JAMES WARREN & Associates Pty Ltd

ENVIRONMENTAL CONSULTANTS

COBAKI LAKES

Cobaki Parkway 'Missing Link'
&
Re-alignment of
Sandy Lane (southern portion)

Revised
Assessment of Significance

JUNE 2010

A REPORT PREPARED FOR LEDA MONORSTEAD PTY LTD

Brisbane Office
Suite 28, Cathedral Village
115 Wickham Street
FORTITUDE VALLEY QLD 4006
PH: 07 3257 2703
Fax: 07 3257 2708

Ballina Office
105 Tamar Street
PO Box 1465
BALLINA NSW 2478
PH: 02 6686 3858
Fax: 02 6681 1659

Sunshine Coast Office
PH: 07 5437 0277
Fax: 07 5437 0922

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1 INTRODUCTION

1.1 Background

James Warren and Associates has been engaged by LEDA Manorstead Pty Ltd to complete an Assessment of Significance (7 Part Test equivalence) for land within the proposed Cobaki Lakes development, Cobaki. The land to be assessed is an area covered by the realignment of Sandy Lane and the construction of a portion of Cobaki Parkway known as the 'Missing Link'.

The assessment has involved the following:

- Assessing vegetation communities;
- Reviewing the suite of Threatened Flora, Fauna and Endangered Ecological Communities identified on the site, as listed by the New South Wales *Threatened Species Conservation Act 1995* (TSC Act);
- Determining the suite of Threatened fauna that occur in the locality (*TSC Act)*;
- Assessing habitat for Threatened species provided by the site; and
- Reviewing supporting documentation and relevant reports.

The assessment has been completed in accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007).

1.2 Locality

1.2.1 Introduction

The Locality is defined as the area within a 10km radius of the Subject site. The Locality therefore extends from North Tumbulgum in the south to Burleigh Heads in the north and from Currumbin Valley in the west to Tweed Heads in the east (**FIGURE 1**).

Prominent features in the locality include the townships of Coolangatta, Palm Beach and Banora Point and the villages of Tallebudgera, Pigabeen and Bilambil Heights. Prominent water bodies in the locality include the Cobaki Broadwater, Currumbin Creek, Cobaki Creek, Terranora Broadwater and the Coral Sea.

Dominant habitat types are eucalypt forest, swamp sclerophyll forest, heathlands, sedgelands, rushlands, subtropical rainforest, littoral rainforest and intertidal communities. Land uses within the locality include residential, forestry, conservation, tourism, commercial, fishing, grazing and agriculture.

1.2.2 Conservation Reserves and Ecologically significant areas in the locality

There are three (3) dedicated conservation reserves in the locality:

- Tweed Estuary Nature Reserve, an area of 59 hectares to the east of the Subject site.
- Stotts Island Nature Reserve, an area of 142 hectares to the south of the Subject site; and
- Ukerebagh Nature Reserve, an area of 150 hectares to the east of the Subject site.

State Wetlands numbers 1 - 30 occur within 10km of the locality, and are shown in **FIGURE 2**. A large area of SEPP 14 wetland no. 1 is located immediately east of the subject site adjacent to Cobaki Broadwater and Cobaki Creek (**FIGURE 3**). These wetlands are protected by State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14).

The portion of the wetland that occurs on the subject site occurs almost entirely within the area dedicated to council (under Section 88b of the Conveyancing Act 1919) and the approved alignment of the Cobaki Parkway (i.e. a major arterial road to be constructed through the subject site).

SEPP 26 Littoral Rainforests numbers 2A, 2B, and 2C occur within the locality and are shown in **FIGURE 4**. These rainforests are protected by State Environmental Planning Policy No. 26 – Littoral Rainforest (SEPP 26).

1.3 The Subject Site

The Cobaki Lakes site covers Lot 1 DP 570076, Lot 2 DP 566529, Lot 1 DP 562222, Lot 1 DP 570077, Lot 1 823679, Lots 46, 54, 55, 199, 200, 201, 202, 205, 206, 209, 228 & 305 DP 755740, Cobaki Lakes, off Pigabeen Road, Tweed Heads. The site covers an area of approximately 598 hectares and is shown in **FIGURE 5 & 6**.

The site is surrounded by a narrow belt of forested land adjacent to the northern and western boundaries of the site. This belt of vegetation occurs within the Crown Reserve separating Queensland from New South Wales. Private large landholdings occur adjacent to the southern site boundary. Piggabeen Road separates these landholdings from the Cobaki Lakes site.

Cobaki Creek (tidal) occurs adjacent to part of the eastern boundary of the site. Cobaki Broadwater and a large area of wetland occur alongside the north-eastern boundary.

Overall the Cobaki Lakes site has been extensively cleared for agricultural purposes (i.e. grazing) and the strip of land that constitutes the Subject site extends through a number of vegetation communities. Extensive clearing and subsequent slashing over the drainage basin has resulted in the recruitment of a combination of native and introduced grass species in place of native plants.

1.4 The Proposed Development

This assessment will focus on the area of the proposed construction of the southern portion of the realignment of Sandy Lane and the portion of Cobaki Parkway referred to as the 'Missing Link' **(FIGURE 5).**

2 SUMMARY OF SIGNIFICANT SITE VALUES

2.1 Introduction

A number of Flora and Fauna Reports and other sources of information have been reviewed prior to the completion of the current assessment. These include:

- Cameron McNamara (1983), Cobaki Village Environmental Study (Report Prepared for the Bradshaw Group);
- WBM (1990), Evaluation of Terrestrial Fauna – Cobaki Community Project;
- WBM (1991a), Greater Gliders of the Cobaki Lakes Project Property, Cobaki, NSW;
- WBM (1991b), Flora and Fauna Studies, Proposed Boyd Street Extension to Cobaki;
- Warren (1992), Fauna Impact Assessment of the Proposed Boyd Street Access;
- Warren (1993), Flora and Fauna survey of proposed cut/fill areas at Cobaki Lakes development (Unpublished Report);
- Warren (1994), Flora and Fauna survey of the Cobaki Lakes development site (Unpublished Report);
- Debus (1994), Bird Survey of the Cobaki Community Project Site;
- Woodward-Clyde (1997), A Flora and Fauna Assessment of Parcels 7, 8, 9 and 10 of the "Cobaki Lakes Residential Development";
- Woodward-Clyde (1997), Species Impact Statement - AGC Woodward-Clyde Pty Ltd;
- Parker (1999), A Species Impact Statement for the Cobaki Lakes Project;
- EcoPro Pty Ltd (2004), Tugun Bypass: Species Impact Statement (SIS). A report prepared for the Queensland Department of Main Roads; and
- James Warren & Associates (2008) Response to the Director General's Environmental Assessment Requirements. Volume 1 – Ecological Assessment. A report prepared for LEDA Manorstead Pty Ltd.

