectar production Intensive horticulture Nest site loss
3rd order disturbances	Urban development
4th order disturbances	Egg collecting

Square-tailed kites are likely to forage widely within the vicinity of the site, and the mosaic of vegetation types provides habitat for a variety of prey species. Retention of large areas of habitat will continue to provide a variety of forage environments for Square-tailed kites.

Potential threats to the species from development of the site include:

- Human disturbance to areas of forage habitat; and
- Disturbance from straying domestic pets.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3.7%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010); and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

Wallum froglet (*Crinia tinnula*)

Extent of the local population

The NPWS database contains eight (8) records of this species within 10 km of the subject site and a total of fifty-one (51) records within the Coffs Harbour LGA. Twenty-eight (28) records exist from the adjacent Bongil Bongil National Park.

This species was not recorded from the subject site however suitable habitat is considered to occur. Approximately 13.27 hectares of potential forage habitat is considered to occur on the subject site and is comprised of the following vegetation communities (**FIGURE 5**):

- 1 – Tall open swamp sclerophyll forest (2.47ha); and
- 2 – Tall open/closed swamp sclerophyll forest (10.8ha).

The local population for this species is considered to be comprised of all individuals that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified breeding habitat as consisting of marshy or swampy areas with acidic, tannin stained water, typically associated with paper barks and tea trees. Breeding habitat is often, but not always, ephemeral. Eggs are laid in acid paper bark swamps. Tadpoles are free living and adults are terrestrial. The Wallum froglet forages around sedges and rushes adjacent to breeding habitat. This species is closely associated with the coastal zone and is found in altitudes up to 40m.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Wallum froglet, with the following results:

1st order disturbances	Habitat clearing Wetland swamp drainage for mosquito control Altered hydrology from earthworks
2nd order disturbances	Mining/quarrying
3rd order disturbances	Fish Pollution
4th order disturbances	Tea-tree harvesting

Potential threats to the Wallum froglet from development of the site include:

- Changes in hydrology;
- Water pollution;
- Injury/death from vehicle strike; and
- Contamination of habitat by herbicides, pesticides and fertiliser.

The proposed development will result in the removal or modification of a total of 0.5042 hectares (3%) of suitable habitat for this species.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species.

The following relevant recommendations apply:

- Controls on domestic animals;
- Feral animal control;
- A range of measures to reduce vehicle impacts on fauna including: traffic calming features (e.g. speed humps), reduced traffic speeds, lighting;
- Nutrient runoff into wetland habitats is minimised and managed;
- Hydrological regimes are maintained and/or restored;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010); and
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in the local extinction of this species.

(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.

Thirty-seven (37) endangered populations have been identified under the *TSC Act*. The following five (5) endangered populations occur in north-eastern NSW:

- Long-nosed potoroo population, Cobaki Lakes and Tweed Heads West;
- Emu population in the NSW North Coast Bioregion and Port Stephens LGA;
- Low growing form of *Zieria smithii*, Diggers Head;
- Narrow-leaved red gum in the Greater Taree LGA;
- *Glycine clandestina* (Broad-leaf form) in the Nambucca LGA.

The proposed action will not have an adverse affect on any of these endangered populations.

(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.

Not Applicable for Threatened fauna species.

(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

A summary of impacts on habitat for each Threatened fauna species considered a possible occurrence on the subject site is provided in **TABLE 12.**

TABLE 12
POTENTIAL LOSS OF THREATENED FAUNA HABITAT FROM THE SITE

Common Name	Botanical Name	Area of existing habitat	Area of habitat to be removed/ modified
Barking owl	*Ninox connivens*	13.5ha	0.5042ha (3.7%)
Barred cuckoo-shrike	*Coracina lineata*	13.27ha	0.3977ha (3%)
Black bittern	*Ixobrychus flavicollis*	13.27ha	0.3977ha (3%)
Black-necked stork	*Ephippiorhynchus asiaticus*	14.57ha	0.7531 (5%)
Common blossom-bat	*Syconycteris australis*	13.27ha	0.3977ha (3%)
Common planigale	*Planigale maculata*	13.27ha	0.3977ha (3%)
Eastern bent-wing bat	*Miniopterus schreibersii oceanensis*	13.27ha	0.3977ha (3%)
Eastern free-tail bat	*Mormopterus norfolkensis*	13.5ha	0.5042ha (3.7%)
Grey-headed flying-fox	*Pteropus poliocephalus*	13.5ha	0.5042ha (3.7%)

