ECOLOGICAL SITE ASSESSMENT
(INCLUDING THREATENED SPECIES ASSESSMENT)

RIVERSIDE
TEA GARDENS

OCTOBER 2008
(REF: 8020)

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OCTOBER 2008

Conacher Environmental Group

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EXECUTIVE SUMMARY

A Masterplan proposal has been developed for the subject land at Tea Gardens which incorporates areas of residential development and open space areas while retaining significant areas of natural vegetation within conservation zones.

The site covers approximately 229 hectares of land situated between Myall Road and the Myall River, and located north of the existing residential area of Tea Gardens.

Detailed ecological surveys have been completed over several seasons to address the Director General's Requirements issued for the Part 3A (State Significant Development) Application for the site.

The detailed surveys have identified a range of threatened fauna species within the site during 2007/08 surveys. These are:

- Wallum Froglet (*Crinia tinnula*);
- Osprey (*Pandion haliaetus*);
- Barking Owl (*Ninox connivens*);
- Little Bentwing-bat (*Miniopterus australis*);
- Grey-headed Flying-fox (*Pteropus poliocephalus).*

No threatened flora species were identified on the site. Three endangered ecological communities were identified onsite. These are:

- Coastal Saltmarsh;
- Swamp Sclerophyll Forest on Coastal Floodplains;
- Swamp Oak Floodplain Forest.

The areas of vegetation proposed to be retained contain areas of habitat for the threatened fauna species observed.

The proposal will result in the removal of approximately 270m^2 of Coastal Saltmarsh and approximately 12.1ha of Swamp Sclerophyll Forest. Approximately 27.4 hectares of Swamp Sclerophyll Forest and 25.1 hectares of Saltmarsh will be retained within conservation zones.

Biodiversity conservation attributes of the proposal will result in a variety conservation outcomes being achieved. These include:

- Retention of connective habitat through the site to areas of higher biodiversity values;
- Restoration of areas of disturbed land within the proposed wildlife corridors within the site;
- Enhancement of habitat within retained vegetation and corridors through the control of access, fire and weeds;
- Provision of nest boxes within retained habitat areas to offset for the removal of hollow bearing trees;
- Implementation of Ecological Site Management Plan;
- Ongoing biodiversity monitoring and reporting.

The biodiversity conservation proposals will be supported to implementation and monitoring stages by the Ecological Site Management Strategy for the site.
The implementation of the biodiversity conservation proposals will result in the proposal improving or maintaining biodiversity values.

SECTION 1

INTRODUCTION

1.1 INTRODUCTION

Conacher Environmental Group has been engaged to complete an Ecological Site Assessment for the proposed mixed use commercial and residential development at Myall Road, Tea Gardens known as Riverside. This report provides details on the vegetation, fauna and ecological characteristics present on the site in relation to the local area.

This report utilises information and results from a range of ecological studies undertaken in the local area in addition to the results of detailed ecological surveys completed on the site. Details are provided to address various federal and state legislation, state and local council planning policies in relation to ecological and biodiversity issues.

1.2 SITE DETAILS

The planning and cadastral details of the subject site are provided in Table 1.1 while Table 1.2 summarises the geographical characteristics of the site.

TABLE 1.1
SITE DETAILS

Location	Lots 1, 10, 19, 30, 38 DP 270100 Myall Road, Tea Gardens.
Area	Approximately 229 ha.
Topographic Map	Port Stephens 1:25 000
Grid Reference	421000 E, 6387750 N
Local Government Area	Great Lakes Council
Existing Land Use	Vacant / Rural
Zoning (current)	2(f) Mixed Residential / Commercial and Conservation Zones
Proposed Development	Commercial and residential development

TABLE 1.2
SITE CHARACTERISTICS

Topography	Mostly flat with elevations of approximately 2 to 20m AHD in the low ridgelands to the north of the site
Slope	0-8% - mostly less than 2%
Aspect	Various – generally south / south-east
Soil Type	Deep sandy Podzols within Tea Gardens Soil Landscape
Catchment	Port Stephens Catchment
Drainage	Dispersed drainage into Myall River via several small drainage lines and wetlands.
Vegetation	A Mosaic of open forest types wetland and cleared areas.

1.3 DEVELOPMENT AND BIODIVERSITY CONSERVATION PROPOSALS

The proposed development is for a mixed use commercial and residential development. According to the Concept Plan the proposal will include the following:

- Development of approximately 1045 dwellings to be created under Community Title;
- Proposed home based business precinct of approximately 108 allotments (included in the 1045 dwellings);
- Conference and Clubhouse facilities and low rise Townhouse accommodation (15 townhouses included within the 1045 dwellings);
- 50 low density "Lodge Houses" associated with Conference facilities (included within the 1045 dwellings);
- Public Reserve areas;
- Community park incorporating walking trails, gazebo and other facilities;
- Widening of the outlet channel to the existing lake area;
- Extension to existing commercial areas;
- Implementation of Water Sensitive Urban Design features such as storm water detention lake, basins and ponds, drainage corridors;
- Landscaped areas for fauna habitat creation within drainage corridors;
- Areas revegetated to enhance existing habitat values.

The proposal incorporates the following actions and land uses to address biodiversity conservation within the site:

- Incorporation of wildlife corridors to facilitate wildlife movement through the site;
- Retention of SEPP 14 wetland areas;
- Retention of areas of Endangered Ecological Communities;
- Retention of the majority of hollow bearing trees;
- Implementation of an integrated water cycle management strategy;
- Enhancement of frog habitat within water treatment wetlands;
- Provision of open space linkages within drainage corridors which also provide fauna habitat;
- Implementation of detailed Ecological Site Management Strategy for areas of retained vegetation and wildlife movement corridors;
- Restoration and revegetation of disturbed areas of land which are proposed to be retained within corridors and undeveloped land.

The site management zones within the subject site to be developed conserved and subjected to various habitat enhancement measures are identified in Figure 1.1.

1.4 SCOPE OF WORKS

This report has been prepared to detail ecological investigations within the Riverside area and to provide an assessment of the site in relation to the proposed development. This Ecological Site Assessment has been prepared in accordance with the relevant sections of the Director General's Environmental Assessment Requirements (DGEAR's) provided by the Department of Planning as the terms of reference for the preparation of an Environmental Assessment of the site. This Ecological Site Assessment addresses those relevant sections of the DGEAR's relating to Flora and Fauna as identified in Issue 10 and Issue 11 of the DGEAR's.

Issue 10

Outline measures for the conservation of flora and fauna and their habitats within the meaning of the Threatened Species Conservation Act 1995, Native Vegetation Act 2003 and the Fisheries Management Act 1994, including but not limited to Koala populations, and other EEC's.

Issue 11

The EA must consider how the proposal has been managed to conserve flora and fauna habitats on the subject site and subject area. The measures proposed to mitigate any effects of the proposal must be provided, including any long term strategies to protect areas within the study area with threatened species. This may include elements that restore or improve habitats. Pre-construction monitoring plans or on-going monitoring of the effectiveness of the mitigation measures must be outlined in detail.

The following policies and guidelines, as provided within the DGEAR's, are also considered or addressed as part of this Ecological Site Assessment:

- Draft Guidelines for Threatened Species Assessment (DEC 2004);
- Draft Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC & DPI July 2005);
- National Parks and Wildlife Service Atlas of NSW Wildlife Data, GIPSICAM;
- Protection of the Environment Operations Act, 1997;
- Native Vegetation Act, 2003;
- State Environmental Planning Policy No. 26 Littoral Rainforests;
- State Environmental Planning Policy No. 14 Coastal Wetland;
- State Environmental Planning Policy No. 44 Koala Habitat.

This report also considers comments provided by the *Department of Planning*, *Department of Environment and Conservation* and *Great Lakes Council* as a result of their review of preliminary versions of reports prepared by Conacher Travers Pty Limited.

1.5 RELEVANT BACKGROUND INFORMATION

Table 1.3 contains summary details of the relevant previous studies and reports completed within the subject site and the locality which were used as background information for this report.

TABLE 1.3
RELEVANT LOCAL AREA STUDIES/REPORTS

Author	Date	Title	Comment
Gardner Browne Planning Consultants,	1991 1992	Local Environmental Study Myall Quays (and related Supplementary Reports)	Flora and fauna surveys and assessment, vegetation mapping of the subject site.
Mount King Ecological Surveys	1992	Fauna survey of Lot 10 DP733241 & Lot 31 DP808202 Myall Rd Tea Gardens	Fauna survey and recommendation to retain a strip of vegetation along Myall River containing Blackbutt forest, Mangroves and Casuarina.
R. Lembit	1992	Additional Vegetation and Mapping for the Myall Quays Local Environmental Study	Refinement of vegetation mapping completed by Gardner Browne.

TABLE 1.3 (Cont.) RELEVANT LOCAL AREA STUDIES/REPORTS			
Author	**Date**	**Title**	**Comment**
Integrated Site Planning & Management	1995	Flora & fauna report Myall Quays Estate.	Fauna survey and threatened species assessment
Ecotone Ecological Consultants	1995	Mammal & Herptofauna Surveys for the proposed Myall Quays development at Tea Gardens	Fauna survey and threatened species assessment of recorded threatened species.
ERM Mitchell McCotter	1997	Local Environmental Study - North Hawks Nest	Ecological surveys, mapping and assessment of land at North Hawkes Nest. Recommendations made in regard to zoning of land.
Hunter Wetlands Research & Management	1997	Flora and Fauna Assessment for Myall Quays Stage VI	Flora and Fauna Assessment
Shortland Wetlands Centre (SWC)	1988	Tea Gardens Environmental Study stage 1 – Wetlands Assessment	Detailed flora survey & mapping
PPK Environment and Infrastructure	2000	Myall River Downs Local Environmental Study - Great Lakes Council	Ecological surveys, mapping and assessment of Myall River Downs. Recommendations made in regard to zoning of land.
Conacher Travers	2002	Flora and Fauna Assessment Report - Myall Quays Estate	Detailed flora survey
Great Lakes Council	2003	Draft Vegetation Strategy - Eastern Portion	Detailed survey & mapping of the eastern portions of the Great Lakes LGA remnant veg communities including the subject site. Broad scale vegetation mapping.
Department of Environment and Conservation	2003	Recovery Plan - Hawkes Nest Tea Gardens Endangered Koala Population	Recovery Plan prepared for the protection of the Hawkes Nest and Tea Gardens endangered Koala population.
D. Sharpe and R. Goldingay	2006	Ecological Studies of the Squirrel Glider Myall River Downs	Squirrel Glider population analysis at Myall River Downs.
National Parks & Wildlife Service	2003	Key Habitats & Corridors of North-East NSW (Newcastle to Tweed Heads)	Mapping completed by NSW NPWS identifying key habitats and local and regional corridor areas in coastal northern NSW.
Conacher Travers	2007	Species Impact Statement - Myall River Downs	Detailed flora and fauna survey and assessment. Contains extensive local area survey and assessment information.
Harris Research Pty Ltd	2007	Fish Community Survey Riverside Lake	Fish and aquatic area survey and report

Results from various surveys for these reports and detailed surveys of the site have been utilised to generate composite species lists for locally occurring flora and fauna species, including threatened species. These reports have also been utilised to compare the vegetation and fauna habitats on the site with those known to occur in the local area and to allow for an assessment of the site in the context of the ecological attributes of the local area.

1.6 SUPPLEMENTARY REPORTS

The following reports have been prepared as part of the documentation for the Part 3A Application. The Koala Management Strategy and Ecological Site Management Strategy are included in the Appendices of this Report.

KOALA MANAGEMENT STRATEGY
As part of the environmental assessment and reporting a Koala Management Strategy has been prepared by *Conacher Environmental Group* (2008a) for the site for the management of Koalas and Koala habitats within the site. While no Koalas or evidence of recent use were observed within the site during surveys it was considered appropriate to prepare a management strategy for the Koala due to the known local occurrence of this species, including the Hawks Nest Tea Gardens Endangered Koala Population, as listed within the *Threatened Species Conservation Act* (1995), and presence of suitable habitat within the subject site.

The Koala Management Strategy includes information on the following:

- Details and results of Koala and habitat surveys within the site;
- Details on Koalas within the subject site and local area;
- Details on Koala habitats within the subject site and local area;
- Identification of threats to the Koala;
- Proposed management actions for the long term protection of Koalas and Koala habitats within the subject site;
- Timing and implementation of management actions.

ECOLOGICAL SITE MANAGEMENT STRATEGY
An Ecological Site Management Strategy has been prepared by *Conacher Environmental Group* (2008b) to provide information on the long term protection of vegetation, flora and fauna, threatened species and their habitats within the site. Details on the management of the following are provided within the Ecological Site Management Strategy:

- Vegetation and Bushland Management;
- Bushfire Management;
- Fauna and Habitat Management;
- Provision and Establishment of Environmental Corridors;
- Provision of Environmental Buffers;
- Erosion and Sediment Control;
- Stormwater Quality and Management;
- Cultural Values and Management;
- Community Education, Vigilance and Reporting;
- Access, Signage and Fencing;
- Prohibited Use Identification and Management;
- Feral Pest Species;
- Monitoring and Reporting Regime.

WETLANDS ASSESSMENT FOR RIVERSIDE, TEA GARDENS

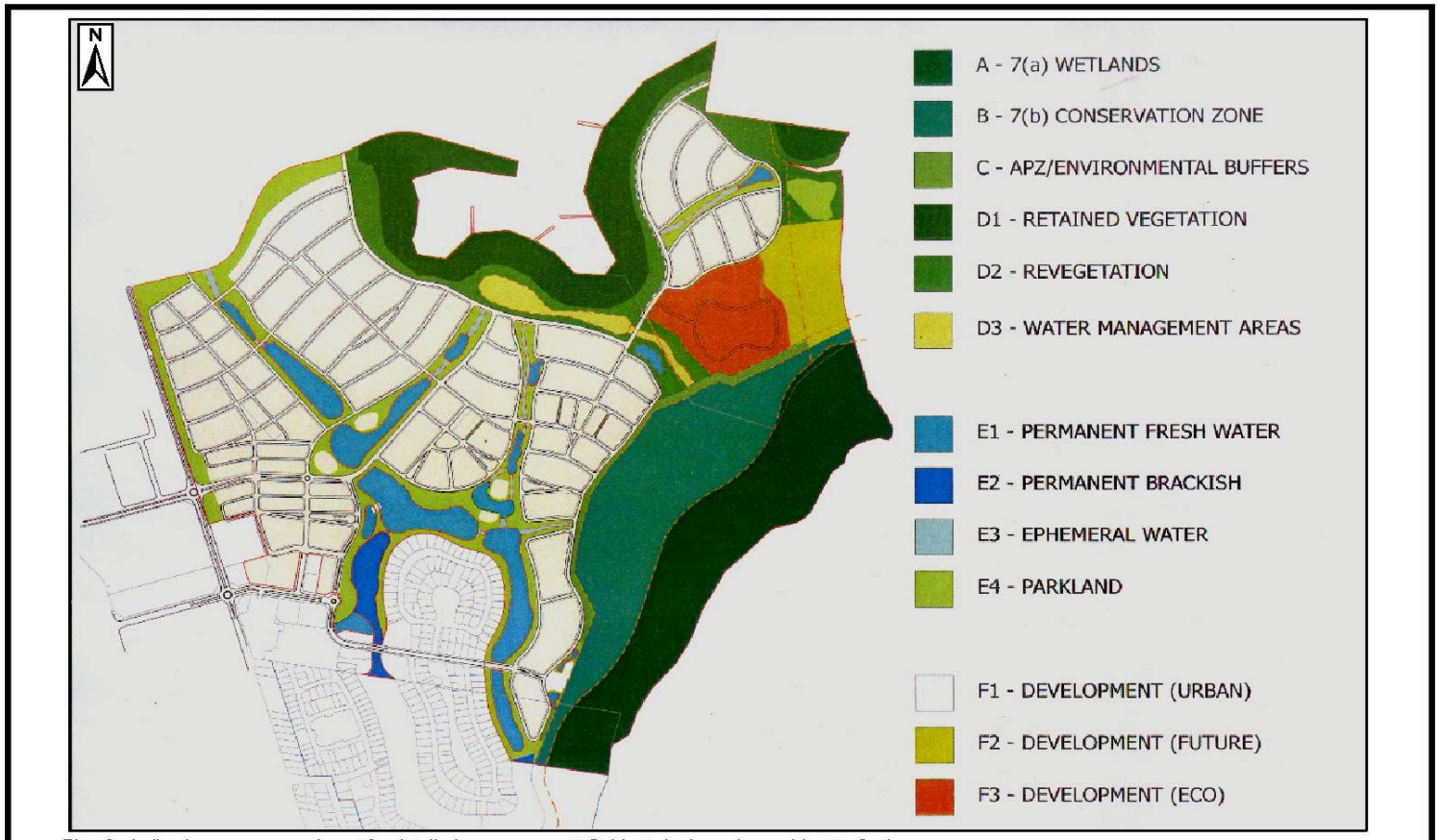
A Wetlands Assessment has been prepared and provides an assessment of the potential effects of the proposal on wetlands of the site and adjoining areas (Hunter Wetlands Research 2008). The report identifies the wetland vegetation communities present on site, discusses their significance in the context of the local area, and identifies potential direct and indirect impacts of the proposal on the communities.

Direct impacts identified include:

- The loss of some areas of wetland vegetation, which have been classified as endangered ecological communities.

Indirect impacts identified include:

- Changes in the quantity and quality of surface and groundwater flows into the wetlands;
- Pedestrian and vehicle intrusion;
- General edge effects including predation of native fauna by cats and dogs, light spill of street lights, dumping of rubbish and garden refuse, weed incursion and mowing of wetland margins.



Plan for indicative purposes only not for detailed measurement. Subject site boundary subject to final survey.

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Approximate at A4

Original plan produced in A4 colour

Drawing No.	8020	Date
Drawn By	JM	21/08/08
Amendment		Date
A		
B		
C		

Figure 1.1

Site Management Zones

Riverside, Tea Gardens

Source: Crighton Properties 2008

SECTION 2

BIODIVERSITY CHARACTERISTICS OF THE SITE

2.1 FLORA CHARACTERISTICS

Flora Survey
The subject site, or portions of it, have previously been surveyed by a number of different consultants since 1992, including, Lembit (1992), Shortland Shortland Wetlands Centre (1988), Hunter Wetlands Research & Management (1997) and *Conacher Travers* (2002, 2007).

More recently (2007 and 2008) detailed field surveys were undertaken in accordance with the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004 (DEC 2004). The subject site was initially divided into five stratification units based on vegetation structure and floristic diversity. These units were further separated into vegetation communities based on dominant canopy species. Transects and quadrats were sampled within these stratification units in accordance with DEC 2004 draft guidelines. Detailed flora surveys were completed on a seasonal basis in 2007 and 2008 as identified in Appendix 1.

Fauna Survey
Fauna survey methods used by *Conacher Environmental Group* follow the methods detailed in the Department of Environment and Conservation (DEC 2004). Where necessary, these have been adapted to satisfy local site conditions. Survey methods may also vary dependant upon environmental conditions (eg. number of vegetation communities, level of disturbance). The following weather data is recorded for all surveys:

- Air temperature;
- Moon (where relevant) (eg none, 1/4 moon, 1/2 moon, 3/4 moon, full moon);
- Rain (eg none, light drizzle, heavy drizzle, heavy rain);
- Recent rain events (where relevant);
- Wind Strength eg calm, light (leaves rustle), moderate (moves branches), strong (moves tree crowns).

The subject site was classified into five stratification units for fauna survey based on biophysical characteristics. These units are:

A) Northern slopes open forest;
B) Western lowland woodlands;
C) Northern Central lowland open forest;
D) Eastern Swamp Forest;
E) Saltmarsh, *Juncus* and mangrove areas associated with the Myall River estuary.

These stratification units formed the basis for the location of the fauna survey methods used

Subject to the stratification units, the following Fauna Assemblages were surveyed within each of the stratification Units (A to E);

- Diurnal Birds
- Nocturnal Birds
- Arboreal Mammals
- Terrestrial Mammals
- Bats
- Amphibians
- Reptiles
- Fish

Details on the various methods used for surveying the above Fauna Assemblages are provided in Appendix 1 – Flora and Fauna Survey Report.

2.2 VEGETATION CHARACTERISTICS

The subject site is characterised by a mosaic of vegetation communities reflecting the topographical and drainage characteristics and land use history. Eighteen vegetation communities have been described within the subject site. These communities are:

1. – Pasture with Scattered Trees;
2. – Acacia / Melaleuca Regrowth Scrub;
3. – Open Forest (*Corymbia gummifera*);
4. – Open Forest (*Corymbia maculata, Eucalyptus paniculata*);
5. – Open Forest (*Eucalyptus microcorys*);
6. – Open Forest (*Eucalyptus pilularis*);
7. – Woodland (*Eucalyptus resinifera*);
8. – Woodland / Open Forest (*Eucalyptus robusta*);
9. – Woodland (*Eucalyptus signata*);
10. – Woodland / Open Forest (*Eucalyptus umbra*);
11. – Pine Forest (*Pinus eliottii*);
12. – Disturbed Estuarine Vegetation;
13. – Casuarina Forest (*Casuarina glauca*);
14. – Mangroves (*Avicennia marina*);
15. – Saltmarsh (*Juncus kraussii*);
16. – Rushland (*Baumea juncea*);
17. – Scrub (*Melaleuca ericifolia*);
18. – Paperbark Forest (*Melaleuca quinquenervia*).

A detailed description of these communities and a cumulative flora species list is provided in Appendix 1 – Flora and Fauna Survey Report. The distribution of vegetation communities throughout the subject site is also shown in Figure 3.1 within Appendix 1.

Large areas of the subject site have been cleared of the native groundcover and shrub vegetation as part of the previous land uses of forestry and agriculture. Figure 2.1 shows the distribution of disturbances to the shrub and groundcover vegetation throughout the site.

2.3 FAUNA CHARACTERISTICS

2.3.1 Fauna Habitats Present

The subject site was classified into five stratification units for fauna survey based on biophysical characteristics. These units are:

A) Northern slopes open forest;
B) Western lowland woodlands;
C) Northern Central lowland open forest;
D) Eastern Swamp Forest;
E) Saltmarsh, *Juncus* and mangrove areas associated with the Myall River estuary.

These stratification units formed the basis for the location of the fauna survey methods used.

The locations of fauna surveys are shown in Figure 2.2 within Appendix 1 – Flora and Fauna Survey Report.

The fauna habitats within the western parts of subject site have been highly disturbed due to a history of clearing and stock grazing. Impacts include soil compaction, trampling of undergrowth, moderate weed infestation and increased nutrient level in dams and watercourses. These areas offer only a low quality of habitat mainly for terrestrial herbivorous mammals and bird species.

The habitats within the eastern and northern foot-slope parts of the subject site are less disturbed and are consequently of better quality and are proposed to be retained. These areas do however, provide suitable foraging habitat within the flowering eucalypts and shrub layers for a number of bird and arboreal mammal species. Several trees within this community also contain hollows of varying size suitable for roosting by hollow dependant bird, reptile and mammal species.

2.4 THREATENED BIODIVERSITY

2.4.1 Threatened Flora Species

A search of the Atlas of NSW Wildlife (NPWS 2008) was undertaken to identify records of threatened flora species located within 10km of the site. In addition to the species listed within the Atlas of NSW Wildlife database, threatened species listed in the botanic gardens records, species identified by NPWS (2008) and local area records have been included for consideration. Details on threatened flora species as listed in Schedules 1 and 2 of the *TSC Act* (1995), with a known or possible occurrence within the local area, are provided in Appendix 1.