A summary of findings is provided below.

2.2 Site vegetation

Flora assessment of the subject site has recorded sixteen (16) broad vegetation associations comprising twenty-two (22) vegetation communities (**FIGURE 7**). **TABLE 1** lists the vegetation communities recorded on the subject site.

TABLE 1: VEGETATION COMMUNITIES PRESENT ON THE SUBJECT SITE

Community	Description
1	**Dry Sclerophyll Communities**
1a	Very Tall Open/Closed Sclerophyll Forest (*Eucalyptus pilularis* +/- *E. microcorys* +/- *E. propinqua* +/- *Corymbia intermedia)*
1b	Tall Open/Closed Sclerophyll Forest (*E. propinqua*)
1c	Tall Open Sclerophyll Woodland (*E. pilularis)*

Community	Description
1d	Tall Open Sclerophyll Forest (*E. pilularis* +/- *E. siderophloia* +/- *E. tereticornis)*
2	**Rainforest Communities**
2a	Tall Closed Forest (*Lophostemon confertus* +/- *Araucaria cunninghamii*)
2b	Tall Open Forest (*Archontophoenix cunninghamiana*)
2c	Very Tall Closed Forest (*Araucaria cunninghamii*)
2d	Mid-high Open/Closed Forest (Riparian species +/- Mixed species)
	Other Communities
3	Tall/Very Tall Open/Closed Forest (*Lophostemon confertus* +/- Mixed rainforest species)
4	Tall Open Woodland (*Araucaria cunninghamii* +/- Mixed species)
5	Closed Scrub (*Banksia aemula, E. racemosa* +\- *Leptospermum* spp.)
6	Mid-high Open Woodland (Mixed rainforest species)
7	Mid-high Open Woodland (*Eucalyptus robusta*)
8	Mid-high Open Woodland (*Eucalyptus racemosa*)
9	Mid-high Open Woodland (*Eucalyptus siderophloia*)
10	Tall Closed Grassland/Fernland/Sedgeland (Mixed Species)
11	Low Closed Forest (Re-vegetation areas +\- Mixed *Eucalyptus* species)
12	Low Closed Grassland with Scattered Trees (Pastoral grasses +/- Mixed species)
13	Low Closed Grassland (*Sporobolus virginicus, Triglochin striata* + /- *Casuarina glauca*)
14	Rushland/Sedgeland/Grassland (Mixed aquatic species)
15	Low to Mid-high Open Mangrove Forest (*Avicennia marina* var. *australasica* / *Aegiceras corniculatum* +/- *Casuarina glauca*)
16	Dam & Drainage Lines (Mixed aquatic species)
17	Low open forest/woodland (*Casuarina glauca* +/- Mixed species)
18	Slashed Grassland/Heath land/Sedgeland (Mixed species)

In total, four hundred and forty-nine (449) flora species have been recorded at the subject site. This list is a compilation of all plant species recorded from the site by JWA as well as during previous flora assessments (i.e. WBM 1990 & 1991b; Woodward-Clyde 1997 & Parker 1999).

2.3 Fauna

The literature review has revealed the presence (historically) of twelve (12) Threatened fauna species on the Cobaki Lakes site with an additional nineteen (19) Threatened species recorded during surveys on adjacent land (**TABLE 2**).

Species status is listed below in accordance with the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act 1999) and NSW *Threatened Species Conservation Act 1995* (TSC Act 1995).

TABLE 2: THREATENED FAUNA SPECIES RECORDED ON OR ADJACENT TO THE SUBJECT SITE

Common name	Scientific name	Status	Source
Wallum froglet	*Crinia tinnula*	Vulnerable (TSC Act 1995)	McNamara 1983, WBM 1990, Warren 1992, 1993, Woodward-Clyde 1997, EcoPro 2004, JWA 2008
Wallum sedge-frog*	*Litoria olongburensis*	Vulnerable (TSC Act 1995) & Endangered (EPBC Act 1999)	Warren 1992, Woodward-Clyde 1997, EcoPro 2004
Bush hen*	*Amaurornis olivaceus*	Vulnerable (TSC Act 1995)	EcoPro 2004
Glossy black-cockatoo*	*Calyptorhynchus lathami*	Vulnerable (TSC Act 1995)	EcoPro 2004
Brolga*	*Grus rubicunda*	Vulnerable (TSC Act 1995)	EcoPro 2004
Black bittern*[U]	*Ixobrychus flavicollis*	Vulnerable (TSC Act 1995)	EcoPro 2004
Mangrove honeyeater*	*Lichenostomus fasciogularis*	Vulnerable (TSC Act 1995)	EcoPro 2004
White-eared monarch*	*Monarcha leucotis*	Vulnerable (TSC Act 1995)	EcoPro 2004
Powerful owl	*Ninox strenua*	Vulnerable (TSC Act 1995)	Warren 1993, 1994, Woodward-Clyde 1997
Osprey	*Pandion haliaetus*	Vulnerable (TSC Act 1995)	McNamara 1983, WBM 1990, Warren 1992, 1993, Woodward-Clyde 1997, EcoPro 2004, JWA 2008
Wompoo fruit-dove*	*Ptilinopus magnificus*	Vulnerable (TSC Act 1995)	EcoPro 2004
Rose-crowned fruit-dove*	*Ptilinopus regina*	Vulnerable (TSC Act 1995)	EcoPro 2004
Superb fruit-dove*[U]	*Ptilinopus superbus*	Vulnerable (TSC Act 1995)	EcoPro 2004

Common name	Scientific name	Status	Source
Collared kingfisher*	*Todiramphus chloris*	Vulnerable (TSC Act 1995)	EcoPro 2004
Eastern grass owl*	*Tyto capensis*	Vulnerable (TSC Act 1995)	EcoPro 2004
Masked owl	*Tyto novaehollandiae*	Vulnerable (TSC Act 1995)	Debus 1994, Woodward-Clyde 1997, EcoPro 2004
Black neck-stork	*Xenorhynchus asiaticus*	Endangered (TSC Act 1995)	WBM 1990, Warren 1993, Woodward-Clyde 1997, EcoPro 2004, JWA 2008
Little bent-wing bat	*Miniopterus australis*	Vulnerable (TSC Act 1995)	Warren 1994, Woodward-Clyde 1997, EcoPro 2004
Common bent-wing bat	*Miniopterus schreibersii*	Vulnerable (TSC Act 1995)	Warren 1994, Woodward-Clyde 1997
Eastern free-tail bat	*Mormopterus norfolkensis*	Vulnerable (TSC Act 1995)	Warren 1994, Woodward-Clyde 1997
Large-footed myotis*	*Myotis adversus*	Vulnerable (TSC Act 1995)	EcoPro 2004
Eastern long-eared bat*	*Nyctophilus bifax*	Vulnerable (TSC Act 1995)	EcoPro 2004
Squirrel glider*	*Petaurus norfolkensis*	Vulnerable (TSC Act 1995)	EcoPro 2004
Koala	*Phascolarctos cinereus*	Vulnerable (TSC Act 1995)	Woodward-Clyde 1997, JWA 2008
Common planigale*	*Planigale maculata*	Vulnerable (TSC Act 1995)	EcoPro 2004
Long-nosed potoroo*	*Potorous tridactylus*	Vulnerable (TSC Act 1995)	Warren 1992, Woodward-Clyde 1997, EcoPro 2004
Black flying-fox*#	*Pteropus alecto*	Vulnerable (TSC Act 1995)	EcoPro 2004
Grey-headed flying-fox	*Pteropus poliocephelus*	Vulnerable (EPBC Act)	Woodward-Clyde 1997, EcoPro 2004, JWA 2008
Yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	Vulnerable (TSC Act 1995)	Warren 1994, Woodward-Clyde 1997