Common Name	Botanical Name	Area of existing habitat	Area of habitat to be removed/ modified
Koala	*Phascolarctos cinereus*	2.47ha (12.45ha under Coffs Harbour KPoM - 2009)	0.0ha (0%) (0.20ha/1.6% under Coffs Harbour KPoM - 2009)
Little bent-wing bat	*Miniopterus australis*	13.27ha	0.3977ha (3%)
Masked owl	*Tyto novaehollandiae*	13.5ha	0.5042ha (3.7%)
Powerful owl	*Ninox strenua*	13.5ha	0.5042ha (3.7%)
Regent honeyeater	*Xanthomyza phrygia*	13.27ha	0.3977ha (3%)
Square-tailed kite	*Lophoictinia isura*	13.5ha	0.5042ha (3.7%)
Wallum froglet	*Crinia tinnula*	13.27ha	0.3977ha (3%)

(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 Proposed development has been designed to utilise disturbed areas of the subject site and is unlikely to contribute significantly to an increase in the fragmentation of native vegetation communities. Existing habitat areas providing movement opportunities will be retained and will ensure existing movement opportunities are maintained for all native flora and fauna species.

(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.

Most of the vegetation to be removed consists of highly disturbed vegetation. The importance of this vegetation is minor when compared to the areas of suitable habitat proposed to be retained, protected and rehabilitated. The assessment of the importance of the habitat to be removed has taken into consideration the stages of the Threatened faunas' life cycles and how reproductive success may be affected. It is considered that, with the adoption of recommended amelioration and management measures, the proposed development will not affect the life cycle or reproductive success of any identified Threatened fauna species.

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

Critical habitat areas listed under the *Threatened Species Conservation Act (1995)* currently consist of habitat for Mitchell's rainforest snail in Stott's Island Nature Reserve, habitat for the Little penguin population in Sydney's North Harbour, habitat for Gould's Petrel and habitat for Wollemi Pine.

There will be no adverse effects on any critical habitat listed, in the Register of critical habitat in NSW, from the action proposed.

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

It is considered that the proposed development is consistent with the objectives and actions of all relevant Recovery Plans.

No Threat abatement plans exist for any of the Threatened species considered a possible occurrence on the subject site.

A range of protection measures have been proposed with the objective of retaining and protecting areas of habitat on the site for Threatened fauna species and reducing impacts on Threatened fauna wherever possible. With the implementation of these measures it is considered that Threatened flora species will continue to persist on the site following development.

(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 proposed development has the potential to result in an increase in the **'Invasion and establishment of exotic vines and scramblers'**, **'Invasion of native plant communities by exotic perennial grasses'** and **'Invasion, establishment and spread of *Lantana camara*'**. A VMP (JWA 2010) has been prepared for the development and will ensure that these key threatening processes are not exacerbated.

The proposed development has the potential to result in an increase in the **'Invasion and establishment of the Cane Toad'**, **'Predation by feral cats'** and **'Predation by the European Red Fox'**. It is recommended that a Fauna Management Plan should be prepared or included as a condition of consent for the development to ensure that these key threatening processes are not exacerbated.

The proposed development has the potential to result in an increase in the **'Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands'.** A Stormwater Management Plan (Moon 2010) has been prepared to ensure that this key threatening process is not exacerbated.

The proposed development will contribute towards the **'Clearing of native vegetation'**, a key threatening process listed on Schedule 3 of the *TSC Act (1995)*. The final determination of the NSW Scientific Committee notes that clearing of native vegetation is recognised as a major factor contributing to loss of biological diversity,

with impacts such as: destruction of habitat; fragmentation of habitat; riparian zone degradation; increased greenhouse gas emissions; increased habitat for invasive species; loss of leaf litter layer; loss or disruption of ecological function (*e.g.* loss of populations of pollinators or seed dispersers) and changes to soil biota.

