STATEMENT OF EFFECT ON THREATENED FLORA AND FAUNA

for a proposed Subdivision and Civil works at Lot 284 DP 806310 SALAMANDER WAY, SALAMANDER BAY, NSW

EXECUTIVE SUMMARY

It is proposed that Lot 284 DP806310, Salamander Way, Salamander Bay has for many years been zoned under the Port Stephens LEP as commercial land. It is now proposed that it be subdivided into seven Lots (including roads), that the area not presently occupied by a Library and Day Care Centre be subject to recontouring through a cut and fill process and that some drainage works be undertaken.

The habitat, flora and fauna surveys leading to this Statement of Effect have found that this 12 ha site supported Coastal Sand Woodland and approximately 3 ha of Swamp Forest, an Endangered Ecological Community. The site has been subject to anthropogenic activities such as clearing and the construction of the community facilities and car parking. These have allowed the penetration of weed species, two of which (Bitou Bush and Lantana) are listed as weeds of national significance and as key threatening processes under State legislation. The site is also subject to an undesirable means of disposal of stormwater from the Salamander Centre car park onto Lot 284 and subsequently into a SEPP 14 wetland.

There were no threatened flora species identified on the site, however, Wallum Froglet (*Crinia tinnula*) and Koala (*Phascolarctos cinereus*), were both detected on the western part of the site. The assessment also considered the impact of the development on 36 Threatened Species with habitat on the site under state legislation and 23 Migratory Species under Commonwealth legislation

Improvement in the quality of the water flowing through this land and into Mambo Wetland to the west of the site was seen to be a potential benefit from the development which may also be of benefit to the resident Wallum Froglet population.

It is proposed that the loss of about 3 ha of the Swamp Forest, which includes Wallum Froglet and Koala habitat, be ameliorated by the provision of an offset area of the same endangered community on Lot 21 DP1044009 (No 100 Salamander Way). This land is on the opposite side of Salamander Way but close by Lot 281 and is seen to be part of the habitat of the same local populations of Wallum Froglet and Koala as occupy Lot 284. It is proposed

that the area provided as an offset be 4 times the area of Endangered Ecological Community to be lost.

This proposal does not comply with the performance criteria of the Port Stephens Comprehensive Koala Plan of Management (CKPoM) and the approval for the development is to be sought under the 'waiver provisions', which allow for approval where a building envelope and associated works cannot be located in such a way that would avoid the removal of native vegetation within Preferred or Supplementary Koala Habitat, Habitat Buffers, or Habitat Linking Areas, or the removal of preferred koala food trees.

Although not ameliorations envisaged by the CKPoM, habitat offsets and tree planting have precedent elsewhere and it has been subsequently recommended that, as well as the provision of the area of land offered as an offset, that 300 long stem tube stock *E. robusta* be planted as part of the landscaping of the site and that this planting be concentrated on the western boundary as a means of providing a future Koala movement corridor adjacent to an existing corridor in the Mambo Wetland.

Ecological matters pertinent to SEPP 71 – Coastal Protection have been addressed and it was found that the provisions of this SEPP have been met. No part of Lot 284 has been classified under SEPP 14 – Coastal Wetlands but the boundary of wetland No.761 presently lies on, or immediately adjacent to the boundary of Lot 284. A remapping of the wetland boundary was undertaken early in 2009 and an amended boundary proposed. Under the SEPP this boundary amendment will need to be formally endorsed.

Given the ameliorative measures proposed and the provision for future koala Habitat, the assessment of this proposal under Section 5A of the EPA Act has found that it would not have a significant impact upon a viable local population of a Threatened Species, Endangered Population or Endangered Ecological Community such that there may be a risk of extinction. Under Commonwealth legislation, the proposal was found not to have a significant impact upon any matter of National environmental Significance

STATEMENT OF EFFECT ON THREATENED FLORA AND FAUNA

for a proposed Subdivision and Civil works at Lot 284 DP 806310 SALAMANDER WAY, SALAMANDER BAY, NSW

EXECUTIVE SUMMARY

It is proposed that Lot 284 DP806310, Salamander Way, Salamander Bay has for many years been zoned under the Port Stephens LEP as commercial land. It is now proposed that it be subdivided into seven Lots (including roads), that the area not presently occupied by a Library and Day Care Centre be subject to recontouring through a cut and fill process and that some drainage works be undertaken.

The habitat, flora and fauna surveys leading to this Statement of Effect have found that this 12 ha site supported Coastal Sand Woodland and approximately 3 ha of Swamp Forest, an Endangered Ecological Community. The site has been subject to anthropogenic activities such as clearing and the construction of the community facilities and car parking. These have allowed the penetration of weed species, two of which (Bitou Bush and Lantana) are listed as weeds of national significance and as key threatening processes under State legislation. The site is also subject to an undesirable means of disposal of stormwater from the Salamander Centre car park onto Lot 284 and subsequently into a SEPP 14 wetland.

There were no threatened flora species identified on the site, however, Wallum Froglet (*Crinia tinnula*) and Koala (*Phascolarctos cinereus*), were both detected on the western part of the site. The assessment also considered the impact of the development on 36 Threatened Species with habitat on the site under state legislation and 23 Migratory Species under Commonwealth legislation

Improvement in the quality of the water flowing through this land and into Mambo Wetland to the west of the site was seen to be a potential benefit from the development which may also be of benefit to the resident Wallum Froglet population.

It is proposed that the loss of about 3 ha of the Swamp Forest, which includes Wallum Froglet and Koala habitat, be ameliorated by the provision of an offset area of the same endangered community on Lot 21 DP1044009 (No 100 Salamander Way). This land is on the opposite side of Salamander Way but close by Lot 281 and is seen to be part of the habitat of the same local populations of Wallum Froglet and Koala as occupy Lot 284. It is proposed

that the area provided as an offset be 4 times the area of Endangered Ecological Community to be lost.

This proposal does not comply with the performance criteria of the Port Stephens Comprehensive Koala Plan of Management (CKPoM) and the approval for the development is to be sought under the 'waiver provisions', which allow for approval where a building envelope and associated works cannot be located in such a way that would avoid the removal of native vegetation within Preferred or Supplementary Koala Habitat, Habitat Buffers, or Habitat Linking Areas, or the removal of preferred koala food trees.

Although not ameliorations envisaged by the CKPoM, habitat offsets and tree planting have precedent elsewhere and it has been subsequently recommended that, as well as the provision of the area of land offered as an offset, that 300 long stem tube stock *E. robusta* be planted as part of the landscaping of the site and that this planting be concentrated on the western boundary as a means of providing a future Koala movement corridor adjacent to an existing corridor in the Mambo Wetland.

Ecological matters pertinent to SEPP 71 – Coastal Protection have been addressed and it was found that the provisions of this SEPP have been met. No part of Lot 284 has been classified under SEPP 14 – Coastal Wetlands but the boundary of wetland No.761 presently lies on, or immediately adjacent to the boundary of Lot 284. A remapping of the wetland boundary was undertaken early in 2009 and an amended boundary proposed. Under the SEPP this boundary amendment will need to be formally endorsed.

Given the ameliorative measures proposed and the provision for future koala Habitat, the assessment of this proposal under Section 5A of the EPA Act has found that it would not have a significant impact upon a viable local population of a Threatened Species, Endangered Population or Endangered Ecological Community such that there may be a risk of extinction. Under Commonwealth legislation, the proposal was found not to have a significant impact upon any matter of National environmental Significance

STATEMENT OF EFFECT

ON

THREATENED FLORA AND FAUNA

for a proposed

Subdivision and Civil Works

at

Lot 284 DP 806310

SALAMANDER WAY,

SALAMANDER BAY,

NSW

Prepared by: **Garry Worth**
of
Garry Worth Project Consulting
11 Hough Street
Tea Gardens NSW 2324

For: **Port Stephens Council**

April 2009

CONTENTS

1.0 INTRODUCTION

It is proposed that a subdivision and drainage works take place within Lot 284 DP 806310 Salamander Way, Salamander Bay (Figure 1). This report is intended to indicate the likelihood of these proposals having a significant effect on threatened species of flora, fauna and ecological communities and to fulfil other requirements of the Environmental Planning and Assessment Act (EPA Act) 1979 and the Threatened Species Conservation Act (TSC Act) 1995. Consideration has also been afforded to the Port Stephens Comprehensive Koala Plan of Management (CKPoM) and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. The report will also incorporate the results of a previous Statement of Effect on Threatened Flora and Fauna (Wildthing Environmental Consultants, 1998).

1.1 GENERAL DESCRIPTION OF SITE

The site consists of approximately 12 ha of land in a 'U' shape adjacent to the western, northern and eastern sides of the Salamander Bay Commercial centre and associated car parking (Figure 2). The land is zoned 3A Commercial and presently contains a Library, Community Centre and Day Care Centre. These cover only a small portion of the land and the remainder is undeveloped.

Prior to the 1970's this locality was mined for mineral sands, with some clearing of vegetation. In the 1980's, parts of it were further disturbed by the construction of the commercial centre, parking and Salamander Way, which again disturbed some vegetation and changed some of the topography.

In the western part of the site there is a headwall where stormwater from the commercial centre parking area empties into the lot and eventually drains into the Mambo Wetland. This surplus of water appears to have altered the hydrology of the central western part of Lot 284 and induced the growth of a much more hydrophytic vegetation community on that part of the land.

1.2 DESCRIPTION OF THE PROPOSAL

It is proposed that a seven-lot subdivision (including one lot consisting of roads) take place within Lot 284 DP 806310 (Figure 3). As it is intended to recontour the site by using the sand dune along the northern part of the Lot in a cut and fill operation, this activity will result in the removal of almost all vegetation occurring within the site.

Figure 1 – Salamander Bay locality map.

Figure 2 – Site plan

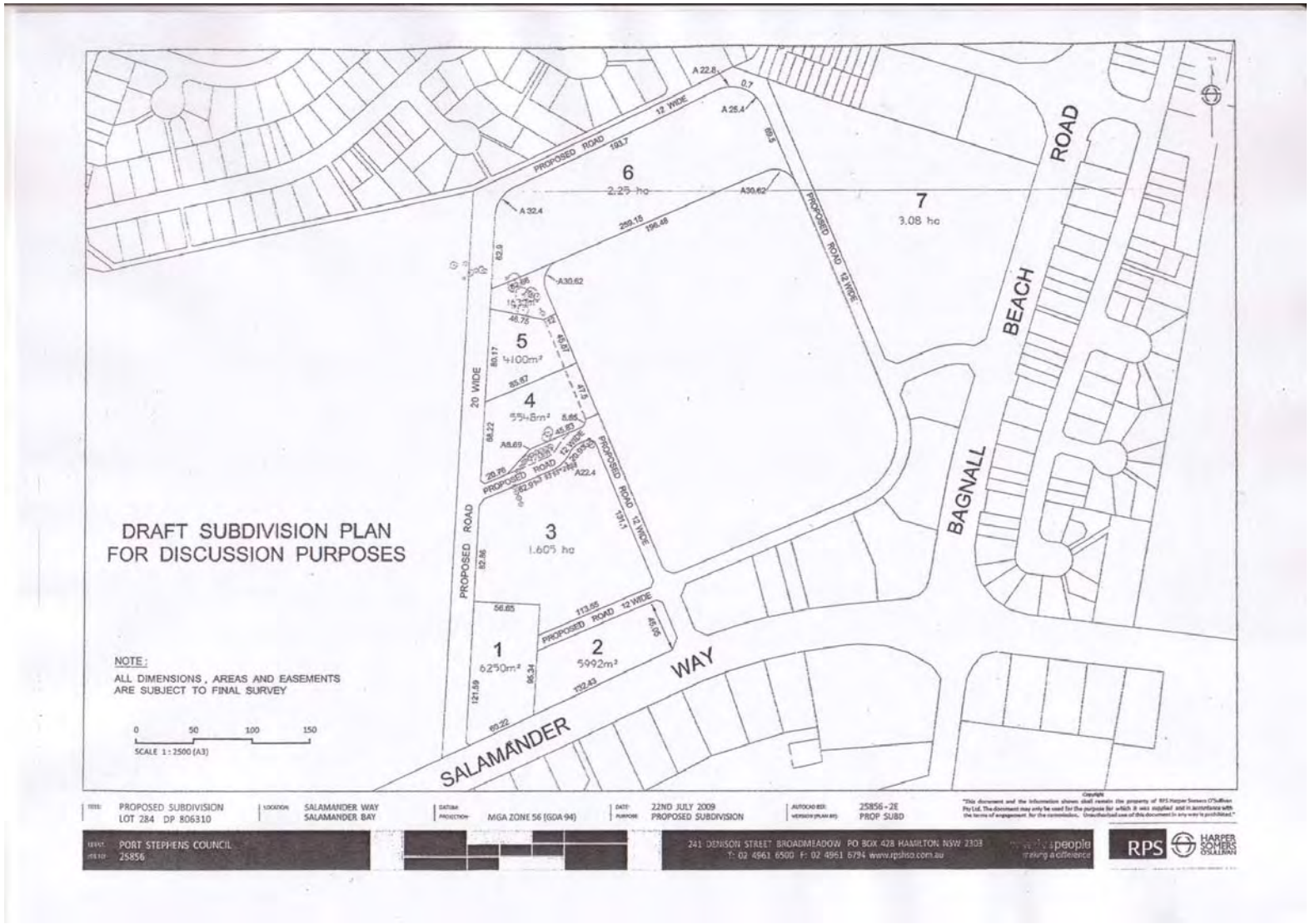


Figure 3 – Proposed subdivision plan

It is also proposed that the existing storm water disposal arrangements be altered so that storm water from the Salamander Centre western parking lot is directed across the northern boundary of the proposed Lot 4, and thence to a disposal area in the Mambo Wetland coinciding with stormwater disposal from the nearby urban area.. This stormwater would be passively treated to reduce hydrocarbon contamination during this process.

2.0 SCOPE OF THE STUDY

This study was designed to address any likely flora and fauna issues of significance occurring as a result of the proposal. This was achieved by appraisal of the vegetation assemblage and structural formation, and identification of representative plant species of the various structural layers. Potential habitat offered by the vegetation present was also assessed. The possibility of this site being significant for any Schedule 1 and 2 (endangered and vulnerable) flora, fauna and ecological communities was paramount in the assessment process.

2.1 LEGISLATIVE REQUIREMENTS

This Statement of Effect on Threatened Flora and Fauna report has been structured upon the guidelines laid down in Section 5A of the Environmental Planning and Assessment Act (1979), and the Threatened Species Conservation Act (1995), which requires consideration of the impact of the proposed development upon any Schedule 1 and 2 (endangered or vulnerable) species and ecological communities expected or found on the site. Endangered and vulnerable species are collectively referred to as 'threatened' species in this report.

Also considered in this report were the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) and the Port Stephens Comprehensive Koala Plan of Management (CKPoM).

This land is zoned 3A and consequently the provisions of the Native Vegetation Act do not apply.

Fieldwork undertaken by Wildthing Environmental Consultants was carried out under the following NPWS Scientific Investigation Licence S10475 and under Animal Care and Ethics Approval: Animal Research Authority Issue by the Director General of NSW Agriculture (File No. 08 – 361) for the Fauna Survey for Biodiversity and Impact Assessment.

3.0 METHODOLOGY

3.1 VEGETATION APPRAISAL METHODOLOGY

The initial determination of the basic vegetation community boundaries was undertaken through the review of an orthophoto covering the site. Following this, a detailed ground survey was conducted. The vegetation survey was undertaken in accordance with the Lower Hunter and Central Coast Region – Flora and Fauna Guidelines (Murray et al, 2002). This involved three 100m vegetation transects and three plots 20×20m in area. During the transect-based surveys all species observed within 2m either side of the centre line were recorded as well as the physical attributes of the surrounding area. Within the survey plots, the height of each primary structural layer and relative cover abundance of the species within was recorded, along with location, elevation, slope, aspect and general soil type.

In addition to the above, flora searches for threatened species were undertaken across the site in the manner described by Cropper (1993) as the 'Random Meander Technique'. This involved walking in a random manner throughout the entire study site, visiting the full range of potential habitats and checking every plant species seen. A list of all flora species identified on site has been provided in Appendix B and the results of transect and plot surveys can be seen in Appendix C.

3.1.1 TARGETED FLORA SURVEYS

Targeted surveys were undertaken to detect the threatened flora species; *Tetratheca juncea* (Black-eyed Susan), *Prostanthera densa* (Villous Mintbush) *Eucalyptus parramattensis ssp. decadens* (Drooping Red Gum), *Grevillea parviflora* ssp. *parviflora* (Small-flowered Grevillea) and threatened orchids. The searches were undertaken by walking parallel transects (Cropper 1993) which were spaced at approximately 15m intervals across the entire site. The locations of all individuals were recorded by the use of a hand held Global Positioning System (GPS). It must be noted that the survey was undertaken outside the known flowering periods for *T. juncea* and all of the targeted orchid species. The flowering periods of these cryptic flora species are shown in Table 1.

Table 1: Flowering periods of targeted threatened flora species.

ORCHID SPECIES	Flowering Period months of the year											
	J	F	M	A	M	J	J	A	S	O	N	D
Cryptostylis hunteriana	■											■
Corybas dowlingii							■	■				
Diuris arenaria								■	■			
Diuris praecox							■	■				
Tetratheca juncea							■	■	■	■	■	■

3.2 HABITAT APPRAISAL METHODOLOGY

Habitat may be defined as the physical and biological environment required for the survival of a specific population of a species. In modern usage habitat has also come to be regarded as an association of landform and plant life, which provides sustenance and shelter for a particular fauna assemblage.

The methodology of the habitat appraisal used the vegetation community data combined, where relevant, with geomorphological features and the occurrence of particular plant species or forms (i.e. tree hollows) to provide a basis for a subjective habitat assessment aimed at placing the ecological status of the site within a local perspective.

3.2.1 GENERAL HABITAT FOR NATIVE SPECIES

From the vegetation appraisal and a general inspection of the site and surrounding areas, a subjective assessment of the general habitat value of this site was made. Considered in this assessment were:

- occurrence of that habitat type in the general vicinity;
- degree of disturbance and degradation;
- area occupied by that habitat on site;
- continuity with similar habitat adjacent to the site, or connection with similar habitat off site by way of corridors; and

structural and floral diversity.

3.2.1.1 HOLLOW-BEARING TREE SURVEY

Hollow-bearing trees are a habitat resource utilised by a variety of native avifaunal and mammalian species. This resource is usually a limiting factor in the occurrence of hollow-dependent species on a site, due to the time taken for hollows to form in trees. During the fieldwork a survey was undertaken to identify the number of hollow-bearing trees within the study area and to classify the size of the hollow openings.

3.2.2 HABITAT FOR SIGNIFICANT SPECIES

This site was evaluated as potential habitat for each of the threatened species reported on the Department of Environment and Climate Change (DECC) Database and the Department of Environment, Water, Heritage and the Arts (DEWHA) on-line database from within 10km of the site. This evaluation was based on home-range, feeding, roosting, breeding, movement patterns and corridor requirements for fauna and hydrology, soil types, aspect and structural formation for flora species.

3.3 FAUNA APPRAISAL METHODOLOGY

The fauna survey was initiated with the production of an Expected Fauna Species List and an assessment of the potential use of the study area by any threatened species identified in the DECC and DEWHA database searches. Subsequently, the confirmation and supplementation of the Expected Fauna Species List, by way of on-site observation, trapping and recording, was carried out as described below. The survey was carried out using the Lower Hunter and Central Coast Region – Flora and Fauna Guidelines (Murray. et. al, 2002).

The numbers of certain animal traps used were lower than those required within the guidelines due to the high level of human activity throughout the majority of the site that would have placed the traps at risk of disturbance or theft. The presence of surface water within one area of swamp forest and the small number of larger tree species present also limited the number of terrestrial traps and arboreal traps that could be used.

3.3.1 SMALL TERRESTRIAL MAMMAL TRAPPING

Terrestrial mammal trapping was undertaken using 30 Elliott Type A traps (8x10x33cm) within the site. The traps were left in place for three consecutive nights giving a total of 90 small terrestrial trap nights. The traps were hidden in thick grass, under shrubs or and around trees and were camouflaged with vegetation where the ground cover was sparse. The baits used for the traps were a mixture of rolled oats and honey, Good-O's (dry dog food) and peanut butter. The traps were checked early each morning and, where necessary, reset and rebaited. The location of the small terrestrial traps is shown in Figure 4.

3.3.2 MEDIUM TERRESTRIAL MAMMAL TRAPING

Medium terrestrial mammal trapping was undertaken using 10 cage traps (60×35×40cm) within the site. The traps were left in place for three consecutive nights giving a total of 30 terrestrial trap nights. The traps were hidden in thick grass, under shrubs or near fallen logs and were camouflaged with vegetation where the ground cover was sparse. The bait used for the traps was sardines and a mixture of rolled oats and honey. The traps were checked early each morning and, where necessary, reset and rebaited. The location of the Medium terrestrial traps is shown in Figure 5.

3.3.3 ARBOREAL TERRESTRIAL MAMMAL TRAPING

Arboreal mammal trapping was undertaken using 3 Elliott Type B traps (15 × 15 × 46cm) within the site area to determine the presence of arboreal mammals. The traps were left in place for three consecutive nights giving a total of 9 arboreal trap nights. The traps were placed around 3 - 4 metres above the ground on platforms mounted on tree trunks. Trees which were targeted contained hollows, were flowering or had scratches present on the boles. The baits used consisted of a rolled oats and honey

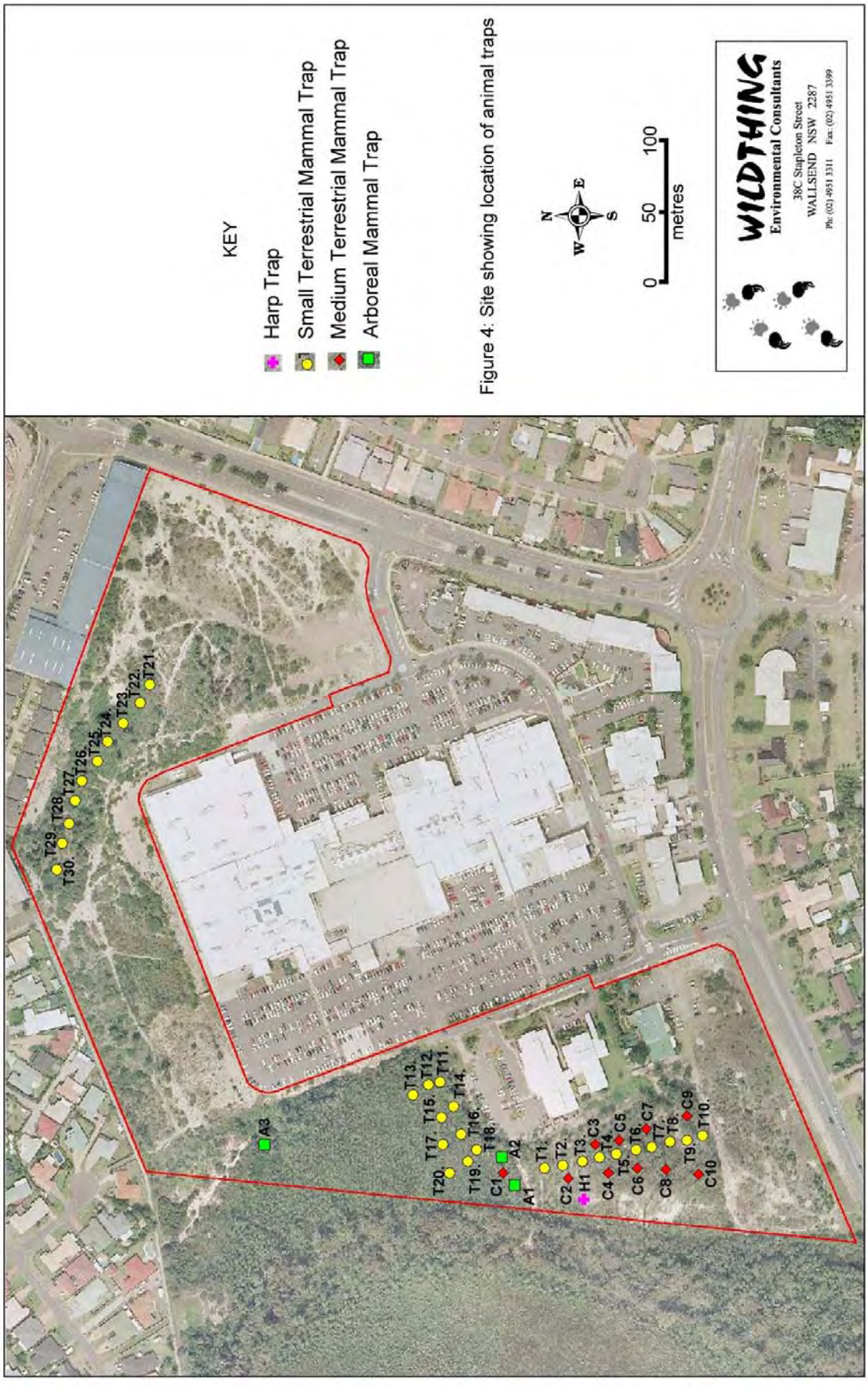


Figure 4: Site showing location of animal traps

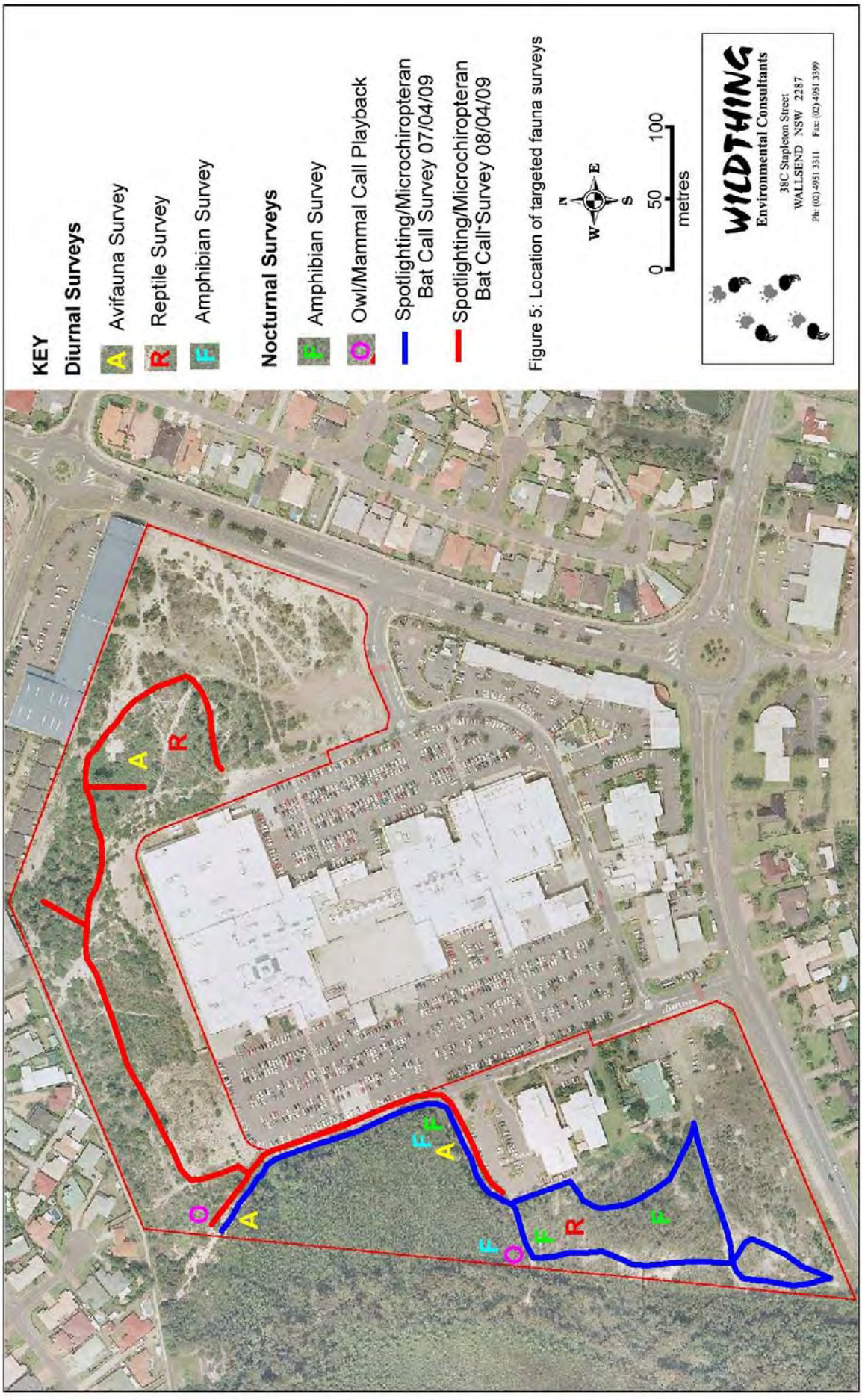


Figure 5: Location of targeted fauna surveys

mixture, peanut butter and an aniseed ring (sugar coated sweet). The traps were sprayed with honey mixed in water before being placed in the trees to attract fauna and mask the smell of humans. The tree trunks were also sprayed with this mixture each day. In all cases the traps were checked early each morning and, where necessary, reset and rebaited. The position of the arboreal traps within the study area can be seen in Figure 5.

3.3.4 HARP TRAPPING

One monofilament harp trap was set for two consecutive nights within the site. The harp trapping was undertaken in order to sample the use of the site by sub-canopy microchiropteran bat species. The trap was positioned in a potential flyway and was checked early each morning, with any captures being identified directly via the use of dichotomous keys and subsequent comparison with commercially available field guides, where degrees of uncertainty prevailed. The locations of the harp trap are shown in Figure 4.

3.3.5 MICROCHIROPTERAN BAT CALL SURVEY

Bat echo-location calls were taped using an Anabat detector in areas which were considered likely to be used by bats. These positions were selected to sample potential hunting sites for bats, including flyways, clearings and ecotones. Echolocation surveys used a combination of set point and hand held mobile surveys. Surveys were conducted for approximately 60 minutes over two nights giving a total of 120 minutes of bat call survey. The bat calls recorded by Wildthing Environmental Consultants were analysed in-house by Mungo Worth. The location of the bat call survey is shown in Figure 5.

3.3.6 AMPHIBIAN SURVEY

The amphibian survey included a combination of diurnal and nocturnal census methods. Diurnal searches were undertaken for two half-person hour periods. Systematic searches involved searches within appropriate habitat for basking or sheltering individuals. Any appropriate cover such as logs were turned over for resting individuals. Nocturnal surveys were undertaken for a one person hour period. The surveys were undertaken in suitable habitat and involved listening for the characteristic call of male frogs. Playback of frog calls was undertaken in an attempt to elicit a response from threatened amphibian species in particular Crinia tinnula (Wallum Froglet), which is known to occur within the locality. Other calls broadcasted include those of *Litoria aurea* (Green and Golden Bell Frog). The location of the frog census conducted is shown in Figure 6.

3.3.7 REPTILE SURVEY

Searches for reptiles involved a combination of diurnal and nocturnal searches. Diurnal searches for reptiles involved searching in likely habitat (i.e. leaf litter, dead logs and long grass) during the

morning and afternoon survey period. Nocturnal searches were conducted for reptile species active at night such as geckos and some species of snakes and involved searching in likely habitats with the aid of a spotlight. The location of the reptile surveys is shown in Figure 6.

3.3.8 DIURNAL AVIFAUNA SURVEY

The diurnal avifauna census involved point surveys targeting potential habitat in the study area for species such as Xanthomyza phrygia (Regent Honeyeater). Surveys were conducted at peak activity periods (i.e. dawn and dusk) for four periods of half an hour. A total of 2 hours of targeted diurnal bird surveys were undertaken. Incidental observations and secondary indications (i.e. distinctive feathers and nests) of avifauna were also recorded. The location of the diurnal avifauna surveys is shown in Figure 5.

3.3.9 NOCTURNAL AVIFAUNA AND MAMMAL CALLPLAYBACK SURVEY

During the nocturnal avifauna and mammal survey pre-recorded calls of *Ninox connivens* (Barking Owl), *Ninox strenua* (Powerful Owl), *Tyto capensis* (Grass Owl), *Tyto novaehollandiae* (Masked Owl), *Tyto tenebricosa* (Sooty Owl), *Petaurus australis* (Yellow-bellied Glider), *Petaurus norfolcensis* (Squirrel Glider), and *Phascolarctos cinerea* (Koala) were broadcast through an amplification system designed to project the sound for at least 1km under still night conditions. An initial listening period of 10 minutes was undertaken, followed by 5 minutes of calls (repeated in four different directions). A period of two minutes of quiet listening was then employed after each 5-minute bracket of calls. At the conclusion of the call playback survey, spotlighting was carried out in the vicinity of the call playback site. The locations of the call playback are shown in Figure 5.

3.3.10 SPOTLIGHTING SURVEY

Spotlighting was undertaken on foot using 100watt hand-held spotlights. The spotlighting undertaken was completed by one persons and involved walking at a slow pace along the particular survey area and stopping every 2 minutes, allowing the observer to hear movements of animals. A total of 4 person hours of spotlighting was conducted during the survey. The spotlight routes are shown in Figure 5.

No stag watching was conducted due to the lack of hollow bearing trees.

3.4 DATE, TIMES, ACTIVITIES & WEATHER CONDITIONS

A summary of the time spent on site during fieldwork and the prevailing weather conditions at the time is contained below in Table 2.

Table 2: Survey Dates, Times and Weather Conditions

DATE	TIME	ACTIVITY	WEATHER
Monday 06/04/09	1230 - 1300	General Site inspection	
	1300 - 1630	Trap deployment: Arboreal traps; Small mammal traps; Cages; Harp Trap.	7/8 cloud, SE, 25°C.
Tuesday 07/04/09	0615 – 0830	Checking traps. Incidental observations.	8/8 cloud, calm, 17°C. Light rain
	0930 - 1100	Vegetation surveys (Ramdom meander) and incidental searches.	
	1800 - 2030	Nocturnal Work: Spotlighting; Bat call detection; Owl Call Playback. Amphibian Survey	6/8 cloud, 21°C, Calm, no moon seen.
Wednesday 08/04/09	0615 – 0800	Checking traps. Incidental observations.	5/8 cloud, 16°C.
	0800 – 0830	Avifauna survey	4/8 cloud, 19°C.
	1000 - 1030	Reptile Survey	
	1100 - 1200	Searches for scats and other traces	
	1430 - 1600		
	1730 - 1800	Avifauna survey	
	1800 - 2030	Nocturnal Work: Stag Watch Spotlighting; Bat call detection; Owl Call Playback. Stag Watching Amphibian Survey	6/8 cloud, 17°C, Calm, no moon seen.
Thursday 09/04/09	0545 – 0900	Checking Traps, Trap retrieval & Incidental observations.	0/8 cloud, 16°C.
	0900 – 0930	Avifauna survey	0/8 cloud, 16°C.
Wednesday 15/04/09	0930 - 1200	Vegetation Survey	0/8 cloud, 23°C.

3.5 SIGNIFICANT SPECIES

The following threatened species (Table 3) have been recorded on the DECC Database within 10km of the site. Species marked with an asterisk (*) are considered to have potential habitat available within 10km according to DEWHA's on-line database.

Table 3: Threatened Species Considered.

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
Corybas dowlingii	Red Helmet Orchid	E	
**Cryptostylis hunteriana*	Leafless Tongue Orchid	V	V
Diuris arenaria	Sand Doubletail	E	
Diuris praecox	Rough Doubletail	V	V
Tetratheca juncea	Black-eyed Susan	V	V
Chamaesyce psammogeton	Sand Spurge	E	
Grevillea parviflora ssp. parviflora	Small Flowered Grevillea	V	V
Callistemon linearifolius	Netted Bottle Brush	V	
Eucalyptus parramattensis spp. *decadens*	Drooping Red Gum	V	V
Melaleuca groveana	Grove's Paperbark	V	
Prostanthera densa	Cliff Mintbush	V	V
Senecio spathulatus	Coastal Fireweed	E	
Petalura gigantea	Giant Dragonfly	E	
Crinia tinnula	Wallum Froglet	V	
**Litoria aurea*	Green and Golden Bell Frog	E	E
**Mixophyes balbus*	Stuttering Frog	E	V
Mixophyes iteratus	Giant Barred Frog	E	E
Chelonia mydas	Green Turtle	V	
Botaurus poiciloptilus	Australian Bittern	V	
Ixobrychus flavicollis	Black Bittern	V	
Rostratula benghalensis australis	Australian Painted Snipe	V	V
Ephippiorhynchus asiaticus	Black-necked Stork	E	
Irediparra gallinacea	Comb-crested Jacana	V	
Pterodroma leucoptera leucoptera	Gould's Petrel	E	
Pterodroma nigripennis	Black-winged Petrel	V	
Puffinus carneipes	Flesh-footed Shearwater	V	
Macronectes giganteus	Southern Giant Petrel	E	
Macronectes halli	Northern Giant Petrel	V	V
Sterna albifrons	Little Tern	E	
Haematopus fuliginosus	Sooty Oystercatcher	V	
Haematopus longirostris	Pied Oystercatcher	V	
Burhinus grallarius	Bush Stone-curlew	E	
Ptilinopus magnificus	Wompoo Fruit-Dove	V	
Ptilinopus regina	Rose-crowned Fruit-Dove	V	
Ptilinopus superbus	Superb Fruit Dove	V	
Lathamus discolor	Swift Parrot	E	E
Callocephalon fimbriatum	Gang Gang Cockatoo	V	
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	
**Xanthomyza phrygia*	Regent Honeyeater	E	E
Pandion haliaetus	Osprey	V	
Ninox connivens	Barking Owl	V	
Ninox strenua	Powerful Owl	V	
Tyto novaehollandiae	Masked Owl	V	
Tyto tenebricosa	Sooty Owl	V	
Dasyurus maculatus maculatus	Tiger Quoll	V	V
Phascogale tapoatafa	Brush-tailed Phascogale	V	

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
Phascolarctos cinereus	Koala	V	
Cercartetus nanus	Eastern Pygmy-possum	V	
Petaurus norfolcensis	Squirrel Glider	V	
**Potorous tridactylus tridactylus*	Long-nosed Potoroo	V	V
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	V	
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Mormopterus norfolkensis	Eastern Freetail-bat	V	
Miniopterus australis	Little Bentwing-bat	V	
Miniopterus schreibersii oceanensis	Large Bentwing-bat	V	
Myotis adversus	Large-footed Myotis	V	
Scoteanax rueppellii	Greater Broad-nosed Bat	V	
Vespadelus troughtoni	Eastern Cave Bat	V	
**Chalinolobus dwyeri*	Large Pied Bat	V	V

E=Endangered Species V=Vulnerable Species Crit E=Critically Endangered

4.0 RESULTS

4.1 FLORA ASSEMBLAGES

A large portion of the vegetation within the site had been subject to disturbance as a result of past sand mining, weed invasion, the proximity to the Salamander Centre and the surrounding urban environment. Past sand mining in the 1970's appears to have altered the topography of the site and removed some areas of native vegetation. There has been some regeneration of native vegetation in previously disturbed areas. The close proximity to the shopping centre and residences has resulted in the formation of tracks, altered water runoff, increased weed invasion and rubbish dumping.

Two broad vegetation assemblages, Swamp Forest and Coastal Sand Woodland were found to be present within the site. A general description of the flora assemblages identified is given below. A full list of the flora species recorded during the fieldwork is listed in Appendix B. The vegetation within the site is shown in Figure 6.

*Note on Vegetation Community Distribution Map. A map of vegetation of any area seeks to describe the distribution of the plant species in that area by defining a number of vegetation units (assemblages or communities), which are relatively internally homogenous. Whilst such mapping is a convenient tool, it greatly oversimplifies the real situation. Plants rarely occur in defined communities with distinct boundaries. Accordingly vegetation units used for the accompanying map should be viewed as indicative of their extent rather than being precise edges of communities.

Swamp Forest

Areas of Swamp Forest were generally confined to the lower ground in the western portion of the site. They were composed of a relatively low, dense stand of *Melaleuca quinquenervia* (Broad-leaved Paperbark). Larger specimens of *M. quinquenervia* and individuals of *Eucalyptus robusta* (Swamp Mahogany) were present in the north-west and north-east of the site. Based on the level and duration of inundation three variations of swamp forest were distinguished. These three variations were:

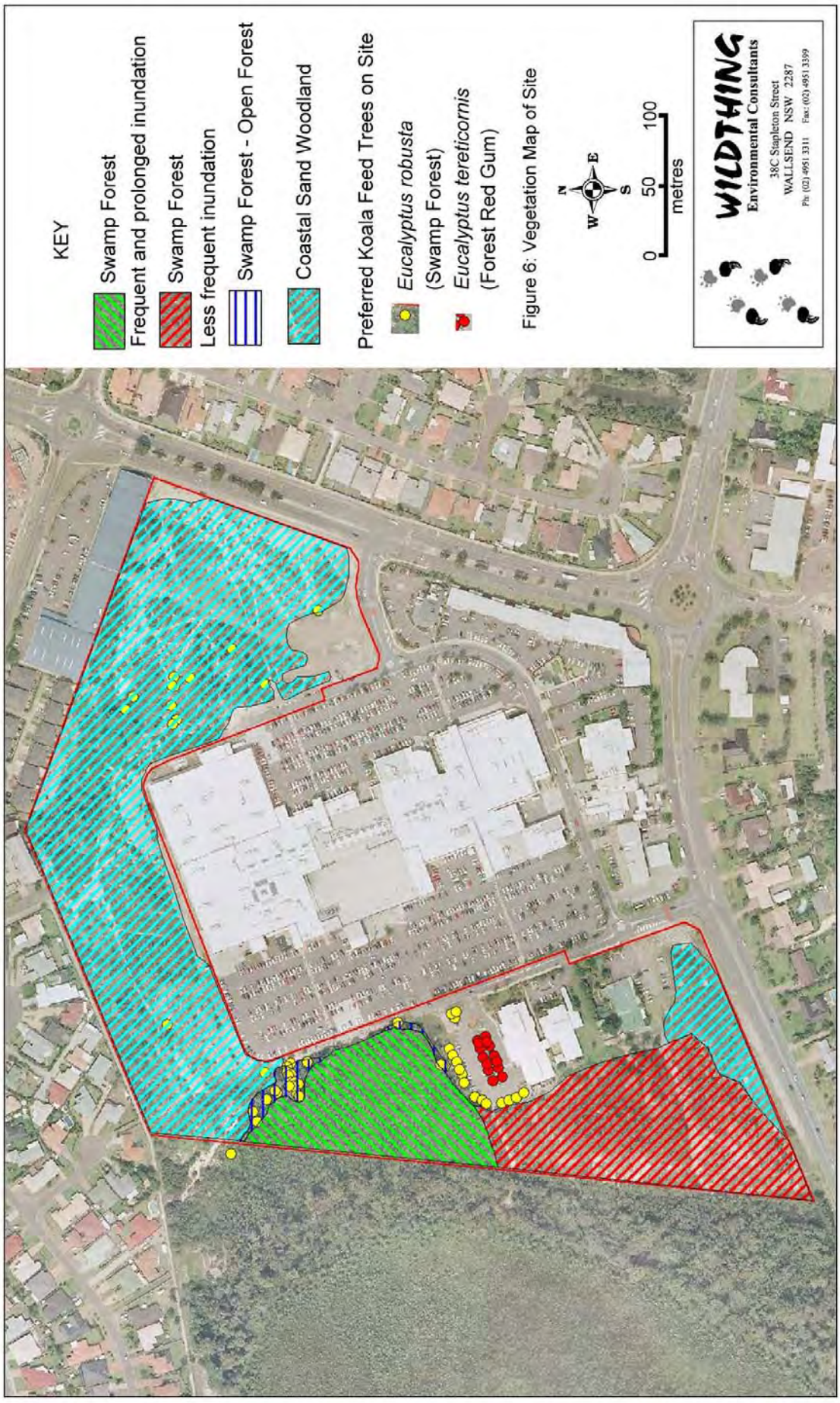
Swamp Forest: Subject to frequent and prolonged inundation.

Swamp Forest: Subject to less frequent inundation

Swamp Forest – Open Forest: Rarely subject to inundation

<u>Swamp Forest – Subject to frequent and prolonged inundation.</u>

Approximately 1.1ha of Swamp Forest subject to prolonged periods of inundation was located to the north of the library carpark. A large portion of the inundation would result from runoff originating from the Salamander Centre parking area via a large culvert. This area of swamp forest was characterised by a relatively low, dense stand of *Melaleuca quinquenervia* (Broad-leaved Paperbark) with a thick understorey of species adapted to wetter conditions. Common understorey species included *Gahnia*


KEY
Swamp Forest
Frequent and prolonged inundation
Swamp Forest
Less frequent inundation
Swamp Forest - Open Forest
Coastal Sand Woodland
Preferred Koala Feed Trees on Site
Eucalyptus robusta
(Swamp Forest)
Eucalyptus tereticornis
(Forest Red Gum)
Figure 6: Vegetation Map of Site
N
E
S
W
0
50
100
metres
WILDTHING
Environmental Consultants
38C Stapleton Street
WALLSEND NSW 2287
Ph: (02) 4951 3311 Fax: (02) 4951 3399

sieberana (Swordgrass), *Gleichenia microphylla* (Coral Fern), *Baloskion tetraphyllum* ssp. *meiostachyum* (Tassell Rush) and *Lepironia articulata* and *Blechnum indicum.*

Vegetation Structure – Swamp Forest - Subject to frequent and prolonged inundation (Figure 7).

Canopy: (<10m) - *Melaleuca quinquenervia* (Broad-leaved Paperbark).