Common name	Scientific name	Status	Source
Greater broad-nosed bat	*Scoteanax rueppellii*	Vulnerable (TSC Act 1995)	Warren 1994
Common blossom bat*	*Syconycteris australis*	Vulnerable (TSC Act 1995)	EcoPro 2004

* Historically recorded adjacent to the subject site only
U Unconfirmed sighting
De-listed in August 2008

2.4 Flora

The literature review has also revealed the presence (historically) of eight (8) Threatened flora species, with an additional five (5) Threatened flora species recorded during surveys on adjacent land (**TABLE 3**).
Species status is listed below in accordance with the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act 1999) and NSW *Threatened Species Conservation Act 1995* (TSC Act 1995).

TABLE 3: THREATENED FLORA SPECIES RECORDED ON OR ADJACENT TO THE SUBJECT SITE

Common name	Scientific name	Status	Source
Marblewood	*Acacia bakeri*	Vulnerable (TSC Act 1995)	Woodward-Clyde 1997, Parker 1999, JWA 2008
Scented acronychia	*Acronychia littoralis*	Endangered (TSC Act 1995 & EPBC Act 1999)	JWA 2008
White lace flower*	*Archidendron hendersonii*	Vulnerable (TSC Act 1995)	EcoPro 2004
Brush cassia	*Cassia brewsteri* var. *marksiana*	Endangered (TSC Act 1995)	Woodward-Clyde 1997, Parker 1999, JWA 2008
Stinking cryptocarya*	*Cryptocarya foetida*	Vulnerable (TSC Act 1995 & EPBC Act 1999)	EcoPro 2004
Green-leaved rose-walnut*	*Endiandra muelleri* subsp. *bracteata*	Endangered (TSC Act 1995)	EcoPro 2004
Pink nodding orchid*	*Geodorum densiflorum*	Endangered (TSC Act 1995)	EcoPro 2004
White yiel yiel*	*Grevillea hilliana*	Endangered (TSC Act 1995)	EcoPro 2004
Fine-leaved tuckeroo*	*Lepiderema pulchella*	Vulnerable (TSC Act 1995)	EcoPro 2004

Common name	Scientific name	Status	Source
Rough-shelled bush-nut*	*Macadamia tetraphylla*	Vulnerable (TSC Act 1995 & EPBC Act 1999)	EcoPro 2004
Swamp orchid*	*Phaius australis*	Endangered (TSC Act 1995 & EPBC Act 1999)	EcoPro 2004
Spiny gardenia	*Randia moorei*	Endangered (TSC Act 1995 & EPBC Act 1999)	Woodward-Clyde 1997, JWA 2008
Coolamon	*Syzygium moorei*	Vulnerable (TSC Act 1995)	Woodward-Clyde 1997, EcoPro 2004, JWA 2008

* Historically recorded adjacent to the subject site only

2.5 Endangered Ecological Communities

Six (6) Endangered Ecological Communities (EECs) are considered to occur on the Cobaki Lakes site, including:

- Swamp sclerophyll forest on coastal floodplain - which occurs as an isolated clump of scattered Swamp mahogany in the central eastern of the Subject site;
- Lowland rainforest on floodplain - occurring at various locations generally in association with drainage lines and depressions;
- Lowland rainforest - occurring on Mt. Woodgee and on lower slopes in the northern portion of the subject site;
- Freshwater wetlands - occurring in the central and eastern portions of the site;
- Swamp oak floodplain forest – occurring in association with drainage lines in the south-east of the site; and
- Coastal saltmarsh in the NSW North Coast bioregion - occurring in the south-east of the site.

2.6 Significant site values relevant to this assessment

TABLE 4 outlines which of the significant site values identified for the Cobaki Lakes development are relevant to the southern portion of the re-alignment of Sandy Lane and the Cobaki Parkway 'Missing Link' based on the availability of suitable habitat within these areas. Threatened species potentially occurring in other areas of the Cobaki site but without suitable habitat in the area of the road construction will not be further addressed in this assessment.

TABLE 4: SUMARY OF RELEVANT SIGNIFICANT SITE VALUES FOR THE ROADWAY CONSTRUCTION AREAS

Common Name	Scientific name	Relevant to Road Construction Areas
Fauna		
Wallum froglet	*Crinia tinnula*	✓
Wallum sedge-frog*	*Litoria olongburensis*	X
Bush hen*	*Amaurornis olivaceus*	X
Glossy black-cockatoo*	*Calyptorhynchus lathami*	X
Brolga*	*Grus rubicunda*	✓
Black bittern*[U]	*Ixobrychus flavicollis*	X
Mangrove honeyeater*	*Lichenostomus fasciogularis*	X
White-eared monarch*	*Monarcha leucotis*	X
Powerful owl	*Ninox strenua*	X
Osprey	*Pandion haliaetus*	X
Wompoo fruit-dove*	*Ptilinopus magnificus*	X
Rose-crowned fruit-dove*	*Ptilinopus regina*	X
Superb fruit-dove*[U]	*Ptilinopus superbus*	X
Collared kingfisher*	*Todiramphus chloris*	✓
Eastern grass owl*	*Tyto capensis*	X
Masked owl	*Tyto novaehollandiae*	X
Black neck-stork	*Xenorhynchus asiaticus*	✓
Little bent-wing bat	*Miniopterus australis*	X
Common bent-wing bat	*Miniopterus schreibersii*	X
Eastern free-tail bat	*Mormopterus norfolkensis*	X
Large-footed myotis*	*Myotis adversus*	✓
Eastern long-eared bat*	*Nyctophilus bifax*	X
Squirrel glider*	*Petaurus norfolkensis*	X
Koala	*Phascolarctos cinereus*	✓
Common planigale*	*Planigale maculata*	X
Long-nosed potoroo*	*Potorous tridactylus*	X
Black flying-fox*[#]	*Pteropus alecto*	X
Grey-headed flying-fox	*Pteropus poliocephelus*	X
Yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	X
Greater broad-nosed bat	*Scoteanax rueppellii*	X
Common blossom bat*	*Syconycteris australis*	X