Habitat loss is the main threatening process affecting all subject species. The Proposed development will make a minor contribution towards the loss of habitat in the region. However, as previously discussed, the majority of vegetation to be lost has been highly disturbed by past landuse activities.

The proposed development has the potential to result in an increase in the '**Ecological consequences of high frequency fires'.** A Bushfire Management Plan has been prepared by a suitably qualified firm to ensure that this key threatening processes is not exacerbated.

5.2.4.3. Results of Assessment of Significance

On the basis of this assessment, it is considered that the proposed development will not result in any significant impacts on Threatened fauna species considered a possible occurrence on the subject site over time.

5.3 Coffs Harbour City Council Koala Plan of Management (2009)

5.3.1 Introduction

A Comprehensive Koala Plan of Management (KPoM) was prepared by the NSW NPWS in close consultation with Coffs Harbour City Council (CHCC) under the statutory provisions of SEPP 44 – Koala Habitat Protection. The adoption of the KPoM replaces the requirement under SEPP 44 for developments in Coffs Harbour LGA to address Koala issues individually and sets out a framework for conserving Koalas in Coffs Harbour LGA (Lunney *et al* 1999). The adoption of the KPoM does not negate the responsibility of Council or a proponent considering undertaking a development requiring Council consent to fully consider whether such an activity is likely to result in a significant effect on a threatened species, population or ecological community or their habitat.

5.3.2 Relevance to the Subject site

The Subject site contains areas of Primary Koala habitat as mapped by the CHCC KPoM (1999), and is shown as **FIGURE 12**.

Areas of Primary Koala Habitat are the most significant habitats available to Koalas in the Coffs Harbour LGA, and accordingly require a high level of protection. The KPoM notes that the importance of preserving the remaining viable Koala habitat remnants in the broader Primary habitat area is critical in securing the Koala population within the Coffs Harbour LGA.

Primary Koala Habitat

The aim of the Coffs Harbour Koala Plan of Management (KPoM) in relation to Primary Koala Habitat is:

"To prevent further clearing, disturbance, fragmentation or isolation of existing primary koala habitat, and where appropriate, restore habitat and encourage sympathetic management to ensure the maintenance of koalas".

Council will not grant consent to development on areas of Primary Koala Habitat which will remove the following tree species: Tallowwood, Swamp mahogany, Broad-leaved paperbark, Flooded gum, Blackbutt, Forest red gum, Small-fruited grey gum, or Forest oak, unless the development will not destroy, damage or compromise the values of the land as Koala habitat. In assessing an application Council will take into consideration:

- That there should be zero net loss of Primary Koala Habitat;
- The threats to Koalas which may result from the development;
- The likely impacts to adjacent or nearby Primary Koala Habitat and existing or potential Koala movement corridors;
- All other options for preventing or ameliorating impacts from the development on Koalas; and
- Whether the land is accredited under the *Timber Plantation (Harvest Guarantee) Act 1995*.

There will be loss of a small area (0.2024ha) of Primary Koala Habitat as mapped by Coffs Harbour City Council (**FIGURE 13**). Options for ameliorating potential impacts on Koalas from the development include:

- Controls on domestic animals;
- Feral animal control;
- A range of measures to reduce vehicle impacts on fauna including: traffic calming features (e.g. speed humps), reduced traffic speeds, lighting;
- Lighting is designed to minimise spill;
- Regeneration and revegetation works on the subject site should utilise preferred Koala food trees where appropriate;
- Rehabilitation works on the subject site (in accordance with the VMP) will create a fauna movement corridor from mapped Primary Koala habitat to the Bongil Bongil National Park;
- Fire management to protect habitat in the long-term in accordance with the Bushfire Hazard Assessment Report (Holiday Coast Bushfire Solutions, 2010);
- Contiguous areas of retained vegetation are to be fenced with permeable fencing (e.g. post and rail) to discourage access from human visitation and from trail bikes etc.;
- Weeds within habitat areas are controlled and managed and habitat restoration is to be implemented in accordance with the Vegetation Management Plan (JWA 2010);
- Public education (signage, literature) is to be used wherever possible to educate residents and direct behaviour;

The main loss of land defined as Koala Habitat under the Coffs Harbour LEP (2000) is for the construction of stormwater infrastructure. Amelioration for the minor losses of this habitat area include:

- Ensuring the stormwater discharge into this area is of a high quality/standard; and
- Compensatory planting of koala food trees in other areas of the Subject site.