Shrub Layer: (<3m) - *Callistemon pachyphyllus* (Wallum Bottlebrush), *Hakea teretifolia* (Dagger Hakea)

Ground Layer: (<3m) - *Gahnia sieberana, Gahnia clarkei, Baloskion tetraphyllum* ssp. *meiostachyum, Gleichenia microphylla* (Coral Fern), *Leptocarpus tenax.*

Figure 7: Swamp Forest - Subject to frequent and prolonged inundation north of Library Carpark.

Swamp Forest – Subject to less frequent inundation

Approximately 1.9ha of Swamp Forest subject to less frequent inundation was located to the west and south-west of the library. This area of swamp forest was also dominated by a low relatively dense stand of *M. quinquenervia.* A few small specimens of *Angophora costata* (Smooth-barked Apple) and *Banksia serrata* (Old Man Banksia) where also noted within this swamp forest variation. The understorey tended to be more open and contained a greater diversity of flora species. Common

species noted within the shrub layer included *Leptospermum juniperinum* (Prickly-leaved Tea-tree) and *Persoonia lanceolata* (Persoonia), *Epacris obtusifolia* and *Epacris microphylla* (Coral Heath).

Vegetation Structure – Swamp Forest (Figures 8-9).

Canopy: (<10m) - *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Angophora costata* (Smooth-barked Apple), *Banksia serrata* (Old Man Banksia).

Shrub Layer: (<3m) – *Epacris pulchella* (Coral Heath), *Leptospermum juniperinum* (Prickly-leaved Tea-tree), *Persoonia lanceolata* (Persoonia), *Epacris obtusifolia*, *Epacris microphylla* ssp. *microphylla* (Coral Heath), *Leucopogon lanceolatus* (Lance Beard Heath), *Callistemon pachyphyllus* (Wallum Bottlebrush), *Hakea teretifolia* (Dagger Hakea), *Dillwynia retorta* (Heathy Parrot Pea).

Ground Layer: (<3m) – *Leptocarpus tenax*, *Themeda triandra* (Kangaroo Grass), *Xanthosia pilosa* (Woolly Xanthosia).

Figure 8: Swamp Forest – Subject to less frequent inundation.

Figure 9: Swamp Forest – Subject to less frequent inundation.

Swamp Forest – Open Forest

Small areas of Open Swamp Forest occurring on higher ground were found to fringe the wetter area of Swamp Forest in the north-west of the site adjacent to the Salamander Centre carpark. These areas would be rarely inundated and were characterised by taller specimens of *M. quinquenervia* and the presence of *E. robusta*.

Vegetation Structure – Swamp Forest-Open Forest (Figure 10)

Canopy: (<15m) - *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus robusta* (Swamp Mahogany).

Shrub Layer: (<3m) – *Omalanthus populifolius* (Bleeding Heart)

Ground Layer: (<3m) – *Histiopterus incisa* (Batswing Fern), *Pteridium esculentum* (Bracken), *Gahnia clarkei*.

Figure 10: – Swamp Forest-Open Forest adjacent to far north-eastern carpark.

Coastal Sand Woodland

Approximately 9ha of highly disturbed Coastal Sand Woodland was found to occupy the sandy soils in the east and far south of the site as well as the higher ground in the north. These areas of Coastal Sand Woodland had been subject to a large degree of disturbance making it difficult to accurately define into a Vegetation Map Unit under the Vegetation Survey, Classification and Mapping: Lower Hunter and Central Coast (NPWS, 2001). They appear to be subject to little inundation and were largely cleared of larger and medium tree species. The majority of the vegetation consisted of species adapted to drier sandy conditions. A number of specimens of *M. quinquenervia* and *E. robusta* which are adapted to wetter conditions were found to be present in the east. Based on the groundcover composition these areas were found to be similar to Map Unit 34 Coastal Sand Wallum Woodland Heath and Map Unit 33 – Coastal Sand Apple – Blackbutt Forest (NPWS, 2001). Mapping by (House, 2004) shows part of this area to be composed of Coastal Sand Apple – Blackbutt Forest.

Common small tree species observed included *Banksia integrifolia* (Coastal Banksia) and *Acacia decurrens* (Sydney Green Wattle). *Acacia saligna* (Golden Wreath Wattle) an endemic species to Western Australia was also common within the site. Shrub species observed included *Persoonia lanceolata* (Persoonia), *Leptospermum laevigatum* (Coastal Tea-tree) and *Acacia ulicifolia* (Prickly

Moses). The invasive weed species *Chrysanthemoides monilifera* ssp. *rotundata* (Bitou Bush) was a common species within this assemblage.

Native ground covers noted within the site included *Pteridium esculentum* (Bracken Fern), *Themeda triandra* (Kangaroo Grass) and *Xanthosia pilosa* (Woolly Xanthosia). Introduced groundcovers were very common on the outer margin of this assemblage and included grasses such as *Andropogon virginicus* (Whisky Grass), *Anthoxanthum odoratum* (Sweet Vernal Grass), *Eragrostis curvula* (African Lovegrass) and *Melinis repens* (Red Natal Grass). *Acanthospermum australe* (Star Burr) and *Gazania linearis* (Gazania) were common herbaceous weeds.

Vegetation Structure – Coastal Sand Woodland (Figures 11-12)

Canopy: (<10m) - *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus robusta* (Swamp Mahogany).

Small tree (<7m) - *Acacia decurrens* (Sydney Green Wattle), *Acacia saligna* (Golden Wreath Wattle).

Shrub Layer: (<3m) - *Persoonia lanceolata* (Persoonia), *Chrysanthemoides monilifera* ssp. *rotundata* (Bitou Bush),

Ground Layer: (<1m) - *Pteridium esculentum* (Bracken Fern), *Acanthospermum australe* (Star Burr), *Anthoxanthum odoratum* (Sweet Vernal Grass), *Eragrostis curvula* (African Lovegrass), *Melinis repens* (Red Natal Grass).

Figure 11: Coastal Sand Woodland Heath – Top of sand hill in north of the site.

Figure 12: Coastal Sand Woodland Heath – Eastern portion of site.

4.1.1 ENDANGERED AND LOCALLY SIGNIFICANT ECOLOGICAL COMMUNITIES

Swamp Forest occurring on site was found to contain floristic components consistent with the Endangered Ecological Community - Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions. As previously mentioned in the vegetation description for the site, areas of Swamp Forest were divided up into three variants; Low Swamp Forest subject to prolonged periods of inundation; Low Swamp Forest subject to less frequent inundation and Swamp Forest – Open Forest. All these variants are considered to constitute this Endangered Ecological Community. According to past aerial photography (NSW, Lands Monochrome Air Photo, 1972) areas of swamp sclerophyll forest on site may have been previously cleared or highly disturbed. These areas have regenerated to a state that some areas appear to be untouched. The past disturbance may explain the low density of the *Melaleuca quinquenervia* (Broad-leaved Paperbark) in the west of the site.

A number of Specimens of *Eucalyptus robusta* (Swamp Mahogany) and *Melaleuca quinquenervia* (Broad-leaved Paperbark) were also found to be present within the Coastal Sand Woodland Heath in the eastern portion of the site. These areas did contain similarities to the Endangered Ecological Community - Swamp Sclerophyll Forest, however due to past disturbance, the composition of the understorey layers and little chance of inundation these areas in the east were not considered to constitute this Endangered Ecological Community.

The proposal will lead to the eventual removal of virtually all swamp forest (Approximately 4.2 ha) within the site. This will result in the incremental reduction of swamp forest in the local area. Taking into account the recommendation of compensatory offsets and erosion/sediment/weed control as part of any works to protect adjoining vegetation within Mambo Swamp it is considered that the action is unlikely to have a significant impact on the occurrence of Swamp Sclerophyll Forest in the local area.

The impact of the proposal on this Endangered Ecological Community is assessed in Section 5 and Appendix A of this report.

4.1.2 THREATENED PLANT SPECIES

Eleven threatened plant species together with a number of rare species have been previously recorded within 10km of the site on the DECC database (Table 4). Species marked with an asterisk (*) are also considered to have potential habitat within 10km according to the DEWHA on-line database.

Table 4: Threatened and Rare Flora species recorded within the locality.

FLORA SPECIES	TSC	EPBC	ROTAP
**Cryptostylis hunteriana*	E	E	
Corybas dowlingii			
Diuris arenaria	E		
Diuris praecox	V	V	
Callistemon linearifolius	V		
Eucalyptus parramattensis ssp. *decadens*	V	V	
Melaleuca groveana	V		
Prostanthera densa			
Tetratheca juncea	V	V	
Chamaesyce psammogeton			
**Grevillea parviflora* ssp. *parviflora*	V	V	

None of the above threatened plant species were found to be present within the site. Suitable habitat was found to be present for *E. parramattensis* ssp. *decadens, D. arenaria, D. praecox, C. hunteriana* and *C. linearifolius.*

The impact of the proposal on these threatened flora species is discussed in more detail in Section 5 and Appendix A of this report.

4.1.3 LOCALLY AND REGIONALLY SIGNIFICANT PLANT SPECIES

A list of Regionally Significant Plant species, populations and vegetation communities for the Hunter Catchment which includes the Port Stephens LGA has been established by the Hunter Rare Plants Committee of the Hunter Regional Botanic Gardens (Bell et. al., 2003). A small number of regionally significant flora species other than those listed as threatened or considered to be rare were recorded on site. These species include:

Baumea rubignosa	western limit of its distribution
Caustis recurvata var. *recurvata*	western limit of its distribution
Brachyloma daphnoides	Uncommon?
Acacia decurrens	northern limit of its distribution
Lomandra glauca	northern limit of its distribution
Callistemon pachyphyllus	southern limit of its distribution
Leptospermum liversigei	southern limit of its distribution
Leptospermum trinervium	western limit of its distribution
Leptospermum polygalifolium polygalifolium	northern limit of its distribution

4.14 NOXIOUS WEEDS AND WEEDS OF SIGNIFICANCE

A number noxious weed species were found to be present within the site and are listed below in Table 5. The site lies within the area covered by the Port Stephens Council Noxious Plants Advisory Committee.

Table 5: Noxious Weed species found on site.

WEED SPECIES	WEED CLASS PORT STEPHENS LGA	ADDITIONAL SIGNIFICANCE
Lantana camara (Lantana)	Class 5	N & T
Chrysanthemoides monilifera ssp. *rotundata* (Bitou Bush)	Class 4	N & T
**Ludwigia longifolia* (Long-leaf Willow Primrose)	Class 4	

N – Weed of National Significance (Listed in the Commonwealth Government's National Weeds Strategy 1997)

T – Listed as a Threatening Process under the NSW TSC Act 1995.

*Control Classes under the Noxious Weeds Act 1993.

Class 1 & 2 This plant must be eradicated from the land and the land must be kept free of this plant.

Class 3 This plant must be fully and continuously suppressed and destroyed.

Class 4 The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the LCA. Must also, 'not be sold, propagated or knowingly distributed'.

Class 5 The requirements of the Noxious Weeds Act 1993 for a notifiable weed must be complied with.

It is recommended that weed control be included within any works within the site to prevent the spread of weeds particularly into the adjoining Mambo Wetland Reserve.

4.2 HABITAT APPRAISAL

4.2.1 HABITAT DESCRIPTION AND DISTRIBUTION IN THE VICINITY

Based on the vegetation communities delineated in Section 4.1 the site supports two broad habitat categories, Swamp Forest and Coastal Woodland. Within these two broad categories a number of habitat features, which included winter-flowering eucalyptus, Banksia shrubs and surface water, were also present. Generally a large portion of the habitat had undergone a high degree of disturbance however the site provided foraging/hunting, nesting/roosting and refuge resources for a variety of native fauna. Disturbances observed on site were a result of past sand mining, weed invasion, the proximity to the Salamander Centre and the surrounding urban environment.

Swamp Forest

Swamp Forest occupying the western portion of the site provided resources for a variety of native fauna. The canopy of the woodland was composed of a large number of myrtaceous species particularly *Melaleuca quinquenervia* (Broad-leaved Paperbark) and to a lesser extant *Eucalyptus robusta* (Swamp Mahogany) which provide blossom for insectivorous species (i.e. Gliders, Possums, Flying-foxes, Honeyeaters and Lorikeets). Flowering specimens of *E. robusta* are an important food source during winter for a number of threatened species such as *Petaurus norfolcensis* (Squirrel Glider), *Pteropus poliocephalus* (Grey-headed Flying-fox), *Xanthomyza phrygia* (Regent Honeyeater) and *Lathamus discolor* (Swift Parrot). *Eucalyptus robusta* is also a Preferred Koala Feed Tree Species under the Port Stephens Comprehensive Plan of Management (Port Stephen Council, 2002). Trees also provide a foraging resource for insectivorous species such as Thornbills and Fantails. Nesting opportunities are provided throughout the Swamp Forest habitat for those bird species which construct nests on branches. No nesting/roosting habitat was present for hollow dependent fauna such as the Squirrel Glider and Parrot species.

The thick grassy ground layer in areas provided refuge to a number of reptile, frog and small mammal species. Aquatic habitat was present with areas of surface water occurring to the north of the Library carpark. A small ephemeral drainage line was also present to the south-west of the library. The aquatic habitat provided suitable breeding habitat for a number of frog species and drinking water for species such as birds. Habitat was available for a number of wetland bird species although due to the dense nature of the understorey within the wetter areas this habitat would be limited to species such as *Botaurus poiciloptilus* (Australian Bittern).

Coastal Woodland Heath

Coastal Woodland Heath occupied approximately 6ha and was the most disturbed habitat category on site with some areas on the periphery composed of only introduced species such as *Anthoxanthum odoratum* (Sweet Vernal Grass). This sandy habitat was primarily consisted of a number of Heath species such as *Leptospermum laevigatum* (Coastal Tea Tree) and *Persoonia lanceolata* (Persoonia). An exception was a small number of specimens of *E. robusta* and *M. quinquenervia* clumped together in the north-east of the site. Other small tree species included species such as *Banksia integrifolia* (Coastal Silver Banksia), which provide food for nectivorous species (i.e. Flying-foxes, Honeyeaters and Lorikeets). Nesting opportunities are limited to those birds which construct nests on branches.

Reptiles are provided with both refuge and basking habitat within the grass/herb layer across much of the site. The refuge habitat occurs in the form of fallen branches, leaf litter and rubbish.

Hunting habitat is available over the majority of the site for a number of microchiropteran bat species adapted to hunting within woodland, forests, open spaces or over waterbodies. No roosting habitat was considered to be present due to the lack of tree hollows and loose bark.

4.2.1.1 HOLLOW-BEARING TREES

No hollow-bearing trees were noted within the bounds of the site. The lack of hollow-bearing trees were attributed to the past removal of mature trees and the considerable time it takes for hollows to form.

4.2.1.2 HABITAT CONNECTIVITY AND CORRIDORS

As may be seen in Figure 2, the western part of this site lies adjacent to good quality bushland, incorporating wetlands but this part of the site is bounded on the east by the commercial centre and car parking leading to the conclusion that this does not provide connectivity with any other habitat to the east. The northern and eastern parts of the site constitute outliers of degraded habitat which have a tenuous association with bushland to the east of Bagnall Beach Road. The connectivity level in this direction is poor, being disrupted by urban development and a busy roadway.

Connectivity to the south is also disrupted by a busy road (Salamander Way) but the connection in this direction is seen as being an important corridor for wetland species and it will be retained after the development.

4.2.2 HABITAT FOR SIGNIFICANT SPECIES

An assessment of habitat attributes on site has been undertaken for the threatened species listed in Section 3.5. The results of the assessment are displayed in Table 6. Those species identified in this assessment as having potential habitat available on site have been considered further under Section 5A of the EPA Act in Section 5.0 of this report. The description of the ecology of each species is contained in Appendix A.

Table 6: Habitat Assessment for Significant Species

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
Corybas dowlingii Red Helmet Orchid	TSC Act-E	Is restricted to New South Wales where it is currently known from 4 localities including Port Stephens (2 localities), Bulahdelah and Freemans Waterhole south of Newcastle. A population is known from Stoney Ridge Reserve on Soldiers Point. Forms clonal colonies and typically grows in gullies in tall open forest on well-drained gravelly soil at elevations of 10-200m.	Unlikely *Corybas dowlingii* was unlikely to be present within the site due to the lack of suitable soil types.	No
Cryptostylis hunteriana Leafless Tongue Orchid	TSC Act-E EPBC Act-E	This species is a saprophyte, which grows in small, localised colonies on flat plains close to the coast. This species has also been recorded in mountainous areas growing in moist depressions as well as in swampy habitats.	Moderate - Suitable habitat was considered to be present within the site.	Yes
Diuris arenaria Sand Doubletail	TSC Act - E	Coastal heath, Dry Sclerophyll Forest with patches of *Themeda triandra* (Kangaroo Grass) on sandy flats (Bishop, 1996). This species is only known from the Tomaree Peninsula.	Moderate - Suitable habitat was considered to be present within the site.	Yes
Diuris praecox Rough Doubletail	TSC Act - V EPBC Act – V ROTAP – 2VC-	Found in eucalypt forests on hilltops or slopes, and is widespread in grassy habitats. Large populations have been	Moderate- Suitable habitat was considered to be present	Yes

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
		recorded within power line easements at Anna Bay (ERM, 2003).	within the site.	
Tetratheca juncea Black-eyed Susan	TSC Act-V EPBC Act-V	Heath and Dry Sclerophyll Forests on low nutrient soil with a dense understorey of grasses. Is most commonly found associated with species including, *Angophora costata* (Smooth-barked Apple), *Eucalyptus globoidea* (White Stringybark), *Corymbia gummifera* (Red Bloodwood) and *Acacia myrtifolia* (Myrtle Wattle).	Unlikely - No suitable habitat was considered to be present due to the lack of nearby local records and associated species.	No
Chamaesyce psammogeton Sand Spurge	TSC Act-E	This prostrate perennial herb grows on foredunes and exposed sites on headlands.	Unlikely - No suitable habitat was considered to be present on site.	No
Grevillea parviflora ssp. *parviflora*	TSC Act-V EPBC Act-V	This species of Grevillea occurs in light clayey soils in woodlands. This species grows chiefly in south-western Sydney. Disjunct populations occur near Cessnock, Putty and Cooranbong (Fairley, 2004).	Unlikely - No local records or suitable habitat was considered to be present on site.	No
Callistemon linearifolius Netted Bottle Brush	TSC Act-V ROTAP – 2RCi	Grows in dry sclerophyll forest on the coast and adjacent ranges from the Georges River to the Hawkesbury River in the Sydney area, and north to Nelson Bay.	Low - Suitable habitat was found to be present within the drier areas of the site.	Yes
Eucalyptus parramattensis spp. *decadens* Drooping Red Gum	TSC Act - V EPBC Act – V ROTAP – 2V_	Occurs in woodland on sandy soils in wet sites. In the Port Stephens area, the Drooping Red Gum occurs in open wet sclerophyll woodland on heavy, often waterlogged, inter-barrier depression soils. This species is present within	Moderate-High - Suitable habitat was present within the site. This species is known to occur within the adjoining	Yes

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
		Mambo Swamp.	Mambo Swamp.	
Melaleuca groveana Grove's Paperbark	TSC Act-V	This species is generally found in north eastern NSW and south east Queensland in heath, often in exposed sites and mainly at higher altitude. In Tomaree National Park, *Melaleuca groveana* occurs in closed heath communities on rhyodacite volcanic rock.	Unlikely No suitable associated habitat was present on site.	No
Prostanthera densa Cliff Mintbush	TSC Act - V EPBC Act – V ROTAP – 3VC-	This species is known to occur on clay soils on volcanic hills and on sandy soils occurring as a shallow mantle over volcanic hills. It has been reported generally from sclerophyll forest and shrubland on coastal headlands and near-coastal ranges, chiefly on sandstone.	Unlikely No suitable associated habitat was present on site.	No
Senecio spathulatus Coastal Fireweed	TSC Act-E	Confined to areas of unstabilised sand on coastal dunes. This species is usually recorded in southern Victoria and Tasmania.	Unlikely - No suitable habitat was considered to be present on site.	No
Petalura gigantea Giant Dragonfly	TSC Act-E	Permanent wetlands both coastal and upland. Larvae occupy permanent long chambered burrows built under swamps. According to the DECC database this Dragonfly has been recorded within mambo Swamp in 2006.	Moderate - Areas of swamp forest in the west of the site were considered to contain suitable habitat for the Giant Dragonfly.	Yes
Crinia tinnula Wallum Froglet	TSC Act-V	Shallow acid swamps (temporary / semi-permanent) and associated connecting channels and deeper water holes (permanent) consisting of hard-leafed heaths, shrubs and woodland on coastal plains and dunes and associated sedgelands and swamps in low lying areas	High - Present on site The Wallum Froglet was found to be present within the site. Suitable habitat was	Yes

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
		collectively known as wallum.	found to occur within the areas of swamp forest in the west of the site.	
Litoria aurea Green and Golden Bell Frog	TSC Act-E EPBC Act-E	This frog species inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. *L. aurea* is thought to be displaced from more established sites by other frog species thus explaining its existence on disturbed sites.	Low Suitable habitat was considered to be present on site despite the lack of recent local records.	Yes
Mixophyes balbus Stuttering Frog	TSC Act-V EPBC Act-V	Occurs in wet forest regions of south-eastern Queensland, Eastern NSW and Victoria. In late spring, eggs are deposited among leaf litter on the banks of streams and subsequently are washed into the water during heavy rain.	Unlikely This frog species was not recorded within the site during fieldwork. Suitable habitat was considered to be present along the drainage line within the western portion of the site.	No
Mixophyes iteratus Great Barred Frog	TSC Act-E EPBC Act-E	Occurs on forest slopes of the Great Dividing Range, generally between 20-800m A.S.L. It appears to prefer riparian vegetation or other moist vegetation communities, generally on rich organic soils. Deep leaf litter and/or thick cover is necessary for this species. Water quality must be of a high standard, and the species occurs in 1st to 3rd order streams (i.e. 'young' streams), and is absent from ponds and	Unlikely This frog species was not recorded within the site during fieldwork. Suitable habitat was considered to be present along the drainage line within the western portion of the site.	No

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
		ephemeral pools. Graded banks with undercuts and steep edges are favourable haunts of this frog.		
Chelonia mydas Green Turtle	TSC Act-V EPBC Act-V	Occurs in shallow seas where there is sufficient light to ensure an abundant growth of marine grasses. When resting this species searches out an appropriate rest area i.e. rock overhang, rocky pothole, which gives some protection from predators.	No habitat present. No habitat was present for this marine species.	No
Botaurus poiciloptilus Australasian Bittern	TSC Act-V	Favours permanent fresh-waters dominated by sedges, rushes, reeds or cutting grasses (eg. Phragmites, Scirpus, Eleocharis, Juncus, Typha, Baumea and Gahnia).	Moderate – Suitable habitat was present for this species within the swamp forest in the west of the site.	Yes
Ixobrychus flavicollis Black Bittern	TSC Act-V	Near water in mangroves and other trees, often forming only a narrow fringe of cover.	Moderate – Suitable habitat was present for this species within the swamp forest in the west of the site.	Yes
Rostratula benghalensis australis Australian Painted Snipe	TSC Act-V	Margins of swamps and streams, chiefly those covered with low and stunted vegetation.	Moderate – Suitable habitat was present for this species within the swamp forest in the west of the site.	Yes
Ephippiorhynchus asiaticus Black-necked Stork	TSC Act-E	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. It has also been recorded on farm dams and sewage treatment ponds.	Unlikely – The swamp forest was too densely vegetated for the Black-necked Stork.	No

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
Irediparra gallinacea Comb-crested Jacana	TSC Act-V	Inhabits mostly deep permanent freshwater wetlands, which are abundant with floating aquatic vegetation that forms dense mats or rafts on the surface of the water (eg. *Nymphaeaceae, Myriophyllum lacifolium, Marsilea* and *Riccia*).	Unlikely – No habitat was considered to be present due to the dense nature of the vegetation and lack of deep water and floating aquatic vegetation.	No
Pterodroma leucoptera leucoptera Gould's Petrel	TSC Act - E	Lives pelagic life, nests on Cabbage Tree Island.	No habitat present – No habitat was present for this pelagic species.	No
Pterodroma neglecta Kermadec Petrel	TSC Act-V	It is a pelagic species inhabiting the subtropical and tropical waters of the Pacific Ocean, rarely reaching mainland.	No habitat present – No habitat was present for this pelagic species.	No
Pterodroma nigripennis Black-winged Petrel	TSC Act-V	Pelagic species	No habitat present – No habitat was present for this pelagic species.	No
Puffinus carneipes Flesh-footed Shearwater	TSC Act-V	Lives pelagic life, nests on Lord Howe Island.	No habitat present – No habitat was present for this pelagic species.	No
Macronectes giganteus Southern Giant Petrel	TSC Act - E	The Southern Giant Petrel ranges from deep circumpolar waters from Antarctica across the entire length of the New South Wales coast.	No habitat present – No habitat was present for this pelagic species.	No
Macronectes halli Northern Giant Petrel	TSC Act - E	Inhabits subtropical waters in winter and early spring.	No habitat present – No habitat was present for this pelagic	No

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
		Potential foraging resources in N.S.W. are regarded as significant during the winter months although representing a small proportion of the total foraging area for this species.	species.	
Sterna albifrons Little Tern	TSC Act - E	Little Terns nest only on or near the coast in N.S.W. The typical features of the nesting area are a sandy substrate, flat or gently sloping topography, abundant shells and pebbles and little vegetation.	Unlikely – no suitable nesting habitat was considered to be present.	No
Haematopus fuliginosus Sooty Oystercatcher	TSC Act-V	Prefer rocky intertidal shorelines and sandy beaches.	No habitat present –	No
Haematopus longirostris Pied Oystercatcher	TSC Act-V	Prefer rocky intertidal shorelines and sandy beaches.	No habitat present –	No
Burhinus grallarius Bush Stone-curlew	TSC Act-E	This species inhabits dry open forest and woodland with an open grassy understorey that has not been overgrazed. It prefers woodland with many fallen branches where it roosts during the day. It has also been known to utilise coastal scrub, mangrove fringes, golf courses and plantations.	Low-moderate – Suitable habitat was present for this species.	Yes
Ptilinopus magnificus Wompoo Fruit-Dove	TSC Act-V	This frugivorous Rainforest specialist inhabits the canopy of Sub-tropical, Warm-temperate and Littoral Rainforests. Favoured feed trees include Figs, Laurels, Myrtles and native Tamarind. The females lay one egg on a flimsy platform of vine tendrils on a slender horizontal branch.	Unlikely – No suitable habitat was considered to be present.	No
Ptilinopus superbus Superb Fruit Dove	TSC Act-V	Lives mainly in Rainforest but will feed in adjacent Mangroves or Eucalypt forest, venturing into coastal habitats. The nest is a	Unlikely – No suitable habitat was considered to be present.	No

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
		platform built in a small tree on a horizontal fork situated in Open Forest at the edge of scrub.		
Lathamus discolor Swift Parrot	TSC Act-E TSC Act-E	Open Forest to Woodland, also street trees and in parks and gardens, winter flowering eucalypts for feeding. This species nests in Tasmania during the summer months.	Moderate – Suitable foraging habitat was present in the form of winter flowering species particularly *Eucalyptus robusta* (Swamp Mahogany).	Yes
Callocephalon fimbriatum Gang-gang Cockatoo	TSC Act-V	Tall montane forests and woodlands in mature wet sclerophyll forests. Requires hollows in which to breed between October and January.	Low – Moderate – Suitable foraging habitat was present within the site. No nesting habitat was present.	Yes
Calyptorhynchus lathami Glossy Black-Cockatoo	TSC Act-V	Lowland coastal forests, dense mountain forests, semi-arid woodland and trees bordering watercourses, with (Allo)Casuarina trees for foraging.	Low – Moderate – Only a limited amount of foraging habitat in the form of a small number of *Allocasuarina littoralis* (Black Sheoak) specimens were present. No nesting habitat was present due to the lack of large tree hollows.	Yes
Xanthomyza phrygia Regent Honeyeater	TSC Act-E EPBC Act-E	Temperate woodlands and open forest, including forest edges, preferring to forage on large-flowered Eucalypts.	Moderate – Suitable foraging habitat was present in the form of flowering myrtaceous species particularly the winter flowering	Yes

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
			Eucalyptus robusta (Swamp Mahogany).	
Pandion haliaetus Osprey	TSC Act-V	Open and swamp forest adjacent to the coast or estuaries, fishing mainly in brackish or salt water.	Low – Due to the close proximity of Nelson Bay the site would contain marginal roosting and nesting habitat.	Yes
Ninox connivens Barking Owl	TSC Act-V	This species is found in forest and woodland, encountered most commonly in savanna and paperbark woodlands. It sometimes roosts in rainforests, but it requires the more open country for hunting and hollow Eucalypts for breeding.	Moderate – Suitable hunting and limited roosting habitat was present within the site. Due to the lack of large hollows no nesting habitat was present.	Yes
Ninox strenua Powerful Owl	TSC Act-V	Inhabits a wide range of vegetation types from wet Eucalypt forests with a Rainforest understorey to Dry Open Forests and Woodlands. The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the ground.	Moderate-High – Suitable hunting and limited roosting habitat was present within the site. Due to the lack of large hollows no nesting habitat was present.	Yes
Tyto capensis Grass Owl	TSC Act-V	This species roost and nest on the ground, in crops or in thick grass tussock often associated with swamps.	Low – Limited hunting and nesting habitat was considered to be present in the west of the site.	Yes
Tyto novaehollandiae Masked Owl	TSC Act-V	A range of wooded habitats that contain mature trees with large hollows for roosting and nesting, and more open areas for hunting.	Moderate-High – Suitable hunting habitat was present	Yes

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
			within the site. Due to the lack of large hollows no roosting or nesting habitat was present.	
Tyto tenebricosa Sooty Owl	TSC Act-V	Prefers dense dimly-lit forests, inhabiting pockets of rainforest and wet sclerophyll forest mainly in mountainous areas, often in south-east facing gullies.	Unlikely – Due to the lack of rainforest and tall wet sclerophyll forest the Sooty Owl would be considered unlikely to be present on site.	No
Dasyurus maculatus maculatus Tiger Quoll	TSC Act-V	Inhabits sclerophyll forests, rainforests and coastal woodlands. Nests are made in rock caves and hollow logs or trees, and basking sites are usually found nearby.	Low - Only marginal habitat is considered to be present for the Tiger Quoll due to the disturbance to the site and proximity to urban development.	Yes
Phascogale tapoatafa Brush-tailed Phascogale	TSC Act-V	Sparsely distributed outside the semi-arid zone in dry sclerophyll forest and monsoonal forest and woodland.	Low – Due to the lack of timbered dry woodland, and associated nesting hollows only limited habitat was considered to be available on site.	Yes
Phascolarctos cinereus Koala	TSC Act-V	Coastal woodland and open forest containing suitable food trees.	High - Present on site Preferred feed trees in the form of *Eucalyptus robusta* (Swamp Mahogany) were	Yes

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
			present on site.	
Cercartetus nanus Eastern Pygmy-possum	TSC Act-V	Feeds mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit. Hollow bearing trees are favoured for shelter and nesting although spherical nests constructed of short shredded bark have been found between the wood and bark of eucalypts.	Moderate Foraging habitat was available over the majority of the site. However there was a lack of suitable nesting sites.	Yes
Petaurus norfolcensis Squirrel Glider	TSC Act-V	Dry sclerophyll forests and woodlands with exudates for foraging and hollows for nesting.	Low-Moderate Suitable foraging habitat was available within the site, however the was a lack of suitable nesting habitat.	Yes
Potorous tridactylus tridactylus Long-nosed Potoroo	TSC Act-V	This species is known from a variety of habitats, including Rainforest, Open Forests and Woodlands with dense groundcover, and dense, wet coastal heathlands. Soft (often sandy) substrates are preferred by this species.	Low Suitable habitat was available within denser vegetation in the west of the site.	Yes
Pseudomys gracilicaudatus Eastern Chestnut Mouse	TSC Act-V	Found in heathland, wet heathland and swamps.	Moderate Suitable habitat was present in the west of the site.	Yes
Pteropus poliocephalus	TSC Act-V	Wet and Dry Sclerophyll Forests, Rainforest, Mangroves and	High	Yes

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
Grey-headed Flying-Fox	EPBC Act-V	Paperbark swamps and Banksia Woodlands.	Suitable foraging habitat was present over the majority of the site.	
Mormopterus norfolkensis East Coast Freetail-bat	TSC Act-V	This species appears to live in Sclerophyll Forests and Woodland. Roosts in tree hollows or under loose bark.	Moderate Suitable hunting habitat was present on site.	Yes
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	TSC Act-V	This microchiropteran bat species occupies a range of habitats including eucalypt forests, Mallee or open country. Roosts in tree hollows, animal burrows, dry clay cracks, under rock slabs and in abandoned Sugar Glider nests.	Moderate Suitable hunting habitat was present on site.	Yes
Miniopterus australis Little Bentwing-bat	TSC Act-V	Tropical Rainforest to warm-temperate Wet and Dry Sclerophyll Forest; caves or similar structures for roosting.	Moderate Suitable hunting habitat was present on site.	Yes
Miniopterus schreibersii oceanensis Large Bentwing-bat	TSC Act-V	Wet and Dry Tall Open Forest, Rainforest, Monsoon Forest, Open Woodland, Paperbark Forests and Open Grasslands; caves or similar structures for roosting. It occasionally uses tree hollows.	Moderate Suitable hunting habitat was present on site.	Yes
Myotis adversus Large Footed Myotis	TSC Act-V	Various habitats of the coast and adjacent ranges with suitable waterbodies for hunting; caves or similar structures for roosting. It occasionally uses tree hollows.	Moderate Suitable hunting habitat was present on site.	Yes

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE	7-PART TEST REQUIRED
Scoteanax rueppellii Greater Broad-nosed Bat	TSC Act-V	Tree-lined creeks, woodland/clearing ecotones and rainforest creeks, roosting mainly in tree hollows.	Moderate Suitable hunting habitat was present on site.	Yes
Vespadelus troughtoni (Eastern Cave Bat)	TSC Act-V	The Eastern Cave Bat roosts in caves and occurs in wet/dry sclerophyll forests to the semi arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally buildings.	Low Suitable hunting habitat was present on site.	
Chalinolobus dwyeri Large-eared Pied Bat	TSC Act-V	This species has been found occupying Dry Sclerophyll Forest and Woodland. Roosts in caves, abandoned mud-nests of Fairy Martins and mine tunnels.	Moderate Suitable hunting habitat was present on site.	Yes

4.3 FAUNA APPRAISAL RESULTS

A full list of fauna species observed during the survey is contained in Appendix D.

4.3.1 SMALL TERRESTRIAL MAMMAL TRAPPING

During this component of the survey three species of mammal were captured, these being *Antechinus swainsonii* (Dusky Antechinus), *Rattus lutreolus* (Swamp Rat) and the introduced *Mus musculus* (House Mouse). The results of the small mammal trapping survey are shown in Table 7.

Table 7: Small Terrestrial Mammal Trapping Results.

DATE	TRAP NO	SPECIES	SEX
Tuesday 07/04/09	T3 T7	*Antechinus stuartii* (Brown Antechinus) *Rattus lutreolus* (Swamp Rat)	Female Female
Wednesday 08/04/09	T5 T7 T17	*A. stuartii* *Rattus lutreolus* *A. stuartii*	Male Male Female
Thursday 09/04/09	T9 T11 T15 T27	*Rattus lutreolus* *A. stuartii* *A. stuartii* *Mus musculus* (House Mouse)	Female Male Female

4.3.2 MEDIUM TERRESTRIAL MAMMAL TRAPPING

One mammal species, *Felis catus* (Cat) was captured during the medium terrestrial trapping component of the survey. The results of the medium terrestrial mammal trapping survey are shown in Table 8.

Table 8: Medium Terrestrial Mammal Trapping Results.

DATE	TRAP NO	SPECIES	SEX
Wednesday 23/04/08	T4	*Felis catus* (Cat)	Female

4.3.3 ARBOREAL MAMMAL TRAPPING

No mammals were captured within the arboreal terrestrial traps.

4.3.4 HARP TRAPPING

During the harp trapping component of the survey no species microchiropteran bat were captured.

4.3.5 MICROCHIROPTERAN BAT CALL DETECTION

During the Bat Call Survey only one species, *Chalinolobus gouldii* (Gould's Wattled Bat) was positively identified. Calls not inconsistent with those of *Chalinolobus morio* (Chocolate Wattled Bat) were also identified.

No microchiropteran bats were noted during the previous survey of part of the site (Wildthing Environmental Consultants, 1998).

4.3.6 AMPHIBIAN SURVEY

Five frog species, *Litoria jervisiensis* (Jervis Bay Tree Frog), *Crinia tinnula* (Wallum Froglet), *Crinia signifera* (Common Eastern Froglet), *Lymnodynastes peronii* (Striped Marsh Frog) and *Paracrinia haswelli* (Haswell's Froglet) were recorded during the survey. Another species *Litoria tyleri* (Tyler's Tree Frog) was recorded during a previous study on site (Wildthing Environmental Consultants, 1998).

4.3.7 REPTILE SURVEY

Three species of reptile, *Egernia major* (Land Mullet), *Ctenotus robustus* (Striped Skink) and *Ctenotus taeniolatus* (Copper-tailed Skink) were identified on site during the survey. *Egernia major* was noted on two occasions within the swamp forest in the west of the site. Both *C. robustus* and *C. taeniolatus* were found to be common within the drier sandy areas of the site. Tracks consistent with that of a large monitor lizard were found to be present along a sandy track in the west of the site. These tracks would most likely be that of *Varanus varius* (Lace Monitor) that is known to occur within Mambo Swamp.

No reptiles were noted during the previous survey of part of the site (Wildthing Environmental Consultants, 1998).

4.3.8 DIURNAL AVIFAUNA SURVEY

A number of avifauna species were found to be present within the site. Birds commonly encountered over the site included *Gymnorhina tibicen* (Magpie), *Manorina melanocephala* (Noisy Miner), *Trichoglossus chlorolepidotus* (Scaly Breasted Lorikeet), *Trichoglossus haematodus* (Rainbow Lorikeet), *Anthrochaera carunculata* (Red Wattlebird), *Phylidonyris nigra* (White-cheeked Honeyeater), *Anthrochaera chrysoptera* (Brush Wattlebird) and *Cormobates leucophaea* (White-throated Treecreeper).

Also there was:
no whitewash, regurgitation pellets or prey remains consistent with Owl species noted, and
no chewed *Allocasuarina littoralis* (Black Oak) cones found on site consistent with those eaten by Glossy Black Cockatoos.

A complete list of bird species recorded during the survey is listed in Appendix D.

4.3.9 NOCTURNAL AVIFAUNA SURVEY

There were no responses heard as a result of the owl and mammal calls played during the survey.

4.3.10 SPOTLIGHTING SURVEY

One species of mammal, *Phascolarctos cinereus* (Koala) was observed within the site just to the north of the library carpark. The Koala is listed as vulnerable under the TSC Act (1995) and as a consequence has been further assessed within Section 5 and Appendix A of this report.

4.3.11 INCIDENTAL SURVEYS

A number of relatively fresh scats consistent with those of the Koala were found under *Eucalyptus robusta* (Swamp Mahogany) trees within the west of the site and adjacent areas.

Small conical diggings were commonly encountered within the western portion of the site. These digging were consistent with that of a species of Bandicoot.

Tracks consistent with the introduced *Vulpes vulpes* (Red Fox) were observed within the central area of the site. The occurrence of the Red Fox is listed as a Key threatening process under the NSW Threatened Species Conservation Act, 1995.

4.3.12 SURVEY LIMITATIONS

As with all reports of this type the main survey limitation is considered to be the short period of time in which the fieldwork was carried out during one season. Limitations to the likelihood of detecting certain subject species were also encountered during this survey. Such limitations were generally related to the seasonal detectability of species, be it as a result of known flowering periods for flora or migratory movements by fauna. For example the locally occurring threatened flora species, *Diuris arenaria* and *Diuris praecox* have a short flowering period in spring and would be unlikely to be detected outside this period. Another pertinent limitation was the intermittent inclement weather experienced at the time of the survey, which may have had an impact on the diversity of microchiropteran bats and reptile species recorded within the study area.

These limitations have been overcome by applying the precautionary principle in all cases where the survey methodology may have given a false negative result. This precautionary principle was achieved by recognising that most threatened species are rare and therefore unlikely to be encountered during a survey even if they may utilise the site at other times. These species have been assessed on the basis of the presence of their habitat and the likely significance of that habitat to a viable local population.

5.0 CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT

Considerations of the effects of the proposal under the guidelines of Section 5A of the Environmental Planning and Assessment Act (1995) are given in Appendix A. The species dealt with were those species identified on site during the fieldwork and those considered to have potential habitat available within the study area as detailed in Section 4.2.2 of this report.

The assessment of the level of significance of the potential impact of this proposal on the Threatened species, Endangered Populations and Endangered Ecological Communities has been made taking into consideration the past history of the site, its present condition and the future conditions should the proposal proceed.

An air photograph from 1972 shows little vegetation on the site, although it does not appear to have been sand mined. Further disturbance followed the establishment of the Salamander Commercial Centre in the 1980's, which directs its car park runoff into the land, and the subsequent development of the Day Care Centre and the Library. These activities have resulted in a generally disturbed site which still satisfies the criteria for an EEC (Swamp Sclerophyll Forest) on the western 3 ha. There has been a substantial amount of planting of Koala feed trees on the site which is believed to have enhanced the habitat present for Koalas. Wallum Froglet was found to have been present on the western part of the site over the last 10 years but does not appear to be present in the eastern part.

In assessing the impact of the removal of almost all of the vegetation within the site, consideration was given to the extensive areas of Swamp Sclerophyll Forest extant on the Tomaree Peninsula. The Seven-part Test has found that the proposal would not have a significant impact upon any Threatened Species, Endangered Population or Endangered Ecological Community such as would cause the extinction of a viable local population.

As a further precaution against underestimating the significance of the impact of this proposal, it is recommended that there be the provision of a substantial ecological offset, the treating of storm water from the parking area beyond the present removal of gross pollutants, and the planting of up to 300 advanced E. robusta tube stock in suitable areas. Such suitable areas are seen to be along a road reserve down the western side of the land and as a component of other landscaping where the koalas are not likely to be encouraged into places of conflict with traffic and other hazards. The details of the land proposed as the offset are given in Appendix E along with an evaluation of the appropriateness of the offset area. This evaluation has been undertaken in accordance with the 13 Principles of Biodiversity Offsets espoused by DECC.

6.0 CONSIDERATIONS UNDER THE PORT STEPHENS COMPREHENSIVE KOALA PLAN OF MANAGEMENT

The Port Stephens Comprehensive Koala Plan of Management (CKPoM) has been prepared for the Port Stephens LGA in accordance with SEPP 44 – 'Koala Habitat Protection'. The principle aim of the Port Stephens CKPoM is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and to reverse the current trend of Koala population decline.

Koala Habitat Assessments under the Port Stephens CKPoM involve four stages: preliminary assessment, vegetation mapping, Koala habitat identification and assessment of the proposal. As published in 2002 the CKPoM does not recognise the provision of ecological offsets as an ameliorative measure although this is recognised in the publication, 'Planning guidelines for Koala conservation and recovery: a guide to best planning practice' (McAlpine *et al*, 2007). Lismore City Council also has a Koala feed tree classification and replacement tree planting scheme providing an offset for feed trees removed during development. These offset schemes have been considered in this assessment.

Because of the specificity of the CKPoM to Port Stephens, a Koala habitat assessment has been completed below under the performance criteria in the CKPoM with a discussion of the appropriateness of the ecological offsets being offered for the development of this site.

6.1 PRELIMINARY ASSESSMENT

The preliminary assessment for the site involves reviewing the Koala Habitat Planning Map for the area as contained in the CKPoM and undertaking a site inspection to determine whether the site contains individuals of Koala trees outside areas marked as 'Preferred Koala Habitat'. Review of the Koala Habitat Planning Map (Figure 13) showed the site to contain two Koala habitat categories:
'Preferred Koala Habitat';
'Buffer over cleared land'

The majority of the site has been designated as 'Cleared land'.

The Koala Habitat Planning Map also shows that 'Preferred' habitat occurs on land to the west of the property and contiguous with that on the site.

6.2 VEGETATION MAPPING

As the survey of the site has identified a number of Swamp Mahogany and Forest Red Gum present on site the next step in the Koala Habitat Assessment is to provide a description of the vegetation

assemblages present on site and to compare the results of the vegetation survey conducted for this report with the LGA wide vegetation map (Figure 2.5 - 'Eastern Section Vegetation' in Part 2 of the Port Stephens CKPoM).

The vegetation mapping in the CKPoM shows the site as supporting Coastal Swamp forest with *E. robusta* (Swamp Mahogany) dominant

The vegetation survey found that *E. robusta* was present within the Swamp Forest – Open Forest on the edge of the commercial centre parking area, and in the Coastal Sand Woodland, both of which were dominated by *Melaleuca quinquenervia*. A small number of *E. tereticornis* had been planted in the car park associated with the library building (Figure 6). This does not comply with the mapping used to define Koala Habitat in the CKPoM and the assessment proceeds to the next level, being Koala Habitat Identification.

6.3 KOALA HABITAT IDENTIFICATION

The object of this step is to determine if there are areas of 'Potential Koala Habitat', 'Supplementary Koala Habitat', 'Habitat Buffers', 'Habitat Linking Areas' or preferred Koala food trees on site

Within the CKPoM there are three species of Eucalypt identified as Koala food trees, being *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus parramattensis* ssp. *decadens* (Drooping Red Gum) and *Eucalyptus tereticornis* (Forest Red Gum). *E. robusta* was present within the Swamp Forest – Open Forest and in the Coastal Sand Woodland. It was also present where it had been planted, adjacent to the Swamp Forest – Open Forest on the edge of the library parking area. A small number of *E. tereticornis* had been planted in the car park associated with the library building (Figure 6).