Common Name	Scientific name	Relevant to Road Construction Areas
Flora		
Marblewood	*Acacia bakeri*	X
Scented acronychia	*Acronychia littoralis*	X
White lace flower*	*Archidendron hendersonii*	X
Brush cassia	*Cassia brewsteri* var. *marksiana*	X
Stinking cryptocarya*	*Cryptocarya foetida*	X
Green-leaved rose-walnut*	*Endiandra muelleri* subsp. *bracteata*	X
Pink nodding orchid*	*Geodorum densiflorum*	X
White yiel yiel*	*Grevillea hilliana*	X
Fine-leaved tuckeroo*	*Lepiderema pulchella*	X
Rough-shelled bush-nut*	*Macadamia tetraphylla*	X
Swamp orchid*	*Phaius australis*	X
Spiny gardenia	*Randia moorei*	X
Coolamon	*Syzygium moorei*	X
EEC's		
Swamp sclerophyll forest on coastal floodplain		X
Lowland rainforest on floodplain		X
Lowland rainforest		X
Freshwater wetlands		✓
Swamp oak floodplain forest		✓
Coastal saltmarsh		✓

* Historically recorded adjacent to the subject site only
# De-listed in August 2008

3 THREATENED SPECIES ASSESSMENTS

3.1 Background

An Assessment of Significance (7-part test equivalence) has been undertaken for all listed species/EECs considered possible occurrences in the impact areas. Potential impacts on threatened species, populations or ecological communities, or their habitats was assessed using the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007).

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.

3.2 Fauna

3.2.1 Background

Six (6) Threatened species recorded on or adjacent to the Cobaki Lakes site are considered potential occurrences in the proposed road construction areas:

- Koala (*Phascolarctos cinereus*);
- Black-necked stork (*Xenorhynchus asiaticus*);
- Brolga (*Grus rubicunda*);
- Collared kingfisher (*Todiramphus chloris*);
- Large-footed myotis (*Myotis adversus*); and
- Wallum froglet (*Crinia tinnula*).

An Assessment of Significance will be completed for each of these Threatened fauna species.

3.2.2 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.

3.2.2.1 Koala (*Phascolarctos cinereus*)

Extent of the local population

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the western region. The NPWS database (June 2010) contains ninety-eight (98) records of this species within 10 km of the Subject site. Five hundred and seventy-four (574) records occur within the Tweed LGA.

Warren (1994) completed a targeted search on the Subject site for evidence of Koala activity (i.e. scratches and scats). A small number of faecal pellets were recorded and a low density of scratches on Grey gums and Tallowwoods were observed throughout the site **(FIGURE 8).** In December 2007, areas of the site containing preferred Koala

food trees (i.e. Swamp mahogany, Forest red gum, Tallowwood, Grey gum) were searched for evidence of Koala activity. A nocturnal survey was also completed including spotlighting and call playback techniques. No conclusive evidence of Koala activity (scats) was recorded from the site. Whilst a number of trees contained scratch marks, this is not considered a conclusive method of identifying Koala activity when not accompanied by scats and may be attributable to other more common arboreal species (i.e. Common brushtail possum). One (1) male Koala was heard calling approximately 200-300m north of the south-western corner of the subject site (**FIGURE 9)**.

It is considered that Koalas may utilise the site occasionally as they disperse throughout the locality, however large areas of more suitable habitat is considered to occur throughout the locality (particularly within intact forested areas to the west) and are likely to be preferred by the local population of Koalas. The local population for this species is considered to be comprised of any individuals within adjoining areas (contiguous or otherwise) that are known or likely to use habitat in the study area.

Potential Habitat on the Cobaki Site

The Cobaki site contains a number of tree species listed under Schedule 2 of SEPP 44 – Koala Habitat Protection as Koala feed tree species including: Tallowwood; Swamp mahogany; Grey gum; Forest red gum; and Scribbly gum. In September 2009, all individuals of these species were located (**FIGURE 10**). In total, four hundred and sixty three (463) Koala food trees were mapped as follows:

- One hundred and fifty six (156) Forest red gum (*Eucalyptus tereticornis*);
- One hundred and twenty nine (129) Tallowwood (*Eucalyptus microcorys*);
- Seventy three (73) Swamp mahogany (*Eucalyptus robusta*);
- One hundred and thirteen (113) Scribbly gum (*Eucalyptus signata*).

It is estimated that approximately 42.41 hectares of potential Koala habitat occurs on the Cobaki site.

Direct and Indirect Impacts from the Proposed Development

The DECCW website lists the following threats to the Koala:

- Human-induced climate change, especially drought;
- Loss, modification and fragmentation of habitat;
- Predation by feral and domestic dogs;
- Intense fires that scorch or kill the tree canopy; and
- Road-kills.

Impacts of the proposed road construction on Koalas include:

- Increased risk of death or injury from vehicle strike;
- Risk of harassment, death or injury from straying dogs; and
- Restriction of movement opportunities over the site.

It is estimated that approximately 39.27 hectares of potential Koala habitat occurs on the subject site (**FIGURE 10**). Vegetation communities that are considered to provide suitable habitat for the Koala on the subject site will not be affected by the proposed

road construction activities. The majority of the Koala food trees on the Cobaki site will be retained within Environmental Protection Areas (**FIGURE 6**). However, the construction of the southern portion of Sandy Lane and the 'Missing Link' has the potential to remove three (3) preferred Koala food trees (**FIGURE 10**). It is worth noting however that no Koala activity has been recorded in this portion of the Cobaki Lakes site. Furthermore, approximately 92.59ha of revegetation/regeneration will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) to offset any loss of remnant bushland and to provide vegetated links across the site. These areas are all likely to provide suitable forage habitat for the Koala in the long-term and provide vegetated linkages through the landscape (**FIGURE 11**). It is also worth noting that habitat for the Koala will be retained in perpetuity within the adjacent border reserve. The Fauna Management Plan (JWA 2009b) includes additional relevant amelioration measures.

Likelihood of local extinction

The removal of a small area of potential habitat from the subject site as a result of the proposed road construction is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species. With the adoption of the above amelioration measures discussed above it is considered that the proposed road construction is highly unlikely to result in the local extinction of this species.

3.2.2.2 Black-necked stork (*Xenorhynchus asiaticus*)

Extent of local population

The NPWS database (June 2010) contains forty-five (45) records of this species within 10 km of the Subject site. Eighty-six (86) records occur within the Tweed LGA. This species has been recorded foraging within the low-lying eastern and south-eastern portions of the subject site (**FIGURE 8**).