No signs of Koala activity (scats, tree scratchings) were recorded from the area of Koala Habitat to be lost during the site survey(s) by JWA. Some of the areas classified by Coffs Harbour City Council as Primary Koala Habitat were found to contain conditions not ideal for Koala habitation during ground truthing by JWA.

It is considered that, with the adoption of recommended management practices, the proposed development is unlikely to result in a significant impact on the local Koala population.

Inappropriate development on lands adjoining or separating Primary Koala Habitat, particularly where such areas may contain scattered preferred Koala food trees, has the potential to impact on Koalas by removing habitat and creating barriers to Koala movement between habitat remnants.

The aim of the Coffs Harbour Koala Plan of Management (KPoM) in relation to Lands Adjoining Primary Koala Habitat is:

"To minimise impacts on Primary Koala Habitat from development proposed on adjoining lands, particularly where such areas may contain scattered preferred Koala trees, and to maintain opportunities for free movement of Koalas between areas of habitat."

Council shall not grant consent to the carrying out of development on lands adjoining areas identified as Primary Koala Habitat unless it is satisfied that:

- The proposal will not result in barriers to Koala movement;
- Boundary fencing does not prevent free movement of Koalas;
- Lighting and Koala exclusion fencing is provided where appropriate on roadways adjacent to Koala habitat;
- Preferred Koala food trees are retained where possible;
- New local roads are designed to reduce traffic speed to 40kph in potential koala "blackspots";
- Preferred Koala food trees are used in landscaping where suitable;
- Threats to Koalas by dogs have been minimised (i.e. banning of dogs or confining dogs to Koala proof yards);
- Fire protection zones, including fuel reduced zones and radiation zones, are provided outside the area of Primary Koala Habitat.

All of the above recommendations have been considered by the proposed development.

5.4 Commonwealth Environment Protection and Biodiversity Conservation Act (1999)

5.4.1 Introduction

The *Environment Protection & Biodiversity Conservation (EPBC) Act (1999)* was passed by Commonwealth Parliament in June 1999 and came into force on 16 July, 2000. A person must not, without an approval under the Act, take an action that has or will have, or is likely to have, a significant impact on a matter of National Environmental Significance (NES). These matters are listed as:

(a) The world heritage values of a declared World Heritage property;

(b) The ecological character of a declared Ramsar wetland;

(c) A threatened species or endangered community listed under the Act;

(d) A migratory species listed under the Act; or

(e) The environment in a Commonwealth marine area or on Commonwealth land.

The Act also prohibits the taking, without an approval under the Act, of:

(a) A nuclear action; or

(b) An action in a Commonwealth marine area or on Commonwealth land that has or will have, or is likely to have, a significant impact on the environment.

An action includes a project, development, undertaking or an activity or series of activities. An action does not require approval if it is a lawful continuation of a use of land, sea or seabed that was occurring before the commencement of the Act. An enlargement, expansion or intensification of a use is not a continuation of a use.

The *EPBC Act (1999)* does not require Commonwealth approval for the rezoning of land. It does, however, suggest that when rezoning land, planning authorities should consider whether to allow actions that could significantly affect NES matters or the environment of Commonwealth land.

Matters of NES in NSW are:

(a) Declared World Heritage Areas;

(b) Declared Ramsar Wetlands;

(c) Listed Threatened Species (Schedule 1 and 2 of Commonwealth Endangered Species Protection Act 1992);

(d) Listed Ecological Communities in NSW; and

(e) Listed migratory species (JAMBA and CAMBA).

5.4.2 Subject Site Assessment

A Commonwealth Assessment will be required for proposed activities on the subject site if they affect a matter of NES. Matters of NES in NSW were identified in the previous section. There are no declared World Heritage Areas or Ramsar Wetlands in the Locality, Study area or Subject site.