It is considered that within the subject site there is suitable or sub-optimal habitat for the following threatened species as listed in Schedule 1 (Endangered) or Schedule 2 (Vulnerable) of the *TSC Act* (1995) or the *EPBC Act* (1999):

- *Asperula asthenes*
- *Eucalyptus glaucina*
- *Galium australe*
- *Maundia triglochinoides*
- *Persicaria elatior*
- *Syzygium paniculatum*
- *Thesium australe*
- *Cryptostylis hunteriana*
- *Eucalyptus parramattensis* subsp. *decadens*
- *Lindernia alsinoides*
- *Melaleuca biconvexa*
- *Rhizanthella slateri*
- *Tetratheca juncea*

None of these species were observed during detailed targeted searches.

2.4.2 Threatened Fauna Species

A search of the Atlas of NSW Wildlife (NPWS 2008) was undertaken to identify records of threatened fauna species located within 10km of the site. In addition to the species listed within the Atlas of NSW Wildlife database, species identified by NPWS (2008) and local area records have been included for consideration.

Details on threatened species (Schedule 1 or 2), which are known to occur within the area, are provided in Appendix 1.

It is considered that there is suitable or sub-optimal habitat within the subject site for the following threatened species, as listed in Schedule 1 (Endangered) or Schedule 2 (Vulnerable) of the *TSC Act* (1995) or the *EPBC Act* (1999):

- Wallum Froglet
- Green and Golden Bell Frog
- Green Thighed Frog
- Stephens' Banded Snake
- Magpie Goose
- Painted Snipe
- Black-necked Stork
- Sooty Oystercatcher
- Pied Oystercatcher
- Little Tern
- Osprey
- Square-tailed Kite
- Bush Stone-curlew
- Wompoo Fruit-dove
- Rose-crowned Fruit Dove
- Superb Fruit-dove
- Glossy Black-Cockatoo
- Gang-gang Cockatoo
- Swift Parrot
- Turquoise Parrot
- Barking Owl
- Powerful Owl
- Masked Owl
- Grass Owl
- Sooty Owl
- Regent Honeyeater
- Black-chinned Honeyeater
- Spotted-tailed Quoll
- Brush-tailed Phascogale
- Common Planigale
- Koala
- Eastern Pygmy-possum
- Yellow-bellied Glider
- Squirrel Glider
- Rufous Bettong
- Eastern Chestnut Mouse
- Long-nosed Potoroo
- Common Blossom-bat
- Grey-headed Flying-fox
- Yellow-bellied Sheathtail-bat
- Eastern Freetail-bat
- Long-eared Pied Bat
- Little Bentwing-bat
- Eastern Bentwing-bat
- Eastern False Pipistrelle
- Large-footed Myotis
- Greater Broad-nosed Bat

The detailed seasonal surveys undertaken during 2007 and 2008 or within the last five years, identified the following threatened fauna species within the subject site.

- Wallum Froglet (*Crinia tinnula*);
- Osprey (*Pandion haliaetus*);
- Barking Owl (*Ninox connivens*);
- Squirrel Glider (*Petaurus australia*);
- Little Bentwing-bat (*Miniopterus australis*);

- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Grey-headed Flying-fox (*Pteropus poliocephalus).*

Additionally the following species have previously been recorded on the subject site but not within the last five years.

- Koala (*Phascolarctos cinereus*);
- Common Blossom-bat (*Syconycteris australis*);
- Large-footed Myotis (*Myotis adversus*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*).

The detailed surveys completed for the subject site have identified several threatened fauna species utilising habitats present for foraging purposes. Details of these species and other threatened fauna species with suitable habitat present are provided in Appendix 1.

2.4.3 Endangered Populations

There are no endangered flora populations within the local government area that require assessment for this proposal.

There are two endangered fauna populations listed on Schedule 1, Part 2 of the *Threatened Species Conservation Act (1995)* that occur in the local area. These are the Hawks Nest and Tea Gardens Endangered Koala (*Phascolarctos cinereus*) Population and the Emu population in the NSW North Coast Bioregion and Port Stephens Local Government Area.

Emu population in the NSW North Coast Bioregion and Port Stephens Local Government Area
This population is distinct from other populations in the Sydney Basin and New England Tableland Bioregions. The population in the NSW North Coast Bioregion and Port Stephens LGA represents the north-eastern limit of the species in NSW. The majority of recent records are concentrated between Coffs Harbour and Ballina.

There are no records of this species on the Atlas of NSW Wildlife (DECC, 2008) within the local area. It is considered that the subject site contains sub-optimal habitat for the endangered population of Emus. This species was not observed on site or in adjacent areas and has not been observed by any site workers or ecologists. The site is fully fenced by stock exclusion fencing which would exclude emu access to the site.

Hawks Nest and Tea Gardens Population of the Koala

General Description
This population is reliably reported as occurring in Hawks Nest and Tea Gardens and in the immediate vicinity of these towns in the Great Lakes Local Government Area.

Habitat Requirements
Suitable vegetation containing koala Feed Tree species such as *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus punctata* (Grey Gum), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus microcorys* (Tallowwood), *Eucalyptus haemastoma* (Scribbly Gum), *Eucalyptus*

signata (Scribbly Gum), *Eucalyptus viminalis* (Manna Gum), *Eucalyptus camaldulensis* (River Red Gum), *Eucalyptus albens* (White Box) and *Eucalyptus populnea* (Bimble Box).

Conservation Status and Distribution
In 1989 the population was thought to contain at least 21 individuals, but by 1998 the population had fallen to about 12 with 2 or 3 in the vicinity of Tea Gardens and the remainder in Hawks Nest and environs (NSW Scientific Committee, Aug 1999). This population of koalas extends in the south-east to the Yaccaba Headland and in the south-west to the peninsula west of Winda Woppa. The population is limited in the west and north-west to the outskirts of the built-up area of Tea Gardens including the Shearwater Estate, where it is bounded by Toonang Drive. The population is limited in the north to an east-west line three kilometres north of the northern boundary of the Hawks Nest Golf Course, although occasional sightings have been made outside these boundaries. The population is bounded in the south and east by the ocean (NSW Scientific Committee, Aug 1999).

Key Threatening Processes
Small population, continuing sub-division and associated clearing of food and habitat trees, road mortality and attacks by dogs.

Occurrence in Subject Site
Habitat requirements and food tree species that characterise habitat for the Hawks Nest and Tea Gardens population of the Koala were located on the subject site and adjacent lands.

2.4.4 Endangered Ecological Communities

The Endangered Ecological Communities known within the Great Lakes LGA are:

- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South-East Corner Bioregions;
- Littoral Rainforest in the NSW North Coast, Sydney Basin and South-East Corner Bioregions;
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions;
- Lowland Rainforest on Floodplain in the NSW North Coast Bioregion;
- Subtropical Coastal Floodplain Forest of the NSW North Coast Bioregion;
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner Bioregions;
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner Bioregions;
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South-East Corner Bioregions;
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner Bioregions;

Descriptions and details of the diagnostic species and habitat requirements of these ecological communities are provided in Appendix 1.

Endangered Ecological Communities observed within the subject site are:

- Coastal Saltmarsh;
- Swamp Sclerophyll Forest; and
- Swamp Oak Floodplain Forest

The Coastal Saltmarsh (29 hectares) and Swamp Oak Floodplain Forest (one hectare) are located in the eastern parts of the site within the areas proposed to be retained within the Conservation Zones.

The Swamp Sclerophyll Forest on Coastal Floodplains is predominantly located within the eastern parts of the site with small areas occurring in localised depressions within the central and northern parts of the site.

The locations and extent of these Endangered Ecological Communities are shown in shown in Figure 3.1 in Appendix 1.

2.5 VEGETATION/HABITAT CONNECTIVITY

2.5.1 Connectivity and Local Distribution of Vegetation

The subject site is bordered to the west by the Myall Road, disturbed grasslands with scattered trees, industrial and residential development; to the south, by predominately existing residential and commercial development; to the east, by the Myall River; and to the north, by a mixture of open forest vegetation communities, areas of isolated residential development and agricultural lands.

The majority of the vegetation of the site forms a mosaic of highly disturbed woodland with scattered trees and woodland/open forest communities. However, the eastern portion of the subject site is dominated by a large remnant of naturally vegetated Swamp Forests, Heaths and Estuarine vegetation communities associated with the low lying areas adjoining the Myall River. This remnant is largely isolated from adjoining vegetation to the south by existing residential development and to the north of the site by an area of cleared agricultural land. Connectivity of vegetation within the remnant is generally provided by the isolated canopies of the trees present which form a woodland to open forest canopy.

The northern areas of the subject site are dominated by a mixture of open forest vegetation communities and adjoin areas of isolated rural-residential development. There exists some connectivity between the sites eastern remnant vegetation and the areas of remnant open forest to the north, via a mosaic of disturbed woodland and open forest vegetation communities and scattered trees occupying the north-eastern areas of the site. However these vegetation communities provide only limited terrestrial connectivity as they have been significantly impacted by a history of agricultural use and grazing, resulting in a sparse understorey layer.

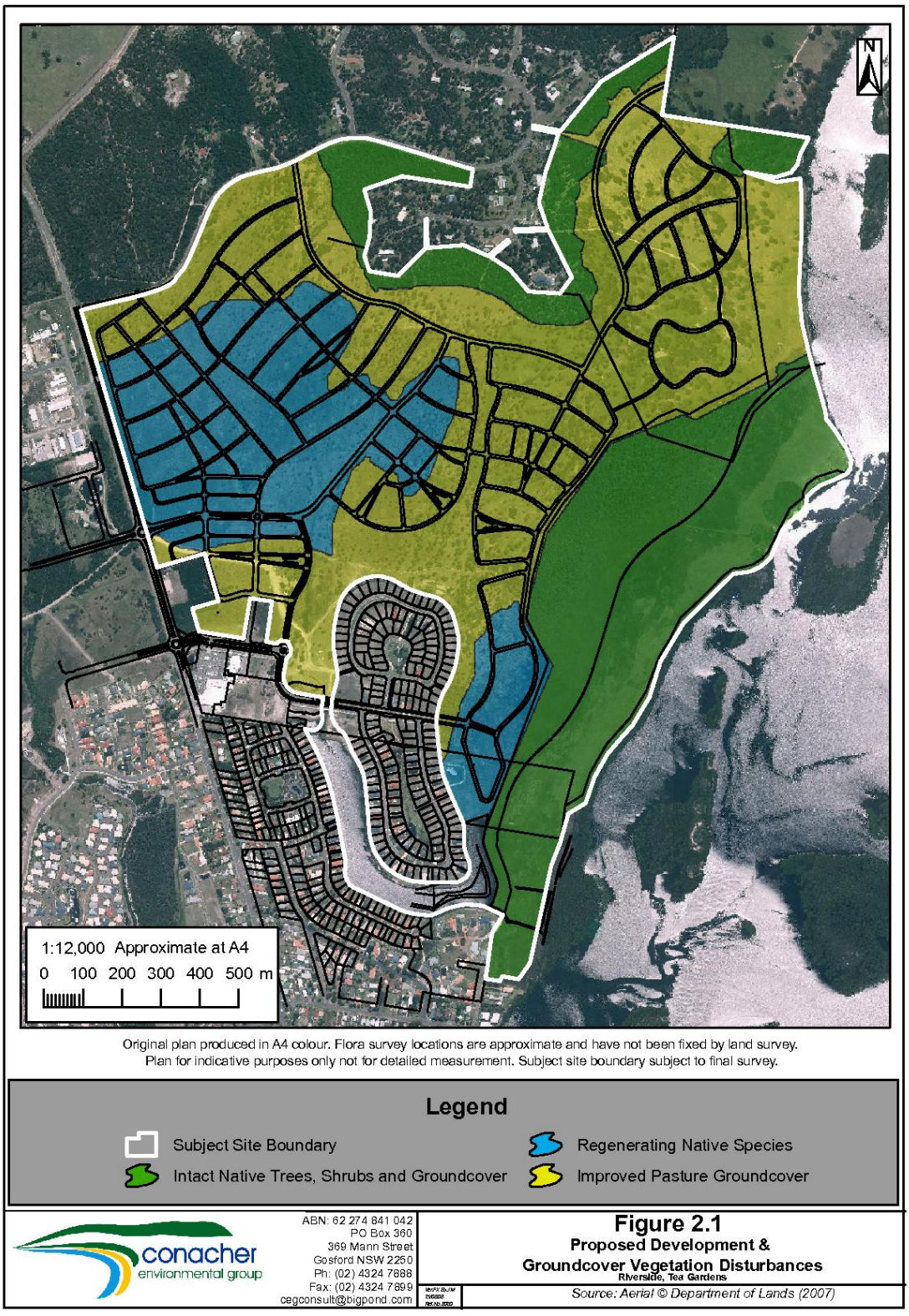
2.6 RIPARIAN AREAS

There are several drainage lines which contain various types of ephemeral, perennial and semi-permanent aquatic habitat present on the subject site. The northern and central-eastern parts of the subject site drain in an easterly direction via several ephemeral drainage lines containing occasional dams. These drainage lines flow directly into Myall River after passing through the

eastern swamp sclerophyll forest and Saltmarsh areas, or alternatively the northern drainage flows directly into the Myall River via well formed incised drainage gullies.

The drainage from the central and central-northern parts of the site is in a generally southerly direction into an area of impeded drainage near the south-western corner of the subject site. Drainage from the southern parts of the subject site is in a northerly direction which then joins the central drainage pattern and exits the site to the east.

The riparian areas are subject to the provisions of the Water Management Act and the various policies and protocols for works within the creekline areas or management of the riparian vegetation. A detailed Ecological Site Management Plan (ESMP) has been prepared for the subject site.


N
1:12,000 Approximate at A4
0 100 200 300 400 500 m
Original plan produced in A4 colour. Flora survey locations are approximate and have not been fixed by land survey.
Plan for indicative purposes only not for detailed measurement. Subject site boundary subject to final survey.
Legend
Subject Site Boundary
Intact Native Trees, Shrubs and Groundcover
Regenerating Native Species
Improved Pasture Groundcover
conacher environmental group
ABN: 62 274 841 042
PO Box 360
369 Mann Street
Gosford NSW 2250
Ph: (02) 4324 7888
Fax: (02) 4324 7899
cegconsult@bigpond.com
Figure 2.1
Proposed Development &
Groundcover Vegetation Disturbances
Riverside, Tea Gardens
Source: Aerial © Department of Lands (2007)

SECTION 3

ECOLOGICAL CONSIDERATIONS AND ASSESSMENTS

3.1 APPLICATION OF THE PRECAUTIONARY PRINCIPLE

The precautionary principle is a component of the ecological sustainable development considerations identified in the Environmental Planning and Assessment Act. The precautionary principle can be defined as:

"*Where there are threats of serious or irreversible environmental damage, lack of full scientific uncertainty should not be used as a reason for postponing measures to prevent environmental degradation".*

The precautionary principle has been applied throughout the undertaking of this threatened biodiversity survey and in the preparation of this assessment report. For example when determining the various species for survey and assessment purposes various species that had not previously been located within the locality were included in the group of species subject to targeted survey and detailed assessment. It was accepted that there was no scientific certainty that these species did not exist, therefore measures (surveys and assessments) were put in place to include these species as species with potential habitat present or suitable habitat present. This enabled consideration of these species, and their habitat, within the various assessments undertaken.

Likewise, in the absence of scientific certainty concerning the presence of various species and details concerning the movement patterns or life cycles of species the proposal has incorporated areas of habitat inclusion for into conservation and potential movement corridors to link retained habitats to larger areas of habitat and other possible corridor linkages.

The precautionary principle has been incorporated into the background investigations, detailed surveys and various assessments completed for this proposal.

3.2 EXTENT AND IMPACT OF VEGETATION/HABITAT REMOVAL

The proposal will result in the direct removal or modification of native vegetation from approximately 126 hectares of land. However much of this 126 hectares has previously been extensively disturbed, cleared and used for stock grazing. Approximately 78 hectares of the better quality native vegetation will be retained in conservation zones or wildlife corridors to connect to areas of vegetation external to the site. An additional 40 hectares (approximately) will be contained in open space and drainage corridors and other undeveloped areas of the site.

The removal and modification of vegetation is likely to result in the following impacts on the biodiversity of the site and its immediate adjoining area:

i) removal of native vegetation;
ii) removal and modification of fauna habitat;
iii) fragmentation of habitat;

iv) direct loss of flora and fauna species during site development stages through loss of habitat;
v) ongoing disturbance to fauna species during site occupation;
vi) increased edge effects to adjoining vegetation (eg. increased light penetration, changes to soil nutrient levels, changed hydrology of surface water flows, weed invasion and fauna predation etc).

3.3 PROVISION OF CONSERVATION OFFSETS

The proposal has incorporated a number of off-set strategies to address the potential loss of native vegetation and impacts on fauna habitats. These strategies include:

i) Water cycle management strategy to treat water quality onsite prior to stormwater leaving the site;
ii) Retention and management of habitats and vegetation within Conservation Zones (approximately 50 hectares);
iii) Retention and improvement of vegetation contained within wildlife corridors (approximately 30 hectares);
iv) Enhancement of habitat within the wildlife corridor to improve the fauna habitat value of the corridor (covering 30 hectares);
v) Fencing of vegetation to be retained to control vehicle and pedestrian access;
vi) Implementation of a vertebrate pest control program within areas of retained vegetation (covering 80 hectares);
vii) Provision of drainage corridors with appropriate planting and landscaping of water ponding areas to enhance habitat for locally occurring frog, reptile and bird species.

3.4 ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT

The *Environment Protection and Biodiversity Conservation Act, (1999)* requires that Commonwealth approval be obtained for certain actions. The Act provides an assessment and approvals systems for actions that have a significant impact on matters of national environmental significance (NES). These may include:

- Wetlands protected by international treaty (the Ramsar Convention);
- Nationally listed threatened species and ecological communities;
- Nationally listed migratory species.

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on a NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, the matter needs to be referred to Department of Environment, Heritage, Water and Arts. A detailed assessment of this proposal in relation to the EP&BC Act is provided in the Appendices.

No threatened flora species or endangered ecological communities listed in the EPBC Act (1999) were identified on or near to the site. It is considered that a referral of this project to the

Department of Environment, Heritage, Water and Arts is not required as it is not likely to impact on a significant population of threatened species or on an endangered ecological community.

3.5 STATE ENVIRONMENTAL PLANNING POLICIES

SEPP 14 – Coastal Wetlands
The site contains an area of wetland mapped under State Environmental Planning Policy No. 14 Coastal Wetlands and known as Wetland No. 746. The extension of the outlet from the existing lake area to the Myall River will not require disturbance to the SEPP 14 wetland. The SEPP 14 Wetland will be buffered by the retention of vegetation communities between the wetland boundary and the development edge.

SEPP 26 – Littoral Rainforests
No areas identified as SEPP 26 littoral rainforests are mapped on or adjoining the subject site. The proposal will not impact on any SEPP 26 littoral rainforest areas.

SEPP 44 – Koala Habitat Protection
An assessment has been undertaken in relation to SEPP 44 Koala Habitat Protection. It was determined that areas of the site contained Potential Koala Habitat according to the criteria of SEPP 44. No Koalas or signs of usage of the site by the Koala were observed within the site during surveys. As such it is considered that the subject site does not constitute Core Koala Habitat. A Management Strategy for Koalas and Koala habitat to be retained has been prepared for this proposal.

SEPP 71 – Coastal Protection
In relation to SEPP 71 it is identified in clause 2(i)(g) that the policy aims to protect and preserve native coastal vegetation.

The proposal has incorporated measures to retain, protect and preserve the areas of swamp forest and estuarine vegetation communities within the 7(a) Environmental Protection and 7(b) Conservation Zones. These areas are proposed to be retained and protected in biodiversity conservation zones. Approximately 80 hectares of coastal native vegetation will be retained and protected to provide protection for native vegetation, fauna habitats and wildlife corridors.

The areas of the proposed development will be limited to:

1) the residential zoned areas of the site which have been cleared of much of the natural vegetation with regrowth and remnant patches of vegetation present and used for a range of primary production purposes including cattle grazing and pine plantations.
2) an area of wetland, to the east of the existing lake, will be disturbed to widen the existing outlet channel. Widening of the channel will require the removal of a portion of the Endangered Ecological Communities (EECs), Swamp Sclerophyll Forest on Coastal Floodplains and Coastal Saltmarsh. These EECs are well represented within the surrounding area and as such the area of removal required for the proposed development is unlikely to have a significant impact on these communities. The assessment of the impact on these vegetation communities is detailed in Section 4, Tables 4.4 and 4.7-4.9.

The proposal will ensure the long term protection of areas of native coastal vegetation in locations that will significantly contribute to the continuance of vegetation along the shores of the Myall River.

3.6 THREATENED SPECIES CONSERVATION ACT

3.6.1 Threatened Species Impacted by the Proposal

Seven threatened fauna species were observed within the subject site during surveys conducted within the last five years. These species are:

- Wallum Froglet (*Crinia tinnula*);
- Osprey (*Pandion haliaetus*);
- Barking Owl (*Ninox connivens*);
- Grey-headed Flying-fox (*Pteropus poliocephalus);*
- Squirrel Glider (*Petaurus australis*).
- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);

Additionally a number of other threatened fauna species with suitable habitat present on-site were observed within the Tea Gardens area (within 5km) during recent local area surveys. These are:

- Powerful Owl (*Ninox strenua*);
- Masked Owl (*Tyto novaehollandiae*);
- Koala (*Phascolarctos cinereus*);
- Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*);
- Eastern Pygmy-possum (*Cercatetus nanus*).

The following threatened fauna species were observed within the subject site during previous surveys, however these have not been recorded within the last five years despite extensive fauna surveys:

- Greater Broad-nosed Bat (*Scoteanax rueppellii*);
- Large-footed Myotis (*Myotis adversus*);
- Eastern Bentwing-bat (*Miniopterusschreibersii oceanensis*) ;
- Common Blossom-bat (*Syconycteris australis*);
- Koala (*Phascolarctos cinereus*).

The following threatened fauna species were identified by the Department of Environment and Climate Change and Department of Planning as requiring assessment despite not being recorded within the locality during recent surveys:

- Sooty Oystercatcher and Pied Oystercatcher;
- Turquoise Parrot;
- Swift Parrot;
- Spotted-tailed Quoll;
- Endangered Emu Population of the North Coast Bioregion.

3.6.2 Direct and Indirect Impacts of the Proposal upon Threatened Species

Table 3.1 provides a summary of potential direct and indirect impacts of the proposal of those threatened species observed within the subject site during surveys.

Table 3.2 provides an assessment of potential impacts of the proposal on threatened fauna species either observed within the locality during recent surveys, observed within the subject but not within the last five years or nominated for assessment by the Department of Environment and Climate Change or Department of Planning (as identified in Section 4.6.1).