Species Attributes and Life-cycle Characteristics

The species is widespread across coastal northern and eastern Australia, becoming increasingly uncommon further south into NSW, and rarely south of Sydney. It inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands, and can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.

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).

Direct and Indirect Impacts from the Proposed Development

NSW NPWS list the following threats for this species:

- Loss of wetland habitat through clearing and draining for flood mitigation, agriculture and residential development;
- Degradation of wetland habitats through pollution and salinisation; and
- Modification of natural wetlands through changes in natural water flow regimes.

The proposed development will not result in significant disturbance to or the removal of habitat for this species within the wetland area located in the south-eastern portion of the site. It is estimated that approximately 140.60 hectares of forage habitat occurs over the entire Cobaki site during suitable conditions (i.e. localised flooding after periods of heavy rainfall).

The removal of a small area of potential forage habitat (i.e. small drainage lines) will be removed from the subject site for the road construction. 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.

Areas in the central portion of the Cobaki site will be rehabilitated in accordance with a Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). This area will provide approximately 21.77 hectares of additional habitat for the Black-necked stork on the subject site. Furthermore, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 11**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). In total, 45.51ha of rehabilitation works on the subject site will result in the creation of suitable forage habitat for the Black-necked stork to partly offset the loss of 69.29ha.

Additionally, Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets for the removal of degraded Freshwater wetland vegetation from the subject site.

Vegetation within the south-eastern portion of the subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2010c). This area covers 58.68 hectares and currently provides suitable forage habitat for the Black-necked stork and will continue to do so in the long term.

Likelihood of local extinction

The removal of a small area of potential forage 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.

With the adoption of the above amelioration measures it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

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.

3.2.2.3 Brolga (*Grus rubicunda*)

Extent of local population

The Brolga was formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. It is still abundant in the northern tropics, but very sparse across the southern part of its range. The NPWS database (June 2010) contains no records of this species within 10 km of the Subject site or within the Tweed LGA. This species has been recorded from wetlands adjacent to the subject site (EcoPro 2004) (**FIGURE 9**) but despite extensive searches on the subject site (JWA 2000 – 2007) the species has not been subsequently sighted.

Species Attributes and Life-cycle Characteristics

Brolgas occur around shallow swamps and swamp margins, floodplains, grasslands and pastoral lands, usually in pairs or parties (NPWS 2002). Though they often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially shallow swamps. The feed mainly on the tubers of sedges which they dig from up to 15cm underground with their long bills, and will also take grain, molluscs and insects, and can be a pest in cereal crops (Readers Digest 1997).

Habitat on the Cobaki Site

It is estimated that as much as 140.60 hectares of potential forage habitat occurs on site at times of suitable environmental conditions such as localised flooding after periods of heavy rainfall.

Direct and Indirect Impacts from the Proposed Development

The NSW NPWS lists the following threats for this species:

- At least in former times, Brolgas were poisoned and shot because of their feeding incursions into crops, following drainage of swamps; and
- Loss of wetland habitat through clearing and draining for flood mitigation and agriculture.

The removal of a small area of potential forage habitat (i.e. small drainage lines) will be removed from the subject site for the road construction. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local or regional distribution of habitat for this species.

Likelihood of local extinction

Areas in the central portion of the subject site will be rehabilitated in accordance with the Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). These areas will provide approximately 21.77 hectares of additional suitable habitat for the Brolga on the subject site. Furthermore, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 11**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a). These areas will provide suitable habitat for this species in the long-term and offset the loss of habitat.

Additionally, 58.61 hectares of vegetation within the south-eastern portion of the subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2010c) (**FIGURE 11**). This area currently provides suitable forage habitat for the Brolga and will continue to do so in the long term.

Additionally, 93.3 hectares of vegetation within the south-eastern portion of the subject site will be retained and rehabilitated in accordance with the Saltmarsh Rehabilitation Plan (JWA 2008c). This area currently provides suitable forage habitat for the Brolga and will continue to do so in the long term.

The removal of a small area of potential forage 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.

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.

3.2.2.4 Collared kingfisher (*Todiramphus chloris*)

Extent of the local population

The NPWS database (June 2010) contains fifty-nine (59) records of the Collared kingfisher within 10 km of the Subject site. Sixty-one (61) records occur within the Tweed LGA. This species has been recorded from the Cobaki Broadwater adjacent to the subject site (EcoPro 2004) (**FIGURE 9**). However, extensive searches on the subject site (JWA 2000 – 2007) have failed to record this species.

Suitable habitat for this species is considered to be comprised of undisturbed mangrove communities on and adjacent to the subject site. Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the subject site, particularly in association with the Cobaki Broadwater. It is estimated that approximately 5.66 hectares of potential habitat for this species occurs on the subject site.

The local population for this species is considered to be comprised of all individuals recorded within the locality of the Cobaki Lakes site as well as any individuals within adjoining areas (contiguous or otherwise) that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

The Collared kingfisher is virtually restricted to mangroves and other estuarine habitats and mainly occurs about the mouths of the larger coastal rivers. It is frequently observed perched on rock walls, jetties, piles and tidal flats and sometimes occurs in parks and gardens along foreshores (NPWS 2002).

The Collared kingfisher pick up their food – crustaceans, small fish, worms, insects, reptiles and other small tidal animals – from the surface of muds and shallow pools exposed by low tide (Readers Digest 1997). Nests are usually in a hollow in a mangrove tree or drilled into termite nests in a large eucalypt or paperbark adjacent to mangroves (NPWS 2002).

The NPWS Threatened Species Unit discusses the following threats for the Collared kingfisher:

- Destruction of old mangrove stands for tourist, residential and infrastructure development;
- Loss of large coastal trees containing hollows or termite nests;
- Pollution of estuaries and accumulation of agricultural herbicide and pesticide residues; and
- Use of pesticides to protect tourist and residential developments.

The proposed road construction will not result in disturbance of or the removal of potential habitat for this species. Overall, impacts on this species are considered to be relatively low and are likely to be restricted to potential noise disturbance during construction.

Likelihood of local extinction

The potential disturbance of this species during construction is not considered to represent a significant impact. It is considered that the proposed development is unlikely to result in the local extinction of this species.

3.2.2.5 Large footed myotis (*Myotis macropus*)

Extent of the local population

The NPWS database (June 2010) contains four (4) records of this species within 10 km of the Subject site. Nineteen (19) records occur within the Tweed LGA. This species has been recorded during surveys adjacent to the subject site (EcoPro 2004) (**FIGURE 9**). However, numerous surveys on the subject site (JWA 2000 – 2007) have failed to record this species.

Large-footed myotis generally roost close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish. Potential forage habitat for this species is generally restricted to the adjacent Cobaki Broadwater however foraging may occur along drainage lines in the proposed construction area of the 'Missing Link".