Based on the actual composition of the vegetation, the CKPoM Koala habitat Community survey ranking is 'Category D' and the Field ranking is 'Secondary Koala Habitat' giving a combined classification of 'Supplementary Habitat'.

A Koala was present in a Swamp Mahogany and Koala scats were present under many of these trees in the western part of the site and under one of the *E. tereticornis* beside the library. This was taken to mean, *ipso facto,* that the vegetation on this part of the site was 'Preferred Koala habitat'. Despite searches, scats were only found to be present under these trees and the 'spot assessment' technique was not able to be applied to this vegetation.

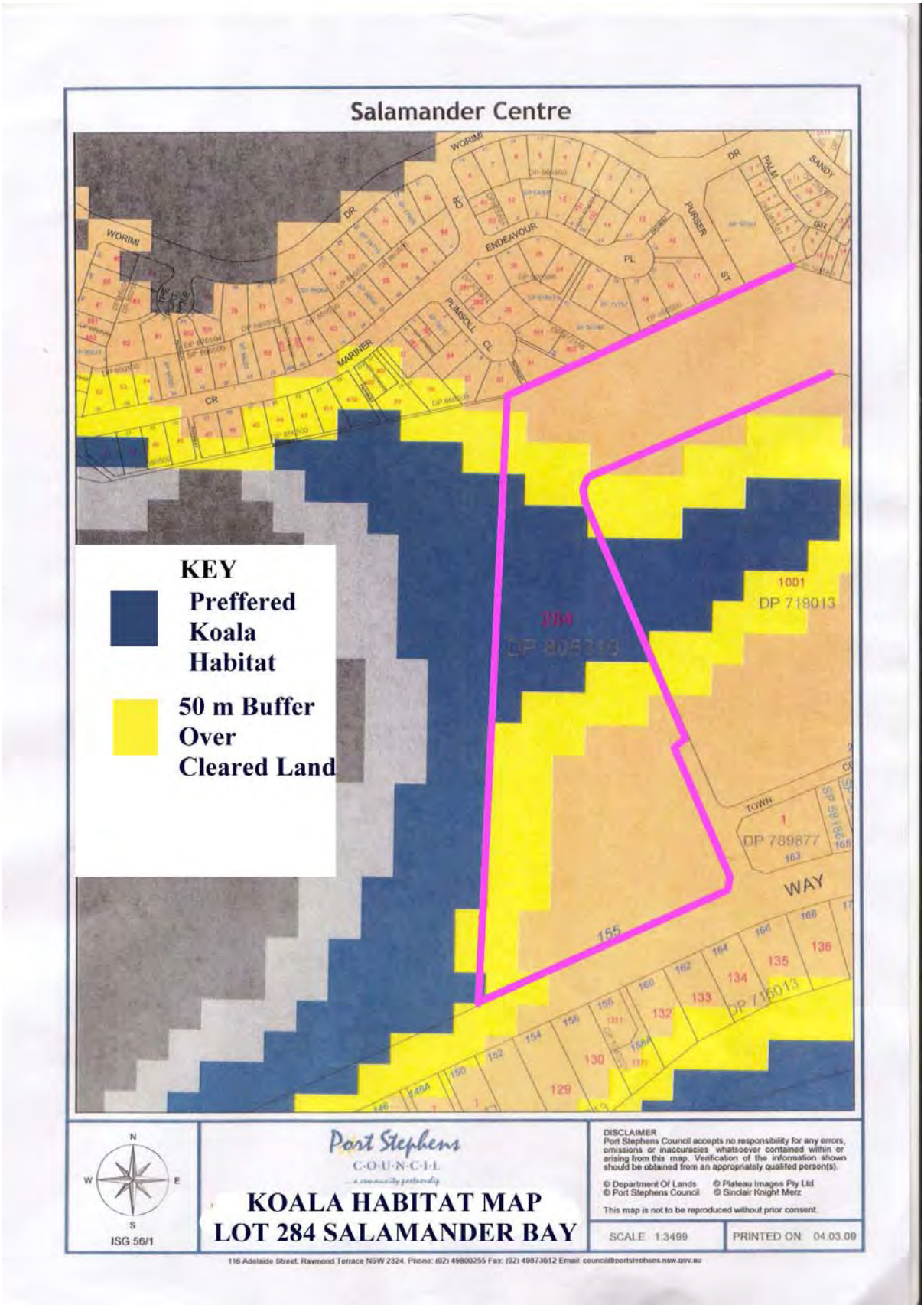


Figure 13 – Mapped Koala Habitat on the site

Due to its location and surrounding development, the site is not considered to contribute to a link between areas of preferred Koala habitat to the north or east.

6.4 ASSESSMENT OF THE PROPOSAL

There are eight performance criteria applied to developments proposed on sites that contain or are adjacent to 'Preferred Koala Habitat', 'Supplementary Koala Habitat', 'Habitat Buffers', 'Habitat Linking Areas' or areas that contain preferred Koala food tree species. Each criterion is displayed below in italics followed by the site-specific answer.

6.4.1 APPLICATION OF THE PERFORMANCE CRITERIA

The following standards are recommended for all developments proposed on sites that contain or are adjacent to primary or secondary koala habitat, habitat buffers or habitat linking areas. For the purposes of these standards, native vegetation is defined as any of the following types of indigenous vegetation: trees (including saplings and shrubs), understorey plants, groundcover or plants occurring in a wetland.

- *The development must:*
  Minimise the removal or degradation of native vegetation within Preferred Koala Habitat or Habitat Buffers;

The proposal would result in the removal of most of the vegetation constituting 'Preferred Habitat' and 'Habitat Buffer'. It is necessary to remove this vegetation in order to be able to undertake the land fill required to proceed with the development. .

It is recommended that as many as possible of the Koala feed trees be retained around the edges of the Swamp Forest within proposed Lots 3 and 4. The exact surveyed position of the feed trees to be retained and those to be removed, their characteristics such as height, diameter at breast height, general condition etc should be the subject of a separate report. Where ever possible any tree planting undertaken within the development away from places where the Koalas are likely to be in conflict with traffic and other hazards. This is seen to provide the opportunity to result in a net gain in Koala habitat in this locality. The ecological offset offered as amelioration will also preserve substantial areas of koala habitat in this locality.

- *Maximise retention and minimise degradation of native vegetation within Supplementary Koala Habitat and Habitat Linking Areas;*

The proposal would result in the removal of all of the vegetation constituting 'Supplementary Habitat'. The ecological offset offered will preserve substantial areas of Koala habitat in this locality and the planting of feed trees are offered as amelioration. Inspection prior to tree removal is necessary.

- *Minimise the removal of any individuals of Koala food trees where ever they occur on a development site. In the Port Stephens LGA these trees species are Eucalyptus robusta (Swamp Mahogany), Eucalyptus parramattensis (Parramatta Red Gum) and Eucalyptus tereticornis (Forest Red Gum);*

The removal of E. robusta (Swamp Mahogany) specimens has been minimised within this proposal.

- *Make provisions, where appropriate, for restoration or rehabilitation of areas identified as Koala Habitat including Habitat Buffers and Habitat Linking Areas over Mainly Cleared Land;*

The planting of preferred food trees has been recommended.

- *Make provision for long term management and protection of Koala habitat including both existing and restored habitat;*

It is recommended that the off set areas of Koala Habitat be protected from future disturbances and managed to maintain habitat attributes.

- *Not compromise the potential safe movement of Koalas across the site. This should include maximum tree retention generally and minimising the likelihood that the proposal would result in the creation of barriers to Koala movement, such as would be imposed by certain types of fencing;*

The retention of some feed trees and the possibility of supplementary planting require the capacity of Koalas to access these trees and; a low vehicle speed limit will be applied within all parts of the development.

- *Be restricted to identified envelopes which contain all buildings and infrastructure and fire fuel reduced zones;*

Not applicable

- *Include measures to effectively minimise the threat posed to Koalas by dogs and motor vehicles by adopting minimum standards.*

As recommended in the answer to criterion f) above, it is recommended that a number of measures be used to ensure the safety of the local Koalas.

From the above it is seen that this proposal does not comply with the Performance Criteria. It is proposed that, for this development, the waiver provisions in the CKPoM be applied. These are:

Council may waive the provisions of a), b) and c) of these criteria only for the purposes of establishing a building envelope and associated works, and only if the proponent can demonstrate:

1. *That the building envelope and associated works including fire fuel reduction zones **cannot** be located in such a way that would avoid the removal of native vegetation within Preferred or Supplementary Koala Habitat, Habitat Buffers, or Habitat Linking Areas, or removal of preferred koala food trees;*

2. *That the location of the building envelope and associated works **minimises** the need to remove vegetation as per 1 above;*

3. *That, in the case of subdivisions, they are designed in such a way as to retain and enhance koala habitat on the site and are consistent with the objectives of this appendix; and*

4. *That koala survey methods (as per the Guidelines for Koala Habitat Assessment in Appendix 6) have been used to determine the most appropriate location for the building envelope and associated works (so as to minimise the impact on koala habitat and any koala populations that might occur on the site).*

6.5 KOALA HABITAT CONCLUSION

As proposed, this development does not comply with the performance criteria for development assessment in the CKPoM. A discussion of the relative benefits to the human community of the proposed development over the benefit of retaining all of the Koala habitat present is more appropriately undertaken within the Statement of Environmental Effects accompanying the Development Application. Consequently this assessment has addressed the amount of Koala habitat that can reasonably be retained within the development.

7.0 SEPP 14 – COASTAL WETLANDS

State Environmental Planning Policy 14 – Coastal Wetlands (SEPP 14) aims to protect coastal wetlands for the environmental and economic interests of the state. SEPP 14 wetlands are defined as being those lands within the outside of the wetland defining line on the SEPP 14 Wetland Map.

The current boundary of Mambo Wetland (SEPP 14 Wetland No 761) to the west of the site is shown in Figure 14 along with a remapping of the wetland boundary undertaken in February 2009 (Harper Somers O'Sullivan, 2009). The existing wetland boundary runs along part of the western boundary of Lot 284 and provision of a 50m buffer to the wetland would not allow the construction of the road along this boundary as proposed. The remapping of the edge of the wetland places its boundary 30m to 50m further to the west and a managed buffer of at least 40m would be possible. It is understood that an application will be made to adjust the wetland map to incorporate the revised boundary.

Even if this wetland boundary is amended, precautions will have to taken to avoid any disturbance to the wetland from the works on Lot 284. Any future construction within the site will need to follow strict sediment and erosion controls. A comprehensive weed management plan will be required to be implemented to avoid any impacts on the SEPP 14 wetland, such as thoroughly cleaning machinery down before being transported to the site to prevent outbreaks of noxious weeds such as *Alternanthera philoxeroides* (Alligator Weed) and *Lugwigia longifolia* (Long-leaf Willow Primrose).

Figure 14 – SEPP 14 Wetland boundaries

8.0 SEPP 71 – COASTAL PROTECTION

State Environmental Planning Policy No. 71 - Coastal Protection (SEPP 71), which came into force in November 2002, aims to protect and enhance the coastal zone and ensure that it is managed in accordance with the principles of ecologically sustainable development. SEPP 71 identifies State significant development within the coastal zone, requires development applications in sensitive locations to be referred to the Director-General of Planning NSW for comment, and identifies master plan requirements for certain development in the coastal zone. The policy applies to all land within the coastal zone. The site containing the proposed redevelopment will be within the coastal zone. SEPP 71 applies to activities under Part 4 of the EP&A Act, therefore the requirements of the policy apply to this proposal. These matters are reproduced below and comments are provided in relation to the proposed development.

The matters for consideration are the following:

(a) The aims of the this Policy set out in clause 2,

The aims of the Policy are reproduced in Appendix F and the proposal is seen to comply with items (a) to (l) of the stated aims, where applicable.

(b) *Existing public access to and along the coastal foreshore for pedestrians or persons with a disability should be retained and, where possible, public access to and along the coastal foreshore for pedestrian or persons with a disability should be improved,*

No public access to foreshore is involved.

(c) *Opportunities to provide new public access to and along the coastal foreshore for pedestrians or persons with a disability,*

Not applicable.

(d) *The suitability of development given its type, location and design and its relationship with the surrounding area,*

These matters have been addressed at the time of the zoning of this land.

(e) Any detrimental impact that development may have on the amenity of the coastal foreshore, including any significant overshadowing of the coastal foreshore and any significant loss of views from a public place to the coastal foreshore,

Not applicable.

(f) The scenic qualities of the New South Wales coast, and means to protect and improve these qualities,

This proposal is not visible from, and will have no impact upon the scenic qualities of the coastline

(g) Measures to conserve animals (within the meaning of the Threatened Species Conservation Act 1995) and plants (within the meaning of that Act), and their habitats,

The impacts of the proposal on flora and fauna and proposed mitigation measures are detailed in Sections 5.0, 6.0 and 9.0.

(h) Measures to conserve fish (within the meaning of Part 7A of the Fisheries Management Act 1994) and marine vegetation (within the meaning of that Part) and their habitats,

Part 7a of the Fisheries *Management Act, 1994* addresses threatened species conservation. No threatened fish or aquatic invertebrates (apart from the giant dragonfly) are expected to occur within the site.

Indirect impacts to potential habitat of the giant dragonfly will be mitigated by implementation of sediment controls during and after construction, weed control activities and by minimising the amount of potential giant dragonfly habitat to be disturbed.

(i) Existing wildlife corridors and the impact of development on these corridors,

The site does not constitute a wildlife corridor.

(j) The likely impact of coastal processes and coastal hazards on development and any likely impacts of development on coastal processes and coastal hazards,

Coastal processes and coastal hazards are unlikely to impact upon this development due to the distance of it from coastal waters and that it is not flood-prone land.

(k) Measures to reduce the potential for conflict between land-based and water-based coastal activities,

Not applicable.

(1) Measures to protect the cultural places, values, customs, beliefs and traditional knowledge of Aboriginals,

Indigenous Archaeology and Cultural Heritage assessments have been addressed in a separate report.

(m) Likely impacts of development on the water quality of coastal waterbodies,

Taking into the considerations the recommendations in Section 10.0 of this report it is unlikely a proposed redevelopment will have a significant impact on the wetland in the eastern portion of the site. Potential impacts include sedimentation, leachate from fill and construction materials, disturbance of acid sulphate soils, fuels and oils from construction equipment.

(n) The conservation and preservation of items of heritage, archaeological or historic significance,

Not applicable.

(o) Only in cases in which a council prepares a draft local environmental plan that applies to land to which this Policy applies, the means to encourage compact towns and cities,

Not applicable.

(p) Only in cases in which a development application in relation to proposed development is determined:

- *(i) the cumulative impacts of the proposed development of the environment, and*
- *(ii) measures to ensure that water and energy usage by the proposed development is efficient."*

These matters have been addressed in the Statement of Environmental Effects accompanying the Development Application.

9.0 CONSIDERATIONS UNDER THE COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Considerations have been made to the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999. Assessments have been made to determine whether or not the proposal or activity has, will have, or is likely to have a significant impact on a matter of National Environmental Significance. The matters of National Environmental Significance and the appropriate responses are listed below:

- *World Heritage properties;*

The proposed development does not affect any World Heritage properties.

- *Wetlands recognised under the Ramsar convention as having international significance;*

The site does not have any impact or occur in proximity to a Ramsar listed wetland.

- *Listed threatened species and communities;*

Thirty-seven nationally threatened species were recorded on the DEWHA on-line database as occurring or having potential habitat available within 10km of the site, these being:

Cryptostylis hunteriana	Leafless Tongue Orchid
Diuris praecox	Newcastle Doubletail
Eucalyptus parramattensis ssp. *decadens*	Drooping Red Gum
Prostanthera densa	Villous Mintbush
Litoria aurea	Green and Golden Bell Frog
Mixophyes balbus	Stuttering Frog
Chelonia mydas	Green Turtle
Dermochelys coriacea	Leatherback Turtle
Diomedea amsterdamensis	Amsterdam Albatross
Diomedea antipodensis	Antipodean Albatross
Diomedea dabbenena	Tristan Albatross
Diomedea exulans	Wandering Albatross
Diomedea gibsoni	Gibsons Albatross
Lathamus discolor	Swift Parrot
Macronectes giganteus	Southern Giant-Petrel
Macronectes halli	Northern Giant-Petrel
Pterodroma leucpotera ssp. *leucpotera*	Gould's Petrel
Pterodroma neglecta ssp. *neglecta*	Kermadec Petrel (western)
Rostratula benghalensis	Painted Snipe
Thalassarche bulleri	Buller's Albatross
Thalassarche cauta	Shy Albatross
Thalassarche impavida	Campbell Albatross
Thalassarche melanophris	Black-browed Albatross
Thalassarche salvini	Salvin's Albatross
Thalassarche steadi	White-capped Albatross
Xanthomyza phygia	Regent Honey Eater
Balaenoptera musculus	Blue Whale
Chalinolobus dwyeri	Large-eared Pied Bat
Dasyurus maculatus ssp. *maculatus*	Tiger Quoll, Spot-tailed Quoll
Eubalaena australis	Southern Right Whale

Megaptera novaeangliae	Humpback Whale
Potorous tridactylus	Long-nosed Potoroo
Pteropus poliocephalus	Grey-headed Flying-Fox
Carcharias taurus	Grey Nurse Shark
Carcharodon carcharias	Great White Shark
Pristis zijsron	Green Sawfish
Rhincodon typus	Whale Shark

No nationally threatened species were recorded within the site during the survey. With the exception of *M. balbus, Prostanthera densa* and listed marine species habitat of varying quality was considered to be available within the site for the remaining species. All nationally listed species that were considered to have habitat on site have been addressed under the provisions of state legislation (ie: Section 5A of the NSW Environmental Planning and Assessment Act 1979). As stated within Section 5, the proposal will lead to a small incremental loss of habitat within the locality, however it is not considered to be locally significant.

- *migratory species protected under international agreements;*

A number of migratory species were recorded on the DEWHA's on-line database as occurring or having potential habitat available within 10km of the site. Two of these species, *Xanthomyza phrygia* and *Lathumus discolor* have been assessed as threatened species within Section 5 and Appendix A of this report. No listed migratory species were recorded during the survey.

Each of the remaining species has been assessed below in Table 9.

Table 9: Assessment of Migratory Species.

Scientific Name	Habitat	Possibility of occurrence & impact of action
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle	Considered to be a migratory species, however any movements are likely to be nomadic rather than migratory, in response to food availability	Due to the proximity to Nelson Bay the site was considered to contain marginal roosting habitat. Nesting habitat was thought to be absent due to the lack of larger suitable trees. The proposal is not likely to have any impact upon this species.
Hirundapus caudacutus White-throated Needletail	Inhabits the airspace above forests, woodlands, farmlands, plains, lakes, coasts and towns.	Due to the general habitat requirements of the White-throated Needletail it is considered unlikely that the proposal will adversely impact upon this species.
Xanthomyza phrygia Regent Honeyeater	Temperate woodlands and open forest, including forest edges, preferring to forage on large-	The removal of specimens of *Eucalyptus robusta* (Swamp Mahogany) a known preferred

Scientific Name	Habitat	Possibility of occurrence & impact of action
	flowered eucalypts.	foraging species will result in the incremental reduction of habitat in the local area for the Regent Honeyeater. Compensatory offsets and the recommendation leaving as many preferred foraging trees on site will reduce the impact on this species where it will not considered to be significant.
Monarcha melanopsis Black-faced Monarch	Utilises a range of habitats including rainforests, eucalypt woodlands, coastal scrubs (Pizzey & Knight, 2001).	Due to its general habitat requirements it is considered unlikely that the proposal will adversely impact upon this species.
Myiagra cyanoleuca Satin Flycatcher	Heavily vegetated gullies in forests and taller woodlands. During migration this species also utilises coastal forests, woodlands, mangroves, remnant trees in paddocks and gardens (Pizzey & Knight, 2001).	Due to its general habitat requirements, it is considered unlikely that the proposal will adversely impact upon this species.
Rhipidura rufifrons Rufous Fantail	Utilises a range of habitats including rainforests, wet sclerophyll forests, monsoon forests, scrubs, mangroves, watercourses, parks and gardens. During migration this species also utilises farms, street trees and buildings (Pizzey & Knight, 2001).	Suitable habitat was present within the site for this species. The proposal will result in a small decrease in habitat for this species however would not be considered to be significant.
Merops ornatus Rainbow Bee-eater	Inhabits areas such as open woodlands with sandy soils, sandridges, riverbanks, beaches, dunes, cliffs and rainforests.	Suitable foraging habitat was contained within the site however no suitable nesting habitat was present. The proposal is unlikely to impact upon this species.
Migratory Wetland Species:		
Ardea alba Great Egret	Inhabits shallows of rivers, larger dams, freshwater wetlands and irrigation areas.	Foraging habitat for this species, within the areas of swamp forest. The proposal is unlikely to adversely impact upon this species.
Ardea ibis Cattle Egret	Inhabits stock paddocks, pastures, croplands, wetlands and drains.	Limited habitat for this species within the wetter areas of swamp forest. The proposal is unlikely to impact upon this species.
Gallinago hardwickii Latham's Snipe	Utilises a variety of habitat, such as soft wet ground, shallow water with tussock and other green and dead vegetation, and scrub or open wetland from sea level to alpine regions.	The site contains limited habitat for this species within the wetter areas of swamp forest. The proposal is unlikely to impact upon this species.
Rostratula benghalensis australis Painted Snipe	This species frequents the margins of swamps and streams, chiefly those covered with low and stunted vegetation.	Marginal foraging habitat available for this species within the wetter areas of swamp forest. The proposal is unlikely to impact upon this species.

Scientific Name	Habitat	Possibility of occurrence & impact of action
Migratory Marine Species (overflies a marine area):		
Apus pacificus Fork-tailed Swift	Inhabits the airspace over open country from semi deserts to coasts.	Due to its general habitat requirements it is considered unlikely that the proposal will adversely impact upon this species.
Ardea alba Great Egret	Inhabits shallows of rivers, larger dams, freshwater wetlands and irrigation areas.	The site contains marginal foraging habitat for this species within the drainage line. The proposal is unlikely to impact upon this species.
Ardea ibis Cattle Egret	Inhabits stock paddocks, pastures, croplands, wetlands and drains.	The site contains no suitable habitat for this species and it would not be adversely impacted as a result of the proposal.
Gallinago hardwickii Latham's Snipe	Utilises a variety of habitat, such as soft wet ground or shallow water with tussock and other green and dead vegetation, and scrub or open wetland from sea-level to alpine bogs (Pizzey & Knight, 2001).	The site contains limited habitat for this species within the wetter areas of swamp forest. The proposal is unlikely to impact upon this species.
Haliaeetus leucogaster White-bellied Sea-Eagle	Considered to be a migratory species, however any movements are likely to be nomadic rather than migratory, in response to food availability	Due to the proximity to Nelson Bay the site was considered to contain marginal roosting habitat. Nesting habitat was thought to be absent due to the lack of larger suitable trees. The proposal is not likely to have any impact upon this species.
Hirundapus caudacutus White-throated Needletail	Inhabits the airspace above forests, woodlands, farmlands, plains, lakes, coasts and towns.	Due to the general habitat requirements of the White-throated Needletail it is considered unlikely that the proposal will adversely impact upon this species.
Lathamus discolor Swift Parrot	Utilises open forest and woodland, as well as winter flowering eucalypt street trees and trees in parks and gardens. The preferred winter food species are *Eucalyptus sideroxylon* (Red Ironbark), *E. albens* (White Box), *E. ovata* (Swamp Gum), *E. robusta* (Swamp Mahogany) and *E. melliodora* (Yellow Gum).	The removal of specimens of *Eucalyptus robusta* (Swamp Mahogany) a known preferred foraging species will result in the incremental reduction of habitat in the local area for the Swift Parrot. Compensatory offsets and the recommendation of leaving as many preferred foraging trees on site will reduce the impact of any future development on this species.
Merops ornatus Rainbow Bee-eater	Inhabits areas such as open woodlands with sandy soils, sandridges, riverbanks, beaches, dunes, cliffs and rainforests.	Suitable foraging habitat was contained within the site however no nesting habitat was present. The proposal is unlikely to impact upon this species.
Monarcha melanopsis Black-faced Monarch	Utilises a range of habitats including rainforests, eucalypt woodlands, coastal scrubs (Pizzey & Knight, 2001).	Due to its general habitat requirements it is considered unlikely that the proposal will adversely impact upon this species.

Scientific Name	Habitat	Possibility of occurrence & impact of action
Myiagra cyanoleuca Satin Flycatcher	Heavily vegetated gullies in forests and taller woodlands. During migration this species also utilises coastal forests, woodlands, mangroves, remnant trees in paddocks and gardens (Pizzey & Knight, 2001).	Due to its general habitat requirements it is considered unlikely that the proposal will adversely impact upon this species.
Rhipidura rufifrons Rufous Fantail	Utilises a range of habitats including rainforests, wet sclerophyll forests, monsoon forests, scrubs, mangroves, watercourses, parks and gardens. During migration this species also utilises farms, street trees and buildings (Pizzey & Knight, 2001).	Suitable habitat was present within the site for this species. The proposal will result in a small decrease in habitat for this species however would not be considered to be significant.
Rostratula benghalensis australis Painted Snipe	This species frequents the margins of swamps and streams, chiefly those covered with low and stunted vegetation.	The site contains marginal foraging habitat for this species within the wetter areas of swamp forest. The proposal is unlikely to impact upon this species.

- *nuclear activities;*

The proposal does not involve any type of nuclear activity.

- *the Commonwealth marine environment;*

The proposal does not involve the modification of the Commonwealth marine environment.

10.0 RECOMMENDATIONS

The recommendations given in the report have been summarised below along with matters relating to the preservation and wellbeing of native animals likely to be affected by the proposed development .

Planning

- Application should be made to amend the position of the mapped boundary of the Sepp 14 Wetland to the west of the site.

Ecological impact

- Retention of as many as possible of *Eucalyptus robusta* (Swamp Mahogany), a Preferred Koala Feed Tree.
- A Koala feed tree report to be undertaken giving the exact surveyed position of the feed trees to be retained and those to be removed, their characteristics such as height, diameter at breast height, general condition etc. Retained *E. robusta* to be protected by exclusion fencing during construction.
- A landscaping concept plan to be produced to show areas where *E. robusta* may be used for landscaping in western part of the site.
- Removal of vegetation within the Endangered Ecological Community is to be compensated by the dedication of an Ecological Offset on Lot 21 DP1044009 (100 Salamander Way) at four times the area removed from Lot 284.

Hydrological impact

- Stormwater runoff carrying possible pollutants and sediment from the Salamander Centre parking area to be treated before disposal into Mambo Wetland.
- Redirection of storm water to an outlet in the north-western corner of the site.

Animal welfare

- Before removal of any trees, they must be checked by a qualified ecologist to ensure that no resident Koalas, bird nests etc.
- All vegetation removal to be undertaken with a suitably qualified ecologist or native animal rescuer present to rescue or relocate native animals injured or exposed.
- Injured animals are to be given necessary veterinary treatment and/or handed over to Native Animal Trust Fund.
- Uninjured animals may be released by rescuers into suitable local habitat.

Weed Control

- Existing infestation of *Ludwigia longifolia* (Willow-leaved Primrose) must be removed and treated before any earthworks are undertaken
- This and other weeds must be prevented from spreading into surrounding native vegetation such as the adjoining Mambo Wetland.

Sediment control

- movement of sediment from any area of soil disturbance must be controlled by standard silt control methods.

11.0 CONCLUSION

Flora, fauna and habitat studies have been undertaken over land identified as Lot 284 DP 806310 Salamander Way Salamander Bay NSW for a proposed subdivision, recontouring by cut and fill and drainage works. This proposal will mean that most of the vegetation present on the site will be removed.

The site has been disturbed by past sand mining, and subsequent commercial and infrastructure development. The vegetation present on the site appears to be regrowth since these disturbances. It has been zoned for commercial use for many years and is presently partly occupied by a day care centre and library. The western part of the site is the disposal area for stormwater runoff from the Salamander Commercial Centre. This water is routed through a gross pollution trap but undergoes no other treatment for the removal or reduction of hydrocarbons or other pollutants, which is seen to be necessary to ensure the quality of the water that eventually enters the Mambo Wetlands.

Legislation applicable to a development application over this site is the Environmental Planning and Assessment Act 1979, the Threatened Species Conservation Act 1995, The Environment Protection and Biodiversity Conservation Act 1999, State Environmental Planning Policies 14 – Coastal wetlands, 71 - Coastal Developments, and *via* the Port Stephens Comprehensive Koala Plan of Management, State Environmental Planning Policy 44 - Koala Habitat Protection. This legislation has been addressed in the report by undertaking an ecological survey of the site using standard flora and fauna methodologies incorporating targeted searches for threatened species of plants and animals. Some of the vegetation was found to constitute of approximately 3 ha of Swamp Sclerophyll Forest, an Endangered Ecological Community. It also contained Primary Koala Feed Trees.

The Fauna survey discovered evidence on the site of *Phascolarctos cinereus* (Koala) and *Crinia tinnula* (Wallum Froglet) on the site. There was habitat present for another 36 threatened species which had been recorded from within 10 k of the site, and a ‘Seven-part Test’ of significance of the impact of the proposal upon all of them was undertaken as well as for the Endangered Ecological Community. The Seven-part Test concluded that there would be no significant impact such that a Threatened Species, Endangered Population or Endangered Ecological Community would be placed at risk of extinction. This conclusion was strengthened by taking into consideration the ecological offset that was offered as an amelioration of the impacts of the development.

Consideration of State Environmental Planning Policy 14 – Coastal Wetland found that the *prima facie* 50 m buffer could not be accommodated within the proposed design however, it was apparent that the mapped wetland boundary did not coincide with the extent of the actual wetland. A review of

this wetland boundary has been undertaken and it has been recommended that the officially recognised mapping be amended to incorporate the wetland boundary defined as shown in this report.

Since the site is within the mapped extent of the NSW Coastal Zone, SEPP 71 – coastal protection was seen to apply and the heads of consideration under this SEPP have been satisfactorily addressed.

Consideration of the Port Stephens Comprehensive Koala Plan of Management identified areas of 'Preferred Koala Habitat' and 'Supplementary Koala Habitat' on site. The development proposal was unable to satisfy the performance criteria of the CKPoM in that, in order to proceed, it would require the removal of native vegetation in the two Koala habitat classifications present and some Koala feed trees. It was recognised that a value judgement regarding the relative merits of retaining Koala habitat versus providing community facilities was outside of the scope of this assessment. If it is seen to be desirable, approval of this development is possible under the 'waiver clause' of the CKPoM.

While the assessment under Part 5A of the EPA Act did not find that there would be a significant impact upon Koalas such that a local population may be driven to extinction, it is recognised that there is likely to be some impact upon the local Koala population. The development offers the retention of most of the feed trees presently used by Koalas in the western area of the site, the preservation of the offset areas off site and the extensive feed tree planting program as amelioration of these impacts. The CKPoM does not contain provision for Koala Habitat offsets, there are precedents in other places for such measures.

Considerations have been made to the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act (1999). It was found that the proposal was not likely to significantly affect any items of National Environmental Significance.

12.0 BIBLIOGRAPHY

Andrews Neil (2007). *Environmental Assessment Part Lot 4 DP 1117732 (formally Part Lot 59 DP 831253) 320 Soldiers Point Road Salamander Bay*. Hill PDA/Port Stephens Council.

Auld, B.A. and Medd, R.W. (1996). *Weeds: An Illustrated Botanical Guide to the Weeds of Australia.* Inkata Press, Sydney.

Barker, J., Grigg, G.C. and Tyler, M.J. (1995). *A Field Guide to Australian Frogs*. Surrey, Beatty & Sons, New South Wales.

Bishop, A. (1996). *Field Guide to the Orchids of New South Wales and Victoria.* University of New South Wales Press: Sydney.

Braithwaite, R.W. (1991). *Fauna and Habitat Surveys as Ecological Pathfinders. In: Nature Conservation-Cost Effective Biological Surveys and Data Analysis*. Margules, C.R. and Austin, M.P. (Eds.). CSIRO, Australia.

Chippendale, G.M. (Ed) (1988). *Flora of Australia-Volume 19: Myrtaceae-Eucalyptus, Angophora*. Australian Government Publishing Service, Canberra.

Churchill, S. (1998). *Australian Bats.* Reed New Holland, Sydney.

Cogger, H.G. (1992). *Reptiles and Amphibians of Australia* (5th edn.). Reed International, New South Wales.

Cropper, S. (1993). *Management of Endangered Plants*. CSIRO Publications, East Melbourne.

Department of Environment and Climate Change (DECC, 16 February 2009), *Flora and Fauna Database 1:100,000 map sheet covered '9332' Port Stephens.*

Department of Environment and Conservation NSW (2005). *Draft Recovery Plan for the Green and Golden Bell Frog (Litoria aurea)*. DEC NSW, Hurstville, NSW.

Fairley, A. (2004). *Seldom Seen, Rare Plants of Greater Sydney*. New Holland Publishers (Australia) Pty Ltd.

Gibbons, P., Ayers, D., Seddon, J., Doyle, S. and Briggs, S. (2005) *BioMetric Version 1.8: A*

Terrestrial Biodiversity Assessment Tool for the NSW Property Vegetation Plan Developer - Operational Manual. NSW Department of Environment and Conservation

Gibbons, P., Briggs, S., Ayers, D., Seddon, J., Doyle, S., Cosier, S., McElhinny, C., Pelly, V., and Roberts, K. (2009). An operational method to assess impacts of land clearing on terrestrial biodiversity. *Ecological Indicators* 9; 26-42

Harden, G (1991-2000). *Flora of New South Wales. Vols 1-4.* NSW University Press.

Jones, D. L. (2006). *A Complete Guide to Native Orchids of Australia including the Island Territories.* New Holland Publishers (Australia) Pty Ltd.

Land & Property Information (2001), *Topographic & Orthophoto Map 1:25000: Port Stephens 9332-4S*, LPI, Bathurst, NSW

Leonard, G. (2007). *Eucalypts: A Bushwalker's Guide.* New South Wales 2nd Ed. University Press, Sydney.

McAlpine, C., Rhodes, J., Peterson, A.,Possingham, H., Callighan, J. Curran, T and Lunney, D. (2007) *Planning Guidelines for Koala conservation and recovery*. Australian Research Council and Australian Koala Foundation

Murray, M., Bell, S., Hoye, G. (2002). *Flora and Fauna survey Guidelines: Lower Hunter & Central Coast Region.* Lower Hunter & Central Coast Regional Environmental Management Strategy, Callaghan.

NSW Lands Department (1972). *Monochrome Air Photo 09/09/72 Sortie 2035, Run 8, Photo 5010*
Port Stephens Shire Council, (2002), *Port Stephens Council Comprehensive Koala Plan of Management (CKPoM)*, Prepared by Port Stephens Council with the Australian Koala Foundation.

Port Stephens Council (2006). *Mambo Wetland Plan of Management*. Port Stephens Council (January 2006).

Quin, D.G. (1995). *Population Ecology of the Squirrel Glider (Petaurus norfolcensis) and the Sugar Glider (P. breviceps) (Marsupialia : Petauridae) at Limeburners Creek, on the Central North Coast of New South Wales.* In: Australian Wildlife Research 22: pp 471-505.

Robinson, L. (1994). *Field Guide to the Native Plants of Sydney* (2nd edn.). Kangaroo Press Pty. Ltd., New South Wales.

Slater, P., Slater, P. and Slater, R. (1995*). The Slater Field Guide to Australian Birds.* Lansdowne Publishing, Sydney.

Strahan, R. (Ed) (1995). *The Mammals of Australia*. Reed Books, Australia.

Smith, A. (2000). *Sub-Regional Squirrel Glider Study, North Wyong Shire*. Wyong Shire Council.

Swan, G. (1990). *A Field Guide to the Snakes and Lizards of New South Wales.* Three Sisters Productions, New South Wales.

Triggs, B. (1984). *Mammal Tracks and Signs-A Field Guide for South-eastern Australia*. Oxford University Press, Melbourne.

Tyler, M.J. (1992). *Encyclopedia of Australian Animals-Frogs.* Angus & Robertson, Sydney.

Wildthing Environmental Consultants (1998). *Statement of Effect on Threatened Flora and Fauna for the proposed Salamander Library and Community Centre at Lot 204 DP 806310 Salamander Way Salamander Bay*. Port Stephens Council.

APPENDIX A
CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT

CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT - SIGNIFICANT EFFECT ON THREATENED SPECIES, POPULATIONS OR ECOLOGICAL COMMUNITIES, OR THEIR HABITATS.

Consideration of this development under the guidelines of Section 5A of the Environmental Planning & Assessment Act (1979) as amended by the Environmental Planning and Assessment Amendment Act (1997) has been made. The heads of consideration of this Section are given in italics followed by the answers applicable to this site. Each species found on site is dealt with separately. Species considered having habitat on site have been considered in similar group types.

Endangered Ecological Communities recorded on site:

1. Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Threatened Species recorded on site:

2.	*Phascolarctos cinereus*	Koala
3.	*Crinia tinnula*	Wallum Froglet

Threatened Species recorded within the adjoining Mambo Wetland

4.	*Eucalyptus parramattensis* ssp. *decadens*	Drooping Red Gum
5.	*Petaurus norfolcensis*	Squirrel Glider
6.	*Phascogale tapoatafa*	Brush-tail Phascogale
7.	*Pteropus poliocephalus*	Grey-headed Flying-fox

Threatened species considered to have habitat within the site:

8. Orchids

Cryptostylis hunteriana	Leafless Tongue Orchid
Diuris arenaria	Tomaree Doubletail
Diuris praecox	Rough Doubletail

9. Shrub Species

Callistemon linearifolius	Netted Bottlebrush

10. Frogs

Litoria aurea	Green and Golden Bell Frog

11. Water Birds

Botaurus poiciloptilus	Australasian Bittern
Rostratula benghalensis	Painted Snipe

12. Cockatoos and Parrots

Callocephalon fimbriatum	Gang-gang Cockatoo
Calyptorhynchus lathami	Glossy Black-Cockatoo
Lathamus discolor	Swift Parrot

13. Owls

Ninox connivens	Barking Owl
Ninox strenua	Powerful Owl
Tyto capensis	Grass Owl
Tyto novaehollandiae	Masked Owl

14. <u>Woodland Birds</u>

Burhinus grallarius	Bush stone-curlew
Xanthomyza phrygia	Regent Honeyeater

15. <u>Small Arboreal Marsupials</u>

Cercartetus nanus	Eastern Pygmy-possum

16. Terrestrial Mammals

Dasyurus maculatus ssp. *maculatus*	Tiger Quoll
Potorous tridactylus ssp. *tridactylus*	Long-nosed Potoroo
Pseudomys gracilicaudatus	Eastern Chestnut Mouse

17. <u>Microchiropteran Bats</u>

Chalinolobus dwyeri	Large-eared Pied Bat
Falsistrellus tasmaniensis	Eastern False Pipistrelle
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat
Miniopterus australis	Little Bentwing-bat
Miniopterus schreibersii oceanensis	Large Bentwing-bat
Mormopterus norfolkensis	Eastern Freetail Bat
Myotis adversus	Large-footed Myotis
Scoteanax rueppellii	Greater Broad-nosed Bat
Vespadelus troughtoni	Eastern Cave Bat

18. <u>Invertebrates</u>

Petalura gigantea	Giant Dragonfly

Endangered Populations considered to have potential habitat within the site:

19. *Dromaius novaehollandiae* Emu

1. Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Swamp Sclerophyll Forest occurs along coastal floodplains on waterlogged or periodically inundated alluvial flats and drainage lines with humic clay loams and sandy loams. The community typically occurs below 20m, however can be found up to 50m in elevation.

This community has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The trees may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality where the tree stratum is low and dense. Dominant trees include *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark) and, south from Sydney, *Eucalyptus botryoides* (bangalay) and *Eucalyptus longifolia* (woollybut). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including *Callistemon salignus* (sweet willow bottlebrush) and *Casuarina glauca* (swamp oak). The composition of the community is primarily determined by the frequency and duration of waterlogging and the texture, salinity, nutrient and moisture content of the soil, and latitude. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbances, and may have a substantial component of exotic grasses, vines and forbs.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Not applicable.

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

Not applicable.

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

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

Swamp Forest located within the western portion of the site was found to contain floristic components consistent with the Endangered Ecological Community - Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions. This 3 ha area of Swamp Sclerophyll Forest was divided up into three Swamp Forest variants; Swamp Forest subject to prolonged periods of inundation; Swamp Forest subject to less frequent inundation and Swamp Forest – Open Forest. All these variations were considered to constitute this Endangered

Ecological Community. According to past aerial photography (NSW, Lands *Monochrome Air Photo,* 1975) areas of swamp sclerophyll forest on site have been previously cleared or highly disturbed. These areas have regenerated to a state that some areas appear to have little disturbance. The past disturbance may explain the low height but dense nature of the *Melaleuca quinquenervia* (Broad-leaved Paperbark) in the west of the site.

A number of individual specimens of *E. robusta* and *M. quinquenervia* were present within the Coastal Sand Woodland Heath in the eastern portion of the site. These areas did contain similarities to the Endangered Ecological Community - Swamp Sclerophyll Forest, however due to the past disturbance, the composition of the understorey layers and little chance of inundation in this area, these areas in the east were not considered to constitute this Endangered Ecological Community.

The proposal will lead to the eventual removal of virtually all of the Swamp Forest (Approximately 4.2 ha) within the site. This will result in a small reduction of the extensive tracts of Swamp Forest in the local area (approximately 0.03%). It is considered that the action is unlikely to have a significant impact on the occurrence of Swamp Sclerophyll in the local area. The recommendation of compensatory offsets and water quality control are seen to enhance the insignificance of the impact.

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

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

The proposal will lead to the eventual removal of virtually all of the swamp forest (Approximately 4.2 ha) within the site. This will result in a small reduction in the area of Swamp Forest locally..

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of habitat beside Mambo Wetland in the west occur in close proximity to the site.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for Swamp Sclerophyll Forest in the local area. Taking the recommendations of weed, erosion and sediment control as part of any works within the site to protect areas of Swamp Forest within the adjoining Mambo Swamp Reserve together with the proposal for compensatory offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for this Endangered Ecological

Community, however the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of this community and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help Swamp Sclerophyll Forest recover in NSW. These actions include:

- Weed Control – particularly weed species such as Bitou Bush and Boneseed.
- Prevent erosion.
- Restrict Access to community.

The proposal involving the removal of Swamp Sclerophyll Forest and would not comply with the priority action statements. However, taking into consideration the plan for compensatory offset habitat and actions to prevent any disturbance to areas of Swamp Sclerophyll Forest contained within Mambo Wetland, it is considered that the proposed action will not significantly compromise these strategies.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site, have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The proposed subdivision and subsequent development will result in the removal of Swamp Sclerophyll Forest from the site resulting in an incremental decline in the local area.
- **Invasion of native plant communities by exotic perennial grasses:** This threatening process is already present with a large number of introduced grasses such as *Andropogon virginicus* Whisky Grass, *Anthoxanthum odoratum* (Sweet Vernal Grass), *Chloris gayana* (Rhodes Grass) and *Eragrostis curvula* (African Lovegrass). There is the potential for further infestation in the future particularly within the adjoining Mambo Wetland to the west. Given the recommendation for regular weed control the impact from this threatening process would be reduced.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site.
- ***Lantana camara* -** Infestations of Lantana were found to be present primarily around the periphery of the Swamp Forest community. There is the potential for further infestation of Lantana within the site. It is recommended that the infestation of Lantana be managed within this community.
- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** The European Rabbit was not recorded within the site during the survey however would be considered to be present in the local area. The proposal is unlikely to significant increase Rabbit numbers.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush & Boneseed).** Bitou Bush was found to be present within the site. There is the potential for further infestation in the future, however given the recommendation for weed control the impact from this threatening process would be reduced.

Bibliography:

NSW Scientific Committee (2004). *Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions – endangered ecological community determination – final. DEC (NSW*), Sydney.

Threatened Species recorded on site

2. *Phascolarctos cinereus* Koala

The Koala occurs along the east coast of Australia and extends into woodland, mulga and River Red Gum forests west of the Great Dividing Range. Its range covers all such suitable areas of N.S.W. In drier forested areas, Koalas are generally observed as individuals in low densities. They are more abundant in coastal woodland and in open forest, where they have been found in densities as high as ten per hectare. They are rare or absent in wet forests in the south above 600 m which may be due more to distribution of Eucalypt species than climate, as the Koala is limited to areas where there are acceptable food trees. Its diet is generally restricted to that of Eucalypt leaves and much less-often, non-Eucalypt foliage. The foliage of *Eucalyptus camaldulensis* (River Red Gum), *E. tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum), *E. viminalis* (Manna Gum), and *E. robusta* (Swamp Mahogany) are some of the preferred Eucalypt species. Koalas use a wide variety of tree sizes, and do not preferentially use large or tall trees in NSW forests, although this has been listed as a habitat preference in areas where trees are generally small, stunted, or nutrient deprived.

Koalas sleep in the fork of a tree during the day and feed at night with the peak of activity just after sunset. It is generally a solitary animal with a social behaviour pattern that influences its breeding biology. Breeding biology of the Koala is characterised by the occurrence of discrete core breeding groups which are sedentary. A core group may comprise up to several dozen individuals that are usually well separated from other breeding groups. These core groups produce a continual supply of dispersing nomadic sub-adults. Individual Koalas within core breeding groups occupy semi-exclusive territories. There is interaction with and marginal overlap of territories between adjacent individual animals. The territories of breeding males generally occur within a matrix of adjacent territories of breeding females. In the overlap zones of adjacent territories of breeding Koalas, individual trees occur that are habitually used for interaction between the two animals concerned. These breeding core interaction trees (sometimes termed "home range trees") are readily identifiable by scratched "trails" up the bole and copious dung deposits at the base of the tree. Breeding occurs in summer and young females produce one young (rarely twins) each year.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

An individual Koala was observed during the survey within the west of the site just to the north of the library carpark on the fringe of the wetter area of Swamp Sclerophyll Forest. This Koala was feeding within a *Eucalyptus robusta* (Swamp Mahogany), which is listed as a Preferred Koala Feed Tree Species under the Port Stephens Comprehensive Plan of Management (CKPoM). A number of recent Koala scats were also found to be present under specimens of Swamp Mahogany in the west of the site around the periphery of the wetter area of Swamp Forest and *E tereticornis* (Forest Red Gum) within the library carpark. No evidence of Koalas was found in the eastern portion of the site. According to the DECC database one Koala record was present in the eastern portion of the site in 1990.