5.4.3 Listed Threatened species

A number of terrestrial species listed as threatened in the *Commonwealth Endangered Species Protection Act (1992)* are known from the wider locality, these are:

Flora

- Arrow-head Vine (*Tinospora tinosporoides*);
- Austral toadflax (*Thesium australe*);
- Clear milkvine (*Marsdensia longiloba*);
- Dwarf heath casuarina (*Allocasuarina defungens*);
- Hairy-joint grass (*Arthraxon hispidus*);
- Knotweed (*Persicaria elatior*);
- Milky silkpod (*Parsonsia dorrigoensis*);
- Ribbon-root orchid (*Taeniophyllum muelleri*);
- Scented Acronychia (*Acronychia littoralis*);

- Southern swamp orchid (*Phaius australis*);
- Stinking cryptocarya (*Cryptocarya foetida*);
- *Tylophora woollsii;*
- White-flowered wax plant (*Cynanchum elegans*); and
- *Ziera prostrate*.

No Commonwealth Threatened flora species were recorded on the Subject site.

Fauna

- Booroolong frog (*Litoria booroolongensis*);
- Brush-tailed rock-wallaby (*Petrogale penicillata*);
- Giant barred frog (*Mixophyes iteratus*);
- Green and golden bell frog (*Litoria aurea*);
- Grey-headed flying-fox (*Pteropus poliocephalus*);
- Large-eared pied bat (*Chalinolobus dwyeri*);
- Long-nosed potoroo (*Potorous tridactylus tridactylus*);
- Regent honeyeater (*Xanthomyza phrygia*);
- Spotted-tail quoll (*Dasyurus maculatus maculatus*); and
- Stuttering frog (*Mixophyes balbus*).

No Commonwealth Threatened flora species were recorded on the Subject site. Two (2) Commonwealth Threatened fauna species, the Grey-headed Flying-fox and Regent honeyeater, are considered a possible occurrence at the site over time based on the availability of suitable habitat.

If the proposed development is deemed to have a significant impact on any of these species, Commonwealth approval will be required.

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- Lead to a long-term decrease in the size of a population; or
- Reduce the area of occupancy of the species; or
- Fragment an existing population into two or more populations; or
- Adversely affect habitat critical to the survival of a species; or
- Disrupt the breeding cycle of a population; or
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; or
- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat; or
- Interfere with the recovery of the species.

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

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

- Reduce the area of occupancy of an important population; or
- Fragment an existing important population into two or more populations; or
- Adversely affect habitat critical to the survival of a species; or
- Disrupt the breeding cycle of an important population; or
- Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; or
- Result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat; or
- Interferes substantially with the recovery of the species.

An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- Key source 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.

It is considered that the proposed development will not result in any such impacts on the Grey-headed flying-fox or Regent honeyeater.

It is considered that the subject site does not support an important population of any species listed in the *EPBC Act (1999)* and a significant impact on these species will not be incurred.

5.4.4 Listed Ecological Communities in NSW

None of the ecological communities currently listed in the *EPBC Act (1999)* occur in the study area or wider locality.

5.4.5 Listed Migratory Species

Listed migratory species in NSW are considered predominantly in the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA).

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

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

(* Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.)

An area of important habitat is:

1. Habitat utilised 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.

It is considered that although a number of listed migratory species are known or likely to occur occasionally in the Study area, no area of important habitat occurs on the subject site for listed migratory species.

5.4.6 Requirement for Commonwealth Assessment

On the basis of the above assessment, it is concluded that Commonwealth Assessment is not required for the Proposed development of the subject site.

6. SUMMARY AND CONCLUSIONS

James Warren and Associates (JWA) have been engaged by Utila Pty Ltd to complete an Ecological Assessment of land described as Lot 112 DP 1073791, Lyons Road, Sawtell. A project application for the proposed development was lodged with the Department of Planning (DoP)–Application No.08_0080 and Director General's Requirement (DGRs) issued.