The local population for this species would be considered to be all individuals recorded on the Cobaki Lakes site as well as any individuals within adjoining areas (contiguous or otherwise) 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 habitat for the Large-footed myotis as consisting of any forested riparian and adjacent vegetation around water bodies and coastal lakes and streams greater than first order streams. Breeding is in hollows, as well as under bridges and in caves. The Large-footed myotis forages in still water bodies with associated vegetation (tree line) feeding on aquatic and other flying insects, and small fish.

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

- Clearing – habitat loss (riparian vegetation) and fragmentation
- Use of chemicals - mosquito control, pesticides
- Grazing
- Altered hydrology - sedimentation and altered flow
- Bridge removal
- Eutrophication from grazing, agriculture and sewage
- Dams
- Logging – loss of hollows
- Frequent burning
- Recreational activities – fly fishing, boating
- Weeds
- Fish (trout)

The Large-footed myotis is likely to forage widely over the locality, particularly along Cobaki Creek and over the nearby Cobaki Broadwater. The most likely impacts to bats from the proposed road construction would be from noise and vehicle movements adjacent to roosting areas. Potential roost habitat is best represented by consolidated vegetation within Environmental Protection Zones, and development of urban zoned land is likely to have little impact on available roost sites.

Likelihood of local extinction

The removal of a small area of potential habitat (i.e. small drainage lines) 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.

It is considered that the proposed development is unlikely to result in the local extinction of this species.

3.2.2.6 Wallum froglet (*Crinia tinnula*)

The NPWS database (June 2010) contains two hundred and eight (208) records of this species within 10 km of the Subject site. Two hundred and thirty-six (236) records occur within the Tweed LGA. Wallum froglets have been recorded within Paperbark areas, sedgelands and in the main drainage channel and adjacent sedgeland in the east of the property. This species has also been recorded in a numerous locations adjacent to the subject site (EcoPro 2004) (**FIGURE 9**) and is very widespread. The local population is estimated to comprise approximately 10,000 individuals (Hero *et al.* 2001).

Wallum Froglets are found only in acid paperbark swamps and sedge swamps of the coastal 'wallum' country **(FIGURE 12).** The species is a late winter breeder. Males call in choruses from within sedge tussocks or at the water edge.

NSW NPWS lists the following threats to this species:

- Destruction and degradation of coastal wetlands as a result of roadworks, coastal developments and sandmining;
- Reduction of water quality and modification to acidity in coastal wetlands; and
- Grazing and associated frequent burning of coastal wetlands.

Core habitat for this species is considered to be comprised of undisturbed wet heathland and wetland communities adjacent to the subject site whilst remaining habitats (i.e. adjoining areas of grassland and slashed areas) are considered to provide forage habitat when inundated during wet periods. Due to a history of disturbance to wetland communities on the subject site, no core habitat is considered to occur on the Subject site. However, approximately 79.12 hectares of potential forage habitat occurs, as this area becomes inundated during suitable weather conditions (i.e. localised flooding after periods of heavy rainfall).

Potential Impacts from the development

The proposed development may result in the direct mortality of individuals during construction due to either habitat loss or machinery impact. However, the loss of some individuals and habitat during construction is unlikely to significantly impact upon the local population of Wallum froglets. The proposed development will not remove or

modify any area considered to provide core habitat for the Wallum froglet (i.e. breeding habitat, refuge habitat).

Additional impacts may include:

- Alteration of water quality in drainage lines due to soil runoff from the construction site.
- Alteration of hydrology of the drainage lines due to construction.
- Contamination or reduction of water quality in drainage lines due to runoff from chemicals or debris (fertilisers, etc).
- Introduction of weed species into core habitat areas.
- Increased competition from disturbance-adapted native, domestic and introduced fauna (such as Cane toads, Noisy miners, foxes, dogs, cats, rats, etc.).

Offsets for the removal of highly degraded Freshwater wetland vegetation from the subject site will include the following:

1. Recreation of approximately 2.25ha of high quality wetland habitats. These compensatory Freshwater wetlands will be offline from the stormwater treatment train and will also be specifically designed to provide core (breeding) habitat for the Wallum froglet;
2. Approximately 19.52ha of Freshwater wetland vegetation will be provided through revegetation works associated with the stormwater conveyance and treatment infrastructure on the subject site; and
3. Additionally, Leda Manorstead Pty Ltd is currently in negotiations with DECCW with a view to securing appropriate off-site offsets.

A number of areas on the subject site will be rehabilitated in accordance with a Revised Freshwater Wetland Rehabilitation Plan (JWA 2010b). These areas will be designed to provide approximately 2.25 hectares of core habitat (i.e. offline from stormwater treatment) and 19.52 hectares of potential forage habitat for the Wallum froglet on the subject site. Furthermore, 23.74 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the subject site (**FIGURE 11**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2010a) and these areas are likely to provide suitable forage habitat for this species and offset any loss of forage habitat. In total, 45.51ha of rehabilitation works on the subject site will result in the creation of suitable forage habitat for the Wallum froglet to partly offset the loss of 69.29ha.

A detailed Stormwater Management Plan has been prepared for the subject site utilising current best-practice management techniques which will ensure no adverse impacts on the hydrology of the current core habitat or the proposed rehabilitated core freshwater wetland. Furthermore any stormwater treatment devices and sedimentation ponds will be designed so that they provide limited opportunities for the introduced Mosquito fish (*Gambusia* sp.) to breed and hence provide better habitat areas for native frogs.

Likelihood of local extinction

The construction of core habitat areas will result with the implementation of a detailed Wallum froglet Compensatory Habitat Plan at the development application stage. With

the creation of core habitat and the implementation of a detailed Storm Water Management Plan it is considered that the proposed development is highly 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-five (35) 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

(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 recorded on the subject site is provided in **TABLE 5.** Habitat has been considered as the area occupied by Threatened flora species as well as the area potentially providing opportunities for establishment of additional individuals.

It is worth noting that suitable habitat for Threatened flora to be removed from the subject site occurs within existing 2(c) zoned land (i.e. Urban Expansion), land proposed to be rezoned as 2(c), or land that may otherwise be cleared in accordance with existing use rights.