Consideration of the significance of the impact of this proposal on the local Koala population has taken into account the evidence that:

- the area of Swamp Forest containing the koala feed trees in the western part of the site has been regenerated since clearing in the 1970's,
- the attributes of the Swamp Forest in this area have been artificially enhanced by the storm

water runoff from the car park,

- Koala habitat in this locality was considerably enhanced by the planting of 13 E. robusta and a larger number of E. tereticornis about 10 years ago. These trees are now of a size where they are being used by Koalas.
- It is accepted that the *Meleleuca quinquenervia* in the Swamp Forest may be grazed by coastal Koalas, but most of these trees were seen to be stunted and therefore less likely to be palatable and there was no evidence of their use by Koalas.

As recommended, the proposed subdivision and subsequent development will result in the preservation of most of the Koala feed trees in the western part of the site, the planting of Koala feed trees in as many situations as would reasonably increase the habitat resource for this species without increasing the level of hazard to the Koalas and the provision of ecological offsets for the habitat to be removed.

Taking these matters into consideration it is not seen that the proposal would be likely to drive the local koala population to extinction.

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

Two Endangered Koala Populations, Hawks Nest/Tea Gardens and the Pittwater Local Government Area are listed under the TSC Act 1995. Neither of these populations is pertinent to the site.

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

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

Not applicable.

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

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

The site supports up to 60 specimens of *E. robusta* and the proposal may result in the removal of some of these trees but it has been recommended that the Koala feed trees on the western part of the site be preserved as much as possible. It is expected that all but two of the trees planted within the library carpark will remain *in-situ*. The *M .quinquenervia* associated with the Koala feed trees in the Swamp Forest will be removed but together they constitute approximately 0.02% of the Preferred Koala habitat on the Tomaree Peninsula.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and the north-south movement corridor in the Mambo Wetland west of the site will be retained.

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

Taking the recommendations of leaving as many specimens of Swamp Mahogany within the site and compensatory plantings as well as the plan for compensatory offset land it is considered that no significant areas of habitat are likely to be removed that is essential to the long-term survival of the Koala in this area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Draft Recovery Plan has been completed for the Koala. It is important to retain as many Koala Feed Trees as possible within the site to aid the safe movement of Koalas to areas containing preferred habitat. It is considered that the proposed action will not significantly compromise this draft recovery plan.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will include Preferred Koala Feed Tree Species for subsequent development is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was not recorded on site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.

Other pertinent threats would be those posed by dogs and vehicle collision.

Bibliography

Australian Koala Foundation (1996). *The Koala Habitat Atlas - Project No 6: Port Stephens Local Government LGA.* Draft Report prepared for Port Stephen Council.

Callaghan, J., Leathley, S. and Lunney, D. (1994). *Port Stephens Koala Management Plan Draft for Public Discussion, 27th September 1994.* Port Stephens Council, NSW.

Martin, R.W. and Handasyde, K.A. (1995). *Koala (Phascolarctos cinereus). In: The Mammals of Australia, pp: 196-8.* Strahan, R. (Ed). Reed Books, Sydney.

NPWS Database (2000). *Fauna Species List for Protected Areas in NSW, at* 'http://www.npws.gov.au/wildlife/species.htm'.

Reed, P.C., Lunney, D. and Walker, P. (1990). *A 1986-1987 Survey of the Koala Phascolarctos cinereus (Goldfuss) in New South Wales and an Ecological Interpretation of its Distribution.* In: Lee, A.K., Handasyde, K.A. and Sanson, G.D. (eds). Biology of the Koala, Surrey Beatty and Sons Pty Ltd.

3. *Crinia tinnua* Wallum Froglet

The Wallum Froglet is an inhabitant of shallow acid swamps (temporary / semi-permanent) and associated connecting channels and deeper water holes (permanent). The vegetation type in these areas consists of hard-leafed heaths, shrubs and woodland on coastal plains and dunes and associated sedgelands and swamps in low lying areas collectively known as wallum, hence the common name. *C. tinnula* is a very small frog, and is a most difficult species to directly observe.

C. tinnula has a distribution range from Maryborough in Queensland south to Kurnell near Sydney. *C. tinnula* is a winter breeder with females laying approximately 120 eggs. Males are vocal between May and September making identification of the species at this time easier. Due to the morphological similarities with *C. signifera*, positive identification of *C. tinnula* is usually by call. The call of the male is described as being a bell like tinkling: "tching.....tching". Morphologically, *C. tinnula* is described as having a white or light brown belly with a little mottling or flecking and a mid line of white dots along the throat.

Due to the species preference for coastal swamps and associated areas along the east coast, *C. tinnula* is exposed to large habitat loss as this area has the highest growth rate in human population in Australia. Large populations have been recorded in the Myall Lakes National Park area and Moffats Swamp Nature Reserve near Medowie.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

A small number of calls consistent with that of the Wallum Froglet were heard calling from within the area of Swamp Forest to the north and west of the library during fieldwork. A number of calls were also heard originating from a small narrow drainage line to the south-west of the library. Outside the site the Wallum Froglet was heard calling from within the Mambo Wetland within a narrow drainage line running along the southern end of the western boundary. Calls were also heard originating from within an area of Lepironia Swamp located adjacent to the far south-western corner of the site.

Although a small number of calls were heard originating from swamp forest to the north of the library carpark this area was thought to be limited by the dense nature of the vegetation and frequent inundation from stormwater runoff from the large surface area of the Salamander Centre.

The proposed subdivision and subsequent development will lead to the removal of the virtually all habitat for the Wallum Froglet from the site resulting in the incremental decline in suitable habitat within the local area. Taking the recommendations of erosion, sediment and weed control as part of any future works within the site to prevent disturbance to habitat within Mambo Wetlands as well as the plan for compensatory offset land it is considered that no significant areas of habitat are likely to be removed that is important to the long-term survival of the Wallum Froglet.

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

Not applicable.

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

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

Not applicable.

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

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

The proposal will result in the removal of virtually all of the habitat from the site for the Wallum Froglet. This will equate to an area of approximately 1.2ha.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result a small decline in the extensive local areas of habitat for the Wallum Froglet. Taking the recommendations of weed, erosion and sediment control as part of any works within the site to protect areas of suitable habitat within the adjoining Mambo Swamp Reserve together with the proposal for compensatory offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Wallum Froglet. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help the Wallum Froglet recover in NSW. These actions include:

- The control of stormwater and drainage.
- Avoid changes in water chemistry;
- Ground Water Extraction;
- Control the invasion of weed species that threatened Wallum Froglet habitat;
- Control Feral Pigs;
- Control of the Plague Minnow;
- Control of Cane Toads;
- Monitoring of habitat;
- Protect swamps from fire;

Actions such as the control of stormwater, changes in water chemistry, fire and groundwater extraction are all pertinent to the site and surrounding habitat particularly within Mambo Wetland. Actions such as weed control and appropriate stormwater design will be required to be implemented to prevent the degradation to adjoining habitat within Mambo Swamp.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is likely to result in an incremental reduction in habitat for these orchid species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these species.
- **Predation by *Gambusia holbrooki* (Plague Minnow):** This species of fish was not observed during the survey however is known to occur nearby within Mambo Wetland (Port Stephen Council, 2006). The proposal is not likely to further exacerbate the predation by this fish on frog eggs and tadpoles.
- **Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis:** It is possible that this fungus has an impact on frogs in the local area. However the proposal is unlikely to have any impact on this threatening process.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site. Past fire within the site was evidenced by blackened parts of paperbark tree trunks in the west of the site. This fire event was most probably from the fire event on 1 January 2003. The proposal is considered to have little impact on fire frequency.
- **Human-caused Climate Change**: Has the potential to have an adverse effect on these frog species. The proposal is unlikely to significantly contribute to Climate Change.

Bibliography:

Barker, J. , Grigg, G.C. & Tyler, M.J. (1995). A Field Guide to Australian Frogs. Surry Beatty & Sons, Norton, NSW.

Cogger, H.G. (1996). Reptiles and Amphibians of Australia. (5th edn) Reed Books, Victoria.

Ehmann, H. (Ed) (1997). Threatened Frogs of New South Wales: Habitats, Status and Conservation. Frog and Tadpole Study Group of NSW.

Griffiths, K. (1997). Frogs and Reptiles of the Sydney Region. University of New South Wales Press, Sydney.

NPWS Database (2000). Fauna Species Lists for Protected Areas in NSW, at http://www.nationalparks.nsw.gov.au

Robinson, M. (1996). A Field Guide to Frogs of Australia. Reed Books Australia, Melbourne.

Tyler, M.J. (1992). Encyclopedia of Australian Animals: Frogs. Angus & Robertson, NSW.

Threatened Species recorded within the adjoining Mambo Wetland

4. *Eucalyptus parramattensis* ssp. *decadens* Drooping Red Gum

Eucalyptus parramattensis ssp. *decadens* is distributed across the lower Hunter Valley (N.S.W) from Salamander Bay to Kurri Kurri. It occurs in woodland on sandy soils in wet sites. Any occurrences are likely to be restricted to areas along riparian vegetation strips or within close proximity to the water table. In the Port Stephens area, the Drooping Red Gum occurs in open wet sclerophyll woodland on heavy, often waterlogged, interbarrier depression soils. It is distinguished from *E. p. parramattensis* by the larger fruit, which are greater than 7mm in diameter. It is commonly associated with *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus robusta* (Swamp Mahogany). This sub-species is ROTAP listed 2V.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Eucalyptus parramattensis ssp. *decadens* was not recorded within the site during the survey. Suitable habitat was found to be present for this species in the far west of the site primarily within the area of Swamp Forest to the west and south-west of the library. Specimens of *E. parramattensis* ssp. *decadens* are known to occur nearby within Mambo Wetland Reserve (DECC database, 2009)(Port Stephens Council, 2006). The proposal will lead to a small incremental loss of suitable habitat for this tree species. However due to the fact that this species was not recorded on site it is considered that the proposal is unlikely to cause extinction of any local population of this flora species.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for *E. parramattensis* ssp. *decadens.* This equates to approximately 2ha of habitat.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

As *E. parramattensis* ssp. *decadens* was not been recorded within the site and taking into consideration the disturbance to the site it is considered that no areas of habitat important to the long-term survival of this eucalypt species will be removed, modified, fragmented or isolated.

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

To date no Critical Habitat, as defined under Part 3 of the TSC Act has not been declared for *E. parramattensis* ssp. *decadens.*

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

No Recovery or Threat Abatement Plan has been developed for these tree species. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is likely to result in an incremental reduction in habitat for this tree species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this tree species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and**

animals and loss of vegetation structure and composition: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site. Past fire within the site was evidenced by blackened parts of paperbark tree trunks in the west of the site. This fire event was most probably from the fire event on 1 January 2003. The proposal is considered to have little impact on fire frequency.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** The European Rabbit was not recorded within the site during the survey however would be considered to be present in the local area. The proposal is unlikely to significant increase Rabbit numbers.
- **Invasion of native plant communities by exotic perennial grasses:** This threatening process is already present with a large number of introduced grasses such as *Andropogon virginicus* Whisky Grass, *Anthoxanthum odoratum* (Sweet Vernal Grass), *Chloris gayana* (Rhodes Grass) and *Eragrostis curvula* (African Lovegrass). There is the potential for further infestation in the future particularly within the adjoining Mambo Wetland to the west. Given the recommendation for regular weed control the impact from this threatening process would be reduced.
- ***Lantana camara* (Lantana):** A small amount of Lantana was found to be present within the site. Given the recommendation to remove this species from the site the impact from this threatening process would be reduced on this tree species.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush & Boneseed).** Bitou Bush was found to be present within the site. There is the potential for further infestation in the future, however given the recommendation for weed control within the site the impact from this threatening process would be reduced.

Bibliography:

Brooker, M.I.H and Kleining, D.A. (1983). Field Guide to the Eucalypts of South-eastern Australia. Inkata Press, Sydney.

Carolin, R.C. and Tindale, M.D. (1993). Flora of the Sydney Region (4th edn.). Reed, Sydney.

George, A. (exec. ed.) (1988). Flora of Australia, Volume 19: Myrtaceae - Eucalyptus and Angophora. Australian Government Publishing Service, Canberra.

Harden, G. (ed) (1991). Flora of NSW - Vol 2. New South Wales Uni Press, Sydney.

NSW Scientific Committee (1998). Final Determination to List *Grevillea parviflora* ssp. *parviflora* as a Vulnerable species, at 'http://www.nationalparks.nsw.gov.au'.

Robinson, L. (1994). Field Guide to the Native Plants of Sydney (2nd edn.). Kangaroo Press Pty. Ltd., New South Wales.

Wrigley, J.W. and Fagg, M. (1989). Banksias, Waratahs and Grevilleas. Angus and Robertson Books, Sydney.

5. *Petaurus norfolcensis* (Squirrel Glider)

The Squirrel Glider is distributed throughout the dry sclerophyll forests and woodlands of eastern Australia from South Australia to Cairns. In NSW, the Squirrel Gliders' range has recently been extended to coastal habitats, including Swamp Mahogany Swamp forests on the Central Coast. The full range of habitats in which it is found in NSW have not been fully reported in any literature. The Squirrel Glider eats a high proportion of invertebrates from the foliage of Eucalypts and *Acacias* supplemented by plant exudates in the form of Eucalypt and *Melaleuca* sap and *Acacia* gum. The plant exudates, honeydew, pollen and nectar were considered to be more important in winter and spring. In coastal NSW forests a significant component may be mature *Acacia irrorata*, *Melaleuca styphelioides* or *M. nodosa*, providing late winter/early spring carbohydrates.

It has been reported that Squirrel Gliders are consistently preyed upon by cats and foxes and it has been believed that an increase in this predation may result from the opening up of bushland through rural-residential or other development.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

The Squirrel Glider was not recorded on site during fieldwork conducted for this report despite targeted surveys involving arboreal trapping and spotlighting. A previous survey (Wildthing Environmental Consultants, 1998) also did not record this species. The Squirrel Glider however has been recorded within the adjoining Mambo Wetland (Port Stephens Council, 2006)(DECC Database, 2009). The site contained suitable foraging habitat in the form of flowering myrtaceous trees and shrubs such as *Banksia serrata.* An important winter food source, *Eucalyptus robusta* (Swamp Mahogany) was also present. No preferred habitat, however was considered to be present within the site due to dominance of low specimens of paperbarks in the west of the site and scarcity of trees in the east. Additionally no nesting hollows were present within the site. Suitable nesting hollows were however found to be present within nearby drier areas of woodland within Mambo Wetland. It is thought that *P. norfolcensis* may utilise the site for seasonal foraging purposes, within western portion of the site particularly when specimens of *E. robusta* are flowering in winter.

The proposal will lead to a small incremental loss of foraging habitat for the Squirrel Glider and would reduce the size of the greater Mambo Wetland Remnant. Considering the presence of larger areas of better quality habitat occurring outside the site and taking into account the recommendations of compensatory offset habitat the proposal is unlikely to significantly affect the life cycle of this glider species or place any viable local populations of these species at risk of extinction.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for the Squirrel Glider from the site. This will equate to approximately 4ha of habitat for the Squirrel Glider.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result in the incremental decline in foraging habitat for the Squirrel Glider however taking into consideration the plan for compensatory offset habitat it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Squirrel Glider. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help the Squirrel Glider recover in NSW. These actions include:

- Ensure the largest hollow-bearing trees (including dead trees) are given highest priority for retention.
- Delineate boundaries of population to identify the extent to which populations are interconnected.

It is considered that the proposed action will not significantly compromise these Priority Action Plans.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to the Squirrel Glider.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography

Fleay, D.(1947). Gliders of the Gum Trees. Melbourne Bread and Cheese Club.

Humphries, R. and Seebeck, J. (1997). *Brush-tailed Phascogale Phascogale tapoatafa. Victorian Department of Natural Resources and Environment Action Statement No. 79* at http://www.dce.vic.goc.au/plntanml/native/actstats/content/as79.htm

NSW Scientific Committee (2001). Final determination to list *Cercartetus nanus* (Eastern Pygmy-Possum) as a Vulnerable Species at http://www.nationalparks.nsw.gov.au

NPWS Database (2000). Fauna Species List for Protected Areas in NSW, at 'http://www.npws.gov.au/wildlife/species.htm'.

Quin, D.G. (1995). Population Ecology of the Squirrel Glider (*Petaurus norfolcensis*) and the Sugar Glider (*P. breviceps*) (Marsupialia : Petauridae) at Limeburners Creek, on the Central North Coast of New South Wales. In: Australian Wildlife Research 22: pp 471-505.

Quin, D.G. (1993). Sociology of the Squirrel Glider and the Sugar Glider. PhD Thesis, Department of Ecosystem Management, University of New Emgland.

Smith, A. (1996). On The Brink - Squirrel Gliders, Pittwater Council and Housing Development. At 'http://www.nccsw.org.au/bushland/reference/onthebrink/Squirrel.html'.
Suckling, G.C. (1995). Squirrel Glider (*Petaurus norfolcensis*). In: The Mammals of Australia, pp: 234-5. Strahan, R. (Ed). Reed Books, Sydney.

SWC Consultancy (1996). Eleebana Local Squirrel Glider Study. Report to Lake Macquarie City Council.

Triggs, B. (1996). Tracks, Scats and Other Traces: a Field Guide to Australian Mammals. Oxford University Press, Australia.
Turner, V. & Ward, S.J. (1995). Eastern Pygmy-possum (*Cercartetus nanus*). In: The Mammals of Australia, pp: 217-218. Strahan, R. (Ed). Reed Books, Australia.

6. *Phascogale tapoatafa* (Brush-tailed Phascogale)

A nocturnal species, the Brush-tailed Phascogale is mainly arboreal but also forages on the ground, eating insects and occasionally small vertebrates. The Brush-tailed Phascogale is known from a variety of forest types from Rainforest to Woodland, but is most frequently recorded in the drier Sclerophyll Forests with little ground cover, on ridges up to 600m altitude. It requires small tree hollows and suitable foraging sites in the canopy, sub-canopy, and ground layer of vegetation. During the day it sleeps in a nest lined with leaves or shredded bark in a tree hollow, emerging at dusk to feed. Home ranges vary from between 20-70ha for females, and there is often no overlap in this home range with other unrelated females of the species. Males may occupy an area of greater than 100ha and contrary to females, overlap with the home ranges of other males and females. Females may only occupy a home range of 4-5ha when carrying young. It is sexually mature at 11 months, with mating in June. The female has 8 teats and young are weaned at around 5 months of age. Males die soon after mating while females may breed over two consecutive years.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Phascogale tapoatafa was not recorded during fieldwork undertaken for this report or previous reports (Wildthing Environmental Consultants, 1998). Foraging habitat was considered to be present within the site for this species however preferred habitat in the form of drier sclerophyll forest was found to be absent. Additionally no suitable nesting hollows were recorded within the site. *Phascogale tapoatafa* has been recorded within the adjoining Mambo Wetland to the west (Port Stephens Council, 2006) where areas of preferred dry woodland habitat and suitable nesting hollows were present. It is thought that *P. tapoatafa* would at best only occasionally utilise the site for foraging purposes.

The proposal will lead to a small incremental loss of foraging habitat for the Brush-tailed Phascogale and would reduce the size of the greater Mambo Wetland Remnant where it is known to occur. Considering the presence of larger areas of better quality habitat occurring outside the site and taking into account the plan for compensatory offset habitat the proposal is unlikely to significantly affect the life cycle of the Brush-tailed Phascogale or place any viable local populations of these species at risk of extinction.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for *P. tapoatafa*. This will equate to approximately 4ha of habitat for this species.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for the Brush-tailed Phascogale however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Brushtailed Phascogale. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help the Brush-tailed Phascogale recover in NSW. These actions include:

- Ensure the largest hollow-bearing trees (including dead trees) are given highest priority for retention.
- Delineate boundaries of population to identify the extent to which populations are interconnected.

It is considered that the proposed action will not significantly compromise these Priority Action Plans.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography

Fleay, D.(1947). Gliders of the Gum Trees. Melbourne Bread and Cheese Club.

Humphries, R. and Seebeck, J. (1997). *Brush-tailed Phascogale Phascogale tapoatafa. Victorian Department of Natural Resources and Environment Action Statement No. 79* at http://www.dce.vic.goc.au/plntanml/native/actstats/content/as79.htm

NSW Scientific Committee (2001). Final determination to list *Cercartetus nanus* (Eastern Pygmy-Possum) as a Vulnerable Species at http://www.nationalparks.nsw.gov.au

NPWS Database (2000). Fauna Species List for Protected Areas in NSW, at 'http://www.npws.gov.au/wildlife/species.htm'.

Quin, D.G. (1995). Population Ecology of the Squirrel Glider (*Petaurus norfolcensis*) and the Sugar Glider (*P. breviceps*) (Marsupialia : Petauridae) at Limeburners Creek, on the Central North Coast of New South Wales. In: Australian Wildlife Research 22: pp 471-505.

Quin, D.G. (1993). Sociology of the Squirrel Glider and the Sugar Glider. PhD Thesis, Department of Ecosystem Management, University of New Emgland.

Smith, A. (1996). On The Brink - Squirrel Gliders, Pittwater Council and Housing Development. At 'http://www.nccsw.org.au/bushland/reference/onthebrink/Squirrel.html'.
Suckling, G.C. (1995). Squirrel Glider (*Petaurus norfolcensis*). In: The Mammals of Australia, pp: 234-5. Strahan, R. (Ed). Reed Books, Sydney.

SWC Consultancy (1996). Eleebana Local Squirrel Glider Study. Report to Lake Macquarie City Council.

Triggs, B. (1996). Tracks, Scats and Other Traces: a Field Guide to Australian Mammals. Oxford University Press, Australia.
Turner, V. & Ward, S.J. (1995). Eastern Pygmy-possum (*Cercartetus nanus*). In: The Mammals of Australia, pp: 217-218. Strahan, R. (Ed). Reed Books, Australia.

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

The Grey-headed Flying-fox is distributed predominantly along the sub-tropical east coast, from Rockhampton (Qld) through NSW to SE Victoria. It is a fairly large species, weighing up to a kilogram and having a forearm length of up to 180mm. It is the only Australian Flying-fox to possess a mantle of rusty brown fur that full encircles the neck. The fur on the back is dark grey and as the common name suggests, the head is covered with light grey fur. The grey belly fur is often flecked with white and ginger. The fur extends down the legs to the toes, which contrasts with other *Pteropus* species, which are furred only to the knees.

Grey-headed Flying-foxes are known to occupy a variety of habitats, including wet and dry sclerophyll forests, rainforest, mangroves and paperbark swamps and *Banksia* woodlands. Here they forage on a range of fruits and blossoms. Their diet is so varied that they have been recorded eating the fruit or blossom of more than 80 species of plant. The predominant food source is Eucalypt blossom and fruits from trees such as *Ficus* spp. (Figs). It is likely to act as an important pollinator for many of the trees on which they utilise blossoms. They also inhabit cultivated areas where they feed on introduced trees including commercial food crops, and can become a 'pest' animal in these areas. Ironically, this has led to this species being the most intensively researched bat in Australia.

As with most species of Flying-fox, *P. poliocephalus* roost communally where they form large communal colonies called 'camps'. Camps are mostly in rainforest patches, mangroves, paperbark forests and modified vegetation in urban areas. These camps may contain thousands of individuals, and up to 200 000 individuals have been recorded at one camp. They may move up to 70km from the camp each night to forage. Young are raised in maternity camps after birthing in September to October. The young are able to fly at 3 months of age and puberty is reached at 18 months, although males do not achieve effective fertility until 30 months. Vocal communication is highly sophisticated, with over 20 different situation-specific calls being recorded.

The key threats to Grey-headed Flying-fox include the clearing or modification of native vegetation, in particular roost-camp habitat as well as winter food resources in NE NSW. This species is also threatened by persecution in the form of shooting of animals and the destruction of roost camps. This oppression may be a result of Grey-headed Flying-foxes being a perceived pest in agricultural areas or as presenting a noise problem in more urbanised areas. Recently, it has been identified as being a potential carrier of viral pathogens, such as Lyssa-virus. Another threat is from competition and hybridisation with *P. alecto* (Black Flying-fox).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

This species of Flying-fox was not recorded during the survey period however it is expected that this species would utilise the site during flowering periods. The Grey-headed Flying-fox has been recorded within the adjoining Mambo Wetlands (Port Stephens Council, 2006). The site contains a range of seasonal foraging species particularly in the form of *Melaleuca quinquenervia* (Broad-leaved Paperbark) and the winter flowering *Eucalyptus robusta* (Swamp Forest). No suitable roosting habitat was considered to be present

The proposal subdivision and subsequent development will lead to the removal of virtually all foraging habitat from the site for the Grey-headed Flying-fox and will result in the incremental

reduction of habitat in the local area. However, considering the presence of large areas of suitable foraging habitat in the local area and plan for compensatory offset habitat it is unlikely that the proposal would threaten the local population with immediate extinction by disrupting its breeding life-cycle of this highly mobile species.

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

Not applicable to threatened species.

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

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

Not applicable to threatened species.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable foraging habitat for the Grey-headed Flying-fox. This will equate to an area of approximately 7ha containing foraging species.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of this Flying-fox species.

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

The proposed subdivision and subsequent development will result in the incremental decline in foraging habitat for this Flying-fox species however taking the proposal for compensatory habitat offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan has been completed for the (Grey-headed Flying-fox). The plan recommends the protection of roost sites and the retention of as many foraging species as possible. Taking the proposal for offset compensatory habitat into consideration the action is not considered to compromise this recovery plan.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will include preferred foraging species resulting in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this Flying-fox species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.

Bibliography:

Augee, M.L. and Ford, D. (1999). *Radio-tracking studies of Grey-headed Flying-foxes Pteropus poliocephalus, from the Gordon colony, Sydney*. Proceedings of the Linnaean Society of NSW, Vol. 121, pp 61-70.

Catterall, C.P., Storey, R.J. and Kingston, M.B. (1997). *Reality versus rhetoric: a case study monitoring regional deforestation in Hale, P. and Lamb, D. (eds). Conservation Outside Nature Reserves*, pp 367-377. Centre for Conservation Biology, University of Queensland, Brisbane.

Churchill, S. (1998). *Australian Bats*. Reed New Holland Publishers, Sydney, Australia.

Eby, P. (2000). The results of four synchronous assessments of relative distribution and abundance of Grey-headed Flying-fox *Pteropus poliocephalus* in Richards, G. and Hall, L. (Eds). *Proceedings of a Workshop to Assess the Status of the Grey-headed Flying-fox*, Australasian Bat Society, Canberra.

Hall, L.S. and Richards, G. (2000). *Flying Foxes: Fruit and Blossom Bats of Australia*, UNSW Press, Sydney.

NPWS Database (2000). *Fauna Species List for Protected Areas in NSW* at http://www.npws.gov.au/wildlife/species.htm

Tidemann, C.R. (1995). Grey-headed Flying-fox (*Pteropus poliocephalus*) in Strahan, R. (ed) *The Mammals of Australia,* pp 439-441 Australian Museum / Reed Books.

Webb, N. and Tidemann, C.R. (1995). Hybridisation between Black (*Pteropus alecto*) and Grey-headed (*P. poliocephalus*) Flying-foxes in *Australian Mammalogy,* Vol 18, pp 19-26.

Threatened species considered to have habitat within the site

Flora

8. Orchids

***Cryptostylis hunteriana* (Leafless Tongue Orchid)**
Cryptostylis hunteriana is a distinctive species recognised by its leafless habit and reddish black hairy labellum with a central, raised, hairy callus. The Leafless Tongue Orchid occurs from the Gibraltar Range (N.S.W) to eastern Victoria. This species is a saprophtye, which grows in small, localised colonies on flat plains close to the coast. This species has also been recorded in mountainous areas growing in moist depressions as well as in swampy habitats. Flowering time is December - February. This species is ROTAP-coded 3VC-.

***Diuris arenaria* (Tomaree Doubletail)**
Diuris arenaria is a early-flowering coastal Orchid with moderate-sized purple flowers, a darker labellum and a very narrow tubular base to the flower, the area between the callus ridges are ochre yellow and purple (Jones, 1999). This species is known from three main locations on the Tomaree Peninsula (Port Stephens), two of which are reserved (NSW Scientific Committee, 2000). *D. arenaria* grows in coastal heath Dry Sclerophyll Forest with patches of *Themeda triandra* (Kangaroo Grass) on sandy flats. *D. arenaria* flowers in October (Harden, 1993). This species has not been ROTAP-listed.

***Diuris praecox* (Donkey Orchid)**
Diuris praecox is a double-tailed terrestrial Orchid with small to moderate (25mm across) sized light yellow and brown flowers during July/August. It is often found growing in Eucalypt forests on hilltops or slopes (Bishop 1996). Species of the *Diuris* genus are very widespread in grassy habitats but can be easily missed because of their short flowering seasons, usually no more than two weeks. *D. praecox* is known from coastal areas between Ourimbah and Nelson Bay. This species is ROTAP-coded 2VC-.

Bibliography:
NSW Scientific Committee (2008). *Final Determination to list Corybas dowlingii as a Vulnerable species.*

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Cryptostylis hunteriana, Diuris praecox* nor *Diuris arenaria* were recorded on site during the survey. However it must be noted that the survey was carried out outside the known flowering period for these orchid species. A previous flora survey conducted within the flowering period for *D. praecox* and *D. arenaria* (Wildthing Environmental Consultants, 1998) did not record these orchid species within the western portion of the site. According to the Mambo Wetland Plan of Management (Port Stephens Council, 2006) these orchid species have not been recorded within the adjoining 175ha reserve.

Suitable habitat was found to be present for these orchid species within the site outside the wetter areas of swamp forest. This habitat has been subjected to a large amount of disturbance from past sandmining, the proximity to urban development and weed invasion.

The subdivision and subsequent development will result in the removal of all suitable habitat from within the site. However it is considered that the proposal is unlikely to cause extinction of any local population of these orchid species

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for *C. hunteriana, D. praecox* and *D. arenaria* from the site. This equates to approximately 6.7ha of habitat for *C. hunteriana* and 5.5ha for both *C. hunteriana* and *D. praecox.*

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

As these orchid species have not been recorded within the site or in close proximity to it and taking into consideration the disturbance to the site it is considered that no areas of habitat important to the long-term survival of these orchid species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for these orchid species. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is likely to result in an incremental reduction in habitat for these orchid species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site. Past fire within the site was evidenced by blackened parts of paperbark tree trunks in the west of the site. This fire event was most probably from the fire event on 1 January 2003. The proposal is considered to have little impact on fire frequency.
- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** The European Rabbit was not recorded within the site during the survey however would be considered to be present in the local area. The proposal is unlikely to significant increase Rabbit numbers.
- **Invasion of native plant communities by exotic perennial grasses:** This threatening process is already present with a large number of introduced grasses such as *Andropogon virginicus* Whisky Grass, *Anthoxanthum odoratum* (Sweet Vernal Grass), *Chloris gayana* (Rhodes Grass) and *Eragrostis curvula* (African Lovegrass). There is the potential for further infestation in the future particularly within the adjoining Mambo Wetland to the west. Given the recommendation for regular weed control the impact from this threatening process would be reduced.
- ***Lantana camara* (Lantana):** A small amount of Lantana was found to be present within the site. Given the recommendation to remove this species from the site the impact from this threatening process would be reduced on these species.
- **Invasion of Native Plant Communities by Chrysanthemoides monilifera: (Bitou Bush & Boneseed).** Bitou Bush was found to be present within the site. There is the potential for further infestation in the future, however given the recommendation for weed control within the site the impact from this threatening process would be reduced.

Bibliography:

Bishop, T. (1996). Field Guide to the Orchids of New South Wales and Victoria. University of NSW Press, Sydney

Briggs, J.D. and Leigh, J.H. (1995). Rare or Threatened Australian Plants. CSIRO Publishing, Victoria.

Carolin, R.C. and Tindale, M.D. (1994). Flora of the Sydney Region (4th edn.). Reed, Sydney.

Gunninah Environmental Consultants (2003). Wyong Ground Orchid Survey. Wyong Shire Council.

Harden, G. (ed)(1993). Flora of New South Wales - Volume 4. University of NSW Press.

9. Shrub species

Callistemon linearifolius **Netted Bottlebrush**

Callistemon linearifolius is a shrub which grows to 3-4 metres in height. It flowers from spring to summer. *C. linearifolius* grows in dry sclerophyll forest on the coast and adjacent ranges from the Georges River to Hawkesbury River in the Sydney area, and north to Nelson Bay. In the Sydney area records are limited to the Hornsby Plateau area. This species is ROTAP-coded 2RCi.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Callistemon linearifolius was not recorded on site during fieldwork. Drier areas of woodland within the site were found to contain marginal habitat for this species, however due to the disturbance to the site no preferred habitat would be considered to be present. The proposal will lead to a small incremental loss of habitat for *C. linearifolius*. However due to the fact that no primary habitat will be affected it is considered that the proposal is unlikely to cause extinction of any local population of this flora species.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for *C. linearifolius* from the site. This equates to approximately 5.5ha of habitat.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

As *C. linearifolius* has not been recorded within the site or in close proximity to it and taking into consideration the disturbance to the site it is considered that no areas of habitat important to the long-term survival of this bottlebrush species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for this shrub species. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is likely to result in an incremental reduction in habitat for this Bottlebrush species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: A past fire within the site was evidenced by blackened parts of paperbark tree trunks in the west of the site. This fire event was most probably from the fire event on 1 January 2003. The proposal is considered to have little impact on fire frequency.
- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** The European Rabbit was not recorded within the site during the survey however would be considered to be present in the local area. The proposal is unlikely to significant increase Rabbit numbers.

- **Invasion of native plant communities by exotic perennial grasses:** This threatening process is already present with a large number of introduced grasses such as *Andropogon virginicus* Whisky Grass, *Anthoxanthum odoratum* (Sweet Vernal Grass), *Chloris gayana* (Rhodes Grass) and *Eragrostis curvula* (African Lovegrass). There is the potential for further infestation in the future particularly within the adjoining Mambo Wetland to the west. Given the recommendation for regular weed control the impact from this threatening process would be reduced.
- ***Lantana camara* (Lantana):** A small amount of Lantana was found to be present within the site. Given the recommendation to remove this species from the site the impact from this threatening process would be reduced on these species.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush & Boneseed).** Bitou Bush was found to be present within the site. There is the potential for further infestation in the future, however given the recommendation for weed control within the site the impact from this threatening process would be reduced.

Bibliography:

Brooker, M.I.H and Kleining, D.A. (1983). Field Guide to the Eucalypts of South-eastern Australia. Inkata Press, Sydney.

Carolin, R.C. and Tindale, M.D. (1993). Flora of the Sydney Region (4th edn.). Reed, Sydney.

George, A. (exec. ed.) (1988). Flora of Australia, Volume 19: Myrtaceae - Eucalyptus and Angophora. Australian Government Publishing Service, Canberra.

Harden, G. (ed) (1991). Flora of NSW - Vol 2. New South Wales Uni Press, Sydney.

NSW Scientific Committee (1998). Final Determination to List *Grevillea parviflora* ssp. *parviflora* as a Vulnerable species, at 'http://www.nationalparks.nsw.gov.au'.

Robinson, L. (1994). Field Guide to the Native Plants of Sydney (2nd edn.). Kangaroo Press Pty. Ltd., New South Wales.

Wrigley, J.W. and Fagg, M. (1989). Banksias, Waratahs and Grevilleas. Angus and Robertson Books, Sydney.

10. Frogs

***Litoria aurea* (Green and Golden Bell Frog)**
Litoria aurea was formerly known to inhabit the eastern seaboard of New South Wales and Victoria from Byron Bay through to the Gippsland Lake Region as well as highland sites (New England District, south-western slopes of N.S.W. and Monaro District). Recent literature indicates that the northern and southern distribution limits have not changed, however, *L. aurea* is no longer found on sites above an altitude of 300m above sea level. This frog species inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. The Green and Golden Bell Frog is a summer breeder and voraciously cannibalistic. The males call from August through to January using a distinctive four part call: "crawk-awk, crawk, crok, crok". The common name of *L. aurea* is derived from its body colouration described as being dull olive to bright emerald green above with blotches of brown or golden-bronze.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Litoria aurea (Green and Golden Bell Frog) was not recorded within the site despite targeted surveys nor has it been recently recorded within Mambo Wetland (Port Stephens Council, 2006). The wetter area of Swamp Forest within the site to the north of the library is considered to contain suitable habitat for the Green and Golden Bell Frog. A small narrow drainage line within a less inundated area of Swamp Forest to the south-west of the library was also considered to contain some suitable habitat for this frog species. The Green and Golden Bell Frog would have once been one of the more commonly encountered frogs within the local area before its severe contraction in distribution in the 1970's and 1980's. The nearest known populations of Green and Golden Bell Frogs are currently located at Kooragang and Broughton Islands (Department of Environment and Conservation NSW, 2005) and Medowie (Umwelt, 2006).

The proposal will lead to a small incremental loss of suitable habitat for this The Green and Golden Bell Frog, however due to the fact that this species has not recorded in the local area it is considered that the proposal is unlikely to cause extinction of any local population of this flora species.

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

Not applicable to threatened species.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for the Green and Golden Bell Frog. This equates to approximately 1.2ha of habitat.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

As the Green and Golden Bell Frog has not been recorded within the site during the survey or within recent times in the local area it is considered that no areas of habitat important to the long-term survival of this frog species will be removed, modified, fragmented or isolated.

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

To date no Critical Habitat, as defined under Part 3 of the TSC Act has not been declared for the Green and Golden Bell Frog.

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

A Draft Recovery Plan has been developed for the Green and Golden Bell Frog. Objectives include:

- To avoid direct impacts and retain habitat;
- Minimise impacts where ever possible;
- Mitigate or ameliorate impacts; and as a last resort;
- Compensate or offset for any unavoidable impacts.

Given the lack of known key populations in the locality and the plan for compensatory offset habitat it is considered that the proposal development will not significantly conflict with this draft recovery plan.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation particularly

within the wetter areas of swamp forest is likely to result in an incremental reduction in habitat for this species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this frog species.

- **Predation by *Gambusia holbrooki* (Plague Minnow):** This species of fish was not observed during the survey however is known to occur nearby within Mambo Wetland (Port Stephen Council, 2006). The proposal is not likely to further exacerbate the predation by this fish on frog eggs and tadpoles.
- **Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis:** It is possible that this fungus has an impact on frogs in the local area. However the proposal is unlikely to have any impact on this threatening process.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site. Past fire within the site was evidenced by blackened parts of paperbark tree trunks in the west of the site. This fire event was most probably from the fire event on 1 January 2003. The proposal is considered to have little impact on fire frequency.
- **Human-caused Climate Change**: Has the potential to have an adverse effect on these frog species. The proposal is unlikely to significantly contribute to Climate Change.

Bibliography:

Barker, J., Grigg, G.C. & Tyler, M.J. (1995). A Field Guide to Australian Frogs. Surry Beatty & Sons, Norton, NSW.

Cogger, H.G. (1996). Reptiles and Amphibians of Australia. (5th edn) Reed Books, Victoria.

Department of Environment and Conservation NSW (2005). *Draft Recovery Plan for the Green and Golden Bell Frog (Litoria aurea)*. DEC NSW, Hurstville, NSW.

Ehmann, H. (Ed) (1997). Threatened Frogs of New South Wales: Habitats, Status and Conservation. Frog and Tadpole Study Group of NSW.

NPWS Database (2000). Fauna Species Lists for Protected Areas in NSW, at http://www.nationalparks.nsw.gov.au

Robinson, M. (1996). A Field Guide to Frogs of Australia. Reed Books Australia, Melbourne.

Tyler, M.J. (1992). Encyclopedia of Australian Animals: Frogs. Angus & Robertson, NSW.

Umwelt Environmental Consultants (2006). *Flora and Fauna Assessment for Medowie Structure Plan*. Port Stephens Council.

11. Water Birds

***Botaurus poiciloptilus* (Australasian Bittern)**
The Australasian Bittern occurs in the south-east and south-west, as well as in Tasmania and is also known as a vagrant in the north-west of Australia. This species is probably sedentary in permanent habitat with possible regular short distance movements during winter and is occasionally irruptive following heavy rains and floods, or drought elsewhere. The Australasian Bittern lives alone or in loose groups and favours permanent fresh-waters with tall dense vegetation dominated by sedges, rushes, reeds or cutting grasses (eg. *Phragmites, Scirpus, Eleocharis, Juncus, Typha, Baumea* and *Gahnia*). The Australasian Bittern feeds on insects, small fish, eels, frogs and other aquatic life, sometimes in ricefields. It is partly nocturnal in habits and, keeping as it does to the depths of reedy swamps, is seldom seen during the day unless flushed. The breeding season is from October to January and it is during this time that the distinct 'booming' calls can be heard.

***Rostratula benghalensis australis* (Australian Painted Snipe)**
The Painted Snipe is usually found in pairs, frequenting the margins of swamps and streams, chiefly those covered with low and stunted vegetation. It probes in mud along the shore to gather snails, water insects and aquatic plants. The Painted Snipe appears to be nomadic, with movements mainly north in winter and south in summer. It requires shallow fresh water for breeding, though the nest is not deserted if the water dries up. Nests are usually in groups, and consist of a shallow depression in the ground, lined with grass or leaves and frequently sheltered by a low bush or tuft of grass.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Despite targeted and incidental surveys, neither *Botaurus poiciloptilus* (Australasian Bittern) or *Rostratula benghalensis australis* (Australian Painted Snipe) were recorded on site during the survey. Wetter areas of swamp forest in the west of the site were considered to contain habitat for both these species particularly, *B. poiciloptilus.* The proposed subdivision and subsequent development will result in the removal of virtually all of the habitat from within the site for both these waterbird species which will lead to a small incremental loss of habitat in the local area. Taking the occurrence of larger areas of suitable habitat within the area including Mambo Wetland the proposal is unlikely to cause extinction of any local population of these bird species.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for these waterbird species from within the site. This equates to approximately 1.2ha of habitat.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of these bird species.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for these bird species however it is considered that no areas of habitat important to the long-term survival of these waterbird species will be removed, modified, fragmented or isolated.

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

To date no Critical Habitat, as defined under Part 3 of the TSC Act has not been declared for either waterbird species.

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

No Recovery or Threat Abatement Plan has been developed for these wetland bird species. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will include some potential habitat is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these waterbird species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.

Bibliography:

Garnett, S.T. and Crowley, G.M. (2000). *The Action Plan for Australian Birds 2000*. Report to Environment Australia and Birds Australia, October 2000.

Marchant, S. and Higgins, P.J. (Eds.) (1993). *Handbook of Australian, New Zealand & Antarctic Birds: Volume 2 Raptors to Lapwings*, Oxford University Press, Melbourne.

NPWS. (2003). *Atlas of NSW Wildlife*, at 'www.nationalparks.nsw.gov.au'.

Pizzey, G. & Knight, F. (1997). *Field Guide to the Birds of Australia*, Angus and Robertson, Sydney

Reader's Digest (1982). *The Complete Book of Australian Birds*, Reader's Digest Services Pty. Ltd., Sydney.

Slater, P., Slater, P. and Slater, R. (1997). *The Slater Field Guide to Australian Birds*, Lansdowne Publishing, Sydney.

12. Cockatoos and Parrots

***Callocephalon fimbriatum* (Gang-gang Cockatoo)**
The Gang-gang Cockatoo is distributed from southern Victoria through south and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and southwest slopes. It is rare at the extremities of its range, with isolated records known from as far west as Mudgee. In summer they are generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter they move to lower altitudes and drier more open eucalypt forests and woodlands, and often found in urban areas. In winter they show a preference for more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting. Breeding usually occurs between October and January in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests. Nests are most commonly recorded in eucalypt hollows in live trees close to water.

***Calyptorhynchus lathami* (Glossy Black-Cockatoo)**
The Glossy Black-Cockatoo inhabits wet and dry sclerophyll forests and woodlands of eastern Victoria to central Queensland, extending to the western slopes in New South Wales. It prefers highlands towards the north but may be found closer to the coast where conditions are suitable. In the south they are widespread in lowland coastal forests, dense mountain forests, semi-arid woodland and trees bordering water courses. It forages primarily on the seeds of Casuarinas, but will also take woodborers from large *Acacia* stems. *Allocasuarina torulosa, A. verticillata* and *A. littoralis* are the predominant food trees, however, on Kangaroo Island *Casuarina stricta* is the predominant food source. They have also been observed eating *Angophora, Acacia* and *Eucalyptus* seeds. Nesting takes place from March through August in the hollows of large Eucalypts, 10-20m above the ground, where a single egg is laid.

***Lathamus discolor* (Swift Parrot)**
During winter the Swift Parrot inhabits mainland Australia from Adelaide (S.A.) through Victoria, and up the east coast to south-east Queensland, as well as visiting the south and central western slopes and the Riverina in NSW. The Swift Parrot returns to eastern Tasmania in spring to breed. The Swift Parrot prefers open forest to woodland on the mainland. It has also been recorded utilising street trees and in parks and gardens. Swift Parrots forage on the nectar of Eucalypts, often in mixed flocks with lorikeets. The preferred winter food species are Red Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Swamp Gum (*E. ovata*), Swamp Mahogany (*E. robusta*) and Yellow Gum (*E. melliodora*) and have also been observed eating the seeds and flowers of *Xanthorrhoea* spp. They also feed on insects and their larvae, fruits, berries, seeds and vegetable matter. Nesting occurs from September to January in a hollow branch of a Eucalypt and they return to the mainland during March and April.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

None of the above Cockatoo and parrot species were recorded on site despite targeted and incidental surveys.