The proposed development includes approximately 170 low density lots, medium density development, roads, associated infrastructure, public open space areas and a residential public reserve.

An initial site survey was completed between the 4th & 8th November 2008 and a subsequent visit (October 2009) verified previous vegetation mapping.

Six (6) vegetation communities were identified including two (2) Endangered Ecological Communities (i.e. Swamp sclerophyll forest and Freshwater wetlands). Eighty-five (85) flora species were recorded with none listed as threatened (TSC Act).

The fauna survey recorded seven (7) species of amphibian, seven (7) reptile specie, sixty (60) bird species and sixteen (16) mammal species. No Threatened fauna species were recorded however, based on the results of the habitat assessment, sixteen (16) Threatened fauna species known from the locality were considered a possible occurrence over time.

The proposed development will result in the loss of 23.1526 hectares of vegetation for the construction of buildings, access roads, driveways and associated infrastructure. The majority of this (over 95%) will be from Low closed grassland with scattered trees. Around 40% of the site will be retained as open space and/or environmental protection. Furthermore, degraded areas of the subject site will be rehabilitated in accordance with the Vegetation Management Plan (JWA 2010). In total, approximately 4.22ha of revegetation works are proposed to offset the removal of 0.3554 hectares of degraded Freshwater wetland EEC. Details of the revegetation/regeneration works are contained within the Vegetation Management Plan (JWA 2011).

An Assessment of Significance (DECC 2007) was completed for the EECs and each of the Threatened fauna species, considered a possible occurrence in the site. This assessment concluded that the impacts of the Proposed development would be unlikely to result in the local extinction of any of these species, and that there would be no significant impact upon any of the EECs occurring on the site. A Species Impact Statement is not required.

The site contains areas of Primary Koala habitat, as mapped by the CHCC KPoM (2009). There will be a small loss (0.2024ha, 1.6%) of land mapped as Primary Koala Habitat for the construction of stormwater infrastructure. Some of the areas classified by Coffs Harbour City Council as Primary Koala Habitat were found to contain conditions not ideal for Koala habitation during ground truthing by JWA. Options for ameliorating potential impacts on Koalas are suggested including ensuring the stormwater discharge into this area is of a high quality/standard and planting additional Koala food trees in the riparian rehabilitation area. A movement corridor

will also be created between mapped Primary Koala habitat and Bongil Bongil National Park.

An assessment under the *Commonwealth Environment Protection and Biodiversity Conservation Act (1999)* concluded that the Proposed development will not have a significant impact on any matters of National Environmental Significance. Commonwealth assessment of the proposal is therefore not required.

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APPENDIX 1 - PLANT SPECIES LIST

Family	*Botanical Name*	Common Name
Alismataceae	*Damasonium minus**	Starfruit
Apiaceae	*Centella asiatica*	Pennywort
Apocynaceae	*Parsonsia straminea*	Common silkpod
Araceae	*Gymnostachys anceps*	Settlers flax
Araliaceae	*Polyscias sambucifolia*	Elderberry panax
Asclepiadaceae	*Asclepias curassavica**	Cotton Bush
Asteraceae	*Ageratina adenophora**	Crofton weed
Asteraceae	*Baccharis halimifolia**	Groundsel Bush
Asteraceae	*Cassinia sp**	
Asteraceae	*Cirsium valgare**	Spear Thistle
Asteraceae	*Senecio madagascariensis**	Fireweed
Blechnaceae	*Blechnum indicum*	Swamp Fern
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Cunoniaceae	*Callicoma serratifolia*	Black Wattle
Cunoniaceae	*Tradescantia albiflora **	Wandering Jew
Cyperaceae	*Cyperus stradbrokensis*	
Cyperaceae	*Gahnia sieberana*	Saw Sedge
Cyperaceae	*Restio tetraphyllus*	Curly Sedge
Cyperaceae	*Gahnia clarkei*	Tall saw-sedge native
Dennstaedtiaceae	*Histiopteris incisa*	Batswing fern
Dennstaedtiaceae	*Pteridium esculentum*	Soft Bracken Fern
Dilleniaceae	*Hibbertia scandens*	Guinea Flower
Dilleniaceae	*Hibbertia vestita*	
Epacridaceae	*Leucopogon lanceolatus*	Lance-leaf Beard-heath
Euphorbiaceae	*Phyllanthus gunnii*	Blunt Spurge
Fabaceae Caesalpinioideae	*Senna X floribunda**	Smooth cassia
Fabaceae Faboideae	*Desmodium brachypodum**	Large Tick-trefoil
Fabaceae Faboideae	*Hardenbergia violacea*	False Sarsparilla
Fabaceae Faboideae	*Indigofera australis*	Native Indigo
Fabaceae Faboideae	*Pultenaea dentata*	Egg and Bacon Pea
Fabaceae Mimosoideae	*Acacia melanoxylon*	Blackwood
Fabaceae Mimosoideae	*Acacia floribunda*	Sally wattle
Flacourtiaceae	*Scolopia braunii*	Flintwood
Juncaceae	*Juncus cognatus**	
Juncaceae	*Juncus continuus*	
Juncaceae	*Juncus polyanthemus*	
Juncaceae	*Juncus usitatus*	Rush
Lauraceae	*Cinnamomum camphora**	Camphor laurel
Lobellaceae	*Pratia purpurascens*	Whitroot
Lomandraceae	*Lomandra hystrix*	
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling lily