TABLE 3.1
ASSESSMENT OF POTENTIAL IMPACTS OF PROPOSED DEVELOPMENT ON THREATENED SPECIES OBSERVED WITHIN THE SUBJECT SITE

Impact	Wallum Froglet	Osprey	Barking Owl	Squirrel Glider	Grey-headed Flying-fox	Micro-bats
Altered Fire Regimes	Frequent or increased intensity of burning of habitat likely to negatively impact on species	No impact.	Loss of foraging habitat. Loss of roosting / nesting habitat. Loss of prey species habitat.	Loss of foraging and refuge habitat. Injury or mortality due to fire.	Loss of foraging habitat.	Loss of foraging habitat. Loss of roosting / nesting habitat. Loss of prey species habitat.
Increased Exposure to Exotic Predators	Mortality risk to exotic predators such as cats, dogs and foxes.	Mortality risk to exotic predators such as cats, dogs and foxes.	No impact.	Mortality risk to exotic predators such as cats, dogs and foxes.	Mortality risk to exotic predators such as cats, dogs and foxes.	Mortality risk to exotic predators such as cats, dogs and foxes.
Loss of Foraging or Nesting Habitat	Decreased amount of habitat. Increased competition for suitable habitat.	No impact.	Loss of nesting / foraging habitat. Increased competition for suitable habitat.	Decreased amount of habitat. Increased competition for suitable habitat.	Decreased amount of habitat. Increased competition for suitable habitat.	Decreased amount of habitat. Increased competition for suitable habitat.
Increased Threat During Clearing and Development	Loss of nesting / foraging habitat. Injury / death during development.	No impact.	Loss of nesting / foraging habitat. Injury / death during development.	Loss of nesting / foraging habitat. Injury / death during development.	Loss of foraging habitat. Injury / death during development.	Loss of nesting / foraging habitat. Injury / death during development
Fragmentation or Isolation of Habitat	Reduction and interruption to movement and dispersal areas.	No impact.	No impact.	Reduction and interruption to movement and dispersal areas.	No impact.	No impact.
Threat of Vehicle Injury / Death	Increased exposure to vehicle injury / death.	Increased exposure to vehicle injury / death.	Increased exposure to vehicle injury / death. Increased exposure of prey to vehicle injury / death.	Increased exposure to vehicle injury / death.	Increased exposure to vehicle injury / death.	Increased exposure to vehicle injury / death.
Soil Erosion	Modification of foraging, refuge and breeding habitat.	Modification of prey habitat.	Modification of prey habitat.	Modification of foraging habitat.	Modification of foraging habitat.	Modification of foraging habitat.
Altered Hydrology	Modification of foraging, refuge and breeding habitat.	Modification of prey habitat.	Modification of foraging habitat.	Modification of foraging habitat.	Modification of foraging habitat.	Modification of foraging habitat.
Increased Runoff	Modification of foraging, refuge and breeding habitat.	Modification of prey habitat.	Modification of foraging habitat.	Modification of foraging habitat.	Modification of foraging habitat.	Modification of foraging habitat.
Flooding	Temporary increase in amount of breeding, refuge and foraging areas.	Temporary modification upon prey habitat.	No impact.	No impact.	No impact.	No impact.
Increased Weed Invasion	Modification of foraging habitat.	No likely impact.	Modification of prey and foraging habitat.	No impact.	No impact.	No impact.
Grazing	Modification of foraging habitat.	No impact.	Modification of prey habitat.	Modification of habitat due to loss of understorey species.	Modification of foraging habitat.	Modification of foraging habitat.

TABLE 3.1 (Cont.)
ASSESSMENT OF POTENTIAL IMPACTS OF PROPOSED DEVELOPMENT ON THREATENED SPECIES OBSERVED WITHIN THE SUBJECT SITE

Impact	Wallum Froglet	Osprey	Barking Owl	Squirrel Glider	Grey-headed Flying-fox	Micro-bats
Mowing / Slashing	Modification of foraging, refuge and breeding habitat.	No impact.	Modification of prey habitat.	Modification of habitat due to loss of understorey species.	Modification of foraging habitat.	Modification of foraging habitat.
Rubbish Dumping	Pollution of foraging, refuge and breeding habitat.	No impact.	No impact.	No impact.	No impact.	No impact.
Physical Damage eg. Trampling	Modification of foraging, refuge and breeding habitat.	No impact.	No impact.	No impact.	No impact.	No impact.

* Micro-bats = Little Bentwing-bat, Eastern Freetail-bat & Greater Broad-nosed Bat

TABLE 3.2
ASSESSMENT OF POTENTIAL IMPACTS OF PROPOSED DEVELOPMENT ON THREATENED SPECIES KNOWN FROM LOCAL AREA OR IDENTIFIED FOR ASSESSMENT

Impact	Sooty & Pied Oyster-catcher	Powerful Owl	Masked Owl	Swift Parrot	Koala	Spotted-tailed Quoll	Eastern Pygmy-possum	Eastern Chestnut Mouse	Common Blossom-bat	Micro-bats*
Altered Fire Regimes	No impact.	Loss of foraging habitat. Loss of roosting / nesting habitat. Loss of prey species habitat.	Loss of foraging habitat. Loss of roosting / nesting habitat. Loss of prey species habitat.	Modification of foraging habitat.	Loss of foraging and refuge habitat. Injury or mortality due to fire.	Loss of foraging and refuge habitat. Loss of prey habitat.	Loss of foraging and refuge habitat. Injury or mortality due to fire.	Loss of foraging habitat. Successional impacts.	Loss of foraging habitat.	Loss of foraging habitat. Loss of roosting / nesting habitat. Loss of prey species habitat.
Increased Exposure to Exotic Predators	Mortality risk to exotic predators such as cats, dogs and foxes.	No impact.	No impact.	Mortality risk to exotic predators such as cats, dogs and foxes.	Mortality risk to exotic predators such as dogs and foxes.	Mortality risk to exotic predators such as cats, dogs and foxes.	Mortality risk to exotic predators such as cats, dogs and foxes.	Increased exposure to exotic predators such as cats, dogs and foxes.	Mortality risk to exotic predators such as cats, dogs and foxes.	Mortality risk to exotic predators such as cats, dogs and foxes.

TABLE 3.2 (Cont.)
ASSESSMENT OF POTENTIAL IMPACTS OF PROPOSED DEVELOPMENT ON THREATENED SPECIES KNOWN FROM LOCAL AREA OR IDENTIFIED FOR ASSESSMENT

Impact	Sooty & Pied Oyster-catcher	Powerful Owl	Masked Owl	Swift Parrot	Koala	Spotted-tailed Quoll	Eastern Pygmy-possum	Eastern Chestnut Mouse	Common Blossom-bat	Micro-bats*
Loss of Foraging or Nesting Habitat	No impact.	Decreased amount of foraging habitat. Increased competition for suitable habitat.	Decreased amount of foraging habitat. Increased competition for suitable habitat.	Decreased amount of foraging habitat.	Decreased amount of foraging habitat. Home range impacts.	Decreased amount of foraging habitat. Home range impacts.	Decreased amount of foraging and nesting habitat. Increased competition for suitable habitat.	Decreased amount of foraging and nesting habitat. Increased competition for suitable habitat.	Decreased amount of habitat. Increased competition for suitable habitat.	Decreased amount of habitat. Increased competition for suitable habitat.
Increased Threat During Clearing and Development	No impact.	Loss of nesting / foraging habitat. Injury / death during development.	Loss of nesting / foraging habitat. Injury / death during development.	Disturbance impacts during clearing.	Disturbance impacts during clearing. Injury/death during works.	Disturbance impacts during clearing. Injury/death during works.	Loss of nesting / foraging habitat. Injury / death during development.	Loss of nesting / foraging habitat. Injury / death during development	Loss of foraging habitat. Injury / death during development.	Loss of nesting / foraging habitat. Injury / death during development
Fragmentation or Isolation of Habitat	No impact.	No impact.	No impact.	No impact.	No isolation or further fragmentation	Reduction in size of movement areas.	Isolation of habitat areas.	Isolation of habitat areas.	No impact.	No impact.
Threat of Vehicle Injury / Death	Increased exposure to vehicle injury / death.	Increased exposure to vehicle injury/death. Increased exposure of prey to vehicle injury / death.	Increased exposure to vehicle injury/death. Increased exposure of prey to vehicle injury / death.	Increased exposure to vehicle injury/death.	Increased exposure to vehicle injury/death.	Increased exposure to vehicle injury/death. Increased exposure of prey to vehicle injury/death.	Increased exposure to vehicle injury/death.	Increased exposure to vehicle injury/death.	Increased exposure to vehicle injury/death.	Increased exposure to vehicle injury/death.
Soil Erosion	No impact.	Modification of prey habitat.	Modification of prey habitat.	No impact.	Modification of foraging habitat.	Modification of prey habitat.	Modification of foraging habitat.	Modification of foraging and refuge habitat.	Modification of foraging habitat.	Modification of foraging habitat.
Altered Hydrology	No impact.	Modification of prey habitat.	Modification of prey habitat.	No impact.	Modification of foraging habitat.	Modification of prey habitat.	Modification of foraging habitat.	Modification of foraging and refuge habitat.	Modification of foraging habitat.	Modification of foraging habitat.

TABLE 3.2 (Cont.)
ASSESSMENT OF POTENTIAL IMPACTS OF PROPOSED DEVELOPMENT ON THREATENED SPECIES KNOWN FROM LOCAL AREA OR IDENTIFIED FOR ASSESSMENT

Impact	Sooty & Pied Oyster-catcher	Powerful Owl	Masked Owl	Swift Parrot	Koala	Spotted-tailed Quoll	Eastern Pygmy-possum	Eastern Chestnut Mouse	Common Blossom-bat	Micro-bats*
Increased Runoff	No impact.	Modification of prey habitat.	Modification of prey habitat.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.
Flooding	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.
Increased Weed Invasion	No impact.	Modification of prey and foraging habitat.	Modification of prey and foraging habitat.	Modification of foraging habitat.	Modification of habitat.	Modification of foraging habitat.	Modification of habitat.	Modification of foraging and refuge habitat.	No impact.	No impact.
Grazing	No impact.	Modification of prey habitat.	Modification of prey habitat.	No impact.	Increased exposure when on ground.	Modification of refuge habitat.	Modification of habitat due to loss of understorey species.	Modification of foraging habitat.	Modification of foraging habitat.	No impact.
Mowing / Slashing	No impact.	Modification of prey habitat.	Modification of prey habitat.	No impact.	Increased exposure when on ground.	Modification of refuge habitat.	Modification of habitat due to loss of understorey species.	Modification of foraging habitat.	Modification of foraging habitat.	No impact.
Rubbish Dumping	Modification of foraging habitat.	No impact.	No impact.	No impact.	Modification of foraging habitat.	Modification of foraging habitat.	Modification of foraging habitat..	Modification of foraging habitat.	No impact.	No impact.
Physical Damage e.g. Trampling	Modification of foraging habitat.	No impact.	No impact.	No impact.	Modification of foraging habitat.	Modification of foraging habitat.	Modification of foraging habitat..	Modification of foraging habitat.	No impact.	No impact.

TABLE 3.3
ASSESSMENT OF POTENTIAL IMPACTS OF PROPOSED DEVELOPMENT ON ENDANGERED ECOLOGICAL COMMUNITIES OCCURING WITHIN THE SUBJECT SITE

	Coastal Saltmarsh	Swamp Oak Floodplain Forest	Swamp Sclerophyll Forest on Coastal Floodplains
Altered Fire Regimes	Inappropriate fire regime will slow community regeneration and alter species composition.	Inappropriate fire regime will slow community regeneration and alter species composition	Inappropriate fire regime will slow community regeneration and alter species composition
Increased Threat During Clearing and Development	Potential physical damage to vegetation, soil compression, run-off, trampling and waste management issues.	Potential physical damage to vegetation, soil compression, run-off, trampling and waste management issues.	Potential physical damage to vegetation, soil compression, run-off, trampling and waste management issues.
Fragmentation or Isolation of Habitat	No impact.	No impact.	No impact.
Soil Erosion	Reduced soil fertility through loss of organic topsoil. Diminished soil seed reserves.	Reduced soil fertility through loss of organic topsoil. Diminished soil seed reserves.	Reduced soil fertility through loss of organic topsoil. Diminished soil seed reserves.
Altered Hydrology	Changes to sediment chemistry and saltmarsh community composition. Damage to condition of the community.	Changes to community structure and composition. Damage to condition of the community.	Changes to community structure and composition. Damage to condition of the community.
Increased Runoff	Weed incursion from soil and water nutrification. Accumulation of contaminants in soil and sediment.	Weed incursion from soil and water nutrification. Accumulation of contaminants in soil and sediment.	Weed incursion from soil and water nutrification. Accumulation of contaminants in soil and sediment.
Flooding	Freshwater pollution and associated salinity changes associated with inappropriate flood regimes.	No impact.	No impact.
Increased Weed Invasion	Competition with native species. Modification of community structure and floristic composition. Loss of species diversity. Hydrological changes.	Competition with native species. Modification of community structure and floristic composition. Loss of species diversity. Hydrological changes.	Competition with native species. Modification of community structure and floristic composition. Loss of species diversity. Hydrological changes.
Grazing	Hydrological changes associated with soil compaction and modification of soil microtopography. Modification of community structure and floristic composition. Weed incursion.	Hydrological changes associated with soil compaction and modification of soil microtopography. Modification of community structure and floristic composition. Weed incursion.	Hydrological changes associated with soil compaction and modification of soil microtopography. Modification of community structure and floristic composition. Weed incursion.
Mowing / Slashing	Modification of community structure and floristic composition. Will slow or prevent vegetation regeneration.	Modification of community structure and floristic composition. Will slow or prevent vegetation regeneration.	Modification of community structure and floristic composition. Will slow or prevent vegetation regeneration.
Rubbish Dumping	Hydrological changes through sediment trapping. Contamination and nutrification of soils and water.	Hydrological changes through sediment trapping. Contamination and nutrification of soils and water.	Hydrological changes through sediment trapping. Contamination and nutrification of soils and water.
Physical Damage e.g. Trampling	Soil compaction. Hydrological changes. Damage to groundcover and understorey species. Will slow or prevent vegetation regeneration.	Soil compaction. Hydrological changes. Damage to groundcover and understorey species. Will slow or prevent vegetation regeneration.	Soil compaction. Hydrological changes. Damage to groundcover and understorey species. Will slow or prevent vegetation regeneration.

3.7 FISHERIES MANAGEMENT ACT

The proposed development is adjacent to the Myall River, associated aquatic habitats and includes the constructed lake and outlet channel to the lake. As such it is considered that there are issues of relevance to the *Fisheries Management Act*. The proposed extension of the existing outlet in to the constructed lake, will result in an area of disturbance to the endangered ecological communities, Swamp Sclerophyll Forest on Coastal Floodplains and Coastal Saltmarsh. The level of disturbance to the wetland and vegetation is considered unlikely to significantly impact aquatic habitat. The assessment of the impact on these vegetation communities is detailed in Section 4, Tables 4.4 and 4.7-4.9.

In addition, there are no threatened fish species listed within the *Fisheries Management Act* (1994) with normal distributional limits that include the Myall River. A detailed report on the impact of the development on fish species present in the lake has been prepared by Harris Research (2007).

3.8 NATIVE VEGETATION ACT

The Native Vegetation Act (2003) (NVAct) is a principal piece of legislation applicable to native vegetation in non-residential zoned areas. Land zoned for residential purposes is excluded from the provisions of the NVAct under Part 1 Section 5 (clause 2), as identified in Schedule 1 Part 3 of the NVAct.

In relation to the subject site the NVAct applies to the areas zoned 7(a) and 7(b) as these zones are not residential zones. The NVAct does not apply to the area of the proposal within the residential zoned parts of the site. The areas of vegetation proposed to be cleared and disturbed for the widening of the lake outlet are subject to the provisions of the NVAct.

An assessment of the proposal in relation to the objectives of the NVAct is provided below. The objective of the NVAct are provided in *italic* print below.

(a) to provide for, encourage and promote the management of native vegetation on a regional basis in the social, economic and environmental interests of the State

The widening of the lake outlet will require the removal of a portion of the EECs, Swamp Sclerophyll Forest on Coastal Floodplains and Coastal Saltmarsh. The assessment of the impact on these vegetation communities is detailed in Section 4, Tables 4.4 and 4.7-4.9. However, the majority of this vegetation will be retained and conserved under the 7(a) - environmental protection and 7(b) – conservation zonings. These areas of land may be subject to future negotiations to enable their incorporation into the estate of the Department of Environment and Climate Change (DECC). This will provide opportunities for the vegetation to be managed on a regional basis for the social, economic and environmental interests of the State.

(b) to prevent broadscale clearing unless it improves or maintains environmental outcomes

Areas of vegetation requiring removal as a result of the proposed channel widening are considered to be of a small, localised scale and will be offset through the restoration

and protection of areas of disturbed estuarine vegetation. This will achieve an outcome that maintains or improves the existing vegetation.

(c) to protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation.

The native vegetation to be retained and conserved under the 7(a) - environmental protection and 7(b) – conservation zonings is located within a SEPP 14 wetland and contains the EECs, Swamp Sclerophyll Forest on Coastal Floodplains and Coastal Saltmarsh. In addition, areas of degraded vegetation will be restored and as such will maintain or improve the existing water quality and biodiversity.

(d) to improve the condition of existing native vegetation, particularly where it has high conservation value.

Degraded areas of vegetation will be improved through the erection of protective fencing to restrict pedestrian and vehicle access. This will enable the existing vegetation opportunities to regenerate and improve in condition. Areas disturbed for the widening of the outlet channel will be restored in the accordance with the Wetland Restoration Strategy for this area.

(e) to encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation.

The area of the retained native vegetation will be allowed to regenerate naturally following previous wildfires and uncontrolled stock grazing. Weed management will assist in the regeneration process. Any restoration works, such as those proposed along the area of channel widening, will utilise locally occurring native species.

From the above assessment it is concluded that the proposed development will maintain or improve the existing vegetation and is compatible with the objective of the NVAct (2003). Vegetation of high conservation value located within the SEPP 14 wetland will be retained and enhanced through the restriction of foreshore access, weed management activities and restoration works. Any impacts associated with the proposed channel widening will be offset by these management measures.

3.9 POTENTIAL TO IMPACT ON DEPARTMENT OF ENVIRONMENT AND CLIMATE CHANGE ESTATE

There are no lands administered by the Department of Environment and Climate Change adjoining the site. The subject site is located approximately four kilometres up river of the Corrie Island Nature Reserve and approximately two kilometres down river of the Myall Lakes National Park. Some areas of the Myall Lakes National Park are also located along the eastern shoreline areas of the Myall River within two kilometres of the subject site.

The proposal will not cause any direct disturbance to these areas of nature reserve or national park administered by the Department of Environment and Climate Change. Some increased visitor activity may result to those areas due to possible increased recreational boating along the Myall River. Any increase in visitor use cannot be quantified at this stage.

Hydrological flows of the Myall River are not expected to be significantly altered by the proposal. Any changed water levels within the Myall River which might impact on the shoreline of Myall Lakes National Park or Corrie Island Nature Reserve are not likely to be attributed to the proposal.

3.10 POTENTIAL TO IMPACT REGIONAL WILDLIFE CORRIDOR

The subject site is included within an area mapped as a regional corridor (Scotts 2003). The subject site has also been mapped as an area of key habitat by Scotts (2003). In a review of a previous assessment report for the site (Conacher Travers 2007) DECC have identified that…"*locally this corridor would facilitate wildlife movement from the north-west to the fringes of Tea Gardens and contribute to fauna from the Myall River through the Shearwater locate to suitable habitats in the Kore Kore Creek area".* DECC also states that…"*Typically Corridors are in the order of kilometres wide to maintain habitat, facilitate movement between areas of significant intact habitat (eg. DECC estate – Myall Lakes National Park)…. and buffer against the fragmentation of corridors*".

DECC acknowledges that this corridor is patchy and discontinuous.

The location of the regional corridor is shown in Figure 3.1. This figure shows the regional corridor extending through the site in a northerly direction over the cleared agricultural area and through a large pine plantation. To the west of the site the corridor includes the industrial areas of Tea Gardens. The corridor also includes areas of residential and commercial development associated with Tea Gardens.

As identified in Figure 3.1 the corridor does not connect to areas of land included in the DECC estate (eg. Myall Lakes National Park and Corrie Island Nature Reserve). Additionally, areas within the DECC estate have not been identified as key habitats by Scotts (2003).

While the concept of establishing regional corridors has ecological merit the reliance on the mapping of corridors by Scotts (2003) and the interpretation of this information should be used cautiously. As identified by Scotts (2003) the mapping is based on faunal models and the corridors derived from them are computer modelled representations of potential habitat or linking habitat for species assemblages at a regional scale. Additionally the corridors have not yet been ground truthed in the field.

Notwithstanding the problems associated with the mapping of regional corridors and exclusion of areas of national parks, nature reserves and state forests from key habitat and corridor mapping the proposal has incorporated wildlife corridors within the site to facilitate possible movement of biodiversity to and from areas of retained habitat both within and external to the site.

As shown in Figure 4.1 the proposed corridor continues in a north-west direction from the Swamp Forest vegetation of the 7(b) environmental zone towards the slopes below Shearwater Estate. The corridor separates into two sections with the northern section extending to the land adjoining the northern boundary which is incorporated into the Regional Corridor mapped by Scott (2003). The western section of the corridor continues in a western then northern direction linking into the public reserves associated with Shearwater Estate. The vegetation within this public reserve area is relatively undisturbed vegetation with low levels of weed invasion present.

The site corridor area varies in width between 60 to 120 metres wide. This corridor will require some areas of regeneration and habitat enhancement (placement of ground hollows, tree mounted nest boxes, weed management etc) as identified in the Ecological Site Management Strategy. Bushfire asset protection zones and water management structures should be located on the outside extremities of the corridor.

This corridor is proposed to be managed as community titled land however the future inclusion in a conservation zone might be appropriate for this corridor to ensure long term protection and appropriate management.

3.11 ASSESSMENT OF PROPOSAL AGAINST RELEVANT RECOVERY PLANS

The following Threatened Species Recovery Plans exist for threatened fauna observed within the subject site or within the locality:

- National Recovery Plan for the Wallum Sedge Frog and Other Wallum Dependant Frogs (QLD EPA 2006);
- Approved Recovery Plan for the Large Forest Owls Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*), Masked Owl (*Tyto novaehollandiae*) (DEC 2006);
- Draft Recovery Plan for the Barking Owl (*Ninox connivens*) (DEC 2003);
- Approved Recovery Plan for the Koala (*Phascolarctos cinereus*) (DEC 2003).

An assessment of the proposal against the recovery plans for these species is provided below. The Department of Planning requested an assessment for the endangered population of the Koala only, however an assessment for all other relevant species covered by recovery plans has been completed.

Each recovery plan contains several objectives, which relate to conservation initiatives of the relevant government departments. An assessment of the proposal in relation to the recovery plan objectives and actions is provided.

NATIONAL RECOVERY PLAN FOR THE WALLUM SEDGE FROG AND OTHER WALLUM DEPENDANT FROGS (QLD EPA 2006)

The National Recovery Plan for the Wallum Sedge Frog and other Wallum Dependent Frogs states;

"*This recovery plan includes four species of frog, however adoption as a national recovery plan under the Environment Protection and Biodiversity Conservation Act 1999 refers only to the wallum sedge frog Litoria olongburensis.*"

Recovery Plan objectives have been addressed for the Wallum Froglet regardless of this.

Action 1: Identify and assess essential habitat

Suitable Wallum Froglet habitat within the subject site has been identified as part of the Ecological Site Assessment. The extent of habitat was determined during fauna surveys completed as part of the initial Flora and Fauna Assessment for the site. Seasonal follow-up surveys have been completed to determine the extent of Wallum Froglet habitat within the site.

Action 2: Protect wallum frog populations and manage habitat

An Ecological Site Management Plan has been prepared for the site that details management strategies in relation to protection of the Wallum Froglet within the site.