TABLE 5: POTENTIAL LOSS OF THREATENED FAUNA HABITAT FROM COBAKI LAKES

Common Name	Botanical Name	Area of existing habitat over entire site	Area of habitat to be removed/ modified
Black-necked stork	*Ephippiorhynchus asiaticus*	142.47 hectares	1.56 hectares (1.1%)
Brolga	*Grus rubicunda*	142.47 hectares	1.56 hectares (1.1%)
Collared kingfisher	*Todiramphus chloris*	5.66 hectares	Nil (0%)
Large-footed myotis	*Myotis adversus*	Undetermined (areas of open water)	Minimal (small drainage lines)
Koala	*Phascolarctos cinereus*	39.27 hectares	3 trees (0%)
Wallum froglet	*Crinia tinnula*	82.86 hectares	Core habitat - Nil (0%) Forage habitat – 1.56 hectares (1.8%)

(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

Habitat for Threatened fauna species is already highly fragmented and has had a history of disturbance from land clearing and grazing activities on the subject site. The Proposed Cobaki Lakes 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. Additionally, proposed rehabilitation works on the Cobaki Lakes site in accordance with the Site Regeneration & Revegetation Plan (JWA 2008a) will ensure suitable movement opportunities are maintained for all native flora and fauna species throughout the site.

Other relevant plans include:

- Freshwater Wetland Rehabilitation Plan (JWA 2008b);
- Saltmarsh Rehabilitation Plan (JWA 2008c);
- Vegetation Management Plan (JWA 2008d); and
- Fauna Management Plan (JWA 2008e).

(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 on the Cobaki Lakes site. 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, and habitat for the Little penguin population in Sydney's North Harbour.

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.

An Approved Recovery Plan has been prepared for the Koala. The Recovery Plan lists the following specific recovery objectives:

- To conserve Koalas in their existing habitat;
- To rehabilitate and restore Koala habitat and populations;
- To develop a better understanding of the conservation biology of Koalas;
- To ensure that the community has access to factual information about the distribution, conservation and management of Koalas at a national, state and local scale;
- To manage captive, sick or injured Koalas and orphaned wild Koalas to ensure consistent and high standards of care;
- To manage over-browsing to prevent both Koala starvation and ecosystem damage in discrete patches of habitat; and
- To co-ordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.

It is considered that the proposed development is consistent with the objectives and actions of the Recovery Plan for the Koala.

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 the road construction.

(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 road construction 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 Site Regeneration & Revegetation Plan (JWA 2008a) has been prepared for the Cobaki Lakes 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'**. A Fauna Management Plan (JWA 2008e) has been prepared for the Cobaki Lakes 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 **'Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands'.** A detailed Stormwater Management Plan has been prepared for the proposed development (Gilbert & Sutherland 2008) and will ensure that this key threatening processes 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.

The proposed development has the potential to result in an increase in the '**Loss of Hollow-bearing Trees'** and '**Removal of dead wood and dead trees'**. The Fauna Management Plan (JWA 2009e) includes the following measures to ensure this key threatening process is not exacerbated:

- Any hollow-bearing trees within the urban zoned land should be retained where possible (or included within buffers, open space etc);
- Intact hollow limbs will be collected for redistribution in the conservation and regeneration areas of the site. Hollow limbs may be stored until appropriate locations within these areas have been identified by the Site Ecologist. These logs shall be positioned so that a fire hazard is not created; and
- Installation of wildlife boxes for bats, birds & other mammals (where appropriate).

3.2.3 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 Threatened fauna recorded or predicted to occur within the area.

3.3 Flora

None of the Threatened flora species recorded on or adjacent to the Cobaki Lakes site occur, or are considered likely to occur, in the area of the road construction **13 & 14**). Therefore an Assessment of Significance has not been completed for these species.

3.4 Endangered Ecological Communities (EEC's)

3.4.1 Background

Three (3) Endangered Ecological Communities (EECs) will be impacted by the proposed construction of the southern portion of Sandy Lane and the Missing Link as follows (**FIGURE 18**):

- Freshwater wetlands,
- Swamp Oak Floodplain Forest; and
- Coastal Saltmarsh.

An Assessment of Significance (7-part test equivalence) has been completed for each. The assessment has been completed in accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* prepared by DECC (2007).

3.4.2 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 road construction is shown in **FIGURE 18**. A summary of impacts on EEC's recorded on the Cobaki Lakes site

is provided in **TABLE 6.** 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 Cobaki Lakes site only.

It is also worth noting that areas of EEC to be removed from the subject site occur within existing 2(c) zoned land (i.e. Urban Expansion), land proposed to be rezoned as 2(c), or land that may otherwise be cleared in accordance with existing use rights.

TABLE 6: POTENTIAL LOSS OF EEC's FROM THE ROAD CONSTRUCTION AREA

EEC Description	Area of existing EEC on entire site	Area of EEC to be removed for road construction (% of occurrence on entire site)
Freshwater wetlands	35.39ha	1.13ha (3.2%)
Swamp oak floodplain forest	4.52ha	0.52ha (11.5%)
Coastal saltmarsh	54.63ha	4.27ha (7.8%)

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.

Freshwater wetlands

This EEC covers a total area of approximately 35.39 hectares (**FIGURE 15**). The area of Freshwater wetland in the eastern portion of the site (i.e. Community 10) has been impacted by adjacent earthworks for the formation of Cobaki Parkway. It is worth noting that the location of the road reserve is fixed by Tweed Council planning as a future four lane arterial road funded by the Section 94 Development Contribution Scheme. Additionally, the large area of Freshwater wetland in the central portion of the site (i.e. Community 14) has been heavily degraded by past and existing land use including drain construction and maintenance, grazing and slashing.

In total 1.13 hectares of Freshwater wetland (3.2%) will be lost from the subject site as a direct result of the road construction (**FIGURE 16**). The removal of this area of degraded Freshwater wetland from the subject site is not considered to represent a significant impact in relation to the regional distribution of this community.

Swamp oak floodplain forest

This EEC occurs in the south-eastern potion of the subject site in association with drainage lines and covers an area of approximately 4.52 hectares (**FIGURE 15**). This community occurs in an area that is currently subject to tidal inundation via the main constructed drain in this portion of the site (i.e. Dunn's drain) and also through a breach in the constructed levy bank adjacent to the creek. It is worth noting that this community occurs as linear stands of trees along the edges of constructed drains. Additionally, this area is currently actively grazed by cattle under existing use rights (i.e. routine agricultural activities) which has resulted in the prevalence of introduced grasses and common agricultural weeds in some areas.

In total 0.52ha hectares of Swamp oak floodplain (11.5%) will be lost from the subject site as a direct result of the road construction (**FIGURE 16**). The removal of this small area of Swamp oak floodplain forest from the subject site is not considered to represent a significant impact in relation to the regional distribution of this community.

Coastal saltmarsh

This EEC occurs in the south-eastern potion of the subject site adjacent to Cobaki Creek and covers an area of approximately 54.63 hectares (**FIGURE 15**). This area is currently subject to tidal inundation via the main constructed drain in this portion of the site (i.e. Dunn's drain) and also through a breach in the constructed levy bank adjacent to the creek. It is worth noting that this area is currently actively grazed by cattle, and slashed in some areas, under existing use rights (i.e. routine agricultural activities). This has resulted in the prevalence of introduced grasses and common agricultural weeds in some areas.