Marginal foraging habitat was found to be present for the Glossy Black Cockatoo in the form of a very small number of *Casuarina glauca* (Swamp Oak) and *Allocasuarina littoralis* (Black Sheoak) trees. No nesting habitat was found to be present for this species due to the absence of suitable tree hollows. The Glossy Black Cockatoo has been recorded within the adjoining Mambo Wetland Management Plan (Port

Stephen Council, 2006). No significant habitat was considered to be present on site for the Glossy Black Cockatoo.

The Gang Gang Cockatoo is usually found in upland areas such as the Watagans to the west of the study area. However this species is known to visit lowland areas during the winter months and may utilise the site and surrounding areas for foraging on an intermittent basis. No suitable nesting hollows were present within the site, however this species would be more inclined to breed in upland areas. The proposal will result in a small incremental reduction in suitable foraging habitat in the local area however it is unlikely to result in the extinction of any local population of this species.

Seasonal foraging habitat was available for the Swift Parrot in the form of winter flowering eucalyptus, particularly *Eucalyptus robusta* (Swamp Mahogany) which was present within the area of swamp forest.

The proposal will lead to a small incremental loss of foraging habitat for these three birds, however due to the fact that no suitable nesting hollows will be affected it is considered that the proposal is unlikely to cause extinction of any local population of these bird species.

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

No endangered population has been identified utilising the site.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for these bird species from within the site. This equates to approximately 6ha of habitat.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of these bird species.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for these bird species however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the above species although a Priority Action Statement (PAS) has been developed for each species. The objective of the PAS is to promote the recovery of threatened species, populations and ecological communities and manage key threatening processes. It is considered that the proposal does not conflict with the PAS for the above bird species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will include seasonally preferred foraging species such as Swamp Mahogany for the Swift Parrot is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these bird species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography:

Forshaw, Joseph M. (1991). *Australian Parrots* (2nd edn.). Ure Smith Press, Willoughby, NSW.

Garnett, S.T. and Crowley, G.M. (2000). *The Action Plan for Australian Birds 2000*. Report to Environment Australia and Birds Australia, October 2000.

Hunter Bird Observers Club (1999). *Hunter Region of New South Wales: Annual Bird Report Number 6 (1998)*. HBOC Inc., August 1999.

NPWS Database (2000). *Fauna Species Lists for Protected Areas in NSW* at 'http://www.npws.nsw.gov.au/wildlife/species.htm'

NSW Scientific Committee (19/2/1999). *Preliminary Determination for the Riverina Population of the Glossy Black Cockatoo*. Hurstville, NSW.

Pizzey, G. & Knight, F. (1997). *Field Guide to the Birds of Australia*, Angus and Robertson, Sydney.

Reader's Digest (1982). *The Complete Book of Australian Birds*. Reader's Digest Services Pty. Ltd., Sydney.

13. Owls

***Ninox connivens* (Barking Owl)**
The Barking Owl is found in forest and woodland, encountered most commonly in savanna and paperbark woodlands. It sometimes roosts in rainforests, but it requires the more open country for hunting and hollow Eucalypts for breeding. These owls are usually found in pairs which occupy permanent territories, generally greater than 100 ha. Each pair has a number of sites where they roost by day, usually in a leafy tree close to the trunk, though not always well hidden. They breed from August to October in large open hollows. Mammals and birds are the main prey, though it also feeds on insects and other invertebrates. In Southern Australia it feeds particularly on rabbits. It also kills hares, rats, mice, occasional small bats and some marsupials, including possums. It kills birds up to the size of Magpies and Tawny Frogmouths.

***Ninox strenua* (Powerful Owl)**
Within NSW, Powerful Owls are distributed throughout the length of the Great Dividing Range, which is their stronghold, and extend from the coast to the western slopes where they occur in much lower numbers. The Powerful Owl inhabits a wide range of vegetation types from wet Eucalypt forests with a rainforest understorey to dry open forests and woodlands. The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. The Powerful Owl is the largest predator of nocturnal forest-dwelling animals in Australian forests. Major prey species in NSW forests are the Greater Glider, Common Ringtail Possum, Sugar Glider, Grey-headed Fruit Bat, and several species of diurnal birds, including the Pied Currawong, Magpie and Lorikeets. It rests during the day amid thick foliage, often grasping food-remains. Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the ground. These trees are usually found growing on a hillside in heavy forest and may be utilised intermittently for several years. One or two young are produced, although some pairs do not breed in every year. Pairs appear to mate for life and occupy exclusive territories in the order of 1000 ha in size.

***Tyto capensis* (Grass Owl)**
The Grass Owl ranges from India eastward to Fiji, excluding New Guinea. It is easily confused with the more common Barn Owl (*Tyto alba*). The Grass Owl stands much more upright than the Barn Owl, with longer and barer legs. Due to the confusion, the range of this species may only be partly determined. Movements are nomadic and irruptive, with local colonisations taking place after flourishings of prey species populations. Island birds appear to breed up in response to plagues of small mammals then disperse, often to die as the plague subsides. Coastal populations of the Grass Owl are considered fairly sedentary though numbers have been observed to fluctuate. The Grass Owl lives in a loose community, several hundred metres usually separating solitary roosting birds or breeding pairs. The birds roost and nest on the ground, in crops or in thick grass tussock often associated with swamps, forming extensive tunnels and trampling the area. The species usually hunts by night but when under stress will hunt by day. Up to 30 have been observed in the air at the same time, sweeping over the grassland at heights of 1-4 metres and dropping directly on to prey. Rodents, including the house mouse, are taken and apparently grasshoppers and other insects.

***Tyto novaehollandiae* (Masked Owl)**
Masked Owls in N.S.W. are distributed throughout the length of the Great Dividing Range and extend from the coast to the western slopes. Within this range they inhabit a range of wooded habitats that contain both mature trees for roosting and nesting and more open areas for hunting. They are most commonly encountered within Open Forest with a sparse understorey as well as along the ecotones of these areas to more or less densely vegetated habitats. Their diet comprises mainly ground-dwelling prey, including several species of native and introduced Rodents, *Antechinus* spp. and Bandicoots. On occasions, other prey such as Possums, Gliders and other birds are taken. Masked Owls usually roost in large hollows inside large, old living trees, most often Eucalypts. Within dry forests they often choose hollow trees in gullies or drainage lines. These hollows are 1 to 5 metres deep, 40 to 50 cm wide. The trees containing these hollows are likely to be quite old (>150 years). They are also known to roost

among the dense foliage of other trees such as *Pandanus, Livistona, Melaleuca* and *Acacia* species. The species also nests in large hollows, although there appears to be a preference for hollow tree trunks and vertical spouts of large trees. The breeding season, like that for other *Tyto* owls, is variable but there is a tendency for breeding to occur in autumn-winter. Pairs appear to mate for life and occupy exclusive territories in order of 1000ha in size.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither the Masked, Powerful, Barking or Grass Owls were not recorded during fieldwork. No evidence of their presence found (ie whitewash, regurgitation pellets, prey remains) nor was a response heard during the call playback census.

Both the Powerful and Masked Owls have been recorded within the locality (Port Stephens Council, 2006)(DECC database, February 2009) and would be considered to occasionally utilise the site for hunting. The Grass and Barking Owls have been less commonly recorded however, are known to occur in the local area (DECC database, February 2009 & Murray. et. al, 2002) and may rarely utilise the site for hunting. Limited roosting habitat was considered to be present for Powerful, Barking and Grass Owls within the denser areas of Swamp Forest in the west of the site. No suitable nesting habitat was present within the site for the Powerful, Masked and Barking Owls due to the absence of large tree hollows. Marginal nesting habitat for the Grass Owl was considered to be present within the swamp forest to the north of the library where a thick dense layer of plants such as Gahnia sp. were present. This habitat would be dependant on the level of water within this area.

The proposal subdivision and subsequent development will lead to the removal of virtually all habitat from the site which will result a small incremental loss of prey species in the local area for all of the owl species assessed. There will also be a small reduction in roosting habitat for the Powerful, Barking and Grass Owls and removal of an area of marginal nesting habitat for the Grass Owl. Considering the relatively large amount of surrounding habitat and large home range of these owl species and plan for compensatory offset habitat it is unlikely that the proposal would threaten the local population with immediate extinction by disrupting its breeding life-cycle.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for these owl species. This will equate to approximately 4ha of habitat for each species.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of these Owl species.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for these Owl species however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

Draft Recovery Plans have been completed for Large Forest Owls (NPWS, 2005) and for the Barking Owl (NPWS, 2003). The recovery plans recommend that proposals containing bushland protect nest and roost sites, patches of habitat and prey bases. The proposal will result in the reduction in the number of prey species in the locality and the removal of a small portion of roosting habitat however is unlikely to significantly compromise these recovery plans.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these Owl species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography:

Davey, S.M. (1993). Notes on the Habitat of Four Australian Owl Species, In Olsen, P.D. (Ed) (1993). Australian Raptor Studies, Australasian Raptor Association, RAOU, Melbourne, pp 126-42.

Debus, S.J.S. and Rose, A.B. (1994). The Masked Owl *Tyto novaehollandiae* in New South Wales, In Australian Birds, 28 (Supplement): pp 40-64

Kavanagh, R.P. (1993). Project 149: Ecology and Management of Large Forest Owls, Unpublished Progress Report to World Wide Fund for Nature, Sydney.

Kavanagh, R.P. and Peake, P. (1993). Distribution and Habitats of Nocturnal Forest Birds in South-eastern New South Wales, In Olsen, P.D. (Ed) (1993). Australian Raptor Studies, Australasian Raptor Association, RAOU, Melbourne, pp 101-5.
Kavanagh, R.P. and Murray, M. (1996). Home Range, Habitat and Behaviour of the Masked Owl *Tyto novaehollandiae* near Newcastle, New South Wales. In: Emu, 96: pp 250-7.

Kavanagh, R.P. (2000). Conservation and Management of Large Forest Owls in South-eastern New South Wales. Proceedings of Owls 2000: Third International Conference on the Biology, Conservation and Cultural Significance of Owls.

Kavanagh, R.P. and Stanton, M. A. (2000). Response to Habitat Fragmentation by the Powerful Owl, Sooty Owl, Masked Owl and other Nocturnal Fauna in South-eastern New South Wales. Proceedings of Owls 2000: Third International Conference on the Biology, Conservation and Cultural Significance of Owls.

Marchant, S. and Higgins, P.J. (1993). Handbook of Australian, New Zealand & Antarctic Birds. Oxford University Press, Melbourne.

NSW Department of Environment and Conservation (2005). *Draft Recovery Plan for the Large Forest Owls: Powerful Owl Ninox strenua Sooty Owl Tyto tenebricosa Masked Owl Tyto novaehollandiae*. NSW DEC, Sydney, NSW.

Pizzey, G. & Knight, F. (1997). Field Guide to the Birds of Australia, Angus and Robertson, Sydney.

14. Woodland Birds

***Xanthomyza phrygia* (Regent Honeyeater)**
The Regent Honeyeater is nomadic, although it does seem to return to nesting areas sporadically. Seasonal movements appear to be dictated by the flowering of various species of Eucalypts that are characteristic of the dry forests and woodlands of south eastern Australia. The Regent Honeyeater prefers to forage on large-flowered Eucalypts (e.g. *Eucalyptus sideroxylon, E. melliodora, E. albens, E. leucoxylon*), particularly where these trees grow in more productive areas and yield plentiful and predictable nectar flows. They also forage on mistletoe and Banksia flowers, and arthropods. In parts of coastal NSW they are also attracted to stands of *Eucalyptus robusta* (Swamp Mahogany). Recent records (winter 2000) exist of this species foraging in flowering *Corymbia maculata* (Spotted Gum) trees at Aberdare State Forest near Ellalong, NSW have been noted (Roderick pers.comm.). Nesting occurs mainly between November and January, but breeding has been recorded in all months between July and February.

***Burhinus grallarius* (Bush Stone-curlew)**
Within N.S.W. this species has been recorded mainly in pastoral areas of the western slopes and plains. It is rare east of the Great Divide, however, isolated populations have been recorded from Western Sydney, Gosford, Port Macquarie and Northern Rivers around Grafton and Brunswick Heads (Marchant and Higgins, 1993). The Bush Stone-curlew inhabits dry open forest and woodland with an open grassy understorey that has not been overgrazed. It prefers woodland with many fallen branches where it roosts during the day. It has also been known to utilise coastal scrub, mangrove fringes, golf courses and plantations. The food of the Bush Stone-curlew is primarily insects, spiders and other invertebrates. Occasionally fruits are eaten when they become available.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Despite targeted and incidental searches, neither the Regent Honeyeater or Bush Stone Curlew were recorded during the survey.

It must be noted that the Regent Honeyeater would not be likely to be present in the area on a continuous basis as it is most commonly found on the western slopes of the Great Dividing Range. Due to the occurrence of records of this species in the vicinity of the study area (DECC database) and the presence of a preferred winter flowering foraging resource in the form of *Eucalyptus robusta* (Swamp Mahogany) it is likely that this species may occasionally utilise the site for foraging.

Suitable habitat was found to be present for *Burhinus grallarius* (Bush Stone-curlew) within the drier areas of the site, however this habitat would be limited by the close proximity of urban development and dense nature of much of the vegetation.

The proposal subdivision and subsequent development will lead to the removal of virtually all habitat from the site for both these bird species and will result in the incremental reduction of habitat in the local area. Considering the presence of larger areas suitable habitat such as the adjoining Mambo Wetland and the plan for compensatory offset habitat it is unlikely that the proposal would threaten the local population with immediate extinction by disrupting its breeding life-cycle.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for these two bird species. This will equate to approximately 6ha of habitat for each species.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of these bird species.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for these bird species however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan has been completed for both the Regent Honeyeater and Bush Stone Curlew.

The Regent Honeyeater Recovery Plan recommends the retention of preferred foraging species. The proposal will result in the removal of specimens of Swamp Mahogany. It is recommended that as many specimens of Swamp Mahogany be retained where possible and that compensatory plantings be

undertaken.

The Bush Stone Curlew Recovery Plan recommends the retention of habitat and habitat attributes such as fallen logs as well as the control of foxes and cats. The removal of habitat from the site would not comply with this recovery plan however considering the disturbance to the site and close proximity to a busy shopping centre as well as the proposal of compensatory offset habitat the proposal should not compromise the recovery plan.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will for a subsequent development is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these bird species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.

Bibliography

Brouwer, J. & Garnett, S. (Eds.) (1990). Threatened Birds of Australia: An annotated list. Royal Australasian Ornithologists Union (RAOU) Report Number 68.

Nature Conservation Council (1999). Threatened Species Network - Regent Honeyeater Species Profile Sheet. http://nccnsw.org.au/member/tsn/context/profiles/22196.html

National Parks and Wildlife Service (1999-2003). Recovery Plan for the Regent Honeyeater *Xanthomyza phrygia*. NPWS, Hurstville.

NPWS Database (2000). Fauna Species Lists for Protected Areas in NSW at 'http://www.npws.nsw.gov.au/wildlife/species.htm'

NSW National Parks and Wildlife Service. (2001). Threatened Species Conservation Act 1995 NSW Scientific Committee Final Determination, Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis.*

NSW National Parks and Wildlife Service. (2001). Threatened Species Conservation Act 1995 NSW Scientific Committee Final Determination, Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis.*

Pizzey, G. & Knight, F. (1997). Field Guide to the Birds of Australia, Angus and Robertson, Sydney

Reader's Digest (1982). The Complete Book of Australian Birds. Reader's Digest Services Pty. Ltd., Sydney.

Slater, P., Slater, P. and Slater, R. (1997). The Slater Field Guide to Australian Birds. Lansdowne Publishing, Sydney.

15. Small Arboreal Marsupials

***Cercartetus nanus* (Eastern Pygmy –possum)**
The Eastern Pygmy –possum is a small arboreal marsupial approximately the size of a mouse. It has soft dense fur, fawn-grey to olive brown above and light grey to white below. The rounded head has very large eyes and ears and long whiskers. The prehensile tail has a seasonally flattened base is almost naked and tapers to a fine point. The species is found from rainforest through sclerophyll forest to tree heath. In New South Wales the species is found in coastal areas. Pygmy-Possums are agile climbers that feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants when in flower, insects throughout the year, and seeds and soft fruits when flowers are unavailable. Individual Pygmy-possums have numerous nests which are slept in during the day. These are usually within tree hollows or constructed spherical nests (drays) made from shredded bark and wood from eucalypts, abandoned bird nests and tea-trees. The species is patchily distributed within the south-eastern corner of mainland Australia and Tasmania.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

***Cercartetus nanus* (Eastern Pygmy –possum)**
Cercartetus nanus was not recorded during fieldwork undertaken for this report. The site contained suitable foraging habitat in the form of flowering myrtaceous trees and shrubs such as *Banksia serrata* (Old Man Banksia) and *Banksia integrifolia* (Coastal Silver Banksia). No nesting habitat in the form of tree hollows was present within the site.

The proposal will lead to a small incremental loss of foraging habitat for the Eastern Pygmy-Possum and would reduce the size of the greater Mambo Wetland Remnant. Considering the presence of larger areas of better quality habitat occurring outside the site and taking into account the recommendations of compensatory offsets the proposal is unlikely to significantly affect the life cycle of these arboreal marsupial species or place any viable local populations of these species at risk of extinction.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for the Eastern Pigmy Possum. This will equate to approximately 4ha of habitat for each species.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for these arboreal mammal species however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Eastern Pygmy Possum. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help the Eastern Pygmy Possum recover in NSW. These actions include:

- Ensure the largest hollow-bearing trees (including dead trees) are given highest priority for retention.
- Delineate boundaries of population to identify the extent to which populations are interconnected.

It is considered that the proposed action will not significantly compromise these Priority Action Plans.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this marsupial species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography

Fleay, D.(1947). Gliders of the Gum Trees. Melbourne Bread and Cheese Club.

Humphries, R. and Seebeck, J. (1997). *Brush-tailed Phascogale Phascogale tapoatafa. Victorian Department of Natural Resources and Environment Action Statement No. 79* at http://www.dce.vic.goc.au/plntanml/native/actstats/content/as79.htm

NSW Scientific Committee (2001). Final determination to list *Cercartetus nanus* (Eastern Pygmy-Possum) as a Vulnerable Species at http://www.nationalparks.nsw.gov.au

NPWS Database (2000). Fauna Species List for Protected Areas in NSW, at 'http://www.npws.gov.au/wildlife/species.htm'.

Quin, D.G. (1995). Population Ecology of the Squirrel Glider (*Petaurus norfolcensis*) and the Sugar Glider (*P. breviceps*) (Marsupialia : Petauridae) at Limeburners Creek, on the Central North Coast of New South Wales. In: Australian Wildlife Research 22: pp 471-505.

Quin, D.G. (1993). Sociology of the Squirrel Glider and the Sugar Glider. PhD Thesis, Department of Ecosystem Management, University of New Emgland.

Smith, A. (1996). On The Brink - Squirrel Gliders, Pittwater Council and Housing Development. At 'http://www.nccsw.org.au/bushland/reference/onthebrink/Squirrel.html'.
Suckling, G.C. (1995). Squirrel Glider (*Petaurus norfolcensis*). In: The Mammals of Australia, pp: 234-5. Strahan, R. (Ed). Reed Books, Sydney.

SWC Consultancy (1996). Eleebana Local Squirrel Glider Study. Report to Lake Macquarie City Council.

Triggs, B. (1996). Tracks, Scats and Other Traces: a Field Guide to Australian Mammals. Oxford University Press, Australia.
Turner, V. & Ward, S.J. (1995). Eastern Pygmy-possum (*Cercartetus nanus*). In: The Mammals of Australia, pp: 217-218. Strahan, R. (Ed). Reed Books, Australia.

16. Terrestrial Mammals

***Dasyurus maculatus maculatus* (Tiger Quoll)**
The Tiger Quoll is an agile climber but spends most of its time on the floor of sclerophyll forests, rainforests and coastal woodlands. Although largely nocturnal, it may forage and bask in the sun during the day. Nests are made in rock caves and hollow logs or trees, and basking sites are usually found nearby. It is an opportunistic hunter of a variety of prey, including birds and their young, rats and other small terrestrial and arboreal mammals, gliders, small Macropods, reptiles and Arthropods.

***Potorous tridactylus* (Long-nosed Potoroo)**
The Long-nosed Potoroo has a patchy distribution from Gladstone, QLD to south-west Victoria and Tasmania. They are regarded as uncommon north of the Sydney region. It is known from a variety of habitats, including rainforest, Open Forests & Woodlands with dense groundcover, and dense, wet coastal heathlands. Soft (often sandy) substrates are preferred by this species. They feed predominantly on fungi, subterranean insects, succulent roots, tubers, seeds and fruits. Many food items are obtained by digging in the soil with their forearms. Conical pits with remnants of the fruiting bodies of an underground fungus nearby are characteristics signs of past feeding by this species. Being predominantly nocturnal, the Long-nosed Potoroo sleeps by day in simple nests of grass and other vegetation placed in scrapes below dense scrub, grass tussocks or grass trees.

Pseudomys gracilicaudatus **Eastern Chestnut Mouse**
This species is most often found in heathland and in dense and wet heathy areas, though it has also been recorded from Open Woodland. Its' optimal habitat however, has been identified as regenerating vegetation. These animals are mainly nocturnal resting in grass nests or burrows by day and emerging at dusk to forage for seeds, stems, fungi and insects. Within NSW the breeding season is from September to March, however, in good seasons, mating extends from mid-August to the end of March. This species is distributed along the east coast and ranges of Australia from the Cairns district to the lower north coast of New South Wales.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Despite targeted surveys, which involved cage trapping and spotlighting neither *Dasyurus maculatus maculatus* nor *Potorous tridactylus* were recorded on site during the survey.

***Dasyurus maculatus maculatus* (Tiger Quoll)**
Suitable hunting habitat was found to be present within the site for *D. maculatus maculatus* although no nesting habitat was considered to be present. This species however would be most commonly found in more isolated, pristine areas of habitat on the Tomaree Peninsula and would be unlikely to be present within the site or nearby areas. There was a paucity of records of the Tiger Quoll in the immediate local area. The proposal will result in the incremental reduction of a small amount of habitat for *D. maculatus maculatus* however it is unlikely to result in the extinction of any local population of this species.

***Potorous tridactylus* (Long-nosed Potoroo)**
Due to the disturbance and proximity of the site to urban development only marginal habitat was considered to be present in the western portion of the site. However there is a lack of local records for this species on the Tomaree Peninsula. The proposal will result in the incremental reduction in a

small amount of habitat for *P. tridactylus* however it is unlikely to result in the extinction of any local population of this species.

***Pseudomys gracilicaudatus* (Eastern Chestnut Mouse)**
Due to the disturbance and proximity of the site to urban development only limited habitat was considered to be present in the western portion of the site. However there is a lack of local records for this species on the Tomaree Peninsula. The proposal will result in the incremental reduction in a small amount of habitat for the Eastern Chestnut Mouse however considering the plan for compensatory offset habitat it is unlikely to result in the extinction of any local population of this species.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for *D. maculatus, P. dactylus* and *P. gracilicaudatus.* This will equate to approximately 4ha of habitat for each species.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result in the incremental decline in marginal habitat for these mammal species however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Tiger Quoll, Long-nosed Potaroo and Eastern Chestnut Mouse. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these mammals recover in NSW. Considered the plan for compensatory offsets the proposed action will not significantly compromise these Priority Action Plans.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site will result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these marsupial species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography:

Edgar, R. and Belcher, C. (1995). *Spotted-tailed Quoll (Dasyurus maculatus) in Strahan, R.* (ed) *The Mammals of Australia*, pp: 67-68. Strahan, R. (Ed). Reed Books, Australia.

NPWS Database (2000). *Fauna Species List for Protected Areas in NSW* at http://www.npws.gov.au/wildlife/species.htm

Fox, B.J. (1995). *Eastern Chestnut Mouse* (*Pseudomys gracilicaudatus*). In: The Mammals of Australia, pp 601-602. Strahan, R. (Ed). Reed Books, Chatswood, NSW.

15. Microchiropteran Bats

***Falsistrellus tasmaniensis* (Eastern Falsistrelle)**
The Eastern Falsistrelle occurs along the coastal ranges from southern Queensland to western Victoria, and is endemic to Australia. These bats inhabit sclerophyll forests from the Great Divide to the east coast. In Tasmania they are found in wet sclerophyll and coastal mallee. A preference has been noted for wet habitats where trees are more than 20m high. On the mainland they eat moths, rove beetles, chafers, weevils, plant bugs, flies and ants. It has been observed roosting in holes and hollow trunks of Eucalypts, with recorded colony sizes ranging from 3 to 36 individuals.

***Mormopterus norfolkensis* (Eastern Freetail-bat)**
This species appears to live in Sclerophyll Forests and Woodland. Usually only solitary bats are captured, but one group was caught flying low over a rocky river in Rainforest and Wet Sclerophyll Forest. When hunting insects it flies swiftly above the forest canopy or in clearings at the edge of the forest. Their diet is largely unknown. Small colonies have been found in tree hollows or under loose bark and specimens have been collected from under house roofs and the metal caps on telegraph poles.

***Miniopterus schreibersii oceanensis* (Large Bentwing-bat)**
The Large Bentwing-bat is a cave (and similar man-made structures) roosting species that generally feeds above the forest canopy in wet and dry tall open forest, catching insects on the wing. However, the species has also been recorded utilising rainforest, monsoon forest, open woodland, paperbark forests and open grasslands. Moths are the main prey item.

***Chalinolobus dwyeri* (Large-eared Pied Bat)**
The Large Pied Bat ranges from Rockhampton in central Queensland to Bungonia in southern NSW. This species has been found occupying dry sclerophyll forest and woodland, both to the east and west of the Great Divide. Recordings of this species have also been made in subalpine woodland and at the ecotone of rainforest and wet Eucalypt forest. The Large-eared Pied Bat roosts in caves, abandoned mud-nests of Fairy Martins and mine tunnels.

***Myotis adversus* (Large-footed Myotis)**
The Large-footed Myotis has been recorded along much of the coastal strip of Australia occurring from the east of SA, around the Victorian, NSW, Queensland and NT coasts and into WA as far as the Kimberleys (the northern population is likely to be a different subspecies - currently undergoing taxonomic revision).

In NSW, the Large-footed Myotis is found in various habitats of the coast and adjacent ranges. It is a small bat that hunts by raking the surface of the water for aquatic insects and small fish, it seldom occurs far from suitable water bodies which range from rainforest streams to large reservoirs and even brackish water. Some aerial hunting also occurs. Prey items include moths, beetles, crickets, cockroaches, flies and many water insects. It roosts in small colonies of between 15 and several hundred individuals with recorded roosts including caves, mines and disused railway tunnels as well as dense rainforest foliage in the tropical parts of its range. Some occurrences of roosting in tree hollows are also noted.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Chalinolobus dwyeri, Falsistrellus tasmaniensis, Myotis adversus, Miniopterus schreibersii oceanensis and *Mormopterus norfolkensis* were not identified on site despite the undertaking of harp trapping and echolocation call recording. The site provided hunting habitat for all of these threatened microchiropteran bat species. Preferred hunting habitat in the form of waterbodies was absent for *Myotis adversus.* No roosting habitat in the form of tree hollows was available within the site. No preferred roosting habitat for *C. dwyeri, M. schreibersii oceanensis* and *M. adversus* in the form of caves and similar man made structures was also present. However, *M. adversus* and *Miniopterus schreibersii oceanensis* have also been known to utilise tree hollows on occasions.

Considering the presence of larger areas of suitable habitat in the local area such as Mambo Wetland and taking into account the plan for compensatory habitat the proposal is unlikely to significantly affect the life cycle of these microchiropteran bat species or place any viable local populations of these species at risk of extinction.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of a large portion of hunting habitat for these microchiropteran bat species. This will equate to an area of approximately 10 ha of habitat.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of these bat species.

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

The proposed subdivision and subsequent development will result in the incremental decline in hunting habitat and limited roosting habitat for these microchiropteran bat species however taking the proposal for compensatory habitat offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for these microchiropteran bat species. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site will result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these microchiropteran bat species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

17. Invertebrates

***Petalura gigantea* (Giant Dragonfly)**

Petalura gigantea (Giant Dragonfly) is a large dragonfly with a wingspan of more than 13cm. The species was known to occur in SE Australia, from Moss Vale to southern Queensland, although the only currently known population of the Giant Dragonfly is at Wingecarribee Swamp south-west of Sydney. It occupies permanent wetlands both coastal and upland. The larvae live in permanent long chambered burrows up to 1.5m long built under swamps and emerge from terrestrial entrances above water level at night to feed. The larval stage is considered to take from 10 to 30 years and the adults emerge from October to November and fly until late January. The adults however have a very limited dispersal due to a poor flying ability.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

No large dragonflies consistent with *Petalura gigantea* (Giant Dragonfly) were noted within the site during incidental surveys. However, it must be noted the survey was undertaken outside the time when this species would not be considered to have emerged from its larval form. The Giant Dragonfly is usually observed between October to late January. The Giant Dragonfly has been recorded nearby in the vicinity of the Horizons Golf Course (DECC Database, 2009). Suitable habitat was considered to be present within the wetter form of in the swamp forest in the north-west of the site.

The proposal subdivision and subsequent development will lead to the removal of virtually all suitable habitat from the site for this Dragonfly species. This will lead to an incremental reduction of habitat in the local area. However, considering the presence of large areas of suitable habitat in the local area and plan for compensatory offset habitat it is unlikely that the proposal would threaten the local population with immediate extinction by disrupting its breeding life-cycle of this Dragonfly species.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all preferred hunting habitat for this Dragonfly bat species. This will equate to an area of approximately 1.2 ha of habitat.

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

No areas of habitat are likely to become fragmented, isolated for this Dragonfly species.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for the Giant Dragonfly however taking the proposal for compensatory habitat offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Giant Dragonfly. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this Dragonfly recover in NSW. Actions pertinent to the site include:

- The maintenance of the hydrological regime of Swamp Forest Habitat.
- Prevent erosion and subsequent erosion of suitable habitat.

The proposal does not comply with a number of the priority actions however taking the plan for compensatory offset habitat and recommendations such as erosion and sediment control to protect suitable habitat in Mambo Swamp it is unlikely that the proposal will significantly compromise the Priority Action Plan.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation

from the site will result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this Dragonfly species.

- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Other pertinent threats include the reduction in water quality within swamps the use of chemical such as herbicides or insecticides within or near swamps and grazing by stock within swamps.

Bibliography:

NSW National Parks and Wildlife Service (2002). *Threatened Species of the Upper North Coast of New South Wales*. NSW National Parks and Wildlife Service.

Theischinger, G. & Hawking, J. (2006). *The Complete Guide to Dragonflies of Australia*. CSIRO Publishing.

Wyong Shire Council. (1999). *Flora and Fauna Guidelines for Development*. Prepared by Wyong Shire Council.

17. Endangered Populations

***Dromaius novaehollandiae*—Emu population in the NSW Coast Bioregion and Port Stephens LGA**

The Emu, *Dromaius novaehollandiae,* is a very large flightless bird that is distributed broadly but patchily through NSW and elsewhere in Australia. It occupies a range of predominantly open habitats, including plains, grasslands, woodlands and scrubs, and may occur occasionally in forest. An isolated population of Emus occurs in the NSW North Coast Bioregion and Port Stephens LGA. The population is disjunct from other populations in the Sydney Basin and New England Tableland Bioregion. The population of Emus in the NSW North Coast Bioregion and Port Stephens LGA represents the north-eastern limit of the species in NSW.

Numbers of Emus in the NSW North Coast Bioregion and Port Stephens LGA have declined severely. The habitat of the Emus in the North Coast Bioregion and Port Stephens LGA has been reduced and fragmented as a result of agricultural and urban development, with consequent local extinctions. The population is threatened by further loss and fragmentation of habitat for suburban and rural development, inappropriate fire regimes, deliberate killing, predation of eggs and young by pigs, dogs and foxes, road kill and altered population dynamics.

The population of Emus in the NSW North Coast Bioregion and Port Stephens LGA is of significant conservation value as the last known population in north coastal NSW, and for the role that birds play in dispersing large seeds of native plant species over long distances (McGrath and Bass, 1999).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Not applicable.

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

Dromaius novaehollandiae was not recorded on site during the survey period. Only marginal habitat was considered to be available due to presence of urban development. There is also a lack of recent records of this species in the locality. Considering that only a relatively small amount of marginal habitat will be removed the proposal is considered unlikely to have a significant effect upon the long-term survival of these species within the local area.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all habitat for the Emu. This will equate to an area of approximately 7 ha of habitat.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result in the incremental decline in marginal habitat for Emu. Taking the proposal for compensatory offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the aforementioned species. The proposal is not considered to compromise the Priority Action Statements (PAS) for these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to

the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to the Emu.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.

References:

McGrath, R.J. and Bass, D. (1999). Seed dispersal by Emus on the NSW north-east coast. Emu **99**:248-252

NSW NPWS Scientific Committee (2002). Final Determination to list *Dromaius novaehollandiae* population in the NSW North Coast Bioregion and Port Stephens LGA—Endangered Population at: http://www.nationalparks.nsw.gov.au

APPENDIX B

FLORA SPECIES LIST

FLORA SPECIES LIST

The following list includes all species of vascular plants observed on site during fieldwork. It should be noted that such a list cannot be considered comprehensive, but rather indicative of the flora. It can take many years of flora surveys to record all of the plant species occurring within any area, especially plant species that are only apparent in some seasons such as orchids.

A number of species cannot always be accurately identified during a brief survey, generally due to a lack of suitable flowering and/or fruiting material. Any such species are identified as accurately as possible, and are indicated in the list thus:

* Specimens which could only be identified to genus level are indicated by the generic name followed by the abbreviation "sp.", indicating an unidentified species of that genus;

* Specimens for which identification of the genus was uncertain are indicated by a question mark ("?") placed in front of the generic, which is followed by the abbreviation "sp.";

* Specimens which could be accurately identified to genus level , but could be identified to species level with only a degree of certainty are indicated by a ("?") placed in front of the epithet.

Authorities for the scientific names are not provided in the list. These follow Harden (1991, 1992, 1993 and 2000). Names of families and higher taxa follow a modified Cronquist System (1981).

Introduced species are indicated by an asterisk ("*").

The following standard abbreviations are used to indicate subspecific taxa:

ssp. - subspecies
var.- variety
× - hybrid between the two indicated species

FAMILY *Scientific Name*	Common Name
SELAGINELLACEAE	
Selaginella uliginosa	
CLASS FILICOPSIDA (FERNS)	
BLECHNACEAE	
Blechnum indicum	Bungwall Fern
DAVALLIACEAE	
**Nephrolepis cordifolia*	Fishbone Fern
DENNSTAEDTIACEAE	
Histiopterus incisa	Batswing Fern
Pteridium esculentum	Bracken
DICKSONIACEAE	
Calochlaena dubia	False Bracken Fern
GLEICHENIACEAE	
Gleichenia microphylla	Coral Fern
SCHIZAEACEAE	
Cheilanthes sieberi ssp. *sieberi*	Mulga Fern
CLASS MAGNOLIOPSIDA (FLOWERING PLANTS)	
SUBCLASS LILIIDAE (Monocotyledons)	
ANTHERICACEAE	
Tricoryne elatior	Yellow Rush Lily
COMMELINACEAE	
Commelina cyanea	Scurvy Weed
CYPERACEAE	
Caustis recurvata var. *recurvata*	
**Cyperus eragrostis*	Umbrella Sedge
Cyperus gracilis	Small Sedge
Gahnia clarkei	Saw Sedge
Gahnia sieberana	Red Fruit Saw-sedge
Lepidosperma flexuosum	Rapier Sedge
Lepironia articulata	Lepironia
Leptocarpus tenax	
LOMANDRACEAE	
Lomandra glauca	
Lomandra longifolia	Spiny Mat Rush
PHORMACEAE	
Dianella caerulea var. *producta*	Blue Flax Lily

POACEAE	
**Andropogon virginicus*	Whisky Grass
**Anthoxanthum odoratum*	Sweet Vernal Grass
**Axonopus affinis*	Narrowleaf Carpet Grass
**Briza maxima*	Quaking Grass
**Chloris gayana*	Rhodes Grass
**Cortaderia selloana*	Pampas Grass
Cynodon dactylon	Common Couch
Entolasia marginata	
**Eragrostis curvula*	African Lovegrass
Imperata cylindrica var. *major*	Blady Grass
**Panicum maximum*	Guinea Grass
**Paspalum dilatatum*	Paspalum
**Paspalum urvillei*	Vasey Grass
**Pennisetum clandestinum*	Kikuyu
**Melinis repens*	Red Natal Grass
Setaria sp.	Pigeon Grass
Themeda triandra	Kangaroo Grass
RESTIONACEAE	
Baloskion tetraphyllum ssp. *meiostachyum*	Tassel Cord-rush
XYRIDACEAE	
Xyris complanata	Feathered Yellow-eye

SUBCLASS MAGNOLIIDAE (Dicotyledons)

APIACEAE	
Actinotus helianthi	Flannel Flower
Centella asiatica	
**Hydrocotyle bonariensis*	Kurnell Curse
Hydrocotyle peduncularis	
Trachymene incisa ssp. *incisa*	
Xanthosia pilosa	Woolly Xanthosia
APOCYNACEAE	
Parsonsia straminea var.*straminea*	Monkey Rope
ASCLEPIADACEAE	
**Gomphocarpus fruticosus*	Narrow-leaf Cotton Bush
ASTERACEAE	
**Acanthospermum australe*	Starburr
**Ambrosia artemisiifolia*	Annual Ragweed
**Bidens pilosa*	Cobbler's Pegs
**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
**Cirsium vulgare*	Spear Thistle
**Conyza bonariensis*	Flaxleaf Fleabane
**Coreopsis lanceolata*	Coreopsis
**Gazania linearis*	Gazania
**Hypochoeris radicata*	Cat's Ear
**Senecio madagascariensis*	Fireweed
**Soliva pterosperma*	Bindii
**Sonchus oleraceus*	Common Sowthistle
**Tagetes minuta*	Stinking Roger

**Taraxacum officinale*	Dandelion
BIGNONIACEAE	
Pandorea pandorana	Wonga Vine
CAESALPINIACEAE	
Senna pendula	
CASSYTHACEAE	
Cassytha pubescens	Common Devil's Twine
CASUARINACEAE	
Allocasuarina littoralis	Black She-oak
Casuarina glauca	Swamp Oak
DILLENIACEAE	
Hibbertia fasciculata	
Hibbertia riparia	
Hibbertia scandens	Golden Guinea Flower
DROSERACEAE	
Drosera spathulata	Common Sundew
EPACRIDACEAE	
Astroloma pinifolium	Pine Heath
Brachyloma daphnoides	Daphne Heath
Epacris obtusifolia	
Epacris microphylla var. microphylla	Coral Heath
Epacris pulchella	Coral Heath
Leucopogon ericoides	Bearded Heath
Leucopogon lanceolatus	Lance Beard-heath
Monotoca elliptica	Tree Broom-heath
Sprengelia incarnata	Pink Swamp Heath
EUPHORBIACEAE	
Omalanthus populifolius	Bleeding Heart
Ricinocarpus pinifolius	Wedding Bush
FABACEAE	
Aotus ericoides	Aotus
Bossiaea heterophylla	Variable Bossiaea
Bossiaea rhombifolia ssp. *rhombifolia*	
Dillwynia retorta	Heathy Parrot Pea
Glycine clandestina	Love Creeper
Hardenbergia violacea	False Sarsaparilla
Kennedia rubicunda	Dusky Coral Pea
Phyllota phylicoides	Heath Phyllota
**Trifolium repens*	White Clover
Viminaria juncea	Golden Spray
HALORAGACEAE	
Gonocarpus teucrioides	Germander Raspwort
LAURACEAE	
**Cinnamomum camphora*	Camphor Laurel

LOBELIACEAE	
Pratia purpurascens	White Root
MALVACEAE	
**Sida rhombifolia*	Paddy's Lucerne
MENYANTHACEAE	
Villarsia exaltata	Erect Marsh Flower
MIMOSACEAE	
Acacia decurrens	Sydney Green Wattle
Acacia irrorata ssp*. irrorata*	
Acacia longifolia	Sydney Golden Wattle
Acacia saligna	Golden Wreath Wattle
Acacia suaveolens	Sweet-scented Wattle
Acacia ulicifolia	Prickly Moses
MYRTACEAE	
Angophora costata	Smooth-barked Apple
Callistemon citrinus	Crimson Bottlebrush
Callistemon pachyphyllus	Wallum Bottlebrush
Eucalyptus pilularis	Blackbutt
Eucalyptus robusta	Swamp Mahogany
Euryomyrtus ramosissima ssp. *ramosissima*	Rosy Baeckea
Kunzea ambigua	Tick Bush
Leptospermum polygalifolium	Lemon-scented Tea-Tree
Leptospermum juniperinum	Prickly-leaved Tea-tree
Leptospermum laevigatum	Coastal Tea-tree
Leptospermum liversidgei	
Leptospermum trinervium	Paperbark Tea-tree
Melaleuca quinquenervia	Broad-leafed Paperbark
Melaleuca thymifolia	Thyme Honey-myrtle
OLEACEAE	
**Fraxinus* sp.	
ONAGRACEAE	
**Ludwigia longifolia*	Long-leaf Willow Primrose
**Oenothera stricta* ssp. *stricta*	Common Evening Primrose
PITTOSPORACEAE	
Billardiera scandens var. scandens	Apple Berry
PLANTAGINACEAE	
**Plantago lanceolata*	Ribwort / Lamb’s Tongues
PROTEACEAE	
Banksia integrifolia	Coastal Banksia
Banksia robur	Swamp Banksia
Banksia serrata	Old Man Banksia
Conospermum taxifolium	Conospermum
Hakea teretifolia	Dagger Hakea
Isopogon anemonifolius	Drum Sticks
Persoonia lanceolata	Geebung
Persoonia levis	Smooth Geebung

RUBIACEAE	
Pomax umbellata	Pomax
RUTACEAE	
Boronia parviflora	Swamp Boronia
Eriostemon australasius	Pink Wax Flower
Zieria laevigata	Zieria
SANTALACEAE	
Exocarpus cupressiformis	Cherry Ballart
Leptomeria acida	Native Current
SAPINDACEAE	
Dodonaea triquetra	Common Hop Bush
SOLANACEAE	
**Solanum nigrum*	Blackberry Nightshade
THYMELAEACEAE	
Pimelea linifolia ssp*. linifolia*	Rice Flower
VERBENACEAE	
**Lantana camara*	Lantana
**Verbena bonariensis*	Purple Top
VITACEAE	
Cayratia clematidea	Native Grape

APPENDIX C

VEGETATION TRANSECT & PLOT DATA

C1.0 TRANSECT METHODOLOGY

Three walking transects were undertaken within the bounds of the site to provide detail on the floral assemblages occurring therein. The location of transects are shown in Figure C1.