The amphibian disease Chytridiomycosis has not yet been observed in the Wallum Froglet and tends to affect amphibian species inhabiting higher altitudes. As such, it is considered that Chytridiomycosis does not present a major threat to the survival of the Wallum Froglet. Should this illness be detected in frog populations on the subject site, management strategies will be implemented as per the 'Threat Abatement Plan for Infection of Amphibians with Chytrid Fungus resulting in Chytridiomycosis'.

The Mosquito Fish (*Gambusia holbrooki*) is likely to be present within drainage lines and creeks within the site. Since the Wallum Froglet is more dependant on semi-permanent wetland areas for breeding, predation on eggs and tadpoles by the Mosquito fish does not present a major threat for survival of the species within the site.

Action 3: Acquire additional information on threats to inform management

The following have been identified as threats to the Wallum Froglet in NSW (DECC 2008).

- 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;
- Grazing and associated frequent burning of coastal wetlands.

As such the proposal represents a threat to the Wallum Froglet.

Action 4: Engage stakeholders and the broader community in recovery of wallum frog species

Actions associated with community engagement on Wallum Froglet recovery are primarily the responsibility of management authorities. However, the Ecological Site Management Plan prepared for the site includes management strategies for public education programs in relation to threatened species within the subject site.

Action 5: Rehabilitate degraded wallum frog habitat

The proposal includes areas of identified Wallum Froglet habitat within the subject site to be retained, protected and rehabilitated. This information is detailed in Section 5.

Rehabilitation strategies include weed removal, regeneration of native vegetation, rubbish removal, exclusion of cattle, maintenance of current hydrological regime and water quality.

Action 6: Monitor frog numbers and distribution

Wallum Froglet populations will be regularly assessed as part on an ongoing monitoring program implemented for the site. Monitoring will review the persistence and extent of Wallum Froglet populations, and will follow survey methodology used during the initial Flora and Fauna Assessment. Where detrimental impacts are identified, management strategies will be re-

evaluated and modified to ensure protection of the species. The proposal is therefore consistent with this Recovery Plan objective.

RECOVERY PLAN FOR THE LARGE FOREST OWLS
POWERFUL OWL (*Ninox strenua*) SOOTY OWL (*Tyto tenebricosa*) and MASKED OWL (*Tyto novaehollandiae*)

Model and Map Owl Habitat and Validate with Surveys

Objective 1: Assess the distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of occupied territories of each species that are, and are not, protected.

Recovery Actions: Recovery actions will be directed towards updating existing owl habitat models, mapping modelled habitat across public and private lands, and carrying out field surveys to validate models and enable estimation of the number of territories for each species supported by public versus private land.

It is considered that this objective and action is not relevant to the proposal. Information on the recorded occurrence of the owl species recorded within the local area are provided to the Department of Environment and Climate Change (DECC) as part of licensing agreements for inclusion on the Atlas of NSW Wildlife for use as part of any updating of owl habitat models.

Monitor Owl Population Parameters

Objective 2: To monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the three species and across different land tenures and disturbance histories).

Recovery Actions: Recovery actions will be directed towards developing and implementing a set of regional monitoring programs for the three species throughout their ranges in NSW that assess occupancy of potential habitat, fidelity to occupied territories and breeding success across a range of land tenures and disturbance histories. Synergies with the field validation component of modelled habitat and monitoring actions will be investigated.

It is considered that this objective and action is not relevant to the proposal. Information on the recorded occurrence of the owl species recorded within the local area are provided to the Department of Environment and Climate Change (DECC) as part of licensing agreements for inclusion on the Atlas of NSW Wildlife for use as part of any updating of owl habitat models.

Audit Forestry Prescriptions

Objective 3: To assess the implementation and effectiveness of forest management prescriptions designed to mitigate the impact of timber-harvesting operations on the three owl species and, (if necessary), to use this information to refine the prescriptions so that forestry activities on state forests are not resulting in adverse changes in species abundance and breeding success.

Recovery Actions: Recovery actions will be directed towards assessing the implementation and effectiveness of forest management prescriptions, and if necessary, refining them so that forestry activities on state forests are not resulting in adverse changes in species abundance and breeding success.

These objectives and actions are specific to state Forests' management and as such are not relevant to the proposal.

Manage and Protect Habitat off Reserves and State Forests

Objective 4: Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes.

Recovery Actions: Recovery actions are directed towards the development, maintenance and evaluation of tools used by consultants, consent and determining authorities for assessing and mitigating the impact of development activities on large forest owls and their habitats.

No environmental impact assessment guidelines for the large forest owls were available at the time of this report. Surveys for the large forest owls within the site were undertaken in accordance with standard survey methodologies (DEC 2005).

This Ecological Site Assessment includes a full assessment of the impacts of the proposal upon threatened owl species.

Objective 5: Minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat (including protection of individual nest sites).

Recovery Actions: Recovery actions will be directed towards encouraging the protection and management of significant habitat.

None of these three owl species have been recorded within the subject site despite extensive surveys. The Powerful Owl and Masked Owl have been recorded recently within the Tea Gardens area. It is not considered that the subject site constitutes significant owl habitat.

Undertake Research

Objective 6: To improve the recovery and management of the three large forest owls based on an improved understanding of key areas of their biology and ecology.

Recovery Actions: Recovery actions will be directed towards encouraging and facilitating scientific investigation into key aspects of the biology and ecology of the three large forest owls that are likely to provide information that is valuable to the recovery and/or management of these species.

It is considered that this objective and action is not relevant to the proposal. This is due mostly to a lack of evidence of these species within the subject site.

Increase Community Awareness and Involvement in Owl Conservation

Objective 7: To raise awareness of the conservation requirements of the three large forest owls amongst the broader community, to involve the community in owl conservation efforts and in doing so increase the information base about owl habitats and biology.

Recovery Actions: Recovery actions will be directed towards raising awareness within the community about the conservation requirements of the three large forest owls and encouraging community involvement in recovery actions and information gathering.

It is considered that this objective and action is not directly relevant to the proposal. The Ecological Site Management Plan prepared for the site includes management actions for the raising of local awareness in relation to threatened species.

Provide Organisational Support and Integration

Objective 8: To coordinate the implementation of the recovery plan and continually seek to integrate actions in this plan with actions in other recovery plans or conservation initiatives.

It is considered that this objective and action is not relevant to the proposal.

DRAFT RECOVERY PLAN FOR THE BARKING OWL (*Ninox connivens*)

Specific Objective 1: Increase understanding of the biology, ecology and management of the Barking Owl

Action 1.1: Assess the size, viability and status of the Barking Owl population in NSW.

Action 1.2: Establish a program to monitor the NSW Barking Owl Population and study its demographics.

Action 1.3: Investigate conservation management strategies.

Action 1.4: Support biological and ecological studies.

Action 1.5: Support population genetics studies.

Action 1.6: Investigate the cultural and historic significant of the Barking Owl.

The actions within this objective relate to the coordination of various NPWS (DECC) and other agencies in gathering together information on the biology, ecology and management of the Barking Owl through research and monitoring programs. The proposal includes a monitoring program for threatened species, including the Barking Owl, within the subject site. The results of this monitoring program will be made available to DECC if required.

Specific Objective 2: Increase education and awareness of and involvement in the conservation of the Barking Owl and its' habitat in NSW

Action 2.1: Develop and distribute the Barking Owl information package.

Action 2.2: Develop and distribute best practice guidelines for Barking Owl conservation to Regional Vegetation management Committees (RVMC's).

Action 2.3: Prepare a poster and undertake a community survey and media campaign in rural and regional NSW.

Action 2.4: Establish formal conservation arrangement for properties with Barking Owls.

It is considered that this objective and action is not directly relevant to the proposal. The actions relate to the establishment of programs by various government agencies in increasing public education and awareness of the Barking Owl. The Ecological Site Management Plan prepared for the site includes management actions for the raising of local awareness in relation to threatened species.

Specific Objective 3: Undertake threat abatement and mitigation

Action 3.1: Protect known Barking Owl nest sites and surrounding habitat.

Action 3.2: Assist with the protection of Barking Owl habitat from disturbance due to developments and activities.

Action 3.3: Assess forestry prescriptions and Threatened Species Licences for their effectiveness in conserving the Barking Owl in State Forests.

Action 3.4: Incorporate the consideration of Barking Owl habitat and potential habitats as a high priority in the assessment of property for reserve establishment.

Action 3.5: Support studies into the effects of agricultural poisons upon the species.

Specific actions within this objective involve the protection of Barking Owl nest sites and suitable habitats. While no nest sites for this species are known from the subject site, given the Barking Owls occurrence during surveys, the proposal will remove areas of foraging habitat.

Specific Objective 4: Gain efficiencies through links with other conservation plans and conservation groups

Action 4.1: Integrate the Barking Owl plan with other plans.

Action 4.2: Maintain the NPWS threatened owl working group and links with owl researchers.

Action 4.3: Maintain links with the community.

These recovery actions refer to the co-ordination and integration of the recovery plan with other plans, research groups, institutions and community conservation groups in facilitating Barking Owl recovery. It is not considered that these objectives and actions are relevant to the proposal.

Specific Objective 5: Provide organisational support

Action 5.1: Coordinate the implementation of the recovery plan

Action 5.2: Review the plan in its final year and prepare a seconds recovery plan.

These objectives and actions refer specifically to the implementation and review of the plan by the NPWS (DEC) and as such it is not considered that these objectives and actions are relevant to the proposal.

RECOVERY PLAN FOR THE HAWKS NEST AND TEA GARDENS ENDANGERED KOALA POPULATION

Objective 1: To co-ordinate the recovery of the Hawks Nest and Tea Gardens Koala Population

Action 1.1: The NPWS, with the support of GLC, will coordinate the implementation of the action outlined in the Recovery Plan.

Action 1.2: The NPWS and the GLC will develop a Koala Working Group (KWG).

The proposal is not inconsistent with the actions contained within the Recovery Plan as part of this objective. These actions relate to the Councils and NPWS co-ordination of the Recovery Plan in particular the establishment of a Koala Working and monitoring program. The Koala Management Strategy developed for this proposal includes a monitoring program for the Koala. The results of monitoring will be made available to the Koala Working Group if required.

Objective 2: To identify and map the distribution of Koala habitat in the Hawks Nest and Tea Gardens area

Action 2.1: The NPWS, with support from GLC, will coordinate the identification and mapping of Koala habitat in the Hawks Nest and tea Gardens area and produce a supporting document.

As part of the actions for this objective the NPWS with support from Council are to coordinate the mapping of Koala habitat. As part of this and other local area proposals detailed vegetation mapping has been supplied to Council that will aid in identifying Koala habitat within the area. No detailed Koala habitat mapping of the site has been completed as part of the proposal. No mapping of Koala habitat within the Hawks Nest Tea Gardens area was available at the time of this report.

Objective 3: To conserve the Hawks Nest and Tea Gardens Population in its existing habitat

Action 3.1: Areas of Koala habitat identified through Action 2.1 will be prioritised for active management and monitoring and/or conservation by the KWG in consultation with the local community. This will include an assessment of the need for a Critical Habitat declaration in the Hawks Nest and Tea Gardens area.

Action 3.2: The NPWS and GLC will establish a survey program to determine if areas to the north and west of Hawks Nest and Tea gardens represent a source of new individuals into the Endangered Koala Population. Methods utilised will be low impact and involve the local community.

Action 3.3: The NPWS, with support from GLC, will prepare survey and assessment guidelines for the Hawks Nest and Tea Gardens Koala Population and distribute them to relevant authorities.

Action 3.4: The KWG will establish an ongoing program of blackspot identification.

Action 3.5: Subsequent to Action 3.4, the KWG will develop and implement of a program of works that integrates strategic streetscaping and street calming.

Action 3.6: The GLC, with assistance from NPWS, will develop a policy that facilitates the effective enforcement of CA Act.

Action 3.7: The NPWS and GLC will coordinate exisiting programs to appropriately manage feral dogs and dingoes in the wider Hawks Nest and tea Gardens area.

The actions contained within this object refer to prioritisation of areas for active management based on Koala habitat mapping. No detailed habitat mapping within the local area has been completed to date. It is identified that Swamp Sclerophyll communities in north Hawks Nest are essential to the existence of the endangered population. A large amount of the Swamp Sclerophyll Forest present within the subject site will be retained as part of the proposal. The small proportion to be removed is degraded and has low habitat value.

The recovery actions also refer to the development of survey and assessment guidelines for the endangered population. No survey and assessment guidelines are currently available.

The recovery actions also refer to identification of black spots and traffic calming and street scape initiatives. Traffic management and road design has been addressed within the Koala Management Strategy prepared for the proposal.

The Koala Management Strategy also addresses companion animal management as referred to in the recovery plan actions of this objective.

Objective 4: To incorporate Koala conservation into planning processes

Action 4.1: The NPWS will recommend to GLC that identified Koala habitat be appropriately zoned to maximise its long-term protection.

Action 4.2: Further to Action 4.1, the NPWS will ensure that public authorities, relevant landholders and land managers are aware of the long-term protection measures available to assist in the conservation of the Hawks Nest and Tea Gardens population.

Action 4.3: The NPWS will provide information to the Bush Fire Management Committee (BFMC) in the Hawks Nest and Tea Gardens area to encourage consideration of Koalas and Koala habitat in the preparation and implementation of Bush Fire Risk Management Plans and Plans of Operations.

Action 4.4: The GLC will consider threatened species, populations and ecological communities in their habitat in the preparation and implementation of Plans of Management for Council owned and managed land and reserves. Specific emphasis would include the management

of resources for the Hawks Nest Tea Gardens Koala population on Council owned and managed lands.

Action 4.5: The NPWS will consider threatened species, populations and ecological communities and their habitat in the preparation and implementation of Plans of Management for Myall Lakes National Park, including Yacaada Head.

The actions within this objective refer to the appropriate zoning of suitable Koala habitat within the local area. The majority of the site is zoned 2(f) Mixed Residential/Commercial. This area is proposed for the development. The conservation zoned areas (7a Wetlands and 7b Buffer) will be retained as part of the proposal. Other actions refer to bushfire management and Council and NPWS managed lands.

Objective 5: To rehabilitate and restore Koala habitat in the Hawks Nest and Tea Gardens area

Action 5.1: The KWG will provide advice on appropriate habitat rehabilitation and restoration activities at priority sites identified through Action 2.1 to individuals, community groups and government agencies. The NPWS will support rehabilitation efforts where resources are available.

The actions within this objective refer to the Koala Working Group providing advice on appropriate rehabilitation and restoration activities of at priority sites identified through Koala habitat mapping. The proposal is not inconsistent with this objective and action. The proposal includes the protection and restoration of retained areas containing Koala habitat.

Objective 6: To ensure the broader community has access to information about the distribution, conservation and management of Koalas

Action 6.1: A database will be established by the KWG to maintain records of Koalas in the Hawks Nest and Tea Gardens area.

Action 6.2: The NPWS, in consultation with GLC, will develop and implement a broad scale education and awareness strategy.

The Koala Management Strategy prepared for the site includes information on Community education and Koala welfare programs. The proposal is consistent with this objective and its actions.

Objective 7: To manage sick, injured or orphaned Koalas with a consistent and high standard of care

Action 7.1: The KWG will facilitate information exchange to ensure that wildlife rehabilitation groups in the Hawks Nest and Tea Gardens area remain informed about the Koala recovery process and advances in Koala care and rehabilitation.

Action 7.2: The KWG will liaise with local wildlife rehabilitation groups to identify appropriate locations for the release of rehabilitated Koalas that cannot be released at point of capture. The KWG will encourage wildlife rehabilitation groups to consult with the NPWS prior to the relocation of rehabilitated Koalas.

The Koala Management Strategy prepared for the site includes information on Community education and Koala welfare programs. The proposal is consistent with this objective and its actions.

The following matters are addressed as identified in Appendix 3 of the Guidelines for Threatened Species Assessments – Draft (DEC & DPI 2005) in relation to threatened species, endangered populations and endangered ecological communities.

i) Does the Proposal Affect any Threatened Species or Populations at the Limit of their known distribution

No threatened species or endangered ecological communities are at the limit of their known distribution in the locality of the subject site. As such the proposal is not likely to affect any threatened species or endangered ecological communities at the limits of their known distribution.

ii) How is the Proposal likely to affect current disturbance regimes

The site has been historically cleared for grazing and for pine plantations. Large areas of the site have had the understorey and tree cover removed and groundlayer altered as part of grazing use and previous forestry practices. The more highly disturbed areas have been mapped as Open Forest (*Angophora costata/Corymbia gummifera*), Open Forest (*Corymbia gummifera*), Open Forest (*Eucalyptus microcorys*), Open Forest (*Eucalyptus pilularis*), Woodland (*Eucalyptus resinifera*), Woodland/Open Forest (*Eucalyptus robusta*) and Pine Forest (*Pinus ellioti*).

The development footprint will be restricted to the currently disturbed vegetation types. While disturbance will ultimately increase as a result of the removal of vegetation for the construction of the development, the disturbance regime will decrease within those areas to be retained. The retained vegetation will have areas restored and managed in the long term as part of the proposal. These areas include SEPP 14 Wetlands, Conservation zoned lands, Asset Protection Zones and buffers, wildlife corridors and drainage corridors. The proposal includes the restoration of currently disturbed corridor areas within the development.

Edge effects are likely to occur at the interface between the development and retained vegetation. Vegetation management strategies and protocols will be established to control and minimise any potential edge effect as detailed in the Ecological Site Management Strategy. Thee establishment of Asset Protection Zones and buffers will aid in buffering the effects of development upon adjacent retained vegetation.

It is not considered that the proposal will alter fire frequencies within the site. The implementation of best practice erosion and sediment controls during construction and occupation will control impacts associated with runoff to lower lying Swamp Forest, Closed Heath and wetland vegetation communities and habitats associated with the Myall River.

Iii) How is the Proposal likely to affect Habitat Connectivity

The subject site is boarded to the west by the Tea Gardens Road, disturbed grasslands with scattered trees, industrial and residential development; to the south, by predominately existing residential and commercial development; to the east, by the Myall River; and to the north, by a

mixture of open forest vegetation communities, areas of isolated residential development and agricultural lands.

The majority of the vegetation of the site forms a mosaic of highly disturbed grasslands with scattered trees and woodland/open forest communities. However, the eastern portion of the subject site is dominated by a large remnant of naturally vegetated Swamp Forests, Heaths and Estuarine vegetation communities associated with the low lying areas adjoining the Myall River. This remnant is largely isolated to the south by existing residential development and the Tea Gardens township and to the north by an area of cleared agricultural land.
The land beyond the northern boundary of the subject site is largely dominated by a mixture of open forest vegetation communities and areas of isolated residential development. There exists some marginal connectivity between the sites eastern remnant vegetation and the areas of remnant open forest to the north, via a mosaic of disturbed woodland and open forest vegetation communities occupying the north eastern areas of the site. However these vegetation communities provide only limited terrestrial connectivity as the have been significantly impacted by a history of agricultural use and grazing, resulting in a sparse understorey layer.

The development proposes the retention of the higher quality less disturbed vegetation types within the subject site. These vegetation types are located along the western bank of the Myall River and consist of wetland variant vegetation communities. The retention of these vegetation types will retain any current north-south connectivity through the site.

The proposal also includes key components of wildlife and drainage corridors within and through the development areas. The retention and restoration of these corridors will serve the purpose of providing threatened species habitat and movement of fauna through the site.

The Wildlife Corridors areas have been provided to retain connectivity within the post development landscape and provision of any fauna movement through the area. These consist of a north-west running corridor in the east of the site and an east-west running corridor at the northern boundary of the site. These areas will allow movement through the site to greater areas of habitat to the north, particularly for arboreal and terrestrial fauna species. These areas will also provide a lesser open space/recreational role.

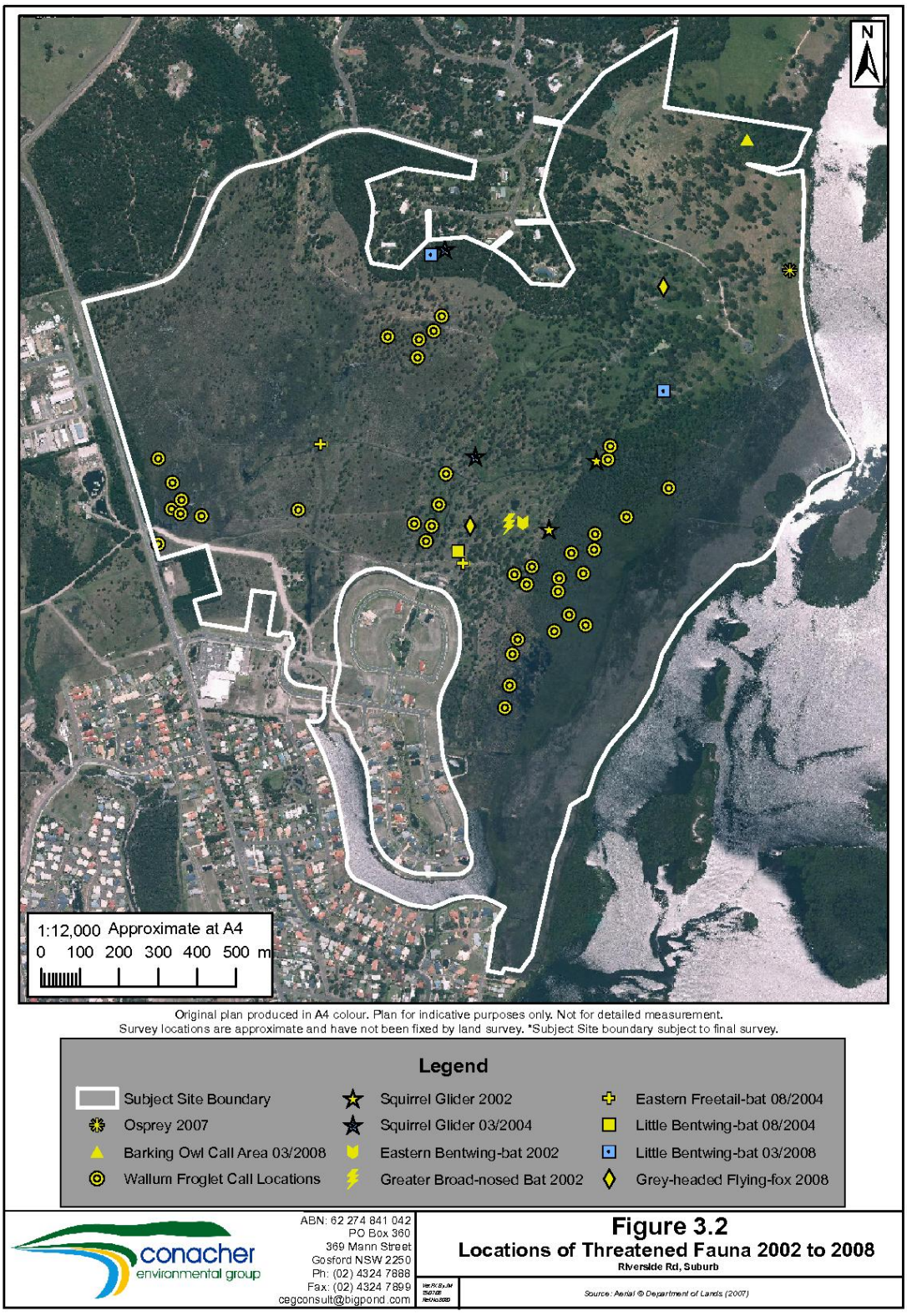
Areas have also been set aside for water/drainage management. These areas will also serve a function in providing landscape linkage and providing habitat for semi-aquatic species within the site, particularly amphibian species. These areas will also provide a lesser open space/recreational role.