Malvaceae	*Sida rhombifolia**	Paddy's lucerne
Moraceae	*Ficus watkinsiana*	Strangler fig
Myrtaceae	*Angophora costata*	Smooth barked apple
Myrtaceae	*Archirhodomyrtus beckleri*	Rose Myrtle
Myrtaceae	*Callistemon salignus*	Willow-Leaved Bottlebrush
Myrtaceae	*Eucalyptus grandis*	Flooded Gum
Myrtaceae	*Eucalyptus intermedia*	Pink Bloodwood
Myrtaceae	*Eucalyptus microcorys*	Tallowwood
Myrtaceae	*Eucalyptus pilularis*	Blackbutt
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Myrtaceae	*Leptospermum juniperinum*	Prickly Tea tree
Myrtaceae	*Lophostemon suaveolens*	Swamp turpentine
Myrtaceae	*Lophostemon confertus*	Brushbox
Myrtaceae	*Melaleuca quinquenervia*	Broad-Leaved Paperbark
Myrtaceae	*Syncarpia glomulifera*	Turpentine
Ochnaceae	*Ochna serrulata**	Mickey mouse plant
Philydraceae	*Philydrum lanuginosum*	Frogsmouth
Phormaceae	*Dianella caerulea*	Blue Flax Lily
Pittosporaceae	*Pittosporum undulatum*	Sweet pittosporum
Poaceae	*Andropogon virginicus**	Whiskey grass
Poaceae	Axonopus *fissifolius**	Narrow leaf carpet grass
Poaceae	*Cynodon dactylon*	Couch
Poaceae	*Imperata cylindrica*	Blady grass
Poaceae	*Leersia hexandra*	Swamp ryegrass Poaceae
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Paspalum wettsteinii* *	Broad leaf paspalum
Poaceae	*Setaria sphacelata**	Setaria
Poaceae	*Sporobolus pyramidalis**	Giant rat's tail grass
Poaceae	*Themeda australis*	Kangaroo Grass
Poaceae	*Trifolium spp.**	Clover
Poaceae	*Urochloa panicoides**	Liverseed Grass
Proteaceae	*Banksia spinulosa*	Hill Banksia
Proteaceae	*Persoonia stradbrokensis*	Geebung
Rhamnaceae	*Alphitonia excelsa*	Red Ash
Santalaceae	*Exocarpus cupressiformis*	Native Cherry
Sapindaceae	*Dodonaea viscosa*	Hop Bush
Solanaceae	*Solanum mauritianum**	Wild tobacco
Thymeleaceae	*Pimelea ligustrina subsp. ligustrina*	Tall rice Flower
Ulmaceae	*Trema tomentosa*	Native Peach
Verbenaceae	*Lantana camara**	Lantana
Xanthorrhoeaceae	*Xanthorrhoea fulva*	Grass Tree