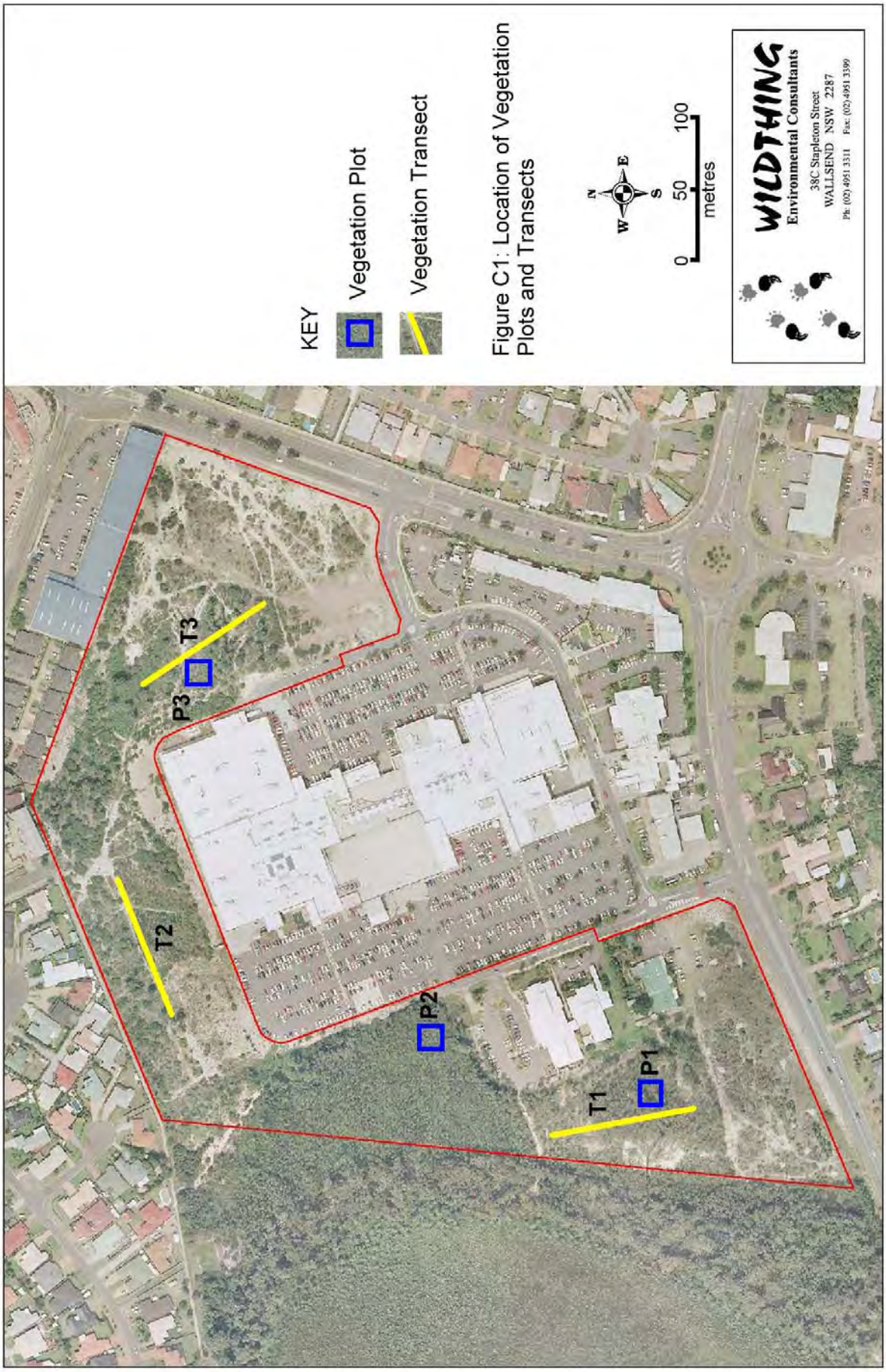
TRANSECT 1

*Community – Swamp Forest - Subject to less frequent inundation. West of Library

*Length – 100m
*Canopy – to 8m
*Aspect – level ground
*Soil Type - Sandy

Species Recorded –

Epacris pulchella	Coral Heath
Melaleuca quinquenervia	Broad-leafed Paperbark
Tricoryne elatior	Yellow Rush-lily
Gleichenia microphylla	Coral Fern
Caustis recurvata var*. recurvata*	
Angophora costata	Smooth-barked Apple
Eucalyptus robusta	Swamp Mahogany (seedling)
Dodonaea triquetra	Common Hop Bush
Xanthosia pilosa	Wooly Xanthosia
Epacris obtusifolia	
**Andropogon virginicus*	Whisky Grass
Leucopogon lanceolatus	Lance Beard-heath
Acacia longifolia	Sydney Golden Wattle
Callistemon pachyphyllus	Wallum Bottlebrush
Dillwynia retorta	Heathy Parrot Pea
Bossiaea rhombifolia ssp*. rhombifolia*	
Banksia serrata	Old Man Banksia
Gahnia clarkei	
Lepidosperma flexuosum	Rapier Sedge
Themeda triandra	Kangaroo Grass
Leptocarpus tenax	
Banksia integrifolia	Coastal Banksia
Leucopogon ericoides	Bearded Heath
Pimelea linifolia ssp*. linifolia*	Rice Flower
Xyris complanata	Feathered Yellow-eye


KEY
Vegetation Plot
Vegetation Transect
Figure C1: Location of Vegetation Plots and Transects
N
E
S
W
0
50
100
metres
WILDTHING
Environmental Consultants
38C Stapleton Street
WALLSEND NSW 2287
Ph: (02) 4951 3311 Fax: (02) 4951 3399
T1
T2
T3
P1
P2
P3

TRANSECT 2

*Community – Coastal Sand Woodland
*Length – 100m
*Aspect – level ground
*Soil Type - Sandy

Species Recorded –

**Andropogon virginicus*	Whisky Grass
Themeda triandra	Kangaroo Grass
**Melinis repens*	Red Natal Grass
Tricoryne elatior	Yellow Rush-lily
**Gazania linearis*	Gazania
**Axonopus affinis*	Narrowleaf Carpet Grass
Brachyloma daphnoides	Daphne Heath
Leptospermum laevigatum	Coastal Tea-tree
**Eragrostis curvula*	African Lovegrass
**Anthoxanthum odoratum*	Sweet Vernal Grass
**Coreopsis lanceolata*	Coreopsis
Ricinocarpus pinifolius	Wedding Bush
Bossiaea rhombifolia ssp*. rhombifolia*	
Persoonia lanceolata	Geebung
Allocasuarina littoralis	Swamp She-oak
Acacia longifolia	Sydney Golden Wattle
**Chloris gayana*	Rhodes Grass
**Oenothera stricta* ssp. *stricta*	Common Evening Primrose
Acacia saligna	Golden Wreath Wattle
Dodonaea triquetra	Common Hop Bush
**Briza maxima*	Quaking Grass
**Conyza bonariensis*	Flaxleaf Fleabane
**Hypochoeris radicata*	Cat's Ear
Acacia ulicifolia	Prickly Moses
**Chrysanthemoides monilifera* ssp*. rotundata*	Bitou Bush
Melaleuca quinquenervia	Broad-leafed Paperbark
Lomandra longifolia	Spiny Mat Rush
Pomax umbellata	Pomax
Entolasia marginata	
Callistemon pachyphyllus	Wallum Bottlebrush
Actinotus helianthi	Flannel Flower
**Acanthospermum australe*	Starburr
Leucopogon ericoides	Bearded Heath
Leptospermum trinervium	Paperbark Tea-tree
Glycine clandestina	Love Creeper
Eucalyptus robusta	Swamp Mahogany
Monotoca elliptica	Tree Broom-heath
Cheilanthes sieberi ssp. *sieberi*	Mulga Fern
Epacris pulchella	Coral Heath
Xanthosia pilosa	Woolly Xanthosia
Acacia suaveolens	Sweet-scented Wattle
Pteridium esculentum	Bracken
Billardiera scandens var. scandens	Apple Berry
Pimelea linifolia ssp*. linifolia*	Rice Flower
Dianella caerulea var*. producta*	Blue Flax Lily
**Lantana camara*	Lantana

TRANSECT 3

*Community – Coastal Sand Woodland.
*Length – 100m
*Aspect – level ground
*Soil Type - Sandy

Species Recorded –

**Chrysanthemoides monilifera* ssp*. rotundata*	Bitou Bush
**Melinis repens*	Red Natal Grass
Persoonia lanceolata	Geebung
Acacia ulicifolia	Prickly Moses
**Acanthospermum australe*	Starburr
Leptospermum laevigatum	Coastal Tea-tree
**Hypochoeris radicata*	Cat's Ear
Acacia saligna	Golden Wreath Wattle
Leucopogon ericoides	Bearded Heath
Leucopogon lanceolatus	Lance Beard-heath
**Andropogon virginicus*	Whisky Grass
**Chloris gayana*	Rhodes Grass
Bossiaea rhombifolia ssp*. rhombifolia*	
Themeda triandra	Kangaroo Grass
Eriostemon australasius	Pink Wax Flower
Acacia suaveolens	Sweet-scented Wattle
**Axonopus affinis*	Narrowleaf Carpet Grass
Monotoca elliptica	Tree Broom-heath
**Eragrostis curvula*	African Lovegrass
**Oenothera stricta* ssp. *stricta*	Common Evening Primrose
Lomandra longifolia	Spiny Mat Rush
**Conyza bonariensis*	Flaxleaf Fleabane

C2.0 PLOT METHODOLOGY

Three plot-based vegetation surveys were undertaken within the bounds of the site to provide additional detail on the flora assemblages present (Figure C1). The plot was 20 × 20m in area. All species observed within the quadrat were recorded, with the dominant species in each stratum being duly noted. A modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927, with selected modifications sourced from Poore 1955 and Austin *et al*. 2000) was used to estimate cover-abundances of all plant species within each plot. The cover-abundance categories are shown in Table C1.

Table C1: Modified Braun-Blanquet Crown Cover-abundance Scale

Class	Cover - Abundance	Notes
1	Few individuals (less than 5% cover)	Herbs, sedges and grasses: < 5 individuals Shrubs and small trees: 5 or more individuals
2	Many individuals (less than 5% cover)	Herbs, sedges and grasses: 5 or more individuals Medium-large over hanging tree
3	5 – < 20% cover	-
4	20 – < 50% cover	-
5	50 – < 75% cover	-
6	75 – 100% cover	-

PLOT 1

Community – Swamp Forest - Subject to less frequent inundation

*Aspect – Relatively Flat

*Structural Components –

Canopy	(to 8m)	%coverage = 40%
Shrub Layer	(to 3m)	%coverage = 35%
Ground Cover	(to 1m)	%coverage = 20%

*Species Recorded –

Canopy Dominants		
Melaleuca quinquenervia	Broad-leafed Paperbark	2
Shrub Layer Dominants		
Leptospermum juniperinum	Prickly-leaved Tea-tree	2
Epacris obtusifolia		2
Leucopogon lanceolatus	Lance Beard-heath	1
Persoonia lanceolata	Geebung	2
Ground Cover Dominants		
Tricoryne elatior	Yellow Rush-lily	2
Additional Species Recorded		
Leucopogon lanceolatus	Lance Beard-heath	1
Gonocarpus teucrioides	Germander Raspwort	1
Dodonaea triquetra	Common Hop Bush	1
Acacia longifolia	Sydney Golden Wattle	1
Acacia saligna	Golden Wreath Wattle	1
Pteridium esculentum	Bracken	1
Billardiera scandens var. scandens	Apple Berry	1
Pimelea linifolia ssp. *linifolia*	Rice Flower	1
Entolasia marginata		1
Drosera spathulata	Common Sundew	1
Callistemon pachyphyllus	Wallum Bottlebrush	1
Caustis recurvata var. *recurvata*		1
Gahnia clarkei		1
Xanthosia pilosa	Woolly Xanthosia	1
Cassytha pubescens	Common Devil's Twine	1
Boronia parviflora	Swamp Boronia	1
Euryomyrtus ramosissima ssp. *ramosissima*	Rosy Baeckea	1
Acacia ulicifolia	Prickly Moses	1
Themeda triandra	Kangaroo Grass	1
Leptocarpus tenax		1
Actinotus helianthi	Flannel Flower	1
Acacia suaveolens	Sweet-scented Wattle	1
Epacris pulchella	Coral Heath	1

PLOT 2

*Community – Swamp Forest - Subject to frequent and prolonged inundation.

*Aspect – Relatively Flat

*Structural Components –

Canopy	(to 8m)	%coverage = 30%
Shrub Layer	(to 3m)	%coverage = 70%
Ground Cover	(to 1m)	%coverage = 20%

*Species Recorded –

Canopy Dominants		
Melaleuca quinquenervia	Broad-leafed Paperbark	2
Shrub Layer Dominants		
Callistemon pachyphyllus	Wallum Bottlebrush	1
Ground Cover Dominants		
Gleichenia microphylla	Coral Fern	3
Gahnia sieberana	Swordrush	3
Baloskion tetraphyllum ssp. *meiostachyum*	Plume Rush	2
Additional Species Recorded		
Leptospermum juniperinum	Prickly-leaved Tea-tree	1
Hakea teretifolia	Dagger Hakea	1
Acacia longifolia	Sydney Golden Wattle	1
Leptocarpus tenax		1
Blechnum indicum	Bungwall Fern	1
Villarsia exaltata	Erect Marsh Flower	1
Baumea juncea		

PLOT 3

*Community – Coastal Sand Woodland

*Aspect – Relatively Flat

*Structural Components –

Canopy	(to 8m)	%coverage = 10%
Mid Layer	(to 4m)	%coverage = 5%
Shrub Layer	(to 2m)	%coverage = 15%
Ground Cover	(to 1m)	%coverage = 40%

*Species Recorded –

Canopy Dominants		
Eucalyptus robusta	Swamp Mahogany	1
Mid Layer Dominants		
Eucalyptus robusta	Swamp Mahogany	1
Melaleuca quinquenervia	Broad-leafed Paperbark	1
Shrub Layer Dominants		
Persoonia lanceolata	Geebung	2
Bossiaea rhombifolia ssp*. rhombifolia*		2
Ground Cover Dominants		
Themeda triandra	Kangaroo Grass	2
**Andropogon virginicus*	Whisky Grass	2
Pteridium esculentum	Bracken	4
Additional Species Recorded		
Tricoryne elatior	Yellow Rush-lily	1
Lomandra longifolia	Spiny Mat Rush	1
Pimelea linifolia ssp*. linifolia*	Rice Flower	1
Xanthosia pilosa	Woolly Xanthosia	1
Brachyloma daphnoides	Daphne Heath	1
Epacris pulchella	Coral Heath	1
Entolasia marginata		1
Leucopogon ericoides	Bearded Heath	1
Actinotus helianthi	Flannel Flower	1
Lomandra glauca		1
**Axonopus affinis*	Narrowleaf Carpet Grass	1
Astroloma pinifolium	Pine Heath	1
Acacia ulicifolia	Prickly Moses	1
Acacia saligna	Golden Wreath Wattle	1

APPENDIX D:
FAUNA LIST FOR THE STUDY AREA

EXPECTED FAUNA SPECIES LIST

Family sequencing and taxonomy follow for each fauna class:

Birds - Pizzey and Knight (1997).

Herpetofauna - Cogger (1996), Ehmann (Ed) (1997) and Barker, Grigg and Tyler (1995).

Mammals - Strahan (Ed) (1995) and Churchill (1998).

- Species observed or indicated by scats, tracks etc. on site during this investigation.

@ - Species recorded during previous surveys – Wildthing Environmental Consultants (1998).

#(?) - Indicates a species identified without certainty or to a Genus level only.

* - Indicates an introduced species.

Threatened species addressed within this assessment appear in **bold** font.

	SCIENTIFIC NAME	COMMON NAME
	Family Phasianidae - True Quails	
	Coturnix ypsilophora	Brown Quail
	Family Anatidae - Ducks, Swans and Geese	
	Cygnus atratus	Black Swan
	Anas castanea	Grey Teal
	Anas gracilis	Chestnut Teal
	**Anas platyrhynchos*	Mallard
	Anas superciliosa	Pacific Black Duck
	Chenonetta jubata	Australian Wood Duck
	Family Anhingidae - Darter	
	Anhinga melanogaster	Australian Darter
	Family Pelecanidae- Pelican	
	Pelecanus conspicillatus	Australian Pelican
	Family Ardeidae - Herons, Egrets and Bitterns	
	Ardea ibis	Cattle Egret
	Ardea alba	Great Egret
	Ardea intermedia	Intermediate Egret
	Botaurus poiciloptilus	**Australasian Bittern**
	Egretta novaehollandiae	White-faced Heron
	Ixobrychus flavicollis	**Black Bittern**
	Family Threskiornithidae - Ibises and Spoonbills	
	Platalea regia	Royal Spoonbill
#	*Threskiornis molucca*	Sacred Ibis
	Threskiornis spinicollis	Straw-necked Ibis
	Family Ciconiidae - Storks	
	Ephippiorhynchus asiaticus	**Black-necked Stork**
	Family Accipitridae - Osprey, Hawks, Eagles and Harriers	
	Accipiter fasciatus	Brown Goshawk
	Accipiter cirrhocephalus	Collared Sparrowhawk
	Accipiter novaehollandiae	Grey Goshawk
	Aquila audax	Wedge-tailed Eagle
	Aviceda subcristata	Pacific Baza
	Elanus notatus	Black-shouldered Kite
	Haliaeetus leucogaster	White-breasted Sea-Eagle

	SCIENTIFIC NAME	COMMON NAME
	Haliastur sphenurus	Whistling Kite
	Hieraaetus morphnoides	Little Eagle
	Pandion haliaetus	**Osprey**
	Family Falconidae - Falcons	
	Falco berigora	Brown Falcon
	Falco cenchroides	Nankeen Kestrel
	Falco longipennis	Australian Hobby
	Falco peregrinus	Peregrine Falcon
	Family Rostratulidae-Painted Snipe	
	Rostratula benghalensis australis	**Painted Snipe**
	Family Charadriidae - Plovers, Dotterels and Lapwings	
#	*Vanellus miles*	Masked Lapwing
	Family Columbidae - Pigeons, Doves	
	Chalcophaps indica	Emerald Dove
	Columba leucomela	White-headed Pigeon
	**Columba livia*	Feral Pigeon
	Geopelia humeralis	Bar-shouldered Dove
	Geopelia striata	Peaceful Dove
	Leucosarcia melanoleuca	Wonga Pigeon
	Lopholaimus antarcticus	Topknot Pigeon
#	*Macropygia amboinensis*	Brown Cuckoo-Dove
	Ocyphaps lophotes	Crested Pigeon
	Phaps chalcoptera	Common Bronzewing
@	**Streptopelia chinensis*	Spotted Turtle-Dove
	Family Cacatuidae - Cockatoos and Corellas	
#	*Cacatua galerita*	Sulphur-crested Cockatoo
#	*Cacatua roseicapilla*	Galah
	Cacatua sanguinea	Little Corella
	Cacatua tenuirostris	Long-billed Corella
#	*Calyptorhyncus funereus*	Yellow-tailed Black-Cockatoo
	Family Psittacidae - Parrots, Rosellas and Lorikeets	
	Alisterus scapularis	King Parrot
	Glossopsitta pusilla	Little Lorikeet
	Glossopsitta concinna	Musk Lorikeet
	Lathamus discolor	**Swift Parrot**
	Neophema pulchella	**Turquoise Parrot**
	Platycercus elegans	Crimson Rosella
#	*Platycercus eximius*	Eastern Rosella
#	*Trichoglossus chlorolepidotus*	Scaly-breasted Lorikeet
#	*Trichoglossus haematodus*	Rainbow Lorikeet
	Family Cuculidae - Cuckoos	
	Chrysococcyx basalis	Horsefield's Bronze-Cuckoo
	Chrysococcyx lucidus	Shining Bronze-Cuckoo
	Cuculus pallidus	Pallid Cuckoo
	Cacomantis flabelliformis	Fan-tailed Cuckoo
	Cacomantis variolosus	Brush Cuckoo
	Eudynamys scolopacea	Common Koel
	Scythrops novaehollandiae	Channel-billed Cuckoo
	Family Centropodidae - Pheasant Coucal	

	SCIENTIFIC NAME	COMMON NAME
	Centropus phasianinus	Pheasant Coucal
	Family Tytonidae - Barn Owls	
	Tyto alba	Barn Owl
	Tyto novaehollandiae	**Masked Owl**
	Family Strigidae - Hawk-Owls	
	Ninox connivens	**Barking Owl**
	Ninox boobook	Southern Boobook
	Ninox strenua	**Powerful Owl**
	Family Podargidae - Frogmouths	
	Podargus strigoides	Tawny Frogmouth
	Family Caprimulgidae - Nightjars	
	Eurostopodus mystacalis	White-throated Nightjar
	Family Aegothelidae - Owlet Nightjars	
	Aegotheles cristatus	Australian Owlet Nightjar
	Family Apodidae - Swifts	
	Apus pacificus	Fork-tailed Swift
	Hirundapus caudacutus	White-throated Needletail
	Family Alcedinidae - River Kingfishers	
	Ceyx azurea	Azure Kingfisher
	Family Halcyonidae - Tree Kingfishers	
#	*Dacelo novaeguineae*	Laughing Kookaburra
	Todiramphus sancta	Sacred Kingfisher
	Family Coraciidae - Rollers	
	Eurystomus orientalis	Dollarbird
	Family Pittidae - Pittas	
	Pitta versicolor	Noisy Pitta
	Family Climacteridae - Treecreepers	
	Climacterus picumnus victoriae	**Brown Treecreeper**
#	*Cormobates leucophaea*	White-throated Treecreeper
	Family Maluridae - Fairy-Wrens and Emu-Wrens	
	Malurus assimilis	Variegated Fairy-Wren
	Malurus cyaneus	Superb Fairy-Wren
	Family Pardalotidae - Pardalotes, Gerygones, Scrubwrens, Heathwrens and Thornbills	
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill
	Acanthiza lineata	Striated Thornbill
#	*Acanthiza nana*	Yellow Thornbill
#	*Acanthiza pusilla*	Brown Thornbill
	Acanthiza reguloides	Buff-rumped Thornbill
	Gerygone mouki	Brown Gerygone
	Gerygone olivacea	White-throated Gerygone
#	*Pardalotus punctatus*	Spotted Pardalote
	Pardalotus striatus	Striated Pardalote
	Sericornis citreogularis	Yellow-throated Scrubwren
	Sericornis frontalis	White-browed Scrubwren

	SCIENTIFIC NAME	COMMON NAME
	Sericornis magnirostris	Large-billed Scrubwren
	Family Meliphagidae - Honeyeaters	
	Acanthorhynchus tenuirostris	Eastern Spinebill
#	*Anthrochaera carunculata*	Red Wattlebird
#	*Anthrochaera chrysoptera*	Brush Wattlebird
	Entomyzon cyanotus	Blue-faced Honeyeater
	Lichenostomus chrysops	Yellow-faced Honeyeater
	Lichenostomous leucotis	White-eared Honeyeater
	Lichmera indistincta	Brown Honeyeater
#	*Manorina melanocephala*	Noisy Miner
	Manorina melanophrys	Bell Miner
	Meliphaga lewinii	Lewin's Honeyeater
	Melithreptus brevirostris	Brown-headed Honeyeater
	Melithreptus lunatus	White-naped Honeyeater
	Myzomela sanguinolenta	Scarlet Honeyeater
#@	*Philemon corniculatus*	Noisy Friarbird
	Phylidonyris novaehollandiae	New Holland Honeyeater
#@	*Phylidonyris nigra*	White-cheeked Honeyeater
	Plectorhyncha lanceolata	Striped Honeyeater
	Xanthomyza phrygia	**Regent Honeyeater**
	Family Petroicidae - Robins and Jacky Winter	
	Eopsaltria australis	Eastern Yellow Robin
	Microeca leucophaea	Jacky Winter
	Petroica rosea	Rose Robin
	Tregellasia capito	Pale-Yellow Robin
	Family Cinclosomatidae - Whipbird and Quail-thrushes	
	Psophodes olivaceus	Eastern Whipbird
	Family Neosittidae - Sitellas	
	Daphoenositta chrysoptera	Varied Sitella
	Family Pachycephalidae - Whistlers, Shrike-tit and Shrike-thrushes	
@	*Colluricincla harmonica*	Grey Shrike-thrush
	Falcunculus frontatus	Crested Shrike-tit
#	*Pachycephala pectoralis*	Golden Whistler
	Pachycephala rufiventris	Rufous Whistler
	Family Dicruridae - Monarchs, Flycatchers, Fantails, Drongo and Magpie-Lark	
	Dicrurus megarhynchus	Spangled Drongo
	Monarcha melanopsis	Black-faced Monarch
	Monarcha trivirgatus	Spectacled Monarch
	Myiagra cyanpleuca	Satin Flycatcher
	Myiagra inquieta	Restless Flycatcher
	Myiagra rubecula	Leaden Flycatcher
	Rhipidura fuliginosa	Grey Fantail
#	*Rhipidura leucophrys*	Willie Wagtail
	Rhipidura rufifrons	Rufous Fantail
#	*Grallina cyanoleuca*	Magpie-lark
	Family Campephagidae - Cuckoo-shrikes and Trillers	

	SCIENTIFIC NAME	COMMON NAME
#	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
	Coracina tenuirostris	Cicadabird
	Lalage leucomela	Varied Triller
	Family Oriolidae - Orioles and Figbird	
	Oriolus sagittatus	Olive-backed Oriole
	Sphecotheres viridus	Figbird
	Family Artamidae - Wood-swallows, Butcherbirds, Magpie and Currawongs	
@	*Artamus cyanopterus*	Dusky Woodswallow
	Artamus leucorhynchus	White-breasted Woodswallow
	Cracticus nigrogularis	Pied Butcherbird
#	*Cracticus torquatus*	Grey Butcherbird
#@	*Gymnorhina tibicen*	Australian Magpie
#	*Strepera graculina*	Pied Currawong
	Family Paradiseaidae - Birds of Paradise	
	Ptiloris paradiseus	Paradise Riflebird
	Family Corvidae - Crows, Raven	
#	*Corvus coronoides*	Australian Raven
	Family Corcoracidae - Mudnest-builders	
	Corcorax melanorhamphos	White-winged Chough
	Family Ptilinorhynchidae - Bowerbirds	
	Ptilinorhynchus violaceus	Satin Bowerbird
	Family Motacillidae - Pipits and Wagtails	
	Anthus novaseelandiae	Richard's Pipit
	Family Passeridae - Sparrows, Grassfinches, Mannikins	
#	*Neochmia temporalis*	Red-browed Finch
	Lonchura castaneothorax	Chestnut-breasted Mannikin
	**Passer domesticus*	House Sparrow
	Poephila bichenovii	Double-barred Finch
	Poephila guttata	Zebra Finch
	Family Fringillidae - Other Finches	
	**Carduelis carduelis*	European Goldfinch
	Family Dicaeidae - Flowerpeckers	
	Dicaeum hirundinaceum	Mistletoebird
	Family Hirundinidae - Swallows and Martins	
	Cecropis ariel	Fairy Martin
	Cecropis nigricans	Tree Martin
#	*Hirundo neoxena*	Welcome Swallow
	Family Sylvidae - Old World Warblers	
	Cisticola exilis	Golden-headed Cisticola
	Megalurus gramineus	Little Grassbird
	Megalurus timoriensis	Tawny Grassbird
	Family Zosteropidae - White-eyes	
	Zosterops lateralis	Silvereye

	SCIENTIFIC NAME	COMMON NAME
	Family Muscicapidae - Thrushes	
	Zoothera lunulata	Bassian Thrush
	Zoothera heinei	Russet-tailed Thrush
	Family Sturnidae - Starlings and Mynas	
#	**Acridotheres tristis*	Common Myna
	**Sturnus vulgaris*	Common Starling
	AMPHIBIANS	
	Family Myobatrachidae - 'Southern Frogs'	
#@	***Crinia tinnula***	**Wallum Froglet**
#	*Crinia signifera*	Common Eastern Froglet
	Limnodynastes dumerilii	Eastern Banjo Frog
	Limnodynastes ornatus	Ornate Burrowing Frog
#	*Limnodynastes peronii*	Striped Marsh Frog
	Limnodynastes tasmaniensis	Spotted Grass Frog
	Mixophyes fasciolatus	Great Barred Frog
#	*Paracrinia haswelli*	Haswell's Froglet
	Pseudophryne bibronii	Brown Toadlet
	Pseudophryne coriacea	Red-backed Toadlet
	Uperoleia fusca	
	Uperoleia laevigata	Smooth Toadlet
	Family Hylidae - Tree Frogs	
	Litoria aurea	**Green and Golden Bell Frog**
	Litoria caerulea	Green Tree Frog
	Litoria chloris	Red-eyed Green Tree Frog
	Litoria dentata	Bleating Tree Frog
	Litoria fallax	Dwarf Tree Frog
	Litoria freycineti	Freycinet's Frog
	Litoria gracilenta	Dainty Tree Frog
#	*Litoria jervisensis*	Jervis Bay Tree Frog
	Litoria latopalmata	Broad-palmed Frog
	Litoria lesueuri	Lesueur's Frog
	Litoria nasuta	Rocket Frog
#	*Litoria peronii*	Peron's Tree Frog
	Litoria phyllochroa	Green Leaf Tree Frog
@	*Litoria tyleri*	Tyler's Tree Frog
	Litoria verreauxii	Verreaux's Tree Frog
	REPTILES	
	Family Chelidae - Tortoises	
	Chelodina longicollis	Eastern Snake-necked Tortoise
	Family Gekkonidae - Geckoes	
	Diplodactylus vittatus	Wood Gecko
	Oedura lesueurii	Lesueur's Velvet Gecko
	Underwoodisaurus milii	Thick-tailed Gecko
	Family Pygopodidae - Legless Lizards	
	Lialis burtonis	Burton's Snake-lizard
	Pygopus lepidopus	Common Scaly-foot
	Family Agamidae - Dragons	
	Amphibolurus muricatus	Jacky Lizard
	Physignathus lesuerii	Eastern Water Dragon

	SCIENTIFIC NAME	COMMON NAME
	Pogona barbata	Eastern Bearded Dragon
	Family Varanidae - Monitors	
	Varanus gouldii	Gould's Monitor
	Varanus varius	Lace Monitor
	Family Scinidae - Skinks	
	Carlia tetradactyla	Rainbow Skink
	Carlia vivax	Tussock Rainbow Skink
	Cryptoblepharus virgatus	Wall Lizard
#	*Ctenotus robustus*	Striped Skink
#	*Ctenotus taeniolatus*	Copper-tailed Skink
#	*Egernia major*	Land Mullet
	Egernia modesta	
	Egernia saxatilis	Black Rock Skink
	Eulamprus heatwolei	Southern Water Skink
	Eulamprus quoyii	Eastern Water Skink
	Eulamprus tenuis	
	Hemisphaeriodon gerrardii	Pink-tongued Lizard
#	*Lampropholis delicata*	Grass Skink
	Lampropholis guichenoti	Garden Skink
	Lygisaurus foliorum	
	Pseudomoia platynota	Red-throated Skink
	Saiphos equalis	Three-toed Skink
	Saproscincus mustelinus	Weasel Skink
	Tiliqua scincoides	Eastern Blue-tongued Lizard
	Family Typhlopidae - Blind Snakes	
	Ramphotyphlops nigrescens	
	Ramphotyphlops proximus	
	Ramphotyphlops wiedii	
	Family Boidae - Pythons	
	Morelia spilota	Carpet (Diamond) Python
	Family Colubridae	
	Boiga irregularis	Brown Tree Snake
	Dendralaphis punctulata	Green Tree Snake
	Family Elapidae - Venomous Snakes	
	Acanthopis antarcticus	Death Adder
	Cacophis krefftii	Dwarf Crowned Snake
	Cacophis squamulosus	Golden Crowned Snake
	Demansia psammophis	Yellow-faced Whip Snake
	Furina diadema	Red-naped Snake
	Hemiaspis signata	Black-bellied Swamp Snake
	Notechis scutatus	Eastern Tiger Snake
	Pseudechis guttatus	Spotted Black Snake
	Pseudechis porphyriacus	Red-bellied Black Snake
	Pseudonaja textilis	Eastern Brown Snake
	Rhinoplocephalus nigrescens	Eastern Small-eyed Snake
	Vermicella annulata	Bandy Bandy
	MAMMALS	
	Family Tachyglossidae - Echidna	
	Tachyglossus aculeatus	Echidna

	SCIENTIFIC NAME	COMMON NAME
	Family Dasyuridae - Dasyurids	
#	*Antechinus stuartii*	Brown Antechinus
	Planigale maculata	Common Planigale
	Phascogale tapoatafa	**Brush-tailed Phascogale**
	Sminthopsis murina	Common Dunnart
	Family Peramelidae - Bandicoots	
	Isoodon macrourus	Northern Brown Bandicoot
	Perameles nasuta	Long-nosed Bandicoot
	Family Phascolarctidae - Koala	
#	***Phascolarctos cinereus***	**Koala**
	Family Petauridae - Gliders	
	Petaurus australis	**Yellow-bellied Glider**
	Petaurus breviceps	Sugar Glider
	Petaurus norfolcensis	**Squirrel Glider**
	Family Pseudocheiridae - Ringtail Possums and Greater Glider	
	Petauroides volans	Greater Glider
	Pseudocheirus peregrinus	Common Ringtail Possum
	Family Acrobatidae - Feathertail Glider	
	Acrobates pygamaeus	Feathertail Glider
	Family Phalangeridae - Brushtail Possums	
	Trichosurus vulpecula	Common Brushtail Possum
	Family Burramyidae	
	Cercartetus nanus	**Eastern Pygmy Possum**
	Family Macropodidae - Kangaroos, Wallabies	
	Macropus giganteus	Eastern Grey Kangaroo
	Macropus rufogriseus	Red-necked Wallaby
	Thylogale thetis	Red-necked Pademelon
	Wallabia bicolor	Swamp Wallaby
	Family Pteropodidae - Fruit Bats	
	Pteropus poliocephalus	**Grey-headed Flying-fox**
	Pteropus scapulatus	Little Red Flying-fox
	Family Rhinolophidae - Horseshoe-bats	
	Rhinolophus megaphyllus	Eastern Horseshoe-bat
	Family Emballonuridae - Sheathtail-bats	
	Saccolaimus flaviventris	**Yellow-bellied Sheathtail-bat**
	Family Molossidae - Freetail-bats	
	Mormopterus norfolkensis	**Eastern Freetail-bat**
	Mormopterus sp.	Freetail-bat sp.
	Nyctinomus australis	White-striped Freetail-bat
	Family Vespertilionidae - Plain-nosed Bats	
	Chalinolobus dwyeri	Large-eared Pied Bat
#	*Chalinolobus gouldi*	Gould's Wattled bat
#?	*Chalinolobus morio*	Chocolate Wattled Bat
	Falsistrellus tasmaniensis	**Eastern Falsistrelle**
	Miniopterus australis	**Little Bentwing-bat**

	SCIENTIFIC NAME	COMMON NAME
	Miniopterus schreibersii oceanensis	**Large Bentwing-bat**
	Myotis adversus	**Large-footed Myotis**
	Nycticeius greyii	Little Broad-nosed Bat
	Nyctophilus geoffroyi	Lesser Long-eared Bat
	Nyctophilus gouldii	Gould's Long-eared Bat
	Scoteanax rueppellii	**Greater Broad-nosed Bat**
	Scotorepens orion	Eastern Broad-nosed Bat
	Vespadelus darlingtoni	Large Forest Bat
	Vespadelus pumilus	Eastern Forest Bat
	Vespadelus regulus	Southern Forest Bat
	Vespaledus vulturnus	Little Cave Bat
	Family Muridae - Rodents	
	Hydromys chrysogaster	Water Rat
	Melomys burtoni	Grassland Melomys
#	**Mus musculus*	House Mouse
	Rattus fuscipes	Southern Bush Rat
#	*Rattus lutreolus*	Swamp Rat
	**Rattus norvegicus*	Brown Rat
	**Rattus rattus*	Black Rat
	Pseudomys novaehollandiae	New Holland Mouse
	Family Canidae	
@	**Vulpes vulpes*	Red Fox
#	**Canis familiaris*	Dog
	Canis familiaris dingo	Dingo
	Family Felidae	
#	**Felis catus*	Cat
	Family Leporidae	
	**Lepus capensis*	European Hare
	** Oryctolagus cuniculus*	European Rabbit

APPENDIX E:

ECOLOGICAL OFFSETS

1.0 INTRODUCTION

The ecological impact of the proposed subdivision, clearing and development of an area of Swamp Sclerophyll Forest Endangered Ecological Community (EEC) on Lot 284 has been seen to have the potential to be ameliorated by the provision of ecological offsets on other land controlled by Port Stephens Council. This Appendix is intended to investigate this offset possibility and to apply a rigorous process that will indicate the validity of the offset proposal.

As described in the main body of the report, Lot 284 supports approximately 3 ha of Swamp Sclerophyll Forest. It is intended to offset the loss of this EEC by the dedication of mature, functioning and good condition EEC on a nearby parcel of land (Lot 21 DP1044009) on the southern side of Salamander Way.

1.1 BACKGROUND TO BIODIVERSITY OFFSETS

The philosophical basis of a 'biodiversity offset' lies in the amelioration of the ecological impact of an activity by the preservation and perpetual management of an area of land that provides an equivalent (or better) ecological asset. The land offered as an offset is not land already preserved through being National Park of Ecological Reserve.

In a land development context, this has been espoused in the biobanking approach being established by the Department of Environment and Climate Change (DECC). Biobanking is intended to provide a means to purchase offset 'credits' on areas of land not owned by the developer requiring the offset.

In this case Port Stephens Council has available land, held by it in fee simple on Lot 21, which supports an extensive area of vegetation mapped as the same EEC as that proposed to be cleared (National Parks and Wildlife Service, date).

1.2 PRINCIPLES OF IMPACT AMELIORATION BY PROVISION OF OFFSETS

There are 13 principles promoted by DECC as being applicable to the consideration of the amelioration of ecological impact by the provision of offsets. These principles have been applied to this proposal below in Section XX.

2.0 EVALUATION OF THE IMPACTED SITE

2.1 DESCRIPTION OF LOT 284

A detailed description of the land subject to impact (Lot 284) and its ecological attributes has been given in the main body of the report. That description leads to a classification of the areas of the EEC present according to their condition.

2.2 CONDITION OF THE VEGETATION

Perceptions of the condition of bushland may be subjective and an assessment of condition in this context must be based upon reproducible criteria. The hydrological and edaphic conditions present in wallum country often impose limitations on the growth of *Eucalyptus robusta* and *Melaleuca quinquenervia,* with indications, such as stunting and die-back, that the trees are subject to high levels of stress. This poor condition of the most obvious plants in the Swamp Sclerophyll Forest does not reflect the ecological condition of the EEC. The distribution and condition of these trees represent the dynamic hydrology of the locality. They may flourish during drought years only to succumb to the permanent waterlogging of wetter years. Similarly their distribution may expand and contract reflecting a cycle of natural physical and ecological changes such as bushfire.

Other factors may have a level of impact on the biodiversity and should be considered in any evaluation of the condition the EEC, such as the quality of the water entering the wallum swamp as run off from developed areas and the incursion of weed species.

It is therefore proposed that an evaluation of the condition of the EEC on Lot 284 be based on the size and shape of the remnant, connectivity, degree of recent anthropogenic disturbance, input water quality and weed incursion.

The vegetation and habitat assessments in Sections 4.1 and 4.2.1 of the main report indicate that the swamp sclerophyll Forest present could be readily divided into three classifications:
<u>Swamp Forest – Subject to frequent and prolonged inundation.</u>

- Triangular, approximately 1.1ha in area, located to the north of the library carpark.
- Connected to similar habitat along the western and southern sides.
- Frequent inundation by runoff from Salamander Centre parking area.
- Runoff water probably contaminated by hydrocarbons etc.

- Minor weed incursion.
- Low, dense stand of *Melaleuca quinquenervia* (Broad-leaved Paperbark)
- Flora restricted to hydrophytic species, diversity moderate.
- Probably cleared in 1980's.
- Habitat for a wide range of swamp-dwelling fauna including Wallum Froglet.

Biodiversity classification of 'Good' applied to this area.

Swamp Forest – Subject to less frequent inundation

- Trapezoid, approximately 1.9ha to the west and south-west of the library.
- Connected to similar habitat along the western and northern sides.
- Dominated by a low relatively dense stand of *M. quinquenervia.*
- Moderately open, diverse understorey.
- No noticeable weed presence.
- Cleared in 1980's.
- Habitat for Wallum Froglet and narrow range of fauna

Although the vegetation did not appear to be as lush or dense as the Swamp Forest undergoing more frequent inundation, this area was floristically more diverse and has been given the same biodiversity condition classification of "good'.

Swamp Forest – Open Forest

- Small areas of Open Swamp Forest occurring on higher ground beside car park.
- Connected to similar habitat to west.
- Dominated by taller specimens of *M. quinquenervia* than other areas of swamp Forest.
- Minor weed incursion.
- Diverse understorey.
- Probably cleared in 1980's.
- Habitat for a wide range of swamp-dwelling fauna including Wallum Froglet.
- Presence of *E. robusta* indicates preferred Koala habitat.

Being of diverse structure and composition, this small area has been classified as being of 'Very Good' condition.

3.0 EVALUATION OF THE OFFSET SITE

3.1 DESCRIPTION OF LOT 21

Lot 21 consists of approximately 93 ha of land lying south of residential development along salamander Way. It contains remnants of aeolian Pleistocene dunes interspersed with acidic swamps. Some of the remnant dunes were mined for mineral sands prior to the 1970's but this activity generally did not have a great effect on the wetlands. Some areas of this land presently show some anthropogenic impact through the dumping of refuse and extending gardens into the bushland but these are mostly limited to land immediately adjacent to residential development.

3.2 CONDITION OF THE VEGETATION

The REMS vegetation mapping shows considerable areas of this Lot as a community that may be interpreted as Swamp Sclerophyll Forest however, this mapping was seen to be inaccurate and the site has been remapped by interpretation of current air photos and ground truthing. The type and distribution of the Endangered Ecological Communities comprising these wetlands are given in FigureE1.

While the vegetation communities present show the effects of continuing inundation noted in Section A2.2 above, these wetlands are considered to be in pristine condition. Photos of the wetland communities on the site are given in Figures E2 – E5.

It is estimated that this site supports approximately 40 ha of Swamp Sclerophyll Forest and 8 ha of associated Fresh Water Wetland.

This land is rectangular in shape being approximately 1,700 m long by an average of 550 m wide. It adjoins similar land, making the habitats on the site contiguous with similar habitat over more than 2,000 m of the southern and eastern boundaries.

4.0 APPLICATION OF THE PRINCIPLES OF OFF BIODIVERSITY OFFSETS

The potential to ameliorate the impact of the proposed development on lot 284 has been investigated by the application of the principles of offsets described in Section A1.2 above. Each of these principles is given below in italics followed by a statement indicating how this proposal is seen to address this principle.

Figure E1 – Distribution of Endangered ecological communities on lot 21 DP1044009

Figure E2 – Freshwater Wetland

Figure E3 – Swamp Sclerophyll Forest

Figure E4 – Regenerating Swamp Sclerophyll Forest

Figure E5 – Possibly planted Swamp Sclerophyll Forest

1. Impacts must be avoided first by using prevention and mitigation measures. Offsets are then used to address remaining impacts.

Lot 284 has been zoned for commercial purposes for over 25 years. It represents the only land providing for viable commercial development in the locality. Consideration was given to the possibility of developing part of Lot 284, leaving the Swamp Forest. This would mean that the existing unsatisfactory disposal of storm water from the parking area into the Swamp Forest, and subsequently into Mambo Wetland would continue. The loss of the small area of Swamp Forest on Lot 284 is seen a small sacrifice which would provide an opportunity to correct the storm water disposal regime at the time of the development of the land according to its zoned purpose.

2. All regulatory requirements must be met.

All regulatory requirements with regard to the EPA Act, TSC Act and the NV Act have been met.

3. Offsets must never reward ongoing poor performance

This proposal is not seen to represent poor performance in planning, ecology or engineering. It is rather seen to be addressing past mistakes.

4. Offsets will complement other government programs.

The perpetual preservation of the wetlands on Lot 21 is seen to complement programs designed to protect threatened and migratory species covered by State and Federal legislation.

5. Offsets must be underpinned by sound ecological principles.

This proposal is based upon the retention of areas of habitat that are of crucial importance to native species generally and threatened species in particular by the preservation of a broad area of wetland habitat with substantial connectivity to adjoining similar habitat

6. Offsets should aim to result in a net improvement in biodiversity over time.

It is believed that this proposal will enforce the management of an ecological asset producing a net improvement in biodiversity.

7. Offsets must be enduring , they must offset the impact of the development for the period that the impact occurs.

This offset arrangement is intended to be perpetual.

8. Offsets should be agreed prior to the impact occurring.

This is the case

9. Offsets must be quantifiable; the impacts and benefits must be reliably estimated.

This has been done

10. Offsets must be targeted. They must offset impacts on the basis of like-for-like or better conservation outcome.

The offsets proposed represent the preservation of the same vegetation community and habitat as that to be impacted. The quality of the habitat offered as offset is slightly better than that to be impacted and it is recommended that the area offered be 4 times that to be impacted i.e. 8 ha as an offset for 2 ha to be impacted.

11. Offsets must be located appropriately.

Lot 21 is close by Lot 284 and both constitute a part of the one contiguous area of habitat divided only by a road (salamander Way)

12. Offsets must be supplementary.

This offset represents the preservation of an area of land constrained by supporting an EEC but not otherwise excluded from development.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

The offsets offered will be enforceable.

4.1 AREA TO BE PRESERVED AS AN OFFSET

The 'Biometric' program used as a tool to determine the biodiversity in property vegetation plans (Gibbons *et al*, 2005) provides a means of determining the amount of land required as an offset for development. The Biometric tool appears to be designed for broad scale

clearing, is complex and requires substantial data input that is unwieldy in application to small areas. In conjunction with others the authors of the Biometric tool have published a simpler method (Gibbons *et al*, 2009) more appropriate to small sites, particularly where a 'like for like' offset is available. Their determination of the area to be provided as offset as a multiplier of the area to be cleared is given graphically in Figure E1 below.

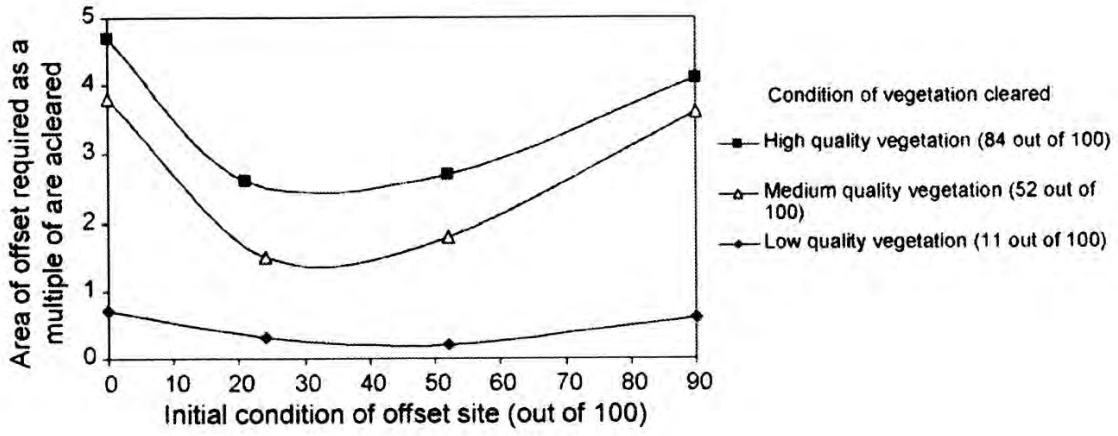


Figure E1 – The area of offset required as a multiple of the area cleared (Gibbons *et al*, 2009)

As may be seen from this figure, for a site with a very high vegetation condition (*x* axis), an offset of similarly high quality requires a multiplier of 4 times the area to be cleared (*y* axis). As a consequence it is proposed that the 3 ha of Swamp Sclerophyll Forest on proposed lots 2, 3 and 4 be offset by the preservation of 12 ha of the same community on Lot 21. It is not proposed that any offset is required for the remaining 9 ha of disturbed vegetation on Lot 284.