The ecological management strategies to be established within the site have been developed to alleviate and ameliorate for any partial fragmentation likely as a result of the proposal.

It is considered that the retained vegetation and habitats are of sufficient size and quality to support the long term viability of threatened species and endangered ecological communities known to occur within the site.

iv) How is the Proposal likely to affect critical habitat

No critical habitat relevant to these endangered ecological communities is declared under the *TSC Act 1995* within the subject site.


N
1:12,000 Approximate at A4
0 100 200 300 400 500 m
Original plan produced in A4 colour. Plan for indicative purposes only. Not for detailed measurement.
Survey locations are approximate and have not been fixed by land survey. *Subject Site boundary subject to final survey.
Legend
Subject Site Boundary
Osprey 2007
Barking Owl Call Area 03/2008
Wallum Froglet Call Locations
Squirrel Glider 2002
Squirrel Glider 03/2004
Eastern Bentwing-bat 2002
Greater Broad-nosed Bat 2002
Eastern Freetail-bat 08/2004
Little Bentwing-bat 08/2004
Little Bentwing-bat 03/2008
Grey-headed Flying-fox 2008
conacher environmental group
ABN: 62 274 841 042
PO Box 360
369 Mann Street
Gosford NSW 2250
Ph: (02) 4324 7888
Fax: (02) 4324 7899
cegconsult@bigpond.com
Figure 3.2
Locations of Threatened Fauna 2002 to 2008
Riverside Rd, Suburb
Source: Aerial © Department of Lands (2007)

SECTION 4

THREATENED BIODIVERSITY IMPROVE OR MAINTAIN ASSESSMENT

4.1 BACKGROUND

The following threatened flora and fauna species and endangered ecological communities assessment relies on the ecological assessment provided in Sections 2 and 3 of this report and the flora and fauna details provided within Appendices. The assessment has been prepared in accordance with the *DRAFT Guidelines for Threatened Species Assessment* (DEC & DPI 2005) and in accordance with Part 3A of the *Environmental Planning and Assessment Act* (1979).

The proposal has incorporated a range of measures addressing the improvement, maintenance and retention of biodiversity values of the site. A detailed assessment of the proposal in relation to the concept of 'improve or maintain' biodiversity values is provided in within this Report.

A range of components of biodiversity have been assessed in relation to whether the proposal will improve or maintain the relevant biodiversity component. The following biodiversity components have been assessed.

1) Biodiversity outcomes in relation to land use and land conservation;
2) Flora biodiversity components
   - Vegetation Communities;
   - Endangered Ecological Communities.
3) Fauna biodiversity components
   - Threatened Fauna Species habitat;
   - Fauna habitat;
   - Hollow bearing trees.
4) Habitat Linkages/Connectivity
5) Mechanisms to achieve biodiversity outcomes.

The following criteria has been used to assess the potential impacts of the Riverside at Tea Gardens Concept Plan on threatened fauna species and endangered ecological communities recorded within the subject site or considered to have potential to occur within the subject site due to known local occurrence.

- Existing area of vegetation or habitat (ha)
- Area of vegetation or habitat to be removed (ha)
- Area of vegetation or habitat to be retained/restored/offset (ha)

The following information is provided to address the impacts of the proposed development on threatened f fauna species and endangered ecological communities. Assessments have been prepared for those threatened species recorded within the subject site during surveys and those recorded recently within local area studies and considered to utilise habitats within the subject site, at least on an occasional basis, due to the presence of suitable habitat.

4.2 CONSIDERATION OF IMPROVEMENT OR MAINTENANCE OF BIODIVERSITY VALUES

4.2.1 Background

An assessment of the proposal in relation to improving or maintaining biodiversity values has been identified in the requirements for the Environmental Study.

The improve or maintain approach has been identified in documentation supporting various acts (eg. *Native Vegetation Act, Environmental Planning and Assessment Act* or *Threatened Species Conservation Act*. For example DECC (2007) identify some matters that should be included in improve or maintain assessments for Biodiversity Certification of Environmental Planning Instruments. However at this stage there are no formal or established quantification methods or procedures to measure prospective gains and losses in biodiversity values.

This particular project (Riverside) is not being assessed for biodiversity certification of the environmental planning instrument at this stage. However the completion of the improve or maintain assessment following similar procedures recently implemented for the Wyong Employment Zone Rezoning (Wyong Shire Council 2007) and Warnervale Town Centre Rezoning for the Department of Planning and Department of Environment and Climate Change (Ecological 2008) would be appropriate for this proposal as they are recent examples accepted by DECC and the Department of Planning. These two relevant case studies have identified the following components for inclusion in an 'improve or maintain' assessment:

1. Biodiversity outcomes for the proposal eg. land to be included in reserves, riparian corridors, public recreation areas etc.
2. Flora criteria for assessment:
    - Vegetation Communities;
    - Threatened Flora Species;
    - Endangered Ecological Communities.
3. Fauna criteria for assessment:
    - Fauna habitats types;
    - Threatened Fauna;
    - Habitat Trees.
4. Habitat Linkages/Connectivity;
5. Offset areas (offsite areas);
6. Mechanisms to achieve biodiversity outcomes eg. Ecological Management Plans, Water Cycle Management, Strategy Habitat Enhancement, Vegetation Management.

The biodiversity outcomes incorporated into the proposal are assessed in relation to improve or maintain in the following sections.

4.2.2. Land Use/Conservation Area Outcomes

The site is currently held in private ownership. The future development will be undertaken as a community title development with the undeveloped areas to be retained within the community title. Management of these areas will be undertaken in accordance with the Ecological Site Management Plan which is to be incorporated into the Community Management Statement.

The areas incorporated into various components of land conservation and site development areas are provided in Table 4.1.

TABLE 4.1 LANDUSE/LAND CONSERVATION – IMPROVE OR MAINTAIN		
LAND USE/CONSERVATION CATEGORY	**AREA INCLUDED IN CATEGORY (HA)**	**% OF TOTAL SITE AREA**
Wetlands Conservation 7(a) Zone	28.4	12.4%
Conservation 7(b) Zone	22.0	9.5%
Corridor (Currently residential zone)	27.3	11.8%
Drainage Corridors	35.1	15.3%
Open Space Areas & Park	10.2	4.5%
Lake Area	7	3.1%
Proposed Development Area	99.3	43.4%
TOTAL SITE AREA	**229ha**	

Biodiversity Outcome: Approximately 77.7 hectares (33.7%) of the site will be retained in conservation areas or areas protected in the wildlife corridor. A further 45.3 hectares (19.8%) of the site will comprise of green space, in the form of drainage corridors and parks, which will supplement the conservation areas.

4.2.3 Flora Criteria for Assessment

Vegetation Communities

The extent of vegetation communities within the site in relation to proposed conservation or removal for development is provided in Table 4.2.

TABLE 4.2 VEGETATION COMMUNITIES IMPROVE OR MAINTAIN					
Vegetation Community No.	**Biodiversity Component Vegetation Community**	**Existing Area of Vegetation (ha)**	**Area Subject to Development (Removal or Modification) (ha)**	**Area Improve or Maintain (ha)**	**Biodiversity Outcome**
1	Pasture with Scattered Trees	51.4	33.8	17.6	34.2% Maintained
2	Acacia / Melaleuca Regrowth Scrub	2.0	0	2.0	100% Maintained
3	Open Forest (*Corymbia gummifera*)	11.0	11.0	0	0% Maintained
4	Open Forest (*Corymbia maculata, Eucalyptus paniculata*)	7.9	0.1	7.8	98.7% Maintained
5	Open Forest (*Eucalyptus microcorys*)	8.6	2.1	6.5	75.6% Maintained
6	Open Forest (*Eucalyptus pilularis*)	11.5	6.6	4.9	42.6% Maintained
7	Woodland (*Eucalyptus resinifera*)	52.9	49.9	3.0	5.7% Maintained
8○	Woodland / Open Forest (*Eucalyptus robusta*)	37.4	21.0	16.4	43.9% Maintained
9	Woodland (*Eucalyptus signata*)	1.1	1.1	0	0% Maintained
10	Woodland / Open Forest (*Eucalyptus umbra*)	2.6	0.1	2.5	96.2% Maintained
11	Pine Forest (*Pinus eliottii*)	0.3	0.1	0.2	66.7% Maintained
12×	Disturbed Estuarine Vegetation	0.2	0.0	0.2	100% Maintained
13×	Casuarina Forest (*Casuarina glauca*)	1.2	0.0	1.2	100% Maintained
14∇	Mangroves (*Avicennia marina*)	0.3	0.0	0.3	100% Maintained
15∇	Saltmarsh (*Juncus krausii*)	17.2	0.018	17.182	99.8% Maintained
16∇	Rushland (*Baumea juncea*)	7.7	0.0	7.7	100% Maintained

TABLE 4.2 (Cont.) VEGETATION COMMUNITIES IMPROVE OR MAINTAIN					
Vegetation Community No.	**Biodiversity Component Vegetation Community**	**Existing Area of Vegetation (ha)**	**Area Subject to Development (Removal or Modification) (ha)**	**Area Improve or Maintain (ha)**	**Biodiversity Outcome**
17○	Scrub (*Melaleuca ericifolia*)	9.5	0.01	9.49	99% Maintained
18○	Paperbark Forest (*Melaleuca quinquenervia*)	1.5	0.0	1.5	100% Maintained
TOTAL VEGETATED AREA		**224.3**	**125.828**	**98.472**	**43.9% Maintained**

∇ - denotes vegetation community commensurate with Coastal Saltmarsh EEC
○ - denotes vegetation community commensurate with Swamp Sclerophyll Forest on Coastal Floodplains EEC
✖ - denotes vegetation community commensurate with Swamp Oak Floodplain Forest EEC

Biodiversity Outcome: Components of almost all vegetation communities will be retained throughout the site. The Open Forest (*Corymbia gummifera*) and Woodland (*Eucalyptus signata*) will be completely removed or modified. It must be noted however that modification within each of these communities includes retention within managed parklands or asset protection areas, thus components of each of these communities will be retained in a modified condition.

The vegetation communities with highest biodiversity values, that is those with the least amount of disturbance and higher habitat qualities will be retained and protected within the development area within those area zoned for conservation and within retained corridor and restoration areas.

TABLE 4.3 GROUNDCOVER VEGETATION– IMPROVE OR MAINTAIN					
Biodiversity Component Groundcover	**Habitat Disturbance**	**Total Area (ha)**	**Area Subject to Development (ha)**	**Area Improve or Maintain (ha)**	**Biodiversity Outcome**
Improved Pasture with Scattered Trees	High	107.2	76.6	30.6	28.5% Improved
Regenerating Heath	Moderate	48.7	48.7	0	0% Retained
Intact Native Shrub and groundcover	Low	68.4	0.1	68.3	99.85% Maintained
TOTAL AREA (ha)		**224.3**	**125.4**	**98.4**	**43.9% Maintained/Improved**

Biodiversity Outcome: The development area will predominately be located in the areas of the site which have been cleared and utilized for timber and agricultural production. Approximately 68.3ha (99.85% of the vegetation with intact native vegetation with low habitat disturbance) will be maintained in Conservation Zones and wildlife corridor. An area of approximately 30.6 hectares (28.5% of the improved pasture areas with scattered trees) will be retained and incorporated into areas subject to habitat and vegetation enhancement to improve the biodiversity value of this disturbed vegetation overall 98.4 hectares (43.9%) of the vegetated areas will be maintained or improved.

Threatened Flora Species

No threatened flora species have been identified within the subject site. There are habitats present within the site for a number of locally occurring threatened flora species which will be incorporated into conservation areas of corridor areas. These areas will generally comprise the vegetation communities with intact shrub and groundlayer stratums which have been identified as being within the low disturbance category.

Biodiversity Outcome:
Retention and protection of potential area for several threatened flora species known to occur locally even though these species have not been identified within the subject site.

Endangered Ecological Communities (Flora)

Three endangered ecological communities are present within the subject site. Their removal or retention within the subject site is detailed within Table 4.4.

TABLE 4.4
ENDANGERED ECOLOGICAL COMMUNITY IMPROVE OR MAINTAIN

Biodiversity Component	Total Area (ha)	Area Subject to Development (Removal or Modification) (ha)	Area Improve or Maintain (ha)	Biodiversity Outcome
Coastal Saltmarsh	25.2	0.018	25.182	99.9% Maintained
Swamp Oak Floodplain Forest	1.4	0	1.4	100% Maintained
Swamp Sclerophyll Forest on Coastal Floodplains	48.4	21	27.4	56.6% Maintained
TOTAL AREA (ha)	**75**	**21.1**	**53.9**	**71.8% Maintained**

Biodiversity Outcome: The proposal will result in the retention, protection and restoration of 71.8% of the areas occupied by these EEC's within the site. Approximately 21 hectares of EEC, Swamp Sclerophyll Forest on Coastal Floodplains and Coastal Saltmarsh will be removed as part of the development area or modified within parklands, asset protection areas or other managed lands.

4.2.4 Fauna Criteria for Assessment

Fauna Habitat Types

The fauna habitat type is generally based on vegetation communities present with further considerations given to the presence or absence of native ground and shrub layer species, ground cover habitat (logs, dense undergrowth etc) and the presence of hollow bearing trees. Table 4.5 outlines the areas of fauna habitat within the site using vegetation community groups as surrogate values for suitable habitat. Wallum Froglet habitat has been determined from both ground vegetation cover and micro-topography, which influences temporary ponding and inundation within the site.

Threatened Fauna

Eleven threatened fauna species have been observed on the site during the various surveys completed. For the improve or maintain assessment for the threatened fauna species known to occur general habitat types have been grouped according to the major vegetation groups within the site. These are Terrestrial Woodland and Forest Communities, Wetland Fringing Woodland and Forest Communities and Wetland Communities.

Table 4.5 also provides details on the improve or maintain assessment for threatened fauna species.

TABLE 4.5
FAUNA HABITATS AND THREATENED FAUNA – IMPROVE OR MAINTAIN

Threatened Species	Total Area Suitable Habitat	Area Subject to Development (ha)	Area Improve or Maintain (ha)	Biodiversity Outcome
Osprey	1.7	0	1.7	100% retention
Swift Parrot	97.7	56.9	40.8	41.7% retention
Barking Owl	132.1	75.8	56.5	42.7% retention
Powerful Owl	132.1	75.8	56.5	42.7% retention
Masked Owl	132.1	75.8	56.5	42.7% retention
Koala	131.6	75.8	60.8	42.4% retention
Squirrel Glider	92.7	42.0	69.7	54.7% retention
Wallum Froglet	37.2	13.4	23.8	73.6% retention
Eastern Pygmy Possum	91.6	40.9	66.7	55.3% retained
Spotted-tailed Quoll	91.6	40.9	66.7	55.3% retained
Grey-headed Flying-fox/ Common Blossom-bat	186.5	125.7	66.2	32.6% retained
Microchiropteran Bat Species	222.2	125.8	96.2	43.5% retained

Biodiversity Outcome: The less disturbed vegetation communities (Wetland Fringing Woodland and Forests, Wetlands) with higher habitat values are afforded a higher level of retention and protection. The development will require the removal or modification of higher proportions of threatened species habitats within the more disturbed terrestrial open forest and woodland communities.

The development will result in the retention of 23% of the terrestrial communities, 55% of the wetland fringing communities and 99% of the wetland communities.

Hollow Bearing Trees

Hollow bearing trees will be removed from most areas to be developed unless they can be classified as safe for retention by a qualified arborist. For the improve or maintain assessment hollow bearing trees have been assessed as removed if they occur in proposed development areas.

The total number of hollow bearing trees present is likely to exceed the numbers identified on the site during surveys as not all of the areas to be retained were surveyed in detail for hollow bearing trees due to access problems through the dense vegetation and other access issues.

TABLE 4.6
HOLLOW BEARING TREES– IMPROVE OR MAINTAIN

Biodiversity Component	Hollow Bearing Trees Observed	Hollow Bearing Trees in Development Area	Hollow Bearing Trees in Conservation area	Biodiversity Outcome
Hollow Bearing Trees	90	48	42	46% Retained

Biodiversity Outcome: Approximately 46% of the hollow bearing trees observed are to be retained. Additional trees not yet surveyed are also likely to occur in areas retained. Replacements for the loss of tree hollows should be incorporated into areas of retained trees. As replacement for hollow bearing tree removal nest boxes should be incorporated into the retained trees to offset for the loss of hollow bearing trees (at approximately 3 to 1 replacement ratio). The Ecological Site Management Strategy contains full details of the nest box replacement program.

4.2.5 Endangered Ecological Communities

Vegetation mapping of the subject site identified three endangered ecological communities as occurring within the subject site. These are:

- Coastal Saltmarsh
- Swamp Oak Floodplain Forest
- Swamp Sclerophyll Forest on Coastal Floodplains

Coastal Saltmarsh
This community occurs in the NSW North Coast, Sydney Basin and South East Corner bioregions. This ecological community occurs in the intertidal zone on the shores of estuaries and lagoons along the NSW coast.

Large areas of this community were observed within the subject site associated with supratidal and tidal flats along the western boundary of the Myall River. Two vegetation communities mapped within the subject site are considered to be representative of the endangered ecological community, Coastal Saltmarsh, these were, Rushland (*Baumea juncea*) and Saltmarsh (*Juncus kraussii*).

TABLE 4.7
ENDANGERED ECOLOGICAL COMMUNITY REMOVAL AND OFFSET DETAILS – COASTAL SALTMARSH

Potential Habitat Type	Current Extent of Suitable Habitat within Vegetation Community (Ha)	Amount to be Retained (Ha)	Amount to be Modified (Ha)	Amount to be Removed (Ha)
Saltmarsh (*Juncus krausii*)	17.2	17.182	0.0182	0.05
Mangroves (*Avicennia marina*)	0.3	0.3	0	0
Rushland (*Baumea juncea*)	7.7	7.7	0	0
TOTAL	**25.2**	**25.182**	**0.0182**	**0.05**

The vegetation assessment has determined that the endangered ecological community Coastal Saltmarsh is present within the subject site, corresponding with the mapped Rushland (*Baumea juncea*), Mangrove (*Avicennia marina*) and Saltmarsh (*Juncus kraussii*) vegetation communities. These communities have been mapped as occupying approximately 25.2 hectares within the subject site, predominantly along the low lying areas and intertidal/estuarine flats associated with the Myall River. Within the region, approximately 2,115 ha of vegetation have been mapped as Coastal Saltmarsh (Great Lakes Shire Council 2003).

Approximately 0.018ha of Coastal Saltmarsh will be removed or modified as part of the proposal to widen the channel outlet of the lake. Approximately 25.1 hectares of Coastal Saltmarsh will be retained and protected as part of the site specific ecological management strategies proposed for the site.

Swamp Oak Floodplain Forest

This ecological community is associated with grey-black clay-loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines. The most dominant canopy species of Swamp Oak Floodplain Forest is *Casuarina glauca.*

This community occurs in a small area of the subject adjacent to the Myall River and has been mapped as Casuarina Forest (*Casuarina glauca*). This vegetation community comprises essentially monospecific stands of *Casuarina glauca*, mostly growing on dredge spoil along the river's edge.

TABLE 4.8 ENDANGERED ECOLOGICAL COMMUNITY REMOVAL AND OFFSET DETAILS – SWAMP OAK FLOODPLAIN FOREST				
Potential Habitat Type	**Current Extent of Suitable Habitat within Vegetation Community (Ha)**	**Amount to be Retained (Ha)**	**Amount to be Modified (Ha)**	**Amount to be Removed (Ha)**
Disturbed Estuarine Vegetation	0.2	0.2	0.0	0.0
Casuarina Forest (*Casuarina glauca*)	1.2	1.2	0.0	0.0
TOTAL	1.4	1.4	0.0	0.0

The endangered ecological community Swamp Oak Floodplain Forest occupies approximately 1.4 hectares within the subject site. The mapped vegetation community Casuarina Forest (*Casuarina glauca*) is a highly disturbed regrowth variant of this EEC. The development does not propose the removal of any of the community. Approximately 1.4 hectares will be retained and restored as part of site specific vegetation management and offset strategies.

Swamp Sclerophyll Forest on Coastal Floodplains

This ecological community is associated with humic clay loams and sandy loams on waterlogged or periodically inundated alluvial flats and drainage lines of coastal floodplains. The most widespread canopy species of Swamp Sclerophyll Forest on Coastal Floodplains include: *Eucalyptus robusta, Melaleuca quinquenervia* and *eucalyptus botryoides.* Other prominent species are *Callistemon salignus, Casuarina glauca*, *Eucalyptus resinifera subsp. hemilampra, Livistona australis,* and *Lophostemon suaveolens.*

A number of species that characterise this EEC were observed throughout the study area within the Scrub (*Melaleuca ericifolia*), Paparbark Forest (*Melaleuca quinquinervia*) and Woodland/Open Forest *(Eucalyptus robusta*) vegetation communities. However, the majority of the subject sites underlying geomorphology has been identified as an aeolian deposited sandplain (Murphy 1995, 1997) and has also been mapped as containing the Tea Gardens Soil Landscape (Murphy 1995), which is described as an aeolian deposit. Coastal areas of poorly drained sandplains are geomorphologically distinct from the characteristically fertile alluvial floodplain deposits, uniquely associated with these floodplain EEC's.

Keith and Scott (2005) identified a number of distinct coastal Swamp Forest vegetation communities occupying the NSW coastal lowlands, and found Swamp Sclerophyll Forest on Coastal Sandplains to be floristically distinct from the endangered ecological community, Swamp Sclerophyll Forest on Coastal Floodplains.

TABLE 4.9 ENDANGERED ECOLOGICAL COMMUNITY REMOVAL AND OFFSET DETAILS – SWAMP SCLEROPHYLL FOREST ON COASTAL FLODDPLAINS				
Potential Habitat Type	**Current Extent of Suitable Habitat within Vegetation Community (Ha)**	**Amount to be Retained (Ha)**	**Amount to be Modified (Ha)**	**Amount to be Removed (Ha)**
Scrub (*Melaleuca ericifolia)*	9.5	9.49	0.0	0.01
Paperbark Forest *(Melaleuca quinquenervia)*	1.5	1.5	0.0	0.0
Woodland / Open Forest (*Eucalyptus robusta)*	37.4	16.4	8.9	12.1
TOTAL	**48.4**	**27.39**	**8.9**	**12.11**

The endangered ecological community Swamp Sclerophyll Forest on Coastal Floodplains occupies approximately 48.4 hectares within the subject site. Approximately 8.9 hectares will be modified and 12.1 hectares removed as part of the proposal. Approximately 27.4 hectares of this EEC will be retained, restored and protected as part of site specific vegetation and habitat management offset strategies.

Based on vegetation surveys, habitat and assessment and occurrence of endangered ecological communities within the local area it is considered that the proposal is unlikely to have an adverse impact on the extent of these ecological communities such that its local occurrence is likely to be placed at risk of extinction.

4.2.6 Habitat Connectivity and Enhancement

The subject site is bordered to the west by the Myall Road, disturbed grasslands with scattered trees, industrial and residential development; to the south, by predominately existing residential and commercial development; to the east, by the Myall River; and to the north, by a mixture of open forest vegetation communities, areas of isolated residential development and agricultural lands.