In total 4.27 hectares of Coastal saltmarsh (7.8%) will be lost from the subject site as a direct result of road construction (**FIGURE 16**). The removal of this small area of degraded Coastal saltmarsh from the subject site is not considered to represent a significant impact in relation to the regional distribution of this community.

JWA (2008a) have prepared a Site Regeneration & Revegetation Plan (SRRP) for the Cobaki Lakes site. The SRRP proposes revegetation/rehabilitation measures aimed at addressing a number of vegetation/habitat management issues, including the management, rehabilitation and protection of EEC's. The objectives of the SRRP are to:

- Provide a plan for the revegetation and regeneration of the Cobaki Lakes site;
- Identify areas of retained vegetation that will be maintained through weed control and general maintenance;
- Identify areas that will be rehabilitated using natural regeneration or enhancement plantings;
- Provide management guidelines for the revegetation, natural regeneration and weed control to be implemented;
- Outline a maintenance and monitoring program for the site; and
- Provide management guidelines for the on-going conservation of vegetation on the site.

This Plan principally applies to those parts of the site zoned as Environmental Protection, or as Ecological Buffers, and identifies areas where active restoration and rehabilitation measures are proposed to offset any removal of EEC's and to enhance retained vegetation communities throughout the site. Proposed offsets for EEC's are depicted in **FIGURE 17**.

The removal of a small area of EEC from the subject site is not considered to represent a significant impact in relation to local occurrence of the above EEC's. 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 Cobaki Lakes 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 following documents have been prepared to ensure that the composition and ecological function of EEC's on the subject site are not significantly impacted by development:

- Site Regeneration & Revegetation Plan (JWA 2008a);
- Saltmarsh Rehabilitation Plan (JWA 2008b);
- Freshwater Wetland Rehabilitation Plan (JWA 2008c); and
- Vegetation Management Plan (JWA 2008d).

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 Site Regeneration & Revegetation Plan (JWA 2008a) 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 19**). A summary of proposed EEC offsets is provided in **TABLE 7.**

TABLE 7: PROPOSED EEC OFFSETS

EEC Offset Areas	Loss - Roadway Construction (ha)	Revegetation Areas (ha)	Natural Regeneration Areas (ha)	Total Offset Area (ha)
Freshwater Wetland	1.13ha (3.2)	2.73	3.09	5.82
Swamp oak Floodplain Forest	0.52ha (11.5%)	8.85#	0	8.85
Saltmarsh	4.27ha (7.8%)	8.85#	0	8.85
Freshwater Wetland / Swamp Sclerophyll Forest on Floodplain (Landscape Area*)	-	-	-	35.21

* Note: The total area of Freshwater Wetland / Swamp Sclerophyll Forest on Floodplain EEC revegetated within Landscape Areas will be dependent on the location of landscaping and recreational facilities within these areas.

\# The revegetation of Saltmarsh and Swamp oak floodplain forest will occur in combination over the same area.

Freshwater wetlands

A Freshwater Wetland Rehabilitation Plan (JWA 2008b) has been prepared for the subject site and includes measures to provide a more intact wetland community on the subject site. This plan aims to rehabilitate an area of the subject site that is considered to have formally been comprised of freshwater wetland communities.

In total, approximately 5.82 hectares of Freshwater wetlands will be regenerated/revegetated on the subject site (**FIGURE 17**) to offset the loss of 1.13 hectares as a direct result of the road construction, as well as any other loss from the site. Additionally, 35.21 hectares of landscaping will be completed within Open Space areas of the site including areas of Freshwater wetlands.

The Freshwater Wetland Rehabilitation Plan include specific performance criteria as well as a detailed maintenance and monitoring program and it is therefore considered that the rehabilitated Freshwater wetland will be more likely to persist in the long-term compared to the existing community.

Swamp oak floodplain forest

The removal of approximately 0.52 hectares of the Swamp oak floodplain forest community from the subject site will be mitigated by regenerating and revegetating compensatory Swamp oak communities on the subject site. Approximately 8.85 hectares within and adjacent to the existing Saltmarsh communities on the subject site are currently comprised of a mixture of exotic grasses and will be restored to Saltmarsh and Swamp oak communities in accordance with the Saltmarsh Rehabilitation Plan (JWA 2008c). Removal of cattle from the area and subsequent relinquishment of existing use rights is considered an integral component of the rehabilitation process.

Coastal saltmarsh

The removal of approximately 4.27 hectares of Saltmarsh communities from the subject site will be ameliorated by regenerating and revegetating compensatory Saltmarsh communities on the subject site. Approximately 8.85 hectares adjacent to the existing Saltmarsh communities are currently comprised of a mixture of exotic grasses and will be restored to Saltmarsh communities in accordance with the Saltmarsh Rehabilitation Plan (JWA 2008c). Removal of cattle from the area and subsequent relinquishment of existing use rights is considered an integral component of the rehabilitation process.

With the adoption of recommended amelioration measures contained within these documents, 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 Cobaki Lakes 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

A summary of impacts on EEC's recorded on the subject has been provided in **TABLE 7** above**.** It is worth noting that areas of EEC to be removed from the subject site occur within existing 2(c) zoned land (i.e. Urban Expansion), land proposed to be rezoned as 2(c), or land that may otherwise be cleared in accordance with existing use rights.

(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

Areas of EEC on the subject site are already highly fragmented and the site has had a history of disturbance from land clearing, grazing, forestry and other activities on the subject site. 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. The development layout has also been designed to provide habitat linkages throughout the Cobaki Lakes site. These habitat linkages will ensure suitable movement opportunities are maintained for all native flora and fauna species throughout the site.

(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, and habitat for the Little penguin population in Sydney's North Harbour.

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 has 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 road construction 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 Site Regeneration & Revegetation Plan (JWA 2008a) has been prepared for the Cobaki Lakes 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'**. A Fauna Management Plan (JWA 2008e) has been prepared for the Cobaki Lakes 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 **'Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands'.** A detailed Stormwater Management Plan has been prepared for the proposed development (Gilbert & Sutherland 2008) and will ensure that this key threatening processes 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.

The proposed development has the potential to result in an increase in the **'Loss of Hollow-bearing Trees'** and **'Removal of dead wood and dead trees'**. The Fauna Management Plan (JWA 2009e) includes the following measures to ensure this key threatening process is not exacerbated:

- Any hollow-bearing trees within the urban zoned land should be retained where possible (or included within buffers, open space etc);
- Intact hollow limbs will be collected for redistribution in the conservation and regeneration areas of the site. Hollow limbs may be stored until appropriate locations within these areas have been identified by the Site Ecologist. These logs shall be positioned so that a fire hazard is not created; and
- Installation of wildlife boxes for bats, birds & other mammals (where appropriate).

3.4.3 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.

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