5.0 SUMMARY OF ASSESSMENT

The basic aim of providing an offset is to provide a result that is seen to be a 'same or better' ecological outcome. In this case the offset has been determined to be of similar geomorphology, hydrology, and soil. The offset entails the preservation of very similar land and habitat, in equivalent or better condition, with similar connectivity for significant flora and fauna to the impacted land, and the offset area being 4 times the area of the impacted land. The two sites are in close proximity to each other and are likely to support similar

populations of native flora and fauna.

It has been demonstrated that the principles of biodiversity offsets have been addressed. In particular, it is seen that Principle 10, the requirement for a 'like-for-like' or better conservation outcome has been satisfied.

Lot 21 supports much more of the habitat subject to this offset than is required in this instance. The excess of Swamp Sclerophyll Forest beyond that required for this offset and the Fresh Water Wetland should be regarded as an ecological banking available for other offsets.

6.0 CONCLUSION

It is believed that this proposal represents reasonable, appropriate and effective conservation planning. It demonstrates that the proposed compensatory offset meets the "improve or maintain" outcome for biodiversity values.

To give effect to this offset proposal, it will be necessary to prepare a legal means of ensuring the preservation of the offset land agreement in the form of a Voluntary Planning Agreement (VPA) or Deed of Agreement may be between the Council and DECC to give effect to the offset. This agreement would relate to issues concerning the form of preservation of the offset land and the mechanism for utilising the remaining EEC credits.

APPENDIX F

SEPP 71 POLICY AIMS

The aims of SEPP 71 as stated in clause 2 of the policy are:

(a) *to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast, and*

(b) *to protect and improve existing public access to and along coastal foreshores to the extent that this is compatible with the natural attributes of the coastal foreshore, and*

(c) *to ensure that new opportunities for public access to and along coastal foreshores are identified and realised to the extent that this is compatible with the natural attributes of the coastal foreshore, and*

(d) *to protect and preserve Aboriginal cultural heritage, and Aboriginal places, values, customs, beliefs and traditional knowledge, and*

(e) *to ensure that the visual amenity of the coast is protected, and*

(f) *to protect and preserve beach environments and beach amenity, and*

(g) *to protect and preserve native coastal vegetation, and*

(h) *to protect and preserve the marine environment of New South Wales, and*

(i) *to protect and preserve rock platforms, and*

(j) *to manage the coastal zone in accordance with the principles of ecologically sustainable development (within the meaning of section 6 (2) of the Protection of the Environment Administration Act 1991), and*

(k) *to ensure that the type, bulk scale and size of development is appropriate for the location and protects and improves the natural scenic quality of the surrounding area, and*

(1) *to encourage a strategic approach to coastal management.*

APPENDIX G:

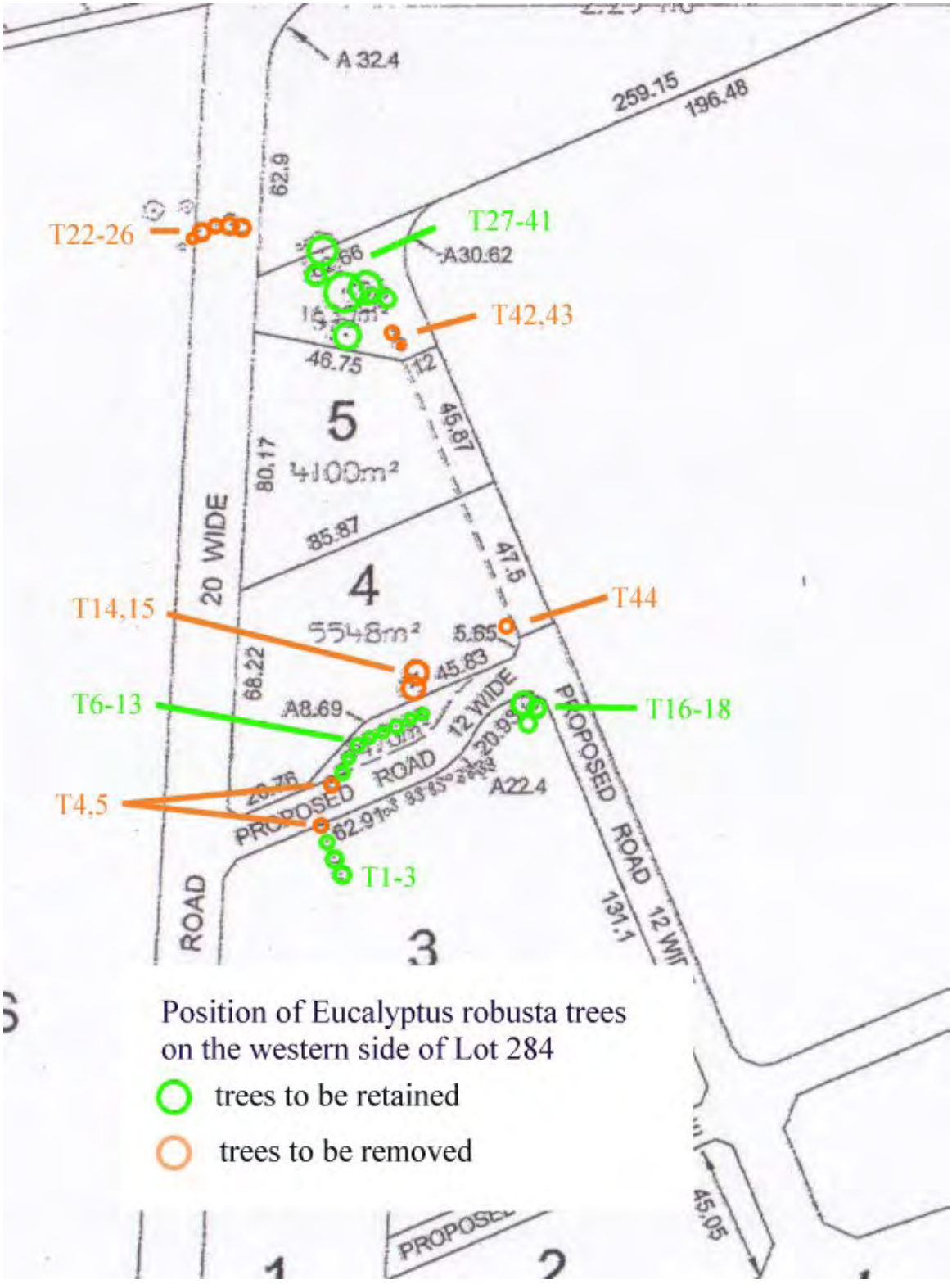
MAPPING OF *E. robusta* TREES

SALAMANDER BAY

TREES

TREE No	HEIGHT (M)	DBH (MM)	SPREAD (M)	POSITION
1	4.5	200	2	LIBRARY CAR PARK
2	6.5	300	3	
3	3.5	100	1.5	
4	6	200	2	
5	5.5	150	2.5	
6	5.5	200	3	
7	4	150	1.5	
8	5.5	250	3	
9	5.5	250	2.5	
10	5	250	3	
11	5	150	2.5	
12	4	150	2	
13	3.5	150	2.5	
14A	9	250	3.5	SWAMP NEAR CAR PARK
14B		200		
15A	8.5	250	5	
15B		200		
15C		150		
15D		100		
16	6	200	3.5	BESIDE ROAD
17	6	250	3	
18	5.5	300	2	
19	3	50	1.5	SWAMP AT NORTH-WESTERN END OF SITE(starting at extreme north-western corner)
20	5	200	2	
21	4.5	150	1.5	
22	4.5	50	1	
23	5	150	1.5	
24A	3.5	50	1.5	
24B	3.5	50		
25	4	150	1.5	
26A	4	200	2	
26B	3.5	150		

27A	3.5	50	1	
27B	3.5	50		
28	3.5	150	1.5	
29	3	50	1	
30	6	300	2.5	
31	6	400		
32A	6.5	450	3.5	
32B	6.5	300		
33	5.5	200	2.5	
34	5.5	150	2	
35	5.5	150	2	
36A	6.5	400	3	
36B	6.5	300		
37A	5	50	1.5	
37B	5	100		
38A	6	250	3	
38B	6	250		
39	6	200	1.5	
40	6	400	3	
41	5.5	200	2.5	
42	5	150	2	
43	4	50	1	
44	3	100	2	SOUTH OF DRAIN


A 32.4
259.15
196.48
62.9
T22-26
T27-41
A30.62
T42.43
46.75
5
4100m²
80.17
45.87
85.87
20 WIDE
4
5548m²
47.5
T14.15
T44
5.65
45.63
68.22
T6-13
A8.69
12 WIDE
T16-18
PROPOSED ROAD
20.99
A22.4
T4.5
PROPOSED
62.91
T1-3
ROAD
131.1
3
Position of Eucalyptus robusta trees
on the western side of Lot 284
trees to be retained
trees to be removed
45.05
PROPOSED
1
2

APPENDIX A
CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT

CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT - SIGNIFICANT EFFECT ON THREATENED SPECIES, POPULATIONS OR ECOLOGICAL COMMUNITIES, OR THEIR HABITATS.

Consideration of this development under the guidelines of Section 5A of the Environmental Planning & Assessment Act (1979) as amended by the Environmental Planning and Assessment Amendment Act (1997) has been made. The heads of consideration of this Section are given in italics followed by the answers applicable to this site. Each species found on site is dealt with separately. Species considered having habitat on site have been considered in similar group types.

Endangered Ecological Communities recorded on site:

1. Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Threatened Species recorded on site:

2.	*Phascolarctos cinereus*	Koala
3.	*Crinia tinnula*	Wallum Froglet

Threatened Species recorded within the adjoining Mambo Wetland

4.	*Eucalyptus parramattensis* ssp. *decadens*	Drooping Red Gum
5.	*Petaurus norfolcensis*	Squirrel Glider
6.	*Phascogale tapoatafa*	Brush-tail Phascogale
7.	*Pteropus poliocephalus*	Grey-headed Flying-fox

Threatened species considered to have habitat within the site:

8. Orchids

Cryptostylis hunteriana	Leafless Tongue Orchid
Diuris arenaria	Tomaree Doubletail
Diuris praecox	Rough Doubletail

9. Shrub Species

Callistemon linearifolius	Netted Bottlebrush

10. Frogs

Litoria aurea	Green and Golden Bell Frog

11. Water Birds

Botaurus poiciloptilus	Australasian Bittern
Rostratula benghalensis	Painted Snipe

12. Cockatoos and Parrots

Callocephalon fimbriatum	Gang-gang Cockatoo
Calyptorhynchus lathami	Glossy Black-Cockatoo
Lathamus discolor	Swift Parrot

13. Owls

Ninox connivens	Barking Owl
Ninox strenua	Powerful Owl
Tyto capensis	Grass Owl
Tyto novaehollandiae	Masked Owl

14. <u>Woodland Birds</u>

Burhinus grallarius	Bush stone-curlew
Xanthomyza phrygia	Regent Honeyeater

15. <u>Small Arboreal Marsupials</u>

Cercartetus nanus	Eastern Pygmy-possum

16. Terrestrial Mammals

Dasyurus maculatus ssp. *maculatus*	Tiger Quoll
Potorous tridactylus ssp. *tridactylus*	Long-nosed Potoroo
Pseudomys gracilicaudatus	Eastern Chestnut Mouse

17. <u>Microchiropteran Bats</u>

Chalinolobus dwyeri	Large-eared Pied Bat
Falsistrellus tasmaniensis	Eastern False Pipistrelle
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat
Miniopterus australis	Little Bentwing-bat
Miniopterus schreibersii oceanensis	Large Bentwing-bat
Mormopterus norfolkensis	Eastern Freetail Bat
Myotis adversus	Large-footed Myotis
Scoteanax rueppellii	Greater Broad-nosed Bat
Vespadelus troughtoni	Eastern Cave Bat

18. <u>Invertebrates</u>

Petalura gigantea	Giant Dragonfly

Endangered Populations considered to have potential habitat within the site:

19. *Dromaius novaehollandiae* Emu

1. Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Swamp Sclerophyll Forest occurs along coastal floodplains on waterlogged or periodically inundated alluvial flats and drainage lines with humic clay loams and sandy loams. The community typically occurs below 20m, however can be found up to 50m in elevation.

This community has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The trees may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality where the tree stratum is low and dense. Dominant trees include *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark) and, south from Sydney, *Eucalyptus botryoides* (bangalay) and *Eucalyptus longifolia* (woollybut). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including *Callistemon salignus* (sweet willow bottlebrush) and *Casuarina glauca* (swamp oak). The composition of the community is primarily determined by the frequency and duration of waterlogging and the texture, salinity, nutrient and moisture content of the soil, and latitude. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbances, and may have a substantial component of exotic grasses, vines and forbs.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Not applicable.

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

Not applicable.

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

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

Swamp Forest located within the western portion of the site was found to contain floristic components consistent with the Endangered Ecological Community - Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions. This 3 ha area of Swamp Sclerophyll Forest was divided up into three Swamp Forest variants; Swamp Forest subject to prolonged periods of inundation; Swamp Forest subject to less frequent inundation and Swamp Forest – Open Forest. All these variations were considered to constitute this Endangered

Ecological Community. According to past aerial photography (NSW, Lands *Monochrome Air Photo,* 1975) areas of swamp sclerophyll forest on site have been previously cleared or highly disturbed. These areas have regenerated to a state that some areas appear to have little disturbance. The past disturbance may explain the low height but dense nature of the *Melaleuca quinquenervia* (Broad-leaved Paperbark) in the west of the site.

A number of individual specimens of *E. robusta* and *M. quinquenervia* were present within the Coastal Sand Woodland Heath in the eastern portion of the site. These areas did contain similarities to the Endangered Ecological Community - Swamp Sclerophyll Forest, however due to the past disturbance, the composition of the understorey layers and little chance of inundation in this area, these areas in the east were not considered to constitute this Endangered Ecological Community.

The proposal will lead to the eventual removal of virtually all of the Swamp Forest (Approximately 4.2 ha) within the site. This will result in a small reduction of the extensive tracts of Swamp Forest in the local area (approximately 0.03%). It is considered that the action is unlikely to have a significant impact on the occurrence of Swamp Sclerophyll in the local area. The recommendation of compensatory offsets and water quality control are seen to enhance the insignificance of the impact.

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

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

The proposal will lead to the eventual removal of virtually all of the swamp forest (Approximately 4.2 ha) within the site. This will result in a small reduction in the area of Swamp Forest locally..

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of habitat beside Mambo Wetland in the west occur in close proximity to the site.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for Swamp Sclerophyll Forest in the local area. Taking the recommendations of weed, erosion and sediment control as part of any works within the site to protect areas of Swamp Forest within the adjoining Mambo Swamp Reserve together with the proposal for compensatory offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for this Endangered Ecological

Community, however the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of this community and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help Swamp Sclerophyll Forest recover in NSW. These actions include:

- Weed Control – particularly weed species such as Bitou Bush and Boneseed.
- Prevent erosion.
- Restrict Access to community.

The proposal involving the removal of Swamp Sclerophyll Forest and would not comply with the priority action statements. However, taking into consideration the plan for compensatory offset habitat and actions to prevent any disturbance to areas of Swamp Sclerophyll Forest contained within Mambo Wetland, it is considered that the proposed action will not significantly compromise these strategies.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site, have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The proposed subdivision and subsequent development will result in the removal of Swamp Sclerophyll Forest from the site resulting in an incremental decline in the local area.
- **Invasion of native plant communities by exotic perennial grasses:** This threatening process is already present with a large number of introduced grasses such as *Andropogon virginicus* Whisky Grass, *Anthoxanthum odoratum* (Sweet Vernal Grass), *Chloris gayana* (Rhodes Grass) and *Eragrostis curvula* (African Lovegrass). There is the potential for further infestation in the future particularly within the adjoining Mambo Wetland to the west. Given the recommendation for regular weed control the impact from this threatening process would be reduced.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site.
- ***Lantana camara* -** Infestations of Lantana were found to be present primarily around the periphery of the Swamp Forest community. There is the potential for further infestation of Lantana within the site. It is recommended that the infestation of Lantana be managed within this community.
- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** The European Rabbit was not recorded within the site during the survey however would be considered to be present in the local area. The proposal is unlikely to significant increase Rabbit numbers.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush & Boneseed).** Bitou Bush was found to be present within the site. There is the potential for further infestation in the future, however given the recommendation for weed control the impact from this threatening process would be reduced.

Bibliography:

NSW Scientific Committee (2004). *Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions – endangered ecological community determination – final. DEC (NSW*), Sydney.

Threatened Species recorded on site

2. *Phascolarctos cinereus* Koala

The Koala occurs along the east coast of Australia and extends into woodland, mulga and River Red Gum forests west of the Great Dividing Range. Its range covers all such suitable areas of N.S.W. In drier forested areas, Koalas are generally observed as individuals in low densities. They are more abundant in coastal woodland and in open forest, where they have been found in densities as high as ten per hectare. They are rare or absent in wet forests in the south above 600 m which may be due more to distribution of Eucalypt species than climate, as the Koala is limited to areas where there are acceptable food trees. Its diet is generally restricted to that of Eucalypt leaves and much less-often, non-Eucalypt foliage. The foliage of *Eucalyptus camaldulensis* (River Red Gum), *E. tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum), *E. viminalis* (Manna Gum), and *E. robusta* (Swamp Mahogany) are some of the preferred Eucalypt species. Koalas use a wide variety of tree sizes, and do not preferentially use large or tall trees in NSW forests, although this has been listed as a habitat preference in areas where trees are generally small, stunted, or nutrient deprived.

Koalas sleep in the fork of a tree during the day and feed at night with the peak of activity just after sunset. It is generally a solitary animal with a social behaviour pattern that influences its breeding biology. Breeding biology of the Koala is characterised by the occurrence of discrete core breeding groups which are sedentary. A core group may comprise up to several dozen individuals that are usually well separated from other breeding groups. These core groups produce a continual supply of dispersing nomadic sub-adults. Individual Koalas within core breeding groups occupy semi-exclusive territories. There is interaction with and marginal overlap of territories between adjacent individual animals. The territories of breeding males generally occur within a matrix of adjacent territories of breeding females. In the overlap zones of adjacent territories of breeding Koalas, individual trees occur that are habitually used for interaction between the two animals concerned. These breeding core interaction trees (sometimes termed "home range trees") are readily identifiable by scratched "trails" up the bole and copious dung deposits at the base of the tree. Breeding occurs in summer and young females produce one young (rarely twins) each year.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

An individual Koala was observed during the survey within the west of the site just to the north of the library carpark on the fringe of the wetter area of Swamp Sclerophyll Forest. This Koala was feeding within a *Eucalyptus robusta* (Swamp Mahogany), which is listed as a Preferred Koala Feed Tree Species under the Port Stephens Comprehensive Plan of Management (CKPoM). A number of recent Koala scats were also found to be present under specimens of Swamp Mahogany in the west of the site around the periphery of the wetter area of Swamp Forest and *E tereticornis* (Forest Red Gum) within the library carpark. No evidence of Koalas was found in the eastern portion of the site. According to the DECC database one Koala record was present in the eastern portion of the site in 1990.

Consideration of the significance of the impact of this proposal on the local Koala population has taken into account the evidence that:

- the area of Swamp Forest containing the koala feed trees in the western part of the site has been regenerated since clearing in the 1970's,
- the attributes of the Swamp Forest in this area have been artificially enhanced by the storm

water runoff from the car park,

- Koala habitat in this locality was considerably enhanced by the planting of 13 E. robusta and a larger number of E. tereticornis about 10 years ago. These trees are now of a size where they are being used by Koalas.
- It is accepted that the *Meleleuca quinquenervia* in the Swamp Forest may be grazed by coastal Koalas, but most of these trees were seen to be stunted and therefore less likely to be palatable and there was no evidence of their use by Koalas.

As recommended, the proposed subdivision and subsequent development will result in the preservation of most of the Koala feed trees in the western part of the site, the planting of Koala feed trees in as many situations as would reasonably increase the habitat resource for this species without increasing the level of hazard to the Koalas and the provision of ecological offsets for the habitat to be removed.

Taking these matters into consideration it is not seen that the proposal would be likely to drive the local koala population to extinction.

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

Two Endangered Koala Populations, Hawks Nest/Tea Gardens and the Pittwater Local Government Area are listed under the TSC Act 1995. Neither of these populations is pertinent to the site.

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

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

Not applicable.

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

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

The site supports up to 60 specimens of *E. robusta* and the proposal may result in the removal of some of these trees but it has been recommended that the Koala feed trees on the western part of the site be preserved as much as possible. It is expected that all but two of the trees planted within the library carpark will remain *in-situ*. The *M .quinquenervia* associated with the Koala feed trees in the Swamp Forest will be removed but together they constitute approximately 0.02% of the Preferred Koala habitat on the Tomaree Peninsula.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and the north-south movement corridor in the Mambo Wetland west of the site will be retained.

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

Taking the recommendations of leaving as many specimens of Swamp Mahogany within the site and compensatory plantings as well as the plan for compensatory offset land it is considered that no significant areas of habitat are likely to be removed that is essential to the long-term survival of the Koala in this area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Draft Recovery Plan has been completed for the Koala. It is important to retain as many Koala Feed Trees as possible within the site to aid the safe movement of Koalas to areas containing preferred habitat. It is considered that the proposed action will not significantly compromise this draft recovery plan.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will include Preferred Koala Feed Tree Species for subsequent development is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was not recorded on site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.

Other pertinent threats would be those posed by dogs and vehicle collision.

Bibliography

Australian Koala Foundation (1996). *The Koala Habitat Atlas - Project No 6: Port Stephens Local Government LGA.* Draft Report prepared for Port Stephen Council.

Callaghan, J., Leathley, S. and Lunney, D. (1994). *Port Stephens Koala Management Plan Draft for Public Discussion, 27th September 1994.* Port Stephens Council, NSW.

Martin, R.W. and Handasyde, K.A. (1995). *Koala (Phascolarctos cinereus). In: The Mammals of Australia, pp: 196-8.* Strahan, R. (Ed). Reed Books, Sydney.

NPWS Database (2000). *Fauna Species List for Protected Areas in NSW, at* 'http://www.npws.gov.au/wildlife/species.htm'.

Reed, P.C., Lunney, D. and Walker, P. (1990). *A 1986-1987 Survey of the Koala Phascolarctos cinereus (Goldfuss) in New South Wales and an Ecological Interpretation of its Distribution.* In: Lee, A.K., Handasyde, K.A. and Sanson, G.D. (eds). Biology of the Koala, Surrey Beatty and Sons Pty Ltd.

3. *Crinia tinnua* Wallum Froglet

The Wallum Froglet is an inhabitant of shallow acid swamps (temporary / semi-permanent) and associated connecting channels and deeper water holes (permanent). The vegetation type in these areas consists of hard-leafed heaths, shrubs and woodland on coastal plains and dunes and associated sedgelands and swamps in low lying areas collectively known as wallum, hence the common name. *C. tinnula* is a very small frog, and is a most difficult species to directly observe.

C. tinnula has a distribution range from Maryborough in Queensland south to Kurnell near Sydney. *C. tinnula* is a winter breeder with females laying approximately 120 eggs. Males are vocal between May and September making identification of the species at this time easier. Due to the morphological similarities with *C. signifera*, positive identification of *C. tinnula* is usually by call. The call of the male is described as being a bell like tinkling: "tching.....tching". Morphologically, *C. tinnula* is described as having a white or light brown belly with a little mottling or flecking and a mid line of white dots along the throat.

Due to the species preference for coastal swamps and associated areas along the east coast, *C. tinnula* is exposed to large habitat loss as this area has the highest growth rate in human population in Australia. Large populations have been recorded in the Myall Lakes National Park area and Moffats Swamp Nature Reserve near Medowie.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

A small number of calls consistent with that of the Wallum Froglet were heard calling from within the area of Swamp Forest to the north and west of the library during fieldwork. A number of calls were also heard originating from a small narrow drainage line to the south-west of the library. Outside the site the Wallum Froglet was heard calling from within the Mambo Wetland within a narrow drainage line running along the southern end of the western boundary. Calls were also heard originating from within an area of Lepironia Swamp located adjacent to the far south-western corner of the site.

Although a small number of calls were heard originating from swamp forest to the north of the library carpark this area was thought to be limited by the dense nature of the vegetation and frequent inundation from stormwater runoff from the large surface area of the Salamander Centre.

The proposed subdivision and subsequent development will lead to the removal of the virtually all habitat for the Wallum Froglet from the site resulting in the incremental decline in suitable habitat within the local area. Taking the recommendations of erosion, sediment and weed control as part of any future works within the site to prevent disturbance to habitat within Mambo Wetlands as well as the plan for compensatory offset land it is considered that no significant areas of habitat are likely to be removed that is important to the long-term survival of the Wallum Froglet.

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

Not applicable.

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

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

Not applicable.

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

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

The proposal will result in the removal of virtually all of the habitat from the site for the Wallum Froglet. This will equate to an area of approximately 1.2ha.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result a small decline in the extensive local areas of habitat for the Wallum Froglet. Taking the recommendations of weed, erosion and sediment control as part of any works within the site to protect areas of suitable habitat within the adjoining Mambo Swamp Reserve together with the proposal for compensatory offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Wallum Froglet. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help the Wallum Froglet recover in NSW. These actions include:

- The control of stormwater and drainage.
- Avoid changes in water chemistry;
- Ground Water Extraction;
- Control the invasion of weed species that threatened Wallum Froglet habitat;
- Control Feral Pigs;
- Control of the Plague Minnow;
- Control of Cane Toads;
- Monitoring of habitat;
- Protect swamps from fire;

Actions such as the control of stormwater, changes in water chemistry, fire and groundwater extraction are all pertinent to the site and surrounding habitat particularly within Mambo Wetland. Actions such as weed control and appropriate stormwater design will be required to be implemented to prevent the degradation to adjoining habitat within Mambo Swamp.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is likely to result in an incremental reduction in habitat for these orchid species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these species.
- **Predation by *Gambusia holbrooki* (Plague Minnow):** This species of fish was not observed during the survey however is known to occur nearby within Mambo Wetland (Port Stephen Council, 2006). The proposal is not likely to further exacerbate the predation by this fish on frog eggs and tadpoles.
- **Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis:** It is possible that this fungus has an impact on frogs in the local area. However the proposal is unlikely to have any impact on this threatening process.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site. Past fire within the site was evidenced by blackened parts of paperbark tree trunks in the west of the site. This fire event was most probably from the fire event on 1 January 2003. The proposal is considered to have little impact on fire frequency.
- **Human-caused Climate Change**: Has the potential to have an adverse effect on these frog species. The proposal is unlikely to significantly contribute to Climate Change.

Bibliography:

Barker, J. , Grigg, G.C. & Tyler, M.J. (1995). A Field Guide to Australian Frogs. Surry Beatty & Sons, Norton, NSW.

Cogger, H.G. (1996). Reptiles and Amphibians of Australia. (5th edn) Reed Books, Victoria.

Ehmann, H. (Ed) (1997). Threatened Frogs of New South Wales: Habitats, Status and Conservation. Frog and Tadpole Study Group of NSW.

Griffiths, K. (1997). Frogs and Reptiles of the Sydney Region. University of New South Wales Press, Sydney.

NPWS Database (2000). Fauna Species Lists for Protected Areas in NSW, at http://www.nationalparks.nsw.gov.au

Robinson, M. (1996). A Field Guide to Frogs of Australia. Reed Books Australia, Melbourne.

Tyler, M.J. (1992). Encyclopedia of Australian Animals: Frogs. Angus & Robertson, NSW.

Threatened Species recorded within the adjoining Mambo Wetland

4. *Eucalyptus parramattensis* ssp. *decadens* Drooping Red Gum

Eucalyptus parramattensis ssp. *decadens* is distributed across the lower Hunter Valley (N.S.W) from Salamander Bay to Kurri Kurri. It occurs in woodland on sandy soils in wet sites. Any occurrences are likely to be restricted to areas along riparian vegetation strips or within close proximity to the water table. In the Port Stephens area, the Drooping Red Gum occurs in open wet sclerophyll woodland on heavy, often waterlogged, interbarrier depression soils. It is distinguished from *E. p. parramattensis* by the larger fruit, which are greater than 7mm in diameter. It is commonly associated with *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus robusta* (Swamp Mahogany). This sub-species is ROTAP listed 2V.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Eucalyptus parramattensis ssp. *decadens* was not recorded within the site during the survey. Suitable habitat was found to be present for this species in the far west of the site primarily within the area of Swamp Forest to the west and south-west of the library. Specimens of *E. parramattensis* ssp. *decadens* are known to occur nearby within Mambo Wetland Reserve (DECC database, 2009)(Port Stephens Council, 2006). The proposal will lead to a small incremental loss of suitable habitat for this tree species. However due to the fact that this species was not recorded on site it is considered that the proposal is unlikely to cause extinction of any local population of this flora species.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for *E. parramattensis* ssp. *decadens.* This equates to approximately 2ha of habitat.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

As *E. parramattensis* ssp. *decadens* was not been recorded within the site and taking into consideration the disturbance to the site it is considered that no areas of habitat important to the long-term survival of this eucalypt species will be removed, modified, fragmented or isolated.

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

To date no Critical Habitat, as defined under Part 3 of the TSC Act has not been declared for *E. parramattensis* ssp. *decadens.*

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

No Recovery or Threat Abatement Plan has been developed for these tree species. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is likely to result in an incremental reduction in habitat for this tree species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this tree species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and**

animals and loss of vegetation structure and composition: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site. Past fire within the site was evidenced by blackened parts of paperbark tree trunks in the west of the site. This fire event was most probably from the fire event on 1 January 2003. The proposal is considered to have little impact on fire frequency.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** The European Rabbit was not recorded within the site during the survey however would be considered to be present in the local area. The proposal is unlikely to significant increase Rabbit numbers.
- **Invasion of native plant communities by exotic perennial grasses:** This threatening process is already present with a large number of introduced grasses such as *Andropogon virginicus* Whisky Grass, *Anthoxanthum odoratum* (Sweet Vernal Grass), *Chloris gayana* (Rhodes Grass) and *Eragrostis curvula* (African Lovegrass). There is the potential for further infestation in the future particularly within the adjoining Mambo Wetland to the west. Given the recommendation for regular weed control the impact from this threatening process would be reduced.
- ***Lantana camara* (Lantana):** A small amount of Lantana was found to be present within the site. Given the recommendation to remove this species from the site the impact from this threatening process would be reduced on this tree species.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush & Boneseed).** Bitou Bush was found to be present within the site. There is the potential for further infestation in the future, however given the recommendation for weed control within the site the impact from this threatening process would be reduced.

Bibliography:

Brooker, M.I.H and Kleining, D.A. (1983). Field Guide to the Eucalypts of South-eastern Australia. Inkata Press, Sydney.

Carolin, R.C. and Tindale, M.D. (1993). Flora of the Sydney Region (4th edn.). Reed, Sydney.

George, A. (exec. ed.) (1988). Flora of Australia, Volume 19: Myrtaceae - Eucalyptus and Angophora. Australian Government Publishing Service, Canberra.

Harden, G. (ed) (1991). Flora of NSW - Vol 2. New South Wales Uni Press, Sydney.

NSW Scientific Committee (1998). Final Determination to List *Grevillea parviflora* ssp. *parviflora* as a Vulnerable species, at 'http://www.nationalparks.nsw.gov.au'.

Robinson, L. (1994). Field Guide to the Native Plants of Sydney (2nd edn.). Kangaroo Press Pty. Ltd., New South Wales.

Wrigley, J.W. and Fagg, M. (1989). Banksias, Waratahs and Grevilleas. Angus and Robertson Books, Sydney.

5. *Petaurus norfolcensis* (Squirrel Glider)

The Squirrel Glider is distributed throughout the dry sclerophyll forests and woodlands of eastern Australia from South Australia to Cairns. In NSW, the Squirrel Gliders' range has recently been extended to coastal habitats, including Swamp Mahogany Swamp forests on the Central Coast. The full range of habitats in which it is found in NSW have not been fully reported in any literature. The Squirrel Glider eats a high proportion of invertebrates from the foliage of Eucalypts and *Acacias* supplemented by plant exudates in the form of Eucalypt and *Melaleuca* sap and *Acacia* gum. The plant exudates, honeydew, pollen and nectar were considered to be more important in winter and spring. In coastal NSW forests a significant component may be mature *Acacia irrorata*, *Melaleuca styphelioides* or *M. nodosa*, providing late winter/early spring carbohydrates.

It has been reported that Squirrel Gliders are consistently preyed upon by cats and foxes and it has been believed that an increase in this predation may result from the opening up of bushland through rural-residential or other development.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

The Squirrel Glider was not recorded on site during fieldwork conducted for this report despite targeted surveys involving arboreal trapping and spotlighting. A previous survey (Wildthing Environmental Consultants, 1998) also did not record this species. The Squirrel Glider however has been recorded within the adjoining Mambo Wetland (Port Stephens Council, 2006)(DECC Database, 2009). The site contained suitable foraging habitat in the form of flowering myrtaceous trees and shrubs such as *Banksia serrata.* An important winter food source, *Eucalyptus robusta* (Swamp Mahogany) was also present. No preferred habitat, however was considered to be present within the site due to dominance of low specimens of paperbarks in the west of the site and scarcity of trees in the east. Additionally no nesting hollows were present within the site. Suitable nesting hollows were however found to be present within nearby drier areas of woodland within Mambo Wetland. It is thought that *P. norfolcensis* may utilise the site for seasonal foraging purposes, within western portion of the site particularly when specimens of *E. robusta* are flowering in winter.

The proposal will lead to a small incremental loss of foraging habitat for the Squirrel Glider and would reduce the size of the greater Mambo Wetland Remnant. Considering the presence of larger areas of better quality habitat occurring outside the site and taking into account the recommendations of compensatory offset habitat the proposal is unlikely to significantly affect the life cycle of this glider species or place any viable local populations of these species at risk of extinction.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for the Squirrel Glider from the site. This will equate to approximately 4ha of habitat for the Squirrel Glider.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result in the incremental decline in foraging habitat for the Squirrel Glider however taking into consideration the plan for compensatory offset habitat it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Squirrel Glider. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help the Squirrel Glider recover in NSW. These actions include:

- Ensure the largest hollow-bearing trees (including dead trees) are given highest priority for retention.
- Delineate boundaries of population to identify the extent to which populations are interconnected.

It is considered that the proposed action will not significantly compromise these Priority Action Plans.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to the Squirrel Glider.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography

Fleay, D.(1947). Gliders of the Gum Trees. Melbourne Bread and Cheese Club.

Humphries, R. and Seebeck, J. (1997). *Brush-tailed Phascogale Phascogale tapoatafa. Victorian Department of Natural Resources and Environment Action Statement No. 79* at http://www.dce.vic.goc.au/plntanml/native/actstats/content/as79.htm

NSW Scientific Committee (2001). Final determination to list *Cercartetus nanus* (Eastern Pygmy-Possum) as a Vulnerable Species at http://www.nationalparks.nsw.gov.au

NPWS Database (2000). Fauna Species List for Protected Areas in NSW, at 'http://www.npws.gov.au/wildlife/species.htm'.

Quin, D.G. (1995). Population Ecology of the Squirrel Glider (*Petaurus norfolcensis*) and the Sugar Glider (*P. breviceps*) (Marsupialia : Petauridae) at Limeburners Creek, on the Central North Coast of New South Wales. In: Australian Wildlife Research 22: pp 471-505.

Quin, D.G. (1993). Sociology of the Squirrel Glider and the Sugar Glider. PhD Thesis, Department of Ecosystem Management, University of New Emgland.

Smith, A. (1996). On The Brink - Squirrel Gliders, Pittwater Council and Housing Development. At 'http://www.nccsw.org.au/bushland/reference/onthebrink/Squirrel.html'.
Suckling, G.C. (1995). Squirrel Glider (*Petaurus norfolcensis*). In: The Mammals of Australia, pp: 234-5. Strahan, R. (Ed). Reed Books, Sydney.

SWC Consultancy (1996). Eleebana Local Squirrel Glider Study. Report to Lake Macquarie City Council.

Triggs, B. (1996). Tracks, Scats and Other Traces: a Field Guide to Australian Mammals. Oxford University Press, Australia.
Turner, V. & Ward, S.J. (1995). Eastern Pygmy-possum (*Cercartetus nanus*). In: The Mammals of Australia, pp: 217-218. Strahan, R. (Ed). Reed Books, Australia.

6. *Phascogale tapoatafa* (Brush-tailed Phascogale)

A nocturnal species, the Brush-tailed Phascogale is mainly arboreal but also forages on the ground, eating insects and occasionally small vertebrates. The Brush-tailed Phascogale is known from a variety of forest types from Rainforest to Woodland, but is most frequently recorded in the drier Sclerophyll Forests with little ground cover, on ridges up to 600m altitude. It requires small tree hollows and suitable foraging sites in the canopy, sub-canopy, and ground layer of vegetation. During the day it sleeps in a nest lined with leaves or shredded bark in a tree hollow, emerging at dusk to feed. Home ranges vary from between 20-70ha for females, and there is often no overlap in this home range with other unrelated females of the species. Males may occupy an area of greater than 100ha and contrary to females, overlap with the home ranges of other males and females. Females may only occupy a home range of 4-5ha when carrying young. It is sexually mature at 11 months, with mating in June. The female has 8 teats and young are weaned at around 5 months of age. Males die soon after mating while females may breed over two consecutive years.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Phascogale tapoatafa was not recorded during fieldwork undertaken for this report or previous reports (Wildthing Environmental Consultants, 1998). Foraging habitat was considered to be present within the site for this species however preferred habitat in the form of drier sclerophyll forest was found to be absent. Additionally no suitable nesting hollows were recorded within the site. *Phascogale tapoatafa* has been recorded within the adjoining Mambo Wetland to the west (Port Stephens Council, 2006) where areas of preferred dry woodland habitat and suitable nesting hollows were present. It is thought that *P. tapoatafa* would at best only occasionally utilise the site for foraging purposes.

The proposal will lead to a small incremental loss of foraging habitat for the Brush-tailed Phascogale and would reduce the size of the greater Mambo Wetland Remnant where it is known to occur. Considering the presence of larger areas of better quality habitat occurring outside the site and taking into account the plan for compensatory offset habitat the proposal is unlikely to significantly affect the life cycle of the Brush-tailed Phascogale or place any viable local populations of these species at risk of extinction.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for *P. tapoatafa*. This will equate to approximately 4ha of habitat for this species.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for the Brush-tailed Phascogale however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Brushtailed Phascogale. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help the Brush-tailed Phascogale recover in NSW. These actions include:

- Ensure the largest hollow-bearing trees (including dead trees) are given highest priority for retention.
- Delineate boundaries of population to identify the extent to which populations are interconnected.

It is considered that the proposed action will not significantly compromise these Priority Action Plans.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography

Fleay, D.(1947). Gliders of the Gum Trees. Melbourne Bread and Cheese Club.

Humphries, R. and Seebeck, J. (1997). *Brush-tailed Phascogale Phascogale tapoatafa. Victorian Department of Natural Resources and Environment Action Statement No. 79* at http://www.dce.vic.goc.au/plntanml/native/actstats/content/as79.htm

NSW Scientific Committee (2001). Final determination to list *Cercartetus nanus* (Eastern Pygmy-Possum) as a Vulnerable Species at http://www.nationalparks.nsw.gov.au

NPWS Database (2000). Fauna Species List for Protected Areas in NSW, at 'http://www.npws.gov.au/wildlife/species.htm'.

Quin, D.G. (1995). Population Ecology of the Squirrel Glider (*Petaurus norfolcensis*) and the Sugar Glider (*P. breviceps*) (Marsupialia : Petauridae) at Limeburners Creek, on the Central North Coast of New South Wales. In: Australian Wildlife Research 22: pp 471-505.

Quin, D.G. (1993). Sociology of the Squirrel Glider and the Sugar Glider. PhD Thesis, Department of Ecosystem Management, University of New Emgland.

Smith, A. (1996). On The Brink - Squirrel Gliders, Pittwater Council and Housing Development. At 'http://www.nccsw.org.au/bushland/reference/onthebrink/Squirrel.html'.
Suckling, G.C. (1995). Squirrel Glider (*Petaurus norfolcensis*). In: The Mammals of Australia, pp: 234-5. Strahan, R. (Ed). Reed Books, Sydney.

SWC Consultancy (1996). Eleebana Local Squirrel Glider Study. Report to Lake Macquarie City Council.

Triggs, B. (1996). Tracks, Scats and Other Traces: a Field Guide to Australian Mammals. Oxford University Press, Australia.
Turner, V. & Ward, S.J. (1995). Eastern Pygmy-possum (*Cercartetus nanus*). In: The Mammals of Australia, pp: 217-218. Strahan, R. (Ed). Reed Books, Australia.

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

The Grey-headed Flying-fox is distributed predominantly along the sub-tropical east coast, from Rockhampton (Qld) through NSW to SE Victoria. It is a fairly large species, weighing up to a kilogram and having a forearm length of up to 180mm. It is the only Australian Flying-fox to possess a mantle of rusty brown fur that full encircles the neck. The fur on the back is dark grey and as the common name suggests, the head is covered with light grey fur. The grey belly fur is often flecked with white and ginger. The fur extends down the legs to the toes, which contrasts with other *Pteropus* species, which are furred only to the knees.

Grey-headed Flying-foxes are known to occupy a variety of habitats, including wet and dry sclerophyll forests, rainforest, mangroves and paperbark swamps and *Banksia* woodlands. Here they forage on a range of fruits and blossoms. Their diet is so varied that they have been recorded eating the fruit or blossom of more than 80 species of plant. The predominant food source is Eucalypt blossom and fruits from trees such as *Ficus* spp. (Figs). It is likely to act as an important pollinator for many of the trees on which they utilise blossoms. They also inhabit cultivated areas where they feed on introduced trees including commercial food crops, and can become a 'pest' animal in these areas. Ironically, this has led to this species being the most intensively researched bat in Australia.

As with most species of Flying-fox, *P. poliocephalus* roost communally where they form large communal colonies called 'camps'. Camps are mostly in rainforest patches, mangroves, paperbark forests and modified vegetation in urban areas. These camps may contain thousands of individuals, and up to 200 000 individuals have been recorded at one camp. They may move up to 70km from the camp each night to forage. Young are raised in maternity camps after birthing in September to October. The young are able to fly at 3 months of age and puberty is reached at 18 months, although males do not achieve effective fertility until 30 months. Vocal communication is highly sophisticated, with over 20 different situation-specific calls being recorded.

The key threats to Grey-headed Flying-fox include the clearing or modification of native vegetation, in particular roost-camp habitat as well as winter food resources in NE NSW. This species is also threatened by persecution in the form of shooting of animals and the destruction of roost camps. This oppression may be a result of Grey-headed Flying-foxes being a perceived pest in agricultural areas or as presenting a noise problem in more urbanised areas. Recently, it has been identified as being a potential carrier of viral pathogens, such as Lyssa-virus. Another threat is from competition and hybridisation with *P. alecto* (Black Flying-fox).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

This species of Flying-fox was not recorded during the survey period however it is expected that this species would utilise the site during flowering periods. The Grey-headed Flying-fox has been recorded within the adjoining Mambo Wetlands (Port Stephens Council, 2006). The site contains a range of seasonal foraging species particularly in the form of *Melaleuca quinquenervia* (Broad-leaved Paperbark) and the winter flowering *Eucalyptus robusta* (Swamp Forest). No suitable roosting habitat was considered to be present

The proposal subdivision and subsequent development will lead to the removal of virtually all foraging habitat from the site for the Grey-headed Flying-fox and will result in the incremental

reduction of habitat in the local area. However, considering the presence of large areas of suitable foraging habitat in the local area and plan for compensatory offset habitat it is unlikely that the proposal would threaten the local population with immediate extinction by disrupting its breeding life-cycle of this highly mobile species.

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

Not applicable to threatened species.

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

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

Not applicable to threatened species.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable foraging habitat for the Grey-headed Flying-fox. This will equate to an area of approximately 7ha containing foraging species.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of this Flying-fox species.

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

The proposed subdivision and subsequent development will result in the incremental decline in foraging habitat for this Flying-fox species however taking the proposal for compensatory habitat offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan has been completed for the (Grey-headed Flying-fox). The plan recommends the protection of roost sites and the retention of as many foraging species as possible. Taking the proposal for offset compensatory habitat into consideration the action is not considered to compromise this recovery plan.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will include preferred foraging species resulting in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this Flying-fox species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.

Bibliography:

Augee, M.L. and Ford, D. (1999). *Radio-tracking studies of Grey-headed Flying-foxes Pteropus poliocephalus, from the Gordon colony, Sydney*. Proceedings of the Linnaean Society of NSW, Vol. 121, pp 61-70.

Catterall, C.P., Storey, R.J. and Kingston, M.B. (1997). *Reality versus rhetoric: a case study monitoring regional deforestation in Hale, P. and Lamb, D. (eds). Conservation Outside Nature Reserves*, pp 367-377. Centre for Conservation Biology, University of Queensland, Brisbane.

Churchill, S. (1998). *Australian Bats*. Reed New Holland Publishers, Sydney, Australia.

Eby, P. (2000). The results of four synchronous assessments of relative distribution and abundance of Grey-headed Flying-fox *Pteropus poliocephalus* in Richards, G. and Hall, L. (Eds). *Proceedings of a Workshop to Assess the Status of the Grey-headed Flying-fox*, Australasian Bat Society, Canberra.

Hall, L.S. and Richards, G. (2000). *Flying Foxes: Fruit and Blossom Bats of Australia*, UNSW Press, Sydney.

NPWS Database (2000). *Fauna Species List for Protected Areas in NSW* at http://www.npws.gov.au/wildlife/species.htm

Tidemann, C.R. (1995). Grey-headed Flying-fox (*Pteropus poliocephalus*) in Strahan, R. (ed) *The Mammals of Australia,* pp 439-441 Australian Museum / Reed Books.