The majority of the vegetation of the site forms a mosaic of highly disturbed pastureland with scattered trees and woodland/open forest communities. However, the eastern portion of the subject site is dominated by remnants of naturally vegetated Swamp Forests, Heaths and Estuarine vegetation communities associated with the low lying areas adjoining the Myall River. This remnant is separated to the south by existing residential development and the Tea Gardens township and to the north by an area of cleared agricultural land.

The land beyond the northern boundary of the subject site is dominated by a mixture of open forest vegetation communities, areas of isolated rural-residential development and cleared agricultural lands. Some marginal connectivity exists between the sites eastern remnant vegetation and the areas of remnant open forest to the north, via a mosaic of disturbed woodland and open forest vegetation communities occupying the north eastern areas of the site. However these vegetation communities provide only limited terrestrial connectivity as the have been significantly impacted by a history of agricultural use and grazing, resulting in a sparse understorey layer.

The development proposes the retention of the higher quality less disturbed vegetation types within the subject site. These vegetation types are located along the western bank of the Myall River and consist of wetland and swamp forest vegetation communities. The retention of these vegetation types will retain any current north-south connectivity through the site.

The proposal also includes key components of wildlife and drainage corridors within and through the development areas (Figure 4.1). The retention and restoration of these corridors will enhance connectivity of threatened species habitat through the site.

The corridor areas have been provided to retain connectivity within the post development landscape and provide for fauna movement through the area. These consist of a north-west running corridor in the east of the site and an east-west running corridor at the northern boundary of the site. These areas will allow movement through the site to greater areas of habitat to the north, particularly for arboreal and terrestrial fauna species. These areas will also provide a lesser open space/recreational role.

Areas have also been set aside for water/drainage management. These areas will also serve a function in providing landscape linkage and providing habitat for semi-aquatic species within the site, particularly amphibian species. These areas will also provide a lesser open space/recreational role.

The ecological management strategies to be established within the site have been developed to alleviate and ameliorate for any partial fragmentation likely as a result of the proposal.

It is considered that the retained vegetation and habitats are of sufficient size and quality to support the long term viability of threatened species and endangered ecological communities known to occur within the site.

4.2.7 Aquatic Estuarine Fish Habitat

Additional area of aquatic estuarine fish habitat will be created by the extension of the western core of the lake system in a northward direction. This will increase the area of available aquatic estuarine habitat to be approximately 2 hectares. Additionally some aquatic habitat enhancements to create additional fish refuge and foraging habitat will be implemented in accordance with the recommendations of the Fish Community Survey Report by Harris Research (2007). A summary of the Aquatic Estuarine Habitat improve or maintain assessment is provided in Table 4.10.

TABLE 4.10
AQUATIC ESTUARINE FISH HABITAT – IMPROVE OR MAINTAIN

Biodiversity Component	Area of Habitat	Habitat Removed	Habitat Created
Lake Area	9.7ha	Nil	2 ha
Lake Edge	2000m	Nil	500m

The area of the existing lake system (9.7ha) comprises a shoreline of approximately 2000 metres which is comprised of a mixture of sand spits, vegetated edges and shallow water. A

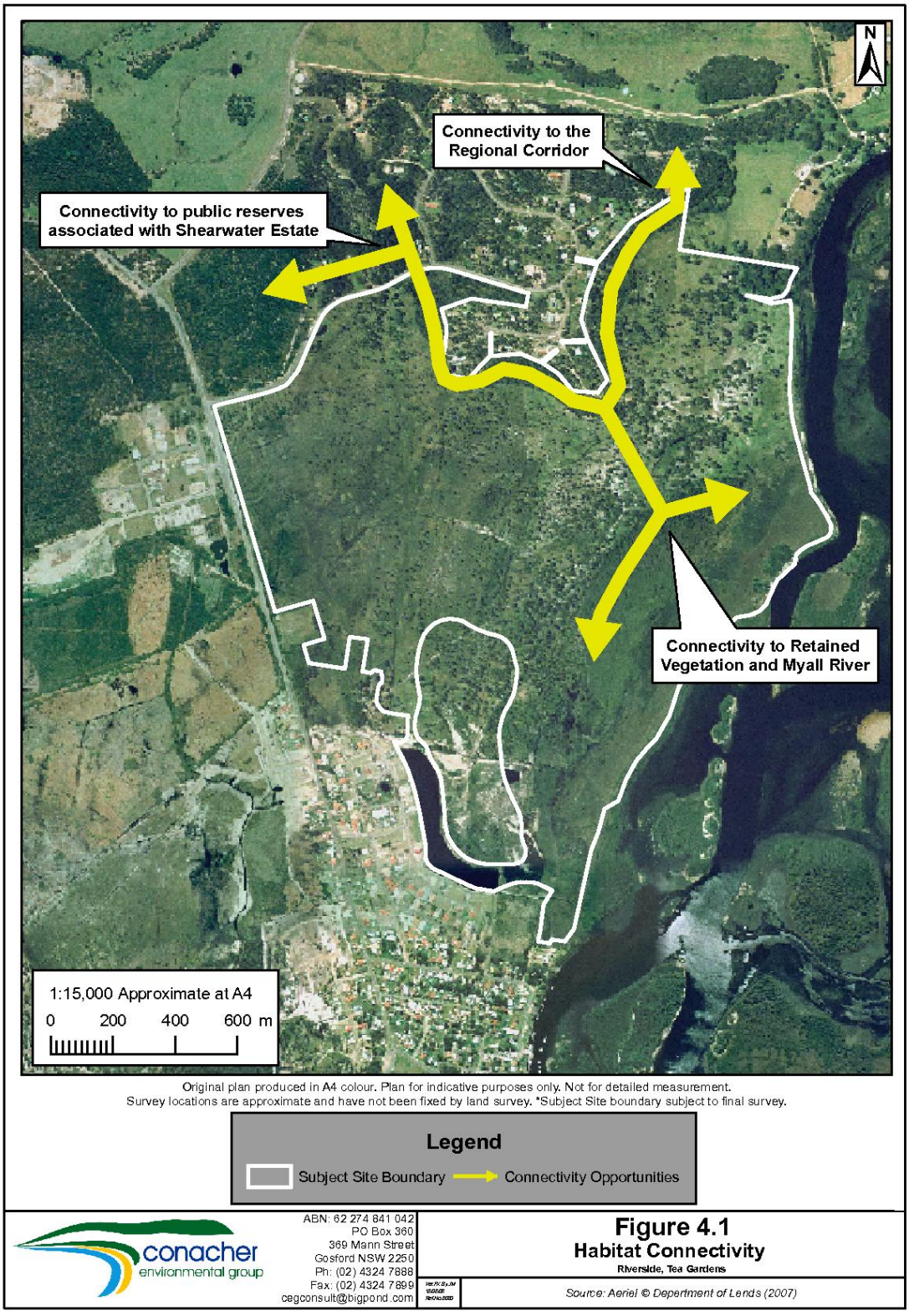
total of 15 different fish species have been recorded in the lake since fish surveys commenced in 1998. Eleven species of fish were recorded in the 2007 survey (Harris Research 2007).

The proposed extensions to the lake system will increase the overall area by 2 hectares (21% increase) with an additional 500 metres of shoreline habitat created (25% increase). Habitat improvement in the form of additional submerged refuge habitat areas (submerged logs, rocks or artificial reefs).

4.2.8 Mechanisms to Achieve Biodiversity Outcomes

The following mechanisms are proposed to improve and maintain the biodiversity within the retained vegetation and fauna habitats of the site.

- Strategic design so as to confine development to highly disturbed areas with lower habitat and biodiversity values.
- Retention of those less disturbed areas with higher habitat and biodiversity values.
- Strategic design measures to include protection and restoration of local corridor and other movement areas to facilitate continuity of habitat within the site and the local landscape.
- Preparation and implementation of Environmental Site Management Strategy and Vegetation Management Plans for areas of retained vegetation.
- Preparation and Implementation of integrated water management systems.
- Implementation of habitat enhancement measures as identified in the Environmental Site Management Strategy.


N
Connectivity to the Regional Corridor
Connectivity to public reserves associated with Shearwater Estate
Connectivity to Retained Vegetation and Myall River
1:15,000 Approximate at A4
0 200 400 600 m
Original plan produced in A4 colour. Plan for indicative purposes only. Not for detailed measurement.
Survey locations are approximate and have not been fixed by land survey. *Subject Site boundary subject to final survey.
Legend
Subject Site Boundary
Connectivity Opportunities
conacher environmental group
ABN: 62 274 841 042
PO Box 360
369 Mann Street
Gosford NSW 2250
Ph: (02) 4324 7888
Fax: (02) 4324 7899
cegconsult@bigpond.com
Figure 4.1
Habitat Connectivity
Riverside, Tea Gardens
Source: Aerial © Department of Lands (2007)

SECTION 5

CONCLUSION

5.1 DOES THE PROPOSAL AFFECT ANY THREATENED SPECIES OR POPULATIONS AT THE LIMIT OF THEIR KNOWN DISTRIBUTION

No threatened species or endangered ecological communities are at the limit of their known distribution in the locality of the subject site. As such the proposal is not likely to affect any threatened species or endangered ecological communities at the limits of their known distribution.

5.2 HOW IS THE PROPOSAL LIKELY TO AFFECT CURRENT DISTURBANCE REGIMES

The site has been historically cleared for grazing and for pine plantations. Large areas of the site have had the understorey and tree cover removed and groundlayer altered as part of grazing use and previous forestry practices. The more highly disturbed areas have been mapped as Open Forest (*Angophora costata/Corymbia gummifera*) (36.9ha), Open Forest (*Corymbia gummifera*) (9.3ha), Open Forest (*Eucalyptus microcorys*) (9.8ha), Open Forest (*Eucalyptus pilularis*) (15.3ha), Woodland (*Eucalyptus resinifera*) (60.9ha), Woodland/Open Forest (*Eucalyptus robusta*) (37.8ha) and Pine Forest (*Pinus ellioti*) (1ha).

The development footprint will be restricted to the currently disturbed vegetation types. While disturbance will ultimately increase as a result of the removal of vegetation for the construction of the development, the disturbance regime will decrease within those areas to be retained. The retained vegetation will have areas restored and managed in the long term as part of the proposal. These areas include SEPP 14 Wetlands, Conservation zoned lands, Asset Protection Zones and buffers, wildlife corridors and drainage corridors. The proposal includes the restoration of currently disturbed corridor areas within the development.

Edge effects are likely to occur at the interface between the development and retained vegetation. Vegetation management strategies and protocols will be established to control and minimise any potential edge effect as detailed in the Ecological Site Management Strategy. Thee establishment of Asset Protection Zones and buffers will aid in buffering the effects of development upon adjacent retained vegetation.

It is not considered that the proposal will alter fire frequencies within the site. The implementation of best practice erosion and sediment controls during construction and occupation will control impacts associated with runoff to lower lying Swamp Forest, Closed Heath and wetland vegetation communities and habitats associated with the Myall River.

5.3 HOW IS THE PROPOSAL LIKELY TO AFFECT HABITAT CONNECTIVITY

The subject site is boarded to the west by the Tea Gardens Road, disturbed grasslands with scattered trees, industrial and residential development; to the south, by predominately existing residential and commercial development; to the east, by the Myall River; and to the north, by a mixture of open forest vegetation communities, areas of isolated residential development and agricultural lands.

The majority of the vegetation of the site forms a mosaic of highly disturbed grasslands with scattered trees and woodland/open forest communities. However, the eastern portion of the subject site is dominated by a large remnant of naturally vegetated Swamp Forests, Heaths and Estuarine vegetation communities associated with the low lying areas adjoining the Myall River. This remnant is largely isolated to the south by existing residential development and the Tea Gardens township and to the north by an area of cleared agricultural land.

The land beyond the northern boundary of the subject site is largely dominated by a mixture of open forest vegetation communities and areas of isolated residential development. There exists some marginal connectivity between the sites eastern remnant vegetation and the areas of remnant open forest to the north, via a mosaic of disturbed woodland and open forest vegetation communities occupying the north eastern areas of the site. However these vegetation communities provide only limited terrestrial connectivity as the have been significantly impacted by a history of agricultural use and grazing, resulting in a sparse understorey layer.

The development proposes the retention of the higher quality less disturbed vegetation types within the subject site. These vegetation types are located along the western bank of the Myall River and consist of wetland variant vegetation communities. The retention of these vegetation types will retain any current north-south connectivity through the site.

The proposal also includes key components of wildlife and drainage corridors within and through the development areas. The retention and restoration of these corridors will serve the purpose of providing threatened species habitat and movement of fauna through the site.

The Wildlife Corridors areas have been provided to retain connectivity within the post development landscape and provision of any fauna movement through the area. These consist of a north-west running corridor in the east of the site and an east-west running corridor at the northern boundary of the site. These areas will allow movement through the site to greater areas of habitat to the north, particularly for arboreal and terrestrial fauna species. These areas will also provide a lesser open space/recreational role.

Areas have also been set aside for water/drainage management. These areas will also serve a function in providing landscape linkage and providing habitat for semi-aquatic species within the site, particularly amphibian species. These areas will also provide a lesser open space/recreational role.

The ecological management strategies to be established within the site have been developed to alleviate and ameliorate for any partial fragmentation likely as a result of the proposal.

It is considered that the retained vegetation and habitats are of sufficient size and quality to support the long term viability of threatened species and endangered ecological communities known to occur within the site.

5.4 HOW IS THE PROPOSAL LIKELY TO AFFECT CRITICAL HABITATS

No critical habitat relevant to these endangered ecological communities is declared under the *TSC Act 1995* within the subject site.

5.5 CONCLUDING COMMENTS

Based on the detailed field survey and information provided in this report it is concluded that:

In relation to the *Threatened Species Conservation Act* (1995)

i) No threatened flora species or endangered populations were observed within the subject site.

ii) Eleven threatened fauna species, the Wallum Froglet, Osprey, Barking Owl, Squirrel Glider, Koala, Grey-headed Flying-fox, Common Blossom-bat, Eastern Bentwing-bat, Little Bentwing-bat, Eastern Freetail-bat and Greater Broad-nosed Bat, as listed within the *TSC Act,* were observed within the subject site during surveys. A number of other fauna species including the Black-necked Stork, Powerful Owl, Masked Owl, Eastern Chestnut Mouse, Eastern Pygmy-possum, and Large-footed Myotis have been recorded as part of other studies completed within the Tea Gardens area.

iii) Three endangered ecological communities were observed within the subject site. These are Coastal Saltmarsh, Swamp Sclerophyll Forest on Coastal Floodplains and Swamp Oak Floodplain Forest.

In relation to the Environment Protection and Biodiversity Conservation Act (1999)

i) No threatened flora or fauna species, endangered population or endangered ecological communities were observed within the subject site. It is considered that a referral of this project to the Department of Environment, Water, Heritage and the Arts is not required.

The proposal will require the removal of vegetation and habitats for the construction of residential and commercial facilities and related infrastructure. Based on the concept masterplan the development will require the removal or modification of approximately 125.9 ha of vegetation (including 33.8ha of pasture land). Approximately 98.4ha of vegetation will be retained, protected and restored as part of the site offset and ecological management strategies.

The proposal includes an Ecological Site Management Strategy that details the site specific strategies for minimising and controlling impacts within the site. This includes information on:

- Vegetation and Bushland Management;
- Bushfire Management;
- Fauna and Habitat Management;
- Provision and Establishment of Environmental Corridors;
- Provision of Environmental Buffers;
- Erosion and Sediment Control;
- Stormwater Quality and Management;
- Cultural Values and Management;
- Community Education, Vigilance and Reporting;
- Access, Signage and Fencing;

- Prohibited Use Identification and Management;
- Feral Pest Species;
- Monitoring and Reporting Regime.

A Koala Management Strategy has also been prepared for the site detailing strategies for the protection and restoration of Koalas and their habitats within the site.

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APPENDIX 1

FLORA AND FAUNA SURVEY REPORT

FLORA AND FAUNA SURVEY REPORT

RIVERSIDE
TEA GARDENS

AUGUST 2008
(REF: 8020)

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FLORA AND FAUNA SURVEY REPORT

RIVERSIDE
TEA GARDENS

AUGUST 2008

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PREFACE

This Flora and Fauna Survey Report has been prepared by *Conacher Environmental Group* to identify the flora and fauna characteristics of the subject site.

This Report provides information regarding existing habitats and the potential for the proposed development to impact on these existing habitats.

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SECTION 1

BACKGROUND INFORMATION

1.1 INTRODUCTION

This Flora and Fauna Survey Report has been prepared by *Conacher Environmental Group* to identify the flora and fauna characteristics and to address various ecological matters relating to the proposed development of the property known as Riverside at Tea Gardens..

1.2 THREATENED FLORA SPECIES

A search of the Atlas of NSW Wildlife (NPWS 2008) was undertaken to identify records of threatened flora species located within 10km of the site. In addition to the species listed within the Atlas of NSW Wildlife database, threatened species listed in the botanic gardens records, species identified by NPWS (2008) and local area records have been included for consideration. These species are listed in Table 1.1. This analysis enabled the preparation of a list of threatened flora species that could possibly occur within the habitats found within the subject site, and therefore could be targeted for observation during flora surveys.

TABLE 1.1
RECORDED AND POTENTIAL THREATENED FLORA SPECIES OF THE AREA

BOTANICAL NAME	PREFERRED HABITAT	COMMENTS	TSC ACT	EPBC ACT
Allocasuarina defungens	A straggly shrub to 2m tall. Grows mainly in tall heath on sand, but may also occur on clay and sandstone soils. Occurs in coastal NSW between Nabiac in the south and Byron Bay in the north (NPWS 2002).	No suitable habitat is present. Not observed during floristic survey.	E1	E
Allocasuarina simulans	Dioecious shrub 1-3m. Grows in heath on sand from Nabiac to Forster (Harden 1990).	No suitable habitat is present. Not observed during floristic survey.	V	V
Asperula asthenes	Decumbent perennial herb, trailing to 30cm. Grows in damp sites along river banks from Taree to Bulahdelah.	Sub-optimal habitat is present. Not observed during floristic survey.	V	V
Callistemon linearifolius	Shrub to 4m high. Grows in Sclerophyll Forest in moist gullies on coast and adjacent ranges, Nelson Bay to Georges River.	No suitable habitat is present. Not observed during floristic survey.	V	-
Chamaesyce psammogeton	Prostrate herb. Coastal dunes. Distribution limits N- Tweed Heads S- Jervis Bay.	No suitable habitat is present. Not observed during floristic survey.	E1	-

TABLE 1.1 (Cont.) RECORDED AND POTNTIAL THREATENED FLORA SPECIES OF THE AREA				
BOTANICAL NAME	**PREFERRED HABITAT**	**COMMENTS**	**TSC ACT**	**EPBC ACT**
Cryptostylis hunteriana	Saprophytic terrestrial orchid lacking leaves and with an erect inflorescence to 45cm. Grows in swamp-heath and woodland associated with *Themeda australis* on sandy soils, chiefly in coastal districts from Grafton to Eden. Ku-ring-gai Chase NP (population unknown).	Suitable habitat present. Not observed during floristic survey.	V	V
Cynanchum elegans	Climber or twiner to 1 m. Grows in rainforest gullies, scrub & scree slopes. Distribution limits N – Gloucester S – Wollongong.	No suitable habitat is present. Not observed during floristic survey.	E	E
Dillwynia tenuifolia	Erect shrub 0.6-1 m high. Grows in Woodlands and Open Forest on sandstone shale or laterite. Distribution limits N - Howes Valley S - Cumberland Plain.	No suitable habitat is present. Not observed during floristic survey.	V	V
Diuris arenaria	A tuberous terrestrial orchid with mauve to light purple flowers. Grows in heathy dry sclerophyll forest in association with Themeda australis. From Nelson Bay to Tomago. Flowers Aug – Sept.	No suitable habitat is present. Not observed during floristic survey.	E1	-
Diuris praecox	Terrestrial orchid that grows in open forests of coastal and near coastal districts, from Ourimbah to Nelson Bay. Flowers July to September. Tomaree NP (population unknown), Glenrock SRA (population unknown), Munmorah SRA (population unknown).	No suitable habitat is present. Not observed during floristic survey.	V	V
Eucalyptus glaucina	Tree to 30m growing in grassy woodland on deep, moderately fertile and well-watered soil. Distribution near Casino and from Taree to Broke.	Suitable habitat is present. Not observed during floristic survey.	V	V
Eucalyptus parramattensis ssp. decadens	Tree to 15m, bark smooth grey-pinkish, sheds in large flakes or plates, fruit >7mm dia. Grows in dry sclerophyll woodland on sandy soils in low often wet sites. Tomago to Kurri Kurri.	Suitable habitat is present. Not observed during floristic survey.	V	V

TABLE 1.1 (Cont.) RECORDED AND POTNTIAL THREATENED FLORA SPECIES OF THE AREA				
BOTANICAL NAME	**PREFERRED HABITAT**	**COMMENTS**	**TSC ACT**	**EPBC ACT**
Galium australe	A straggling and inter-twining herb found in moist gullies of tall forest, *Eucalyptus tereticornis* forest, coastal Banksia shrubland and *Allocasuarina nana* heathland. Known from the near Bega, Lake Yarrunga near Kangaroo Valley, Cullendulla Creek Nature Reserve near Batemans Bay, Conjola National Park, Swan Lake near Swanhaven, and the Big Hole in Deua National Park. The species also occurs beside Lake Windemere in the Australian Capital Territory at Jervis Bay. There is also an outlying record to the north from near Byabarra on the north coast.	Suitable habitat is present. Not observed during floristic survey.	E	-
Grevillia guthrieana	Shrub 1.5-2m high. Grows in sandstone-derived loams and granite on creek lines in moist eucalypt forest and cliff lines, restricted to the Booral-Bulahdelah and Carrai Plateau area.	No suitable habitat is present. Not observed during floristic survey.	E	E
Lindernia alsinoides	A small herb. Grows in poorly drained areas and low lying coastal floodplains between Taree and Bulahdelah.	Suitable habitat is present. Not observed during floristic survey.	E	-
Maundia triglochinoides	A perennial rhizomatous herb growing in swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients. Flowers Nov to Jan. Is associated with wetland species. Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct.	Suitable habitat is present. Not observed during floristic survey.	V	-
Melaleuca biconvexa	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. Distribution limits N – Port Macquarie S – Jervis Bay.	Suitable habitat is present. Not observed during floristic survey.	V	V

TABLE 1.1 (Cont.) RECORDED AND POTNTIAL THREATENED FLORA SPECIES OF THE AREA				
BOTANICAL NAME	**PREFERRED HABITAT**	**COMMENTS**	**TSC ACT**	**EPBC ACT**
Melaleuca groveana	Shrub or small tree 2-5m tall and rarely 10m tall with fibrous paperbark. Grows in heath often in exposed areas within higher areas and the coastal districts north of Port Stephens.	No suitable habitat is present. Not observed during floristic survey.	V	-
Persicaria elatior	An erect herb to 90cm tall growing in damp places especially beside streams and lakes, and occasionally in swamp forest or associated with disturbance. Found in SE NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests).	Suitable habitat is present. Not observed during floristic survey.	V	V
Pomaderris queenslandica	A medium shrub 2 to 3m high. Grows in moist eucalypt forests and occasionally along creeks. Located from the Upper hunter, Mt Danger, Gloucester, Wingham and Kempsey districts in lower NE NSW.	No suitable habitat is present. Not observed during floristic survey.	E1	-
Prostanthera densa	An erect, often compact shrub 0.5-2m tall. Grows in open forests and shrubland on coastal headlands and near coastal ranges chiefly on sandstone. Found from Nelson Bay to Beecroft Peninsular.	No suitable habitat is present. Not observed during floristic survey.	V	V
Prostanthera marifolia	Low straggling shrub to 1m. Grows in sclerophyll forest and woodland, usually near the coast, in sandy loamy soils, on sandstone; Mangrove Mt. and Sydney districts.	No suitable habitat is present. Not observed during floristic survey.	PE	PE
Rhizanthella slateri	Underground orchid, with flowers maturing below the soil surface or extending 2cm above. Grows in sclerophyll forest in shallow to deep loams. Accurate distribution not known, recorded from the Blue Mts., also Bulahdelah south to Dharug N.P.	Suitable habitat is present. Not observed during floristic survey.	V	

TABLE 1.1 (Cont.) RECORDED AND POTNTIAL THREATENED FLORA SPECIES OF THE AREA				
BOTANICAL NAME	**PREFERRED HABITAT**	**COMMENTS**	**TSC ACT**	**EPBC ACT**
Senna acclinis	A shrub to 3m tall. Grows in or adjacent to subtropical and dry rainforest. Occurs in coastal districts and adjacent tablelands from Bulahdelah in the south to Qld (NPSW 2002).	No suitable habitat is present. Not observed during floristic survey.	E1	-
Syzygium paniculatum	Shrub or small tree to 8m tall with flaky bark. Found in subtropical and littoral rainforests on sandy soils or sheltered gullies, especially near watercourses between Bulahdelah and Jervis Bay. Wamberal Lagoon Nature Reserve (<1,000 plants), Jervis Bay NP (<1,000 plants), Wyrrabalong NP (<1,000 plants).	Suitable habitat is present. Not observed during floristic survey.	V	V
Tetratheca juncea	Prostrate shrub to 1m tall. Stems flattened with reduced leaves. This species has a grass-like appearance. Grows in sandy or swampy soils in heathland, woodlands and open forest from Bulahdelah to Lake Macquarie. Glenrock SRA (>1,000 plants), Awabakal Nature Reserve (<1,000 plants), Munmorah SRA (<1,000 plants), Lake Macquarie SRA Green Point Foreshore Park.	Suitable habitat is present. Not observed during floristic survey.	V	V
Thesium australe	A small herb to 40cm tall. Grows in grassland or grassy eucalypt woodland in association with Themeda australis. Occurs on grassy headlands on the coast, is widespread but uncommon in eastern Australia from Vic. To south-east Qld (NPWS 2002).	Suitable habitat is present. Not observed during floristic survey.	V	V
Tylophora woolsii	Slender twiner, ovate to broad ovate leaves. Grows in wet sclerophyll forest and rainforest in the Clouds Creek area near Nymboida and in sclerophyll forest near Parramatta.	No suitable habitat is present. Not observed during floristic survey.	E	E
Zannichellia palustris	Submerged herb. Fresh or slightly saline stationary or slow-flowing water. Distribution limits N - Tweed Heads S - Newcastle.	No suitable habitat is present. Not observed during floristic survey.	E1	-
Note: No records of *Galium australe*, *Maundia triglochinoides* and *Persicaria elatior* were identified within 10km of the subject site by the DECC Atlas of NSW Wildlife (2008), but have been included in this assessment under the recommendation of the Department of Environment and Climate Change.				

1.3 THREATENED FAUNA SPECIES

A search of the Atlas of NSW Wildlife (NPWS 2008) was undertaken to identify records of threatened fauna located within 10 kilometres of the subject site. This identified a number of threatened species that may be present in the area.

Details on those threatened fauna species recorded as occurring within the local area are provided in Table 1.2. Comments are also provided on the suitability of habitat within the subject site for each of those threatened species, and their presence or absence within the subject site based on the results of recent and past surveys.

TABLE 1.2
RECORDED AND POTENTIAL THREATENED FAUNA OF THE AREA

COMMON NAME *Scientific Name*	**TSC Act**	**EPBC Act**	**PREFERRED HABITAT**	**COMMENTS**
Wallum Froglet *Crinia tinnula*	V	-	Found in acidic paperbark swamps and wallum country with dense groundcover. Breeds in temporary and permanent pools and ponds of high acidity. Distribution Limit- N-Tweed Heads S-Tumbi Umbi	Suitable breeding and foraging habitat present. Observed during surveys.
Green Thighed Frog *Litoria brevipalmata*	V	-	Found in rainforests and open forests within or at the edge of streams, swamps, lagoons, dams and ponds. Distribution Limit - N-Border Ranges National Park. S-Near Gosford	Suitable breeding and foraging habitat present. Not observed during surveys.
Green and Golden Bell Frog *Litoria aurea*	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. Distribution Limit - N-Byron Bay. S-South of Eden	Suitable breeding and foraging habitat present. Not observed during surveys.
Stephens' Banded Snake *Hoplocephalus stephensii*	V	-	A nocturnal and partly arboreal species that inhabits open and closed forest communities sheltering under bark, in hollows and under exfoliating slabs of granite. Distribution Limit- N-Border Ranges National Park S-Gosford.	Suitable breeding, refuge and foraging habitat present. Not observed during surveys.
Magpie Goose *Anseranas semipalmata*	V	-	A strongly nomadic species found in tropical through to sub-tropical wetlands, flood plains, large swamps, dams and wet grasslands with dense growths of rushes and sedges. Distribution Limit - N-Tweed Heads. S-Mulwala.	Suitable foraging habitat present. Not observed during surveys.
Black Bittern *Ixobrychus flavicollis*	V	-	Freshwater & brackish streams & ponds. Distribution Limit - N-Tweed Heads. S-South of Eden.	No suitable habitat present.
Comb-crested Jacana *Irediparra gallinacea*	V	-	Deep and permanent vegetation-choked tropical and warm temperate wetlands. Distribution Limit - N-Tweed Heads. S - Ku-ring-gai Chase National Park.	No suitable habitat present.

TABLE 1.2 (Cont.) RECORDED AND POTENTIAL THREATENED FAUNA OF THE AREA				
COMMON NAME *Scientific Name*	**TSC Act**	**EPBC Act**	**PREFERRED HABITAT**	**COMMENTS**
Painted Snipe *Rostratula benghalensis*	V	-	Within marshes and freshwater wetlands with swampy vegetation. Distribution Limit- N-Tweed Heads S-South of Eden	Suitable habitat present. Not observed during surveys.
Black-necked Stork *Ephippiorhynchus asiaticus*	E	-	Occurs in tropical to warm temperate terrestrial wetlands, estuarine and littoral habitats. Distribution Limit - N-Tweed Heads. S-Nowra.	Suitable foraging habitat present. Not observed during surveys.
Sooty Oystercatcher *Haematopus fuliginosus*	V	-	Exclusively coastal in distribution foraging along rocky coastlines and estuaries. Distribution Limit- N-Tweed Heads S-South of Eden.	Suitable habitat present along Myall River flats. Not observed during surveys.
Pied Oystercatcher *Haematopus longirostris*	V	-	Inhabits coastal beaches and estuarine flats. Distribution Limit N-Tweed Heads S-South of Eden.	Suitable habitat present along Myall River flats. Not observed during surveys.
Little Tern *Sterna albifrons*	E	-	An almost exclusively coastal species inhabiting open beaches, sheltered inlets, estuaries and occasionally lakes. Distribution Limit-N-North of Tweed Heads. S-South of Eden.	Suitable habitat present along Myall River flats. Not observed during surveys.
Osprey Pandion haliaetus	V	-	Utilises waterbodies including coastal waters, inlets, lakes, estuaries and offshore islands with a dead tree for perching and feeding. Distribution Limit - N-Tweed Heads. S-South of Eden	Sub optimal roosting habitat present. Known nesting within local area. Observed during surveys.
Square-tailed Kite *Lophoictinia isura*	V	-	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds. Distribution Limit - N-Goondiwindi. S-South of Eden.	Suitable foraging and roosting habitat present. Not observed during surveys.
Bush Stone-curlew *Burhinus grallarius*	E	-	Utilises open forests, savannah woodlands, dune scrub, savannah and mangrove fringes. Distribution Limit- N-Border Ranges National Park S- Near Nowra	Suitable foraging and roosting habitat present. Not observed during surveys.
Wompoo Fruit Dove *Ptilinopus magnificus*	V	-	Inhabits large undisturbed patches of lowland, adjacent highland rainforest and moist eucalypt forests feeding on fruit. Distribution Limit-N-Tweed Heads. S-Sydney	Suitable habitat present. Not observed during surveys.
Rose-crowned Fruit-dove *Ptilinopus regina*	V	-	Occurs in dense rainforests with a substantial understorey where it feeds entirely on fruit. Distribution Limit - N-Tweed Heads. S-Wollongong.	Suitable habitat present. Not observed during surveys.

TABLE 1.2 (Cont.) RECORDED AND POTENTIAL THREATENED FAUNA OF THE AREA				
COMMON NAME *Scientific Name*	**TSC Act**	**EPBC Act**	**PREFERRED HABITAT**	**COMMENTS**
Superb Fruit-Dove *Ptilinopus superbus*	V	-	Rainforests, adjacent mangroves, eucalypt forests, scrublands with native fruits. Distribution Limit - N-Border Ranges National Park. S-Bateman's Bay	Suitable habitat present. Not observed during surveys.
Glossy Black - Cockatoo *Calyptorhynchus lathami*	V	-	Open forests with *Allocasuarina* species and hollows for nesting. Distribution Limit- N-Tweed Heads. S-South of Eden	Suitable habitat present. Not observed during surveys.
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	-	Prefers wetter forests and woodlands from sea level to > 2000m on Divide, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. Distribution Limit –mid north coast of NSW to western Victoria	Suitable habitat present. Not observed during surveys.
Swift Parrot Lathamus discolor	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. Distribution Limit - N-Border Ranges National Park. S-South of Eden	Suitable foraging habitat present. Not observed during surveys.
Turquoise Parrot Neophema pulchella	V	-	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands. Distribution Limit - N-Near Tenterfield. S-South of Eden	Suitable foraging and roosting habitat present. Not observed during surveys..
Barking Owl *Ninox connivens*	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. Distribution Limits- N-Border Ranges National Park S-Eden	Suitable foraging and roosting habitat present. Observed during surveys.
Powerful Owl *Ninox strenua*	V	-	Forests containing mature trees for shelter or breeding and densely vegetated gullies for roosting. Distribution Limits- N-Border Ranges National Park. S-South of Eden	Suitable foraging and roosting habitat present on site. Observed within adjacent lands at Myall River Downs during surveys. Not observed during surveys.
Masked Owl *Tyto novaehollandiae*	V	-	Open forest and woodlands with cleared areas for hunting. Distribution Limit - N-Border Ranges National Park. S-Eden	Suitable foraging and roosting habitat present. Observed within adjacent lands at Myall River Downs during surveys.

TABLE 1.2 (Cont.) RECORDED AND POTENTIAL THREATENED FAUNA OF THE AREA				
COMMON NAME *Scientific Name*	**TSC Act**	**EPBC Act**	**PREFERRED HABITAT**	**COMMENTS**
Grass Owl *Tyto capensis*	V	-	Inhabits grassland, coastal heath and lignum swamps, sheltering in dense grass tussocks by day. Distribution Limit - N-Tweed Heads. S-Lithgow.	Suitable foraging and sub optimal roosting habitat present. Not observed during surveys.
Sooty Owl Tyto tenebricosa	V	-	Tall, dense, wet forests containing trees with very large hollows. Distribution Limit - N-Border Ranges National Park. S-South of Eden	Suitable foraging and sub optimal roosting habitat present. Not observed during surveys.
Regent Honeyeater Xanthomyza phrygia	E	E	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution Limit- N-Urbanville. S-Eden	Suitable foraging habitat present. Not observed during surveys..
Black-chinned Honeyeater Melithreptus gularis gularis	V	-	Found in woodlands containing box-ironbark associations and River Red Gums, also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence. Distribution Limit. N – Cape York pen. Qld. S – Victor H. Mt Lofty Ra & Flinders Ra. SA	Suitable foraging habitat present. Not observed during surveys..
Brown Treecreeper *Climacteris picumnus victoriae*	V	-	Occupies Eucalypt woodlands, open woodland lacking a dense understorey with fallen dead timber. Distribution Limit. (Sub species *victoriae)* Central NSW west of Great Div. Cumberland Plains, Hunter Valley, Richmond, Clarence, and Snowy River Valleys.	No suitable habitat present. Not observed during surveys.
Barred Cuckoo-shrike *Coracina lineata*	V	-	Inhabits warm temperate to tropical rainforest and their margins, feeding mainly on fruit. Distribution Limit - N-Tweed Heads. S-Manning River.	No suitable habitat present. Not observed during surveys.
Spotted-tailed Quoll *Dasyurus maculatus*	V	V	Dry and moist open forests containing rock caves, hollow logs or trees. Distribution Limit- N-Mt Warning National Park. S-South of Eden.	Suitable habitat present. Not observed during surveys.
Brush-tailed Phascogale *Phascogale tapoatafa*	V	-	A largely arboreal mammal of open forests and woodlands using hollows as nesting in hollow bearing trees. Distribution Limit- N-Border Ranges National Park. S-Eden.	Suitable foraging and shelter habitat present. Not observed during surveys.

TABLE 1.2 (Cont.) RECORDED AND POTENTIAL THREATENED FAUNA OF THE AREA				
COMMON NAME *Scientific Name*	**TSC Act**	**EPBC Act**	**PREFERRED HABITAT**	**COMMENTS**
Common Planigale *Planigale maculata*	V	-	Utilises a range of habitats including rainforest, dry open forest, grasslands and marshland with dense groundcover, a deep litter layer and log debris. Distribution Limit- N-Walgett S-Sydney.	Suitable foraging and shelter habitat present. Not observed during surveys.
Koala *Phascolarctos cinereus*	V	-	Inhabits both wet & dry eucalypt forest on high nutrient soils containing preferred feed trees. Distribution Limit- N-Tweed Heads S-South of Eden.	Suitable foraging and shelter habitat present. Observed during surveys.
Eastern Pygmy-possum *Cercatetus nanus*	V	-	Found in a variety of habitats from rainforest through open forest to heath. Feeds on insects but also gathers pollen from banksias, eucalypts and bottlebrushes. Nests in banksias and myrtaceous shrubs. Distribution Limit – N – Tweed Heads S – Eden.	Suitable foraging and shelter habitat present. Observed within adjacent lands during surveys. Not observed during surveys.
Yellow-bellied Glider *Petaurus australis*	V	-	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. Distribution Limit- N-Border Ranges National Park. S-South of Eden.	Suitable foraging and shelter habitat present. Not observed during surveys.
Squirrel Glider *Petaurus norfolcensis*	V	-	Mixed aged stands of eucalypt forest and woodlands including gum barked, high nectar producing species and hollow bearing trees. Distribution Limit - N-Lismore S-Albury	Suitable foraging and den habitat present. Observed during surveys.
Rufous Bettong *Aepyprymnus rufescens*	V	-	Generally found in dry, open woodland dominated by eucalypts preferring a virtual absence of scrub but with dense native grass cover. Distribution Limit - N-Border Ranges National Park. S-Newcastle.	Suitable foraging and shelter habitat present. Not observed during surveys.
Eastern Chestnut Mouse *Pseudomys gracilicaudatus*	V	-	Inhabits heathland including dense wet heath and swampy areas, occasionally in woodland with grassy understorey. Distribution Limit- N-Border Ranges National Park S-Brisbane Water National Park.	Suitable foraging and shelter habitat present. Observed within adjacent lands during surveys. Targeted Survey required.
Long-nosed Potoroo *Potorous tridactylus*	V	V	Coastal heath and dry and wet sclerophyll forests with a dense understorey. Distribution Limit - N-Mt Warning National Park. S-South of Eden.	Suitable habitat present within subject site. Not observed during surveys.

TABLE 1.2 (Cont.) RECORDED AND POTENTIAL THREATENED FAUNA OF THE AREA				
COMMON NAME *Scientific Name*	**TSC Act**	**EPBC Act**	**PREFERRED HABITAT**	**COMMENTS**
Common Blossom-bat *Syconycteris australis*	V	-	Roosts in dense foliage in rainforest and moist hardwood forests and forages for nectar and pollen in coastal forests and heaths. Distribution Limit - N-Tweed Heads. S-Foster	Suitable foraging habitat present within the subject site. Observed during surveys.
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. Distribution Limit – N – Tweed Heads S - Eden	Suitable foraging habitat present. Observed during surveys.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	-	Rainforests, sclerophyll forests and woodlands. Distribution Limit - N-North of Walgett. S-Sydney	Suitable foraging and roosting habitat present. Not observed during surveys.
Eastern Freetail-bat *Mormopterus norfolkensis*	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. Distribution Limit - N-Woodenbong. S-Pambula	Suitable foraging and roosting habitat present on site. Observed during surveys.
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. Distribution Limit - N-Border Ranges Nation Park. S-Wollongong	Suitable foraging and roosting habitat present. Not observed during surveys
Little Bentwing-bat *Miniopterus australis*	V	-	Roosts in caves, old buildings and tree hollows in the higher rainfall forests along the south coast of Australia. Distribution Limit- N-Border Ranges National Park. S-Sydney	Suitable foraging habitat present on site. Observed during surveys.
Eastern Bentwing-bat *Miniopterus schreibersii oceansis*	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well timbered areas. Distribution Limit- N-Border Ranges National Park. S-South of Eden	Suitable foraging habitat present. Observed during surveys..
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	-	Recorded roosting in caves, old buildings and tree hollows. Distribution Limit- N-Border Ranges National Park S-Pambula	Suitable foraging and roosting habitat present. Not observed during surveys.

TABLE 1.2 (Cont.) RECORDED AND POTENTIAL THREATENED FAUNA OF THE AREA				
COMMON NAME *Scientific Name*	**TSC Act**	**EPBC Act**	**PREFERRED HABITAT**	**COMMENTS**
Large-footed Myotis *Myotis adversus*	V	-	Rainforests and sclerophyll forests near creeks and lakes over which it feeds. Roosts in tree hollows, caves, mines and tunnels. Distribution Limit- N-Border Ranges Nation Park. S-South of Eden.	Suitable foraging and roosting habitat present. Observed during surveys.
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	Inhabits areas containing moist river & creek systems especially tree lined creeks. Distribution Limit- N-Border Ranges National Park. S-Pambula.	Suitable foraging and roosting habitat present. Observed during surveys.
E = Endangered Species V = Vulnerable Species				

1.4 ENDANGERED ECOLOGICAL COMMUNITIES

Descriptions and details on the diagnostic species and habitat requirements of ecological communities known to occur in the Great Lakes Local Government Area are provided below.

TABLE 1.3 ENDANGERED ECOLOGICAL COMMUNITIES WITHIN THE LOCAL AREA		
Name	**Habitat Requirements**	**Comments**
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions	Geology/soils: Coastal and estuarine sediment. Topography: Intertidal zone on the shores of estuaries and lagoons. Characteristic species: *Baumea juncea*, *Juncus krausii*, *Sarcocornia quinqueflora*, *Sporobolus virginicus*, *Triglochin striata*, *Isolepis nodosa*, *Samolus repens*, *Selliera radicans*, *Suaeda australis* and *Zoysia macrantha*	Present on-site. Characteristic species found. Requires survey and assessment. Corresponds to the following Vegetation Map Units: Winning – 2b and 2c
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions	Geology/soils: Sand dunes and soils derived from underlying rocks. Topography: Coastal sand dunes, hind dunes and head lands. Characteristic species: Predominantly rainforest species with emergent sclerophyll species such as *Angophora costata*, *Banksia integrifolia*, *Eucalyptus botryoides* and *Eucalyptus tereticornis*.	Not present on-site. Some emergent sclerophyll species present. Rainforest species not present in understorey.

TABLE 1.3 (Cont.) ENDANGERED ECOLOGICAL COMMUNITIES WITHIN THE LOCAL AREA		
Name	**Habitat Requirements**	**Comments**
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	Soils: Fine-grained sedimentary rocks. Topography: Coastal plains and plateaux, footslopes and foothills. Characteristic species: *Ficus* sp., *Argyrodendron trifoliolatum, Castanospermum australe, Dysoxylum muelleri, Archontophoenix cunninghamiana, Livistona australis, Dysoxylum fraserianum, Dendrocnide excels, Doryphora sassafras*, *Daphnandra micranthus, Toona cilliata, Drypetes australasica, Araucaria cunninghamii* and *Flindersia* spp.	Not present on-site. Characteristic species not observed on-site.
Lowland Rainforest on Floodplain in the NSW North Coast Bioregion	Soils: Fertile soils. Topography: Lowland river valleys. Characteristic species: *Ficus macrophylla*, *F. obliqua*, *F. watkinsiana*, *Archontophoenix cunninghamiana*, *Livistona australis*, *Grevillea robusta*, *Castanospermum australe* and *Syzygium australe*.	Not present on-site. Characteristic species not observed on-site.
Subtropical Coastal Floodplain Forest of the NSW North Coast Bioregion	Geology/soils: Clay-loams and sandy loams. Topography: Periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Characteristic Species: *Eucalyptus tereticornis, E. siderophloia, Corymbia intermedia, Lophostemon suaveolens, E. robusta, E. resinifera, E acmenoides, Callistemon spp* and *Melaleuca spp.*	Not present on-site. Most characteristic species not observed on-site
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	Geology/soils: Waterlogged or periodically inundated humic clay loams and sandy loams. Topography: Alluvial flats and drainage lines of coastal floodplains. Characteristic Species: *Eucalyptus robusta, Melaleuca quinquenervia* and *eucalyptus botryoides.*	Present on-site. Characteristic species found. Requires survey and assessment. Corresponds to the following Vegetation Map Units: Winning – 3a, 3b, 4a, 4b, 4c and 5a. CEG – 8.
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	Geology/soils: Silts, clay-loams and sandy loams. Topography: Periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Characteristic species: Eucalyptus tereticornis, E. amplifolia, E. botryoides, E. grandis, E. benthamii, Angophora floribunda, A. subvelutina, Melaleuca decora, M. stypheloides, Backhousia myrtifolia, Casuarina cunninghamiana and Casuarina glauca.	Not present on-site. Most characteristic species not observed on-site.

TABLE 1.3 (Cont.) ENDANGERED ECOLOGICAL COMMUNITIES WITHIN THE LOCAL AREA		
Name	**Habitat Requirements**	**Comments**
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions	Geology / Soils: Alluvial soils of fluvial or estuarine origin, with significant salinity. Topography: Flood plains in areas with saline soils and flats adjoining estuaries. Characteristic Species: *Casuarina glauca.*	Present on-site. Characteristic species found. Requires survey and assessment. Corresponds to the following Vegetation Map Units: Winning – 1b
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	Geology / Soils: Silts, muds or humic loams. Topography: in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. Characteristic Species: *Carex appressa, Paspalum distichum, Baumea articulata, Phylidrum lanuginosum, Ludwigia peploides ssp. montevidensis and Myriophyllum spp.*	Not present on-site. Characteristic species not observed on-site.

1.5 ENDANGERED POPULATIONS (FLORA)

There are no endangered flora populations within the local government area that require assessment for this proposal.

1.6 ENDANGERED POPULATIONS (FAUNA)

There are two Endangered Populations (Fauna) listed on Schedule 1, Part 2 of the *Threatened Species Conservation Act (1995)* that occur in the local area. These are the Hawks Nest and Tea Gardens Endangered Koala (*Phascolarctos cinereus*) Population and the Emu population in the NSW North Coast Bioregion and Port Stephens Local Government Area.

Emu population in the NSW North Coast Bioregion and Port Stephens Local Government Area
This population is distinct from other populations in the Sydney Basin and New England Tableland Bioregions. The population in the NSW North Coast Bioregion and Port Stephens LGA represents the north-eastern limit of the species in NSW. The majority of recent records are concentrated between Coffs Harbour and Ballina.

There are no records of this species on the Atlas of NSW Wildlife (DECC, 2008) within the local area. It is considered that the subject site contains sub-optimal habitat for the endangered population of Emus. This species was not observed on site or in adjacent areas and has not been observed by any site workers or ecologists. The site is fully fenced by stock exclusion fencing which would exclude emu access to the site.

Hawks Nest and Tea Gardens Population of the Koala

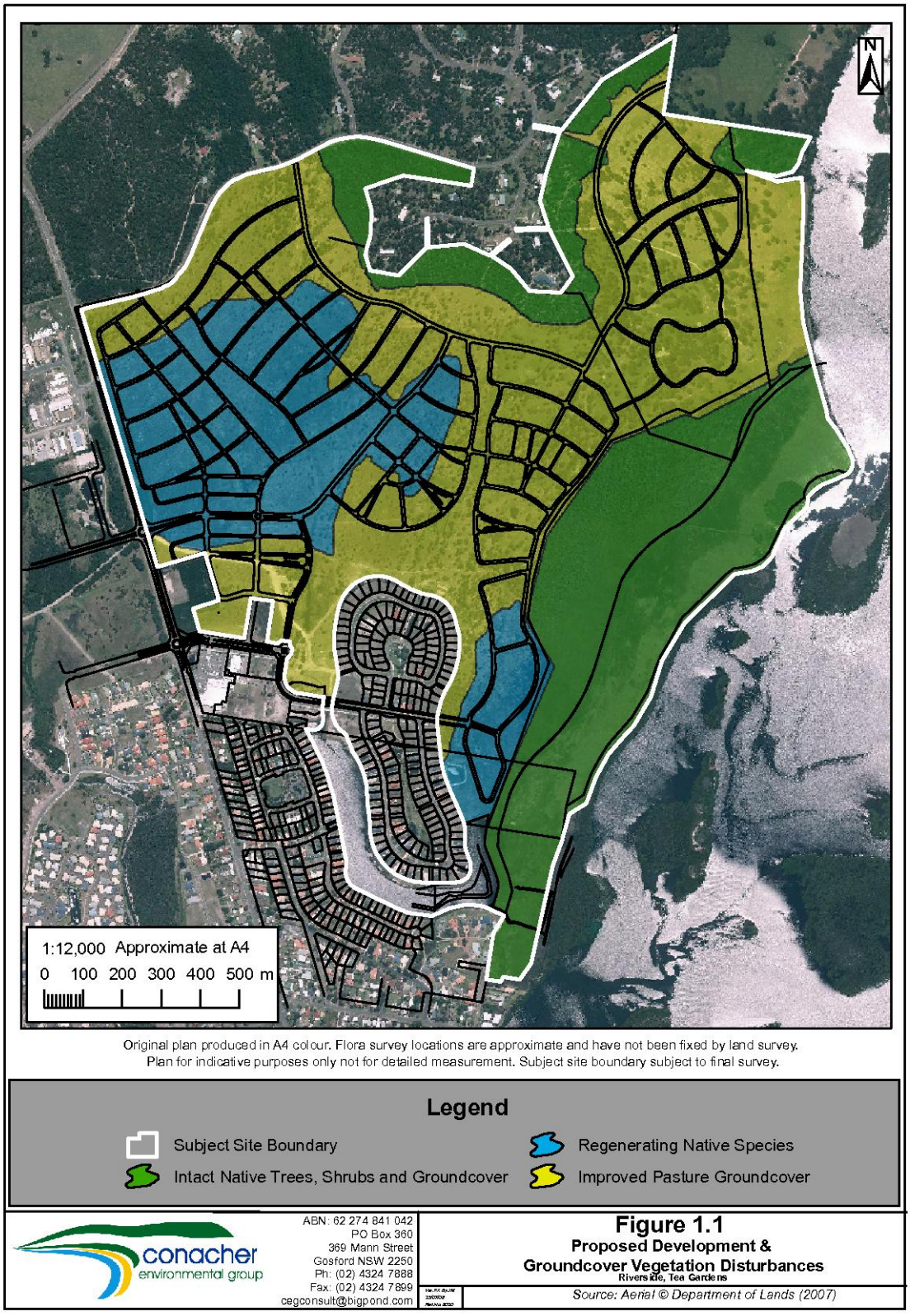
General Description
This population is reliably reported as occurring in Hawks Nest and Tea Gardens and in the immediate vicinity of these towns in the Great Lakes Local Government Area.

Habitat Requirements
Suitable vegetation containing koala Feed Tree species such as *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus punctata* (Grey Gum), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus microcorys* (Tallowwood), *Eucalyptus haemastoma* (Scribbly Gum), *Eucalyptus signata* (Scribbly Gum), *Eucalyptus viminalis* (Manna Gum), *Eucalyptus camaldulensis* (River Red Gum), *Eucalyptus albens* (White Box) and *Eucalyptus populnea* (Bimble Box).

Conservation Status and Distribution
In 1989 the population was thought to contain at least 21 individuals, but by 1998 the population had fallen to about 12 with 2 or 3 in the vicinity of Tea Gardens and the remainder in Hawks Nest and environs (NSW Scientific Committee, Aug 1999). This population of koalas extends in the south-east to the Yaccaba Headland and in the south-west to the peninsula west of Winda Woppa. The population is limited in the west and north-west to the outskirts of the built-up area of Tea Gardens including the Shearwater Estate, where it is bounded by Toonang Drive. The population is limited in the north to an east-west line three kilometres north of the northern boundary of the Hawks Nest Golf Course, although occasional sightings have been made outside these boundaries. The population is bounded in the south and east by the ocean (NSW Scientific Committee, Aug 1999).

Key Threatening Processes
Small population, continuing sub-division and associated clearing of food and habitat trees, road mortality and attacks by dogs.

Occurrence in Subject Site
Habitat requirements and food tree species that characterise habitat for the Hawks Nest and Tea Gardens population of the Koala were located on the subject site and adjacent lands.


N
1:12,000 Approximate at A4
0 100 200 300 400 500 m
Original plan produced in A4 colour. Flora survey locations are approximate and have not been fixed by land survey.
Plan for indicative purposes only not for detailed measurement. Subject site boundary subject to final survey.
Legend
Subject Site Boundary
Intact Native Trees, Shrubs and Groundcover
Regenerating Native Species
Improved Pasture Groundcover
conacher environmental group
ABN: 62 274 841 042
PO Box 360
369 Mann Street
Gosford NSW 2250
Ph: (02) 4324 7888
Fax: (02) 4324 7899
cegconsult@bigpond.com
Figure 1.1
Proposed Development &
Groundcover Vegetation Disturbances
Riverside, Tea Gardens
Source: Aerial © Department of Lands (2007)

SECTION 2

SURVEY METHODOLOGY

2.1 THREATENED FLORA AND FAUNA SPECIES

Following consideration of the threatened biodiversity known to occur locally and the types and suitability of the habitats present on the site a number of threatened flora and fauna species were identified as species requiring targeted survey and assessment, in addition to the general flora and fauna surveys to be completed.

Details of these threatened flora and fauna species and their local occurrences are provided in Table 2.1 and Table 2.2.

TABLE 2.1
THREATENED FLORA SPECIES WITH
SUITABLE HABITAT ON SUBJECT SITE

Species	Local Area Occurrence
Asperula astenes	There are no local records for this species.
Cryptostylis hunteriana	The Atlas of NSW Wildlife (NPWS 2008) has 2 records of this species within 10km of the subject site.
Eucalyptus glaucina	The Atlas of NSW Wildlife (NPWS 2008) has no records of this species within 10km of the subject site.
Eucalyptus parramattensis ssp. Decadens	The Atlas of NSW Wildlife (NPWS 2008) has 5 records of this species within 10km of the subject site.
Galium australe	The Atlas of NSW Wildlife (NPWS 2008) has no records of this species within 10km of the subject site.
Lindernia alsinoides	The Atlas of NSW Wildlife (NPWS 2008) has no records of this species within 10km of the subject site.
Maundia triglochinoides	The Atlas of NSW Wildlife (NPWS 2008) has no records of this species within 10km of the subject site.
Melaleuca biconvexa	The Atlas of NSW Wildlife (NPWS 2008) has no records of this species within 10km of the subject site.
Persicaria elatior	The Atlas of NSW Wildlife (NPWS 2008) has no records of this species within 10km of the subject site.
Rhizanthella slateri	The Atlas of NSW Wildlife (NPWS 2008) has no records of this species within the Port Stephens map sheet.
Syzygium paniculatum	The Atlas of NSW Wildlife (NPWS 2008) has no records of this species within 10km of the subject site. This species is known to occur locally.
Tetratheca juncea	The Atlas of NSW Wildlife (NPWS 2008) has 4 records of this species within 10km of the subject site.
Thesium australe	The Atlas of NSW Wildlife (NPWS 2008) has no records of this species within 10km of the subject site. This species was not observed within the subject site during surveys.

TABLE 2.2 THREATENED FAUNA SPECIES WITH SUITABLE HABITAT ON SUBJECT SITE	
Species	**Local Area Occurrence**
Wallum Froglet *Crinia tinnula*	Observed within subject site during surveys. Observed at other locations within Tea Gardens area. Known from Myall Lakes National Park.
Green Thighed Frog *Litoria brevipalmata*	Not observed during surveys. Not known from local area. Known from Myall Lakes National Park.
Green and Golden Bell Frog *Litoria aurea*	Not observed during surveys. Not known from local area. Known from Myall Lakes National Park.
Stephens' Banded Snake *Hoplocephalus stephensii*	Not observed during surveys. Not known from local area. Known from Myall Lakes National Park.
Magpie Goose *Anseranas semipalmata*	Not observed during surveys. Not known from local area.
Black-necked Stork *Ephippiorhynchus asiaticus*	Not observed during surveys. Small number of local records. Observed at other locations within Tea Gardens area (Myall River Downs). Known from Myall Lakes National Park.
Osprey *Pandion haliaetus*	Observed flying over subject site during surveys. Known local nest site in Tea Gardens. Known from Myall Lakes National Park.
Square-tailed Kite *Lophoictinia isura*	Not observed during surveys. Not known from local area.
Bush Stone-curlew *Burhinus grallarius*	Not observed during surveys. Small number of local records.
Glossy Black - Cockatoo *Calyptorhynchus lathami*	Not observed during surveys. Moderate number of local records. Known from Myall Lakes National Park.
Gang-gang Cockatoo *Callocephalon fimbriatum*	Not observed during surveys. Not known from local area.
Swift Parrot *Lathamus discolor*	Large number of local records. Not observed during surveys. Known from Myall Lakes National Park.
Turquoise Parrot *Neophema pulchella*	Not observed during surveys. Not known from local area. Known from Myall Lakes National Park.
Barking Owl *Ninox connivens*	Observed within subject site during recent surveys. Low number of local records. Known from Myall Lakes National Park.
Powerful Owl *Ninox strenua*	Not observed during surveys. Known from the Tea Gardens area (Myall River Downs). Low number of local records. Known from Myall Lakes National Park.
Masked Owl *Tyto novaehollandiae*	Not observed during surveys. Known from the Tea Gardens area (Myall River Downs). Low number of local records.
Grass Owl Tyto capensis	Not observed during surveys. Not known from local area. Present in Myall Lakes National Park.
Sooty Owl Tyto tenebricosa	Not observed during surveys. Not known from local area. Known from Myall Lakes National Park.
Regent Honeyeater Xanthomyza phrygia	Not observed during surveys. Not known from local area. Known from Myall Lakes National Park.
Black-chinned Honeyeater Melithreptus gularis gularis	Not observed during surveys. Not known from local area.

TABLE 2.2 (Cont.) THREATENED FAUNA SPECIES WITH SUITABLE HABITAT ON SUBJECT SITE	
Species	**Local Area Occurrence**
Brush-tailed Phascogale *Phascogale tapoatafa*	Not observed during surveys. Not known from local area.
Common Planigale *Planigale maculata*	Not observed during surveys. Not known from local area.
Koala *Phascolarctos cinereus*	Observed within the subject site in 1995 (NPWS 2008). Known local population. Present within Myall Lakes National Park.
Eastern Pygmy-possum *Cercatetus nanus*	Not observed during previous surveys. Identified within lands near to subject site (Myall River Downs, Tea Gardens Industrial Estate).
Yellow-bellied Glider *Petaurus australis*	Not observed during previous surveys. Not known from local area.
Squirrel Glider *Petaurus norfolcensis*	Observed within the subject site during surveys. Observed at a number other locations within Tea Gardens. Known from Myall Lakes National Park.
Long-nosed Potoroo Potorous tridactylus	Not observed during surveys. Not known from local area.
Rufous Bettong *Aepyprymnus rufescens*	Not observed during surveys. Not known from local area.
Eastern Chestnut Mouse *Pseudomys gracilicaudatus*	Not observed during surveys. Recorded within local area at Tea Gardens. Known from Myall Lakes National Park.
Common Blossom-bat *Syconycteris australis*	Observed within the subject site during surveys. Low number of local records. Known from Myall Lakes National Park.
Grey-headed Flying-fox *Pteropus poliocephalus*	Observed during surveys. Large number of local records. Known from Myall Lakes National Park.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	Not observed during surveys. Not known from local area.
Eastern Freetail-bat *Mormopterus norfolkensis*	Observed within subject site during surveys. Low number of local records. Known from Tea Gardens area.
Large-eared Pied Bat *Chalinolobus dwyeri*	Not observed during surveys. Low number of local records.
Little Bentwing-bat *Miniopterus australis*	Observed within the subject site during surveys. Large number of local records. Known from Myall Lakes National Park.
Eastern Bentwing-bat *Miniopterus schreibersii oceansis*	Observed within the subject site during surveys. Observed at a number of other locations within Tea Gardens. Known from Myall Lakes National Park.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	Not observed during surveys. Not known from local area.

TABLE 2.2 (Cont.) THREATENED FAUNA SPECIES WITH SUITABLE HABITAT ON SUBJECT SITE	
Species	**Local Area Occurrence**
Large-footed Myotis *Myotis adversus*	Observed within the subject site during surveys. Observed at a number other locations within Tea Gardens. Known from Myall Lakes National Park.
Greater Broad-nosed Bat *Scoteanax rueppellii*	Observed within the subject site during surveys. Low number of local records.

2.2 FLORA SURVEY METHODOLOGY

The methods utilised for the flora survey are detailed below.

Literature Review

- A review of available literature for the area was undertaken to obtain reference material and background information for this study. These documents are listed in the References section of this Report.

- A search of the Atlas of NSW Wildlife (NPWS 2008) was undertaken to identify records of threatened flora species located within 10km of the site. This provided a list of threatened flora species listed on Schedule 1 (Endangered) and Schedule 2 (Vulnerable) of the *Threatened Species Conservation Act* 1995 that occur within the local area.

Aerial Photograph Interpretation

- Aerial photographs at 1:25000 scale were utilised to map the extent of vegetation on the site and in surrounding areas.

Previous Flora Surveys

- The subject site, or portions of it, have previously been surveyed by a number of different consultants over the past 15 years, including, Lembit (1992), Shortland Shortland Wetlands Centre (1988), Hunter Wetlands Research & Management (1997) and *Conacher Travers* (2002, 2007). The cumulative flora species list for these surveys is provided in Table 3.1.

Detailed Field Survey

- Field surveys consisting of foot traverses within vegetated areas were conducted according to Cropper (1993). These surveys were used to identify the occurrence of flora species, identify the extent and location of vegetation communities present across the subject site, and conduct targeted seasonal surveys for threatened species.

- More detailed field surveys were undertaken in accordance with the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004 (DEC 2004). The subject site was initially divided into five stratification units based on vegetation structure and floristic diversity. These units were further separated into vegetation communities based on dominant canopy species. Transects and quadrats were undertaken within these stratification units in accordance with DEC 2004 draft guidelines. Figure 2.1 shows locations of these quadrats and transects. Results of these surveys are shown in the Appendices.

- The boundaries of the vegetation communities (dominant canopy trees) were mapped using a hand held GPS Unit (GeoExplorer 2005 series) to provide specific

mapping lines for vegetation survey. The location of the vegetation survey quadrats were also mapped by this GPS Unit.

- Specimens of plants not readily discernible in the field were collected for identification. Determination of species composition as well as structural descriptions of the vegetation on the site according to Specht *et. al.* (1995) were also carried out.

- The flora survey dates and survey effort details are provided in Table 2.3.

TABLE 2.3
FLORA SURVEY EFFORT

Date	Survey Type
31 August 2005	Cryptic flora searches,
1 September 2005	Cryptic flora searches,
12 January 2007	Cryptic flora searches, Vegetation community mapping
5 February 2007	Cryptic flora searches, Vegetation community mapping
10 March 2007	Cryptic flora searches, Vegetation community mapping
19 March 2007	Cryptic flora searches, Vegetation community mapping, Rapid canopy quadrats
17 July 2007	Cryptic flora searches,
15 August 2007	Cryptic flora searches, Vegetation community mapping
6 September 2007	Cryptic flora searches, Vegetation community mapping
7 September 2007	Cryptic flora searches, Vegetation community mapping
22 January 2008	Cryptic flora searches, Koala habitat, Tree identification surveys
12 February 2008	Cryptic flora searches, Koala habitat, Tree identification surveys
13 February 2008	Cryptic flora searches, Koala habitat, Tree identification surveys
14 February 2008	Cryptic flora searches, Quadrats + transects,
10 March 2008	Flora survey - Quadrats + transects, Habitat searches, Cryptic flora searches
11 March 2008	Flora survey - Quadrats + transects, Habitat searches, Cryptic flora searches
12 March 2008	Flora survey - Quadrats + transects, Habitat searches, Cryptic flora searches
13 March 2008	Flora survey - Quadrats + transects, Habitat searches, Cryptic flora searches
14 March 2008	Flora survey - Quadrats + transects, Habitat searches, Cryptic flora searches
7 May 2008	Flora survey - Quadrats + transects, Habitat searches, Cryptic flora searches

2.3 FAUNA SURVEY METHODOLOGY

2.3.1 Background Details

Literature Review:

A review of local resource documents and previous reports, and a search of the Atlas of NSW Wildlife (NPWS 2008) was undertaken to identify records of threatened fauna species within 10km of the subject site. Additional threatened species were included in this assessment following comments received from the Department of Environment and Climate Change.

Site Specific Survey Assessment:

Fauna survey methods used by *Conacher Environmental Group* follow the methods detailed in the Department of Environment and Conservation (DEC 2004). Where necessary, these have been adapted to satisfy local site conditions. Survey methods may also vary dependant upon environmental conditions (eg. number of vegetation communities, level of disturbance). The following weather data is recorded for all surveys:

- Air temperature;
- Moon (where relevant) (eg none, 1/4 moon, 1/2 moon, 3/4 moon, full moon);
- Rain (eg none, light drizzle, heavy drizzle, heavy rain);
- Recent rain events (where relevant);
- Wind Strength eg calm, light (leaves rustle), moderate (moves branches), strong (moves tree crowns).

The subject site was classified into five stratification units for fauna survey based on biophysical characteristics. These units are:

A) Northern slopes open forest;
B) Western lowland woodlands;
C) Northern Central lowland open forest;
D) Eastern Swamp Forest;
E) Saltmarsh, *Juncus* and mangrove areas associated with the Myall River estuary.

These stratification units formed the basis for the location of the fauna survey methods used.

Fauna Survey Dates and Weather Conditions

The methods used to survey each fauna group (eg. birds, mammals, reptiles and amphibians) are detailed below. Fauna survey details showing dates, times and weather conditions are provided in Table 2.4 with survey locations shown in Figure 2.2.

TABLE 2.4 FAUNA SURVEY DATES & WEATHER CONDITIONS					
Date **Time (hrs)**	**Cloud (8th)**	**Temp (°C)**	**Wind**	**Rain**	**Comments**
19/03/07					
0900	4/8	18	calm	nil	
06/09/07					
0900	4/8	22	calm	nil	light overnight rain
1500	6/8	15	calm	nil	
1900	4/8	18	calm	nil	
07/09/07					
0900	3/8	19	light breeze	nil	Showers
1500	6/8	16	light breeze		
1900	8/8	15	calm		
22/01/08					
0900	6/8	19	light	nil	Overnight shower
1500	2/8	22	Moderate		
1900	6/8	20	Calm		Moon - Full
12/02/08					
0900	8/8	18	Nil	light	
1500	8/8	18	Nil	light	
1900	8/8	17	Nil	light	Moon – 1st ¼
13/02/08					
0900	6/8	18	light	nil	
1500	8/8	22	Mod breeze		
1900	8/8	18	light- mod	light	
14/02/08					
0900	8/8	19	light	nil	
1500	8/8	19	light	nil	
1900	8/8 - 2/8	17	light	nil	
10/03/08					
0900	1/8	20	Light		
1500	0/8	24	light	nil	
1900	0/8	17	light	nil	
11/03/08					
0900	0/8	24	light	nil	
1500	0/8	24	light	nil	
1900	0/8	17	light	nil	
12/03/08					
0900	0/8	24	moderate	nil	
1500	0/8	24	moderate	nil	
1900	0/8	17	light	nil	
13/03/08					
0900	0/8	25	nil	nil	
1500	0/8	25	nil	nil	
1900	0/8	20	nil	nil	Moon – 1st ¼

TABLE 2.4 (Cont.) FAUNA SURVEY DATES & WEATHER CONDITIONS					
Date **Time (hrs)**	**Cloud (8th)**	**Temp (°C)**	**Wind**	**Rain**	**Comments**
14/03/08					
0900	4/8	25	light	nil	
1500	-	-	-	-	
1900	-	-	-	-	
31/03/08					
0900	1/8	20	light	nil	
1500	0/8	23	light	nil	
1900	2/8	18	light	nil	Moon – 1st ¼
01/04/08					
0900	0/8	15	light	nil	
1500	0/8	23	strong	nil	
1900	3/8	20	calm	nil	
02/04/08					
0900	2/8	17	light	nil	
1500	1/8	22	light	nil	
1900	4/8	20	calm	nil	
03/04/08					
0900	3/8	22	calm	nil	
1500	2/8	19	calm	nil	
1900	0/8	19	light	nil	
04/04/08					
0900	1/8	18	light	nil	
1500	1/8	20	light	nil	
1900					

2.3.2 Bird Survey Methods

The survey methods for diurnal and nocturnal birds is outlined below while the survey details are provided in Tables 2.5 and 2.6.

Diurnal Bird Survey

Seasonal diurnal bird surveys were conducted to allow detection of migratory and nomadic species, resident species and seasonal forages.

The following survey methodologies were applied:

Bird Census

- The bird census involved traversing the subject site for 1-2 hours and recording all observed birds. The census was undertaken during periods of peak bird activity (6am-9am and 3pm-6pm or later depending on season). Threatened bird species were targeted during each census by ensuring traverses passed through potential habitat for these species. Birds were observed and identified using binoculars. Calls were identified in the field by the observer. Unknown calls were recorded and identified post-survey using references recordings.