Webb, N. and Tidemann, C.R. (1995). Hybridisation between Black (*Pteropus alecto*) and Grey-headed (*P. poliocephalus*) Flying-foxes in *Australian Mammalogy,* Vol 18, pp 19-26.

Threatened species considered to have habitat within the site

Flora

8. Orchids

***Cryptostylis hunteriana* (Leafless Tongue Orchid)**
Cryptostylis hunteriana is a distinctive species recognised by its leafless habit and reddish black hairy labellum with a central, raised, hairy callus. The Leafless Tongue Orchid occurs from the Gibraltar Range (N.S.W) to eastern Victoria. This species is a saprophtye, which grows in small, localised colonies on flat plains close to the coast. This species has also been recorded in mountainous areas growing in moist depressions as well as in swampy habitats. Flowering time is December - February. This species is ROTAP-coded 3VC-.

***Diuris arenaria* (Tomaree Doubletail)**
Diuris arenaria is a early-flowering coastal Orchid with moderate-sized purple flowers, a darker labellum and a very narrow tubular base to the flower, the area between the callus ridges are ochre yellow and purple (Jones, 1999). This species is known from three main locations on the Tomaree Peninsula (Port Stephens), two of which are reserved (NSW Scientific Committee, 2000). *D. arenaria* grows in coastal heath Dry Sclerophyll Forest with patches of *Themeda triandra* (Kangaroo Grass) on sandy flats. *D. arenaria* flowers in October (Harden, 1993). This species has not been ROTAP-listed.

***Diuris praecox* (Donkey Orchid)**
Diuris praecox is a double-tailed terrestrial Orchid with small to moderate (25mm across) sized light yellow and brown flowers during July/August. It is often found growing in Eucalypt forests on hilltops or slopes (Bishop 1996). Species of the *Diuris* genus are very widespread in grassy habitats but can be easily missed because of their short flowering seasons, usually no more than two weeks. *D. praecox* is known from coastal areas between Ourimbah and Nelson Bay. This species is ROTAP-coded 2VC-.

Bibliography:
NSW Scientific Committee (2008). *Final Determination to list Corybas dowlingii as a Vulnerable species.*

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Cryptostylis hunteriana, Diuris praecox* nor *Diuris arenaria* were recorded on site during the survey. However it must be noted that the survey was carried out outside the known flowering period for these orchid species. A previous flora survey conducted within the flowering period for *D. praecox* and *D. arenaria* (Wildthing Environmental Consultants, 1998) did not record these orchid species within the western portion of the site. According to the Mambo Wetland Plan of Management (Port Stephens Council, 2006) these orchid species have not been recorded within the adjoining 175ha reserve.

Suitable habitat was found to be present for these orchid species within the site outside the wetter areas of swamp forest. This habitat has been subjected to a large amount of disturbance from past sandmining, the proximity to urban development and weed invasion.

The subdivision and subsequent development will result in the removal of all suitable habitat from within the site. However it is considered that the proposal is unlikely to cause extinction of any local population of these orchid species

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for *C. hunteriana, D. praecox* and *D. arenaria* from the site. This equates to approximately 6.7ha of habitat for *C. hunteriana* and 5.5ha for both *C. hunteriana* and *D. praecox.*

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

As these orchid species have not been recorded within the site or in close proximity to it and taking into consideration the disturbance to the site it is considered that no areas of habitat important to the long-term survival of these orchid species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for these orchid species. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is likely to result in an incremental reduction in habitat for these orchid species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site. Past fire within the site was evidenced by blackened parts of paperbark tree trunks in the west of the site. This fire event was most probably from the fire event on 1 January 2003. The proposal is considered to have little impact on fire frequency.
- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** The European Rabbit was not recorded within the site during the survey however would be considered to be present in the local area. The proposal is unlikely to significant increase Rabbit numbers.
- **Invasion of native plant communities by exotic perennial grasses:** This threatening process is already present with a large number of introduced grasses such as *Andropogon virginicus* Whisky Grass, *Anthoxanthum odoratum* (Sweet Vernal Grass), *Chloris gayana* (Rhodes Grass) and *Eragrostis curvula* (African Lovegrass). There is the potential for further infestation in the future particularly within the adjoining Mambo Wetland to the west. Given the recommendation for regular weed control the impact from this threatening process would be reduced.
- ***Lantana camara* (Lantana):** A small amount of Lantana was found to be present within the site. Given the recommendation to remove this species from the site the impact from this threatening process would be reduced on these species.
- **Invasion of Native Plant Communities by Chrysanthemoides monilifera: (Bitou Bush & Boneseed).** Bitou Bush was found to be present within the site. There is the potential for further infestation in the future, however given the recommendation for weed control within the site the impact from this threatening process would be reduced.

Bibliography:

Bishop, T. (1996). Field Guide to the Orchids of New South Wales and Victoria. University of NSW Press, Sydney

Briggs, J.D. and Leigh, J.H. (1995). Rare or Threatened Australian Plants. CSIRO Publishing, Victoria.

Carolin, R.C. and Tindale, M.D. (1994). Flora of the Sydney Region (4th edn.). Reed, Sydney.

Gunninah Environmental Consultants (2003). Wyong Ground Orchid Survey. Wyong Shire Council.

Harden, G. (ed)(1993). Flora of New South Wales - Volume 4. University of NSW Press.

9. Shrub species

Callistemon linearifolius **Netted Bottlebrush**

Callistemon linearifolius is a shrub which grows to 3-4 metres in height. It flowers from spring to summer. *C. linearifolius* grows in dry sclerophyll forest on the coast and adjacent ranges from the Georges River to Hawkesbury River in the Sydney area, and north to Nelson Bay. In the Sydney area records are limited to the Hornsby Plateau area. This species is ROTAP-coded 2RCi.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Callistemon linearifolius was not recorded on site during fieldwork. Drier areas of woodland within the site were found to contain marginal habitat for this species, however due to the disturbance to the site no preferred habitat would be considered to be present. The proposal will lead to a small incremental loss of habitat for *C. linearifolius*. However due to the fact that no primary habitat will be affected it is considered that the proposal is unlikely to cause extinction of any local population of this flora species.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for *C. linearifolius* from the site. This equates to approximately 5.5ha of habitat.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

As *C. linearifolius* has not been recorded within the site or in close proximity to it and taking into consideration the disturbance to the site it is considered that no areas of habitat important to the long-term survival of this bottlebrush species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for this shrub species. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is likely to result in an incremental reduction in habitat for this Bottlebrush species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: A past fire within the site was evidenced by blackened parts of paperbark tree trunks in the west of the site. This fire event was most probably from the fire event on 1 January 2003. The proposal is considered to have little impact on fire frequency.
- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** The European Rabbit was not recorded within the site during the survey however would be considered to be present in the local area. The proposal is unlikely to significant increase Rabbit numbers.

- **Invasion of native plant communities by exotic perennial grasses:** This threatening process is already present with a large number of introduced grasses such as *Andropogon virginicus* Whisky Grass, *Anthoxanthum odoratum* (Sweet Vernal Grass), *Chloris gayana* (Rhodes Grass) and *Eragrostis curvula* (African Lovegrass). There is the potential for further infestation in the future particularly within the adjoining Mambo Wetland to the west. Given the recommendation for regular weed control the impact from this threatening process would be reduced.
- ***Lantana camara* (Lantana):** A small amount of Lantana was found to be present within the site. Given the recommendation to remove this species from the site the impact from this threatening process would be reduced on these species.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush & Boneseed).** Bitou Bush was found to be present within the site. There is the potential for further infestation in the future, however given the recommendation for weed control within the site the impact from this threatening process would be reduced.

Bibliography:

Brooker, M.I.H and Kleining, D.A. (1983). Field Guide to the Eucalypts of South-eastern Australia. Inkata Press, Sydney.

Carolin, R.C. and Tindale, M.D. (1993). Flora of the Sydney Region (4th edn.). Reed, Sydney.

George, A. (exec. ed.) (1988). Flora of Australia, Volume 19: Myrtaceae - Eucalyptus and Angophora. Australian Government Publishing Service, Canberra.

Harden, G. (ed) (1991). Flora of NSW - Vol 2. New South Wales Uni Press, Sydney.

NSW Scientific Committee (1998). Final Determination to List *Grevillea parviflora* ssp. *parviflora* as a Vulnerable species, at 'http://www.nationalparks.nsw.gov.au'.

Robinson, L. (1994). Field Guide to the Native Plants of Sydney (2nd edn.). Kangaroo Press Pty. Ltd., New South Wales.

Wrigley, J.W. and Fagg, M. (1989). Banksias, Waratahs and Grevilleas. Angus and Robertson Books, Sydney.

10. Frogs

***Litoria aurea* (Green and Golden Bell Frog)**
Litoria aurea was formerly known to inhabit the eastern seaboard of New South Wales and Victoria from Byron Bay through to the Gippsland Lake Region as well as highland sites (New England District, south-western slopes of N.S.W. and Monaro District). Recent literature indicates that the northern and southern distribution limits have not changed, however, *L. aurea* is no longer found on sites above an altitude of 300m above sea level. This frog species inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. The Green and Golden Bell Frog is a summer breeder and voraciously cannibalistic. The males call from August through to January using a distinctive four part call: "crawk-awk, crawk, crok, crok". The common name of *L. aurea* is derived from its body colouration described as being dull olive to bright emerald green above with blotches of brown or golden-bronze.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Litoria aurea (Green and Golden Bell Frog) was not recorded within the site despite targeted surveys nor has it been recently recorded within Mambo Wetland (Port Stephens Council, 2006). The wetter area of Swamp Forest within the site to the north of the library is considered to contain suitable habitat for the Green and Golden Bell Frog. A small narrow drainage line within a less inundated area of Swamp Forest to the south-west of the library was also considered to contain some suitable habitat for this frog species. The Green and Golden Bell Frog would have once been one of the more commonly encountered frogs within the local area before its severe contraction in distribution in the 1970's and 1980's. The nearest known populations of Green and Golden Bell Frogs are currently located at Kooragang and Broughton Islands (Department of Environment and Conservation NSW, 2005) and Medowie (Umwelt, 2006).

The proposal will lead to a small incremental loss of suitable habitat for this The Green and Golden Bell Frog, however due to the fact that this species has not recorded in the local area it is considered that the proposal is unlikely to cause extinction of any local population of this flora species.

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

Not applicable to threatened species.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for the Green and Golden Bell Frog. This equates to approximately 1.2ha of habitat.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

As the Green and Golden Bell Frog has not been recorded within the site during the survey or within recent times in the local area it is considered that no areas of habitat important to the long-term survival of this frog species will be removed, modified, fragmented or isolated.

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

To date no Critical Habitat, as defined under Part 3 of the TSC Act has not been declared for the Green and Golden Bell Frog.

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

A Draft Recovery Plan has been developed for the Green and Golden Bell Frog. Objectives include:

- To avoid direct impacts and retain habitat;
- Minimise impacts where ever possible;
- Mitigate or ameliorate impacts; and as a last resort;
- Compensate or offset for any unavoidable impacts.

Given the lack of known key populations in the locality and the plan for compensatory offset habitat it is considered that the proposal development will not significantly conflict with this draft recovery plan.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation particularly

within the wetter areas of swamp forest is likely to result in an incremental reduction in habitat for this species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this frog species.

- **Predation by *Gambusia holbrooki* (Plague Minnow):** This species of fish was not observed during the survey however is known to occur nearby within Mambo Wetland (Port Stephen Council, 2006). The proposal is not likely to further exacerbate the predation by this fish on frog eggs and tadpoles.
- **Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis:** It is possible that this fungus has an impact on frogs in the local area. However the proposal is unlikely to have any impact on this threatening process.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site. Past fire within the site was evidenced by blackened parts of paperbark tree trunks in the west of the site. This fire event was most probably from the fire event on 1 January 2003. The proposal is considered to have little impact on fire frequency.
- **Human-caused Climate Change**: Has the potential to have an adverse effect on these frog species. The proposal is unlikely to significantly contribute to Climate Change.

Bibliography:

Barker, J., Grigg, G.C. & Tyler, M.J. (1995). A Field Guide to Australian Frogs. Surry Beatty & Sons, Norton, NSW.

Cogger, H.G. (1996). Reptiles and Amphibians of Australia. (5th edn) Reed Books, Victoria.

Department of Environment and Conservation NSW (2005). *Draft Recovery Plan for the Green and Golden Bell Frog (Litoria aurea)*. DEC NSW, Hurstville, NSW.

Ehmann, H. (Ed) (1997). Threatened Frogs of New South Wales: Habitats, Status and Conservation. Frog and Tadpole Study Group of NSW.

NPWS Database (2000). Fauna Species Lists for Protected Areas in NSW, at http://www.nationalparks.nsw.gov.au

Robinson, M. (1996). A Field Guide to Frogs of Australia. Reed Books Australia, Melbourne.

Tyler, M.J. (1992). Encyclopedia of Australian Animals: Frogs. Angus & Robertson, NSW.

Umwelt Environmental Consultants (2006). *Flora and Fauna Assessment for Medowie Structure Plan*. Port Stephens Council.

11. Water Birds

***Botaurus poiciloptilus* (Australasian Bittern)**
The Australasian Bittern occurs in the south-east and south-west, as well as in Tasmania and is also known as a vagrant in the north-west of Australia. This species is probably sedentary in permanent habitat with possible regular short distance movements during winter and is occasionally irruptive following heavy rains and floods, or drought elsewhere. The Australasian Bittern lives alone or in loose groups and favours permanent fresh-waters with tall dense vegetation dominated by sedges, rushes, reeds or cutting grasses (eg. *Phragmites, Scirpus, Eleocharis, Juncus, Typha, Baumea* and *Gahnia*). The Australasian Bittern feeds on insects, small fish, eels, frogs and other aquatic life, sometimes in ricefields. It is partly nocturnal in habits and, keeping as it does to the depths of reedy swamps, is seldom seen during the day unless flushed. The breeding season is from October to January and it is during this time that the distinct 'booming' calls can be heard.

***Rostratula benghalensis australis* (Australian Painted Snipe)**
The Painted Snipe is usually found in pairs, frequenting the margins of swamps and streams, chiefly those covered with low and stunted vegetation. It probes in mud along the shore to gather snails, water insects and aquatic plants. The Painted Snipe appears to be nomadic, with movements mainly north in winter and south in summer. It requires shallow fresh water for breeding, though the nest is not deserted if the water dries up. Nests are usually in groups, and consist of a shallow depression in the ground, lined with grass or leaves and frequently sheltered by a low bush or tuft of grass.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Despite targeted and incidental surveys, neither *Botaurus poiciloptilus* (Australasian Bittern) or *Rostratula benghalensis australis* (Australian Painted Snipe) were recorded on site during the survey. Wetter areas of swamp forest in the west of the site were considered to contain habitat for both these species particularly, *B. poiciloptilus.* The proposed subdivision and subsequent development will result in the removal of virtually all of the habitat from within the site for both these waterbird species which will lead to a small incremental loss of habitat in the local area. Taking the occurrence of larger areas of suitable habitat within the area including Mambo Wetland the proposal is unlikely to cause extinction of any local population of these bird species.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for these waterbird species from within the site. This equates to approximately 1.2ha of habitat.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of these bird species.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for these bird species however it is considered that no areas of habitat important to the long-term survival of these waterbird species will be removed, modified, fragmented or isolated.

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

To date no Critical Habitat, as defined under Part 3 of the TSC Act has not been declared for either waterbird species.

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

No Recovery or Threat Abatement Plan has been developed for these wetland bird species. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will include some potential habitat is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these waterbird species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.

Bibliography:

Garnett, S.T. and Crowley, G.M. (2000). *The Action Plan for Australian Birds 2000*. Report to Environment Australia and Birds Australia, October 2000.

Marchant, S. and Higgins, P.J. (Eds.) (1993). *Handbook of Australian, New Zealand & Antarctic Birds: Volume 2 Raptors to Lapwings*, Oxford University Press, Melbourne.

NPWS. (2003). *Atlas of NSW Wildlife*, at 'www.nationalparks.nsw.gov.au'.

Pizzey, G. & Knight, F. (1997). *Field Guide to the Birds of Australia*, Angus and Robertson, Sydney

Reader's Digest (1982). *The Complete Book of Australian Birds*, Reader's Digest Services Pty. Ltd., Sydney.

Slater, P., Slater, P. and Slater, R. (1997). *The Slater Field Guide to Australian Birds*, Lansdowne Publishing, Sydney.

12. Cockatoos and Parrots

***Callocephalon fimbriatum* (Gang-gang Cockatoo)**
The Gang-gang Cockatoo is distributed from southern Victoria through south and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and southwest slopes. It is rare at the extremities of its range, with isolated records known from as far west as Mudgee. In summer they are generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter they move to lower altitudes and drier more open eucalypt forests and woodlands, and often found in urban areas. In winter they show a preference for more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting. Breeding usually occurs between October and January in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests. Nests are most commonly recorded in eucalypt hollows in live trees close to water.

***Calyptorhynchus lathami* (Glossy Black-Cockatoo)**
The Glossy Black-Cockatoo inhabits wet and dry sclerophyll forests and woodlands of eastern Victoria to central Queensland, extending to the western slopes in New South Wales. It prefers highlands towards the north but may be found closer to the coast where conditions are suitable. In the south they are widespread in lowland coastal forests, dense mountain forests, semi-arid woodland and trees bordering water courses. It forages primarily on the seeds of Casuarinas, but will also take woodborers from large *Acacia* stems. *Allocasuarina torulosa, A. verticillata* and *A. littoralis* are the predominant food trees, however, on Kangaroo Island *Casuarina stricta* is the predominant food source. They have also been observed eating *Angophora, Acacia* and *Eucalyptus* seeds. Nesting takes place from March through August in the hollows of large Eucalypts, 10-20m above the ground, where a single egg is laid.

***Lathamus discolor* (Swift Parrot)**
During winter the Swift Parrot inhabits mainland Australia from Adelaide (S.A.) through Victoria, and up the east coast to south-east Queensland, as well as visiting the south and central western slopes and the Riverina in NSW. The Swift Parrot returns to eastern Tasmania in spring to breed. The Swift Parrot prefers open forest to woodland on the mainland. It has also been recorded utilising street trees and in parks and gardens. Swift Parrots forage on the nectar of Eucalypts, often in mixed flocks with lorikeets. The preferred winter food species are Red Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Swamp Gum (*E. ovata*), Swamp Mahogany (*E. robusta*) and Yellow Gum (*E. melliodora*) and have also been observed eating the seeds and flowers of *Xanthorrhoea* spp. They also feed on insects and their larvae, fruits, berries, seeds and vegetable matter. Nesting occurs from September to January in a hollow branch of a Eucalypt and they return to the mainland during March and April.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

None of the above Cockatoo and parrot species were recorded on site despite targeted and incidental surveys.

Marginal foraging habitat was found to be present for the Glossy Black Cockatoo in the form of a very small number of *Casuarina glauca* (Swamp Oak) and *Allocasuarina littoralis* (Black Sheoak) trees. No nesting habitat was found to be present for this species due to the absence of suitable tree hollows. The Glossy Black Cockatoo has been recorded within the adjoining Mambo Wetland Management Plan (Port

Stephen Council, 2006). No significant habitat was considered to be present on site for the Glossy Black Cockatoo.

The Gang Gang Cockatoo is usually found in upland areas such as the Watagans to the west of the study area. However this species is known to visit lowland areas during the winter months and may utilise the site and surrounding areas for foraging on an intermittent basis. No suitable nesting hollows were present within the site, however this species would be more inclined to breed in upland areas. The proposal will result in a small incremental reduction in suitable foraging habitat in the local area however it is unlikely to result in the extinction of any local population of this species.

Seasonal foraging habitat was available for the Swift Parrot in the form of winter flowering eucalyptus, particularly *Eucalyptus robusta* (Swamp Mahogany) which was present within the area of swamp forest.

The proposal will lead to a small incremental loss of foraging habitat for these three birds, however due to the fact that no suitable nesting hollows will be affected it is considered that the proposal is unlikely to cause extinction of any local population of these bird species.

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

No endangered population has been identified utilising the site.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for these bird species from within the site. This equates to approximately 6ha of habitat.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of these bird species.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for these bird species however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the above species although a Priority Action Statement (PAS) has been developed for each species. The objective of the PAS is to promote the recovery of threatened species, populations and ecological communities and manage key threatening processes. It is considered that the proposal does not conflict with the PAS for the above bird species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will include seasonally preferred foraging species such as Swamp Mahogany for the Swift Parrot is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these bird species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography:

Forshaw, Joseph M. (1991). *Australian Parrots* (2nd edn.). Ure Smith Press, Willoughby, NSW.

Garnett, S.T. and Crowley, G.M. (2000). *The Action Plan for Australian Birds 2000*. Report to Environment Australia and Birds Australia, October 2000.

Hunter Bird Observers Club (1999). *Hunter Region of New South Wales: Annual Bird Report Number 6 (1998)*. HBOC Inc., August 1999.

NPWS Database (2000). *Fauna Species Lists for Protected Areas in NSW* at 'http://www.npws.nsw.gov.au/wildlife/species.htm'

NSW Scientific Committee (19/2/1999). *Preliminary Determination for the Riverina Population of the Glossy Black Cockatoo*. Hurstville, NSW.

Pizzey, G. & Knight, F. (1997). *Field Guide to the Birds of Australia*, Angus and Robertson, Sydney.

Reader's Digest (1982). *The Complete Book of Australian Birds*. Reader's Digest Services Pty. Ltd., Sydney.

13. Owls

***Ninox connivens* (Barking Owl)**
The Barking Owl is found in forest and woodland, encountered most commonly in savanna and paperbark woodlands. It sometimes roosts in rainforests, but it requires the more open country for hunting and hollow Eucalypts for breeding. These owls are usually found in pairs which occupy permanent territories, generally greater than 100 ha. Each pair has a number of sites where they roost by day, usually in a leafy tree close to the trunk, though not always well hidden. They breed from August to October in large open hollows. Mammals and birds are the main prey, though it also feeds on insects and other invertebrates. In Southern Australia it feeds particularly on rabbits. It also kills hares, rats, mice, occasional small bats and some marsupials, including possums. It kills birds up to the size of Magpies and Tawny Frogmouths.

***Ninox strenua* (Powerful Owl)**
Within NSW, Powerful Owls are distributed throughout the length of the Great Dividing Range, which is their stronghold, and extend from the coast to the western slopes where they occur in much lower numbers. The Powerful Owl inhabits a wide range of vegetation types from wet Eucalypt forests with a rainforest understorey to dry open forests and woodlands. The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. The Powerful Owl is the largest predator of nocturnal forest-dwelling animals in Australian forests. Major prey species in NSW forests are the Greater Glider, Common Ringtail Possum, Sugar Glider, Grey-headed Fruit Bat, and several species of diurnal birds, including the Pied Currawong, Magpie and Lorikeets. It rests during the day amid thick foliage, often grasping food-remains. Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the ground. These trees are usually found growing on a hillside in heavy forest and may be utilised intermittently for several years. One or two young are produced, although some pairs do not breed in every year. Pairs appear to mate for life and occupy exclusive territories in the order of 1000 ha in size.

***Tyto capensis* (Grass Owl)**
The Grass Owl ranges from India eastward to Fiji, excluding New Guinea. It is easily confused with the more common Barn Owl (*Tyto alba*). The Grass Owl stands much more upright than the Barn Owl, with longer and barer legs. Due to the confusion, the range of this species may only be partly determined. Movements are nomadic and irruptive, with local colonisations taking place after flourishings of prey species populations. Island birds appear to breed up in response to plagues of small mammals then disperse, often to die as the plague subsides. Coastal populations of the Grass Owl are considered fairly sedentary though numbers have been observed to fluctuate. The Grass Owl lives in a loose community, several hundred metres usually separating solitary roosting birds or breeding pairs. The birds roost and nest on the ground, in crops or in thick grass tussock often associated with swamps, forming extensive tunnels and trampling the area. The species usually hunts by night but when under stress will hunt by day. Up to 30 have been observed in the air at the same time, sweeping over the grassland at heights of 1-4 metres and dropping directly on to prey. Rodents, including the house mouse, are taken and apparently grasshoppers and other insects.

***Tyto novaehollandiae* (Masked Owl)**
Masked Owls in N.S.W. are distributed throughout the length of the Great Dividing Range and extend from the coast to the western slopes. Within this range they inhabit a range of wooded habitats that contain both mature trees for roosting and nesting and more open areas for hunting. They are most commonly encountered within Open Forest with a sparse understorey as well as along the ecotones of these areas to more or less densely vegetated habitats. Their diet comprises mainly ground-dwelling prey, including several species of native and introduced Rodents, *Antechinus* spp. and Bandicoots. On occasions, other prey such as Possums, Gliders and other birds are taken. Masked Owls usually roost in large hollows inside large, old living trees, most often Eucalypts. Within dry forests they often choose hollow trees in gullies or drainage lines. These hollows are 1 to 5 metres deep, 40 to 50 cm wide. The trees containing these hollows are likely to be quite old (>150 years). They are also known to roost

among the dense foliage of other trees such as *Pandanus, Livistona, Melaleuca* and *Acacia* species. The species also nests in large hollows, although there appears to be a preference for hollow tree trunks and vertical spouts of large trees. The breeding season, like that for other *Tyto* owls, is variable but there is a tendency for breeding to occur in autumn-winter. Pairs appear to mate for life and occupy exclusive territories in order of 1000ha in size.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither the Masked, Powerful, Barking or Grass Owls were not recorded during fieldwork. No evidence of their presence found (ie whitewash, regurgitation pellets, prey remains) nor was a response heard during the call playback census.

Both the Powerful and Masked Owls have been recorded within the locality (Port Stephens Council, 2006)(DECC database, February 2009) and would be considered to occasionally utilise the site for hunting. The Grass and Barking Owls have been less commonly recorded however, are known to occur in the local area (DECC database, February 2009 & Murray. et. al, 2002) and may rarely utilise the site for hunting. Limited roosting habitat was considered to be present for Powerful, Barking and Grass Owls within the denser areas of Swamp Forest in the west of the site. No suitable nesting habitat was present within the site for the Powerful, Masked and Barking Owls due to the absence of large tree hollows. Marginal nesting habitat for the Grass Owl was considered to be present within the swamp forest to the north of the library where a thick dense layer of plants such as Gahnia sp. were present. This habitat would be dependant on the level of water within this area.

The proposal subdivision and subsequent development will lead to the removal of virtually all habitat from the site which will result a small incremental loss of prey species in the local area for all of the owl species assessed. There will also be a small reduction in roosting habitat for the Powerful, Barking and Grass Owls and removal of an area of marginal nesting habitat for the Grass Owl. Considering the relatively large amount of surrounding habitat and large home range of these owl species and plan for compensatory offset habitat it is unlikely that the proposal would threaten the local population with immediate extinction by disrupting its breeding life-cycle.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for these owl species. This will equate to approximately 4ha of habitat for each species.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of these Owl species.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for these Owl species however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

Draft Recovery Plans have been completed for Large Forest Owls (NPWS, 2005) and for the Barking Owl (NPWS, 2003). The recovery plans recommend that proposals containing bushland protect nest and roost sites, patches of habitat and prey bases. The proposal will result in the reduction in the number of prey species in the locality and the removal of a small portion of roosting habitat however is unlikely to significantly compromise these recovery plans.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these Owl species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography:

Davey, S.M. (1993). Notes on the Habitat of Four Australian Owl Species, In Olsen, P.D. (Ed) (1993). Australian Raptor Studies, Australasian Raptor Association, RAOU, Melbourne, pp 126-42.

Debus, S.J.S. and Rose, A.B. (1994). The Masked Owl *Tyto novaehollandiae* in New South Wales, In Australian Birds, 28 (Supplement): pp 40-64

Kavanagh, R.P. (1993). Project 149: Ecology and Management of Large Forest Owls, Unpublished Progress Report to World Wide Fund for Nature, Sydney.

Kavanagh, R.P. and Peake, P. (1993). Distribution and Habitats of Nocturnal Forest Birds in South-eastern New South Wales, In Olsen, P.D. (Ed) (1993). Australian Raptor Studies, Australasian Raptor Association, RAOU, Melbourne, pp 101-5.
Kavanagh, R.P. and Murray, M. (1996). Home Range, Habitat and Behaviour of the Masked Owl *Tyto novaehollandiae* near Newcastle, New South Wales. In: Emu, 96: pp 250-7.

Kavanagh, R.P. (2000). Conservation and Management of Large Forest Owls in South-eastern New South Wales. Proceedings of Owls 2000: Third International Conference on the Biology, Conservation and Cultural Significance of Owls.

Kavanagh, R.P. and Stanton, M. A. (2000). Response to Habitat Fragmentation by the Powerful Owl, Sooty Owl, Masked Owl and other Nocturnal Fauna in South-eastern New South Wales. Proceedings of Owls 2000: Third International Conference on the Biology, Conservation and Cultural Significance of Owls.

Marchant, S. and Higgins, P.J. (1993). Handbook of Australian, New Zealand & Antarctic Birds. Oxford University Press, Melbourne.

NSW Department of Environment and Conservation (2005). *Draft Recovery Plan for the Large Forest Owls: Powerful Owl Ninox strenua Sooty Owl Tyto tenebricosa Masked Owl Tyto novaehollandiae*. NSW DEC, Sydney, NSW.

Pizzey, G. & Knight, F. (1997). Field Guide to the Birds of Australia, Angus and Robertson, Sydney.

14. Woodland Birds

***Xanthomyza phrygia* (Regent Honeyeater)**
The Regent Honeyeater is nomadic, although it does seem to return to nesting areas sporadically. Seasonal movements appear to be dictated by the flowering of various species of Eucalypts that are characteristic of the dry forests and woodlands of south eastern Australia. The Regent Honeyeater prefers to forage on large-flowered Eucalypts (e.g. *Eucalyptus sideroxylon, E. melliodora, E. albens, E. leucoxylon*), particularly where these trees grow in more productive areas and yield plentiful and predictable nectar flows. They also forage on mistletoe and Banksia flowers, and arthropods. In parts of coastal NSW they are also attracted to stands of *Eucalyptus robusta* (Swamp Mahogany). Recent records (winter 2000) exist of this species foraging in flowering *Corymbia maculata* (Spotted Gum) trees at Aberdare State Forest near Ellalong, NSW have been noted (Roderick pers.comm.). Nesting occurs mainly between November and January, but breeding has been recorded in all months between July and February.

***Burhinus grallarius* (Bush Stone-curlew)**
Within N.S.W. this species has been recorded mainly in pastoral areas of the western slopes and plains. It is rare east of the Great Divide, however, isolated populations have been recorded from Western Sydney, Gosford, Port Macquarie and Northern Rivers around Grafton and Brunswick Heads (Marchant and Higgins, 1993). The Bush Stone-curlew inhabits dry open forest and woodland with an open grassy understorey that has not been overgrazed. It prefers woodland with many fallen branches where it roosts during the day. It has also been known to utilise coastal scrub, mangrove fringes, golf courses and plantations. The food of the Bush Stone-curlew is primarily insects, spiders and other invertebrates. Occasionally fruits are eaten when they become available.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Despite targeted and incidental searches, neither the Regent Honeyeater or Bush Stone Curlew were recorded during the survey.

It must be noted that the Regent Honeyeater would not be likely to be present in the area on a continuous basis as it is most commonly found on the western slopes of the Great Dividing Range. Due to the occurrence of records of this species in the vicinity of the study area (DECC database) and the presence of a preferred winter flowering foraging resource in the form of *Eucalyptus robusta* (Swamp Mahogany) it is likely that this species may occasionally utilise the site for foraging.

Suitable habitat was found to be present for *Burhinus grallarius* (Bush Stone-curlew) within the drier areas of the site, however this habitat would be limited by the close proximity of urban development and dense nature of much of the vegetation.

The proposal subdivision and subsequent development will lead to the removal of virtually all habitat from the site for both these bird species and will result in the incremental reduction of habitat in the local area. Considering the presence of larger areas suitable habitat such as the adjoining Mambo Wetland and the plan for compensatory offset habitat it is unlikely that the proposal would threaten the local population with immediate extinction by disrupting its breeding life-cycle.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for these two bird species. This will equate to approximately 6ha of habitat for each species.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of these bird species.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for these bird species however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan has been completed for both the Regent Honeyeater and Bush Stone Curlew.

The Regent Honeyeater Recovery Plan recommends the retention of preferred foraging species. The proposal will result in the removal of specimens of Swamp Mahogany. It is recommended that as many specimens of Swamp Mahogany be retained where possible and that compensatory plantings be

undertaken.

The Bush Stone Curlew Recovery Plan recommends the retention of habitat and habitat attributes such as fallen logs as well as the control of foxes and cats. The removal of habitat from the site would not comply with this recovery plan however considering the disturbance to the site and close proximity to a busy shopping centre as well as the proposal of compensatory offset habitat the proposal should not compromise the recovery plan.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will for a subsequent development is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these bird species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.

Bibliography

Brouwer, J. & Garnett, S. (Eds.) (1990). Threatened Birds of Australia: An annotated list. Royal Australasian Ornithologists Union (RAOU) Report Number 68.

Nature Conservation Council (1999). Threatened Species Network - Regent Honeyeater Species Profile Sheet. http://nccnsw.org.au/member/tsn/context/profiles/22196.html

National Parks and Wildlife Service (1999-2003). Recovery Plan for the Regent Honeyeater *Xanthomyza phrygia*. NPWS, Hurstville.

NPWS Database (2000). Fauna Species Lists for Protected Areas in NSW at 'http://www.npws.nsw.gov.au/wildlife/species.htm'

NSW National Parks and Wildlife Service. (2001). Threatened Species Conservation Act 1995 NSW Scientific Committee Final Determination, Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis.*

NSW National Parks and Wildlife Service. (2001). Threatened Species Conservation Act 1995 NSW Scientific Committee Final Determination, Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis.*

Pizzey, G. & Knight, F. (1997). Field Guide to the Birds of Australia, Angus and Robertson, Sydney

Reader's Digest (1982). The Complete Book of Australian Birds. Reader's Digest Services Pty. Ltd., Sydney.

Slater, P., Slater, P. and Slater, R. (1997). The Slater Field Guide to Australian Birds. Lansdowne Publishing, Sydney.

15. Small Arboreal Marsupials

***Cercartetus nanus* (Eastern Pygmy –possum)**
The Eastern Pygmy –possum is a small arboreal marsupial approximately the size of a mouse. It has soft dense fur, fawn-grey to olive brown above and light grey to white below. The rounded head has very large eyes and ears and long whiskers. The prehensile tail has a seasonally flattened base is almost naked and tapers to a fine point. The species is found from rainforest through sclerophyll forest to tree heath. In New South Wales the species is found in coastal areas. Pygmy-Possums are agile climbers that feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants when in flower, insects throughout the year, and seeds and soft fruits when flowers are unavailable. Individual Pygmy-possums have numerous nests which are slept in during the day. These are usually within tree hollows or constructed spherical nests (drays) made from shredded bark and wood from eucalypts, abandoned bird nests and tea-trees. The species is patchily distributed within the south-eastern corner of mainland Australia and Tasmania.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

***Cercartetus nanus* (Eastern Pygmy –possum)**
Cercartetus nanus was not recorded during fieldwork undertaken for this report. The site contained suitable foraging habitat in the form of flowering myrtaceous trees and shrubs such as *Banksia serrata* (Old Man Banksia) and *Banksia integrifolia* (Coastal Silver Banksia). No nesting habitat in the form of tree hollows was present within the site.

The proposal will lead to a small incremental loss of foraging habitat for the Eastern Pygmy-Possum and would reduce the size of the greater Mambo Wetland Remnant. Considering the presence of larger areas of better quality habitat occurring outside the site and taking into account the recommendations of compensatory offsets the proposal is unlikely to significantly affect the life cycle of these arboreal marsupial species or place any viable local populations of these species at risk of extinction.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for the Eastern Pigmy Possum. This will equate to approximately 4ha of habitat for each species.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for these arboreal mammal species however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Eastern Pygmy Possum. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help the Eastern Pygmy Possum recover in NSW. These actions include:

- Ensure the largest hollow-bearing trees (including dead trees) are given highest priority for retention.
- Delineate boundaries of population to identify the extent to which populations are interconnected.

It is considered that the proposed action will not significantly compromise these Priority Action Plans.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site is likely to result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this marsupial species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography

Fleay, D.(1947). Gliders of the Gum Trees. Melbourne Bread and Cheese Club.

Humphries, R. and Seebeck, J. (1997). *Brush-tailed Phascogale Phascogale tapoatafa. Victorian Department of Natural Resources and Environment Action Statement No. 79* at http://www.dce.vic.goc.au/plntanml/native/actstats/content/as79.htm

NSW Scientific Committee (2001). Final determination to list *Cercartetus nanus* (Eastern Pygmy-Possum) as a Vulnerable Species at http://www.nationalparks.nsw.gov.au

NPWS Database (2000). Fauna Species List for Protected Areas in NSW, at 'http://www.npws.gov.au/wildlife/species.htm'.

Quin, D.G. (1995). Population Ecology of the Squirrel Glider (*Petaurus norfolcensis*) and the Sugar Glider (*P. breviceps*) (Marsupialia : Petauridae) at Limeburners Creek, on the Central North Coast of New South Wales. In: Australian Wildlife Research 22: pp 471-505.

Quin, D.G. (1993). Sociology of the Squirrel Glider and the Sugar Glider. PhD Thesis, Department of Ecosystem Management, University of New Emgland.

Smith, A. (1996). On The Brink - Squirrel Gliders, Pittwater Council and Housing Development. At 'http://www.nccsw.org.au/bushland/reference/onthebrink/Squirrel.html'.
Suckling, G.C. (1995). Squirrel Glider (*Petaurus norfolcensis*). In: The Mammals of Australia, pp: 234-5. Strahan, R. (Ed). Reed Books, Sydney.

SWC Consultancy (1996). Eleebana Local Squirrel Glider Study. Report to Lake Macquarie City Council.

Triggs, B. (1996). Tracks, Scats and Other Traces: a Field Guide to Australian Mammals. Oxford University Press, Australia.
Turner, V. & Ward, S.J. (1995). Eastern Pygmy-possum (*Cercartetus nanus*). In: The Mammals of Australia, pp: 217-218. Strahan, R. (Ed). Reed Books, Australia.

16. Terrestrial Mammals

***Dasyurus maculatus maculatus* (Tiger Quoll)**
The Tiger Quoll is an agile climber but spends most of its time on the floor of sclerophyll forests, rainforests and coastal woodlands. Although largely nocturnal, it may forage and bask in the sun during the day. Nests are made in rock caves and hollow logs or trees, and basking sites are usually found nearby. It is an opportunistic hunter of a variety of prey, including birds and their young, rats and other small terrestrial and arboreal mammals, gliders, small Macropods, reptiles and Arthropods.

***Potorous tridactylus* (Long-nosed Potoroo)**
The Long-nosed Potoroo has a patchy distribution from Gladstone, QLD to south-west Victoria and Tasmania. They are regarded as uncommon north of the Sydney region. It is known from a variety of habitats, including rainforest, Open Forests & Woodlands with dense groundcover, and dense, wet coastal heathlands. Soft (often sandy) substrates are preferred by this species. They feed predominantly on fungi, subterranean insects, succulent roots, tubers, seeds and fruits. Many food items are obtained by digging in the soil with their forearms. Conical pits with remnants of the fruiting bodies of an underground fungus nearby are characteristics signs of past feeding by this species. Being predominantly nocturnal, the Long-nosed Potoroo sleeps by day in simple nests of grass and other vegetation placed in scrapes below dense scrub, grass tussocks or grass trees.

Pseudomys gracilicaudatus **Eastern Chestnut Mouse**
This species is most often found in heathland and in dense and wet heathy areas, though it has also been recorded from Open Woodland. Its' optimal habitat however, has been identified as regenerating vegetation. These animals are mainly nocturnal resting in grass nests or burrows by day and emerging at dusk to forage for seeds, stems, fungi and insects. Within NSW the breeding season is from September to March, however, in good seasons, mating extends from mid-August to the end of March. This species is distributed along the east coast and ranges of Australia from the Cairns district to the lower north coast of New South Wales.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Despite targeted surveys, which involved cage trapping and spotlighting neither *Dasyurus maculatus maculatus* nor *Potorous tridactylus* were recorded on site during the survey.

***Dasyurus maculatus maculatus* (Tiger Quoll)**
Suitable hunting habitat was found to be present within the site for *D. maculatus maculatus* although no nesting habitat was considered to be present. This species however would be most commonly found in more isolated, pristine areas of habitat on the Tomaree Peninsula and would be unlikely to be present within the site or nearby areas. There was a paucity of records of the Tiger Quoll in the immediate local area. The proposal will result in the incremental reduction of a small amount of habitat for *D. maculatus maculatus* however it is unlikely to result in the extinction of any local population of this species.

***Potorous tridactylus* (Long-nosed Potoroo)**
Due to the disturbance and proximity of the site to urban development only marginal habitat was considered to be present in the western portion of the site. However there is a lack of local records for this species on the Tomaree Peninsula. The proposal will result in the incremental reduction in a

small amount of habitat for *P. tridactylus* however it is unlikely to result in the extinction of any local population of this species.

***Pseudomys gracilicaudatus* (Eastern Chestnut Mouse)**
Due to the disturbance and proximity of the site to urban development only limited habitat was considered to be present in the western portion of the site. However there is a lack of local records for this species on the Tomaree Peninsula. The proposal will result in the incremental reduction in a small amount of habitat for the Eastern Chestnut Mouse however considering the plan for compensatory offset habitat it is unlikely to result in the extinction of any local population of this species.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all suitable habitat for *D. maculatus, P. dactylus* and *P. gracilicaudatus.* This will equate to approximately 4ha of habitat for each species.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result in the incremental decline in marginal habitat for these mammal species however it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Tiger Quoll, Long-nosed Potaroo and Eastern Chestnut Mouse. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these mammals recover in NSW. Considered the plan for compensatory offsets the proposed action will not significantly compromise these Priority Action Plans.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site will result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these marsupial species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Bibliography:

Edgar, R. and Belcher, C. (1995). *Spotted-tailed Quoll (Dasyurus maculatus) in Strahan, R.* (ed) *The Mammals of Australia*, pp: 67-68. Strahan, R. (Ed). Reed Books, Australia.

NPWS Database (2000). *Fauna Species List for Protected Areas in NSW* at http://www.npws.gov.au/wildlife/species.htm

Fox, B.J. (1995). *Eastern Chestnut Mouse* (*Pseudomys gracilicaudatus*). In: The Mammals of Australia, pp 601-602. Strahan, R. (Ed). Reed Books, Chatswood, NSW.

15. Microchiropteran Bats

***Falsistrellus tasmaniensis* (Eastern Falsistrelle)**
The Eastern Falsistrelle occurs along the coastal ranges from southern Queensland to western Victoria, and is endemic to Australia. These bats inhabit sclerophyll forests from the Great Divide to the east coast. In Tasmania they are found in wet sclerophyll and coastal mallee. A preference has been noted for wet habitats where trees are more than 20m high. On the mainland they eat moths, rove beetles, chafers, weevils, plant bugs, flies and ants. It has been observed roosting in holes and hollow trunks of Eucalypts, with recorded colony sizes ranging from 3 to 36 individuals.

***Mormopterus norfolkensis* (Eastern Freetail-bat)**
This species appears to live in Sclerophyll Forests and Woodland. Usually only solitary bats are captured, but one group was caught flying low over a rocky river in Rainforest and Wet Sclerophyll Forest. When hunting insects it flies swiftly above the forest canopy or in clearings at the edge of the forest. Their diet is largely unknown. Small colonies have been found in tree hollows or under loose bark and specimens have been collected from under house roofs and the metal caps on telegraph poles.

***Miniopterus schreibersii oceanensis* (Large Bentwing-bat)**
The Large Bentwing-bat is a cave (and similar man-made structures) roosting species that generally feeds above the forest canopy in wet and dry tall open forest, catching insects on the wing. However, the species has also been recorded utilising rainforest, monsoon forest, open woodland, paperbark forests and open grasslands. Moths are the main prey item.

***Chalinolobus dwyeri* (Large-eared Pied Bat)**
The Large Pied Bat ranges from Rockhampton in central Queensland to Bungonia in southern NSW. This species has been found occupying dry sclerophyll forest and woodland, both to the east and west of the Great Divide. Recordings of this species have also been made in subalpine woodland and at the ecotone of rainforest and wet Eucalypt forest. The Large-eared Pied Bat roosts in caves, abandoned mud-nests of Fairy Martins and mine tunnels.

***Myotis adversus* (Large-footed Myotis)**
The Large-footed Myotis has been recorded along much of the coastal strip of Australia occurring from the east of SA, around the Victorian, NSW, Queensland and NT coasts and into WA as far as the Kimberleys (the northern population is likely to be a different subspecies - currently undergoing taxonomic revision).

In NSW, the Large-footed Myotis is found in various habitats of the coast and adjacent ranges. It is a small bat that hunts by raking the surface of the water for aquatic insects and small fish, it seldom occurs far from suitable water bodies which range from rainforest streams to large reservoirs and even brackish water. Some aerial hunting also occurs. Prey items include moths, beetles, crickets, cockroaches, flies and many water insects. It roosts in small colonies of between 15 and several hundred individuals with recorded roosts including caves, mines and disused railway tunnels as well as dense rainforest foliage in the tropical parts of its range. Some occurrences of roosting in tree hollows are also noted.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Chalinolobus dwyeri, Falsistrellus tasmaniensis, Myotis adversus, Miniopterus schreibersii oceanensis and *Mormopterus norfolkensis* were not identified on site despite the undertaking of harp trapping and echolocation call recording. The site provided hunting habitat for all of these threatened microchiropteran bat species. Preferred hunting habitat in the form of waterbodies was absent for *Myotis adversus.* No roosting habitat in the form of tree hollows was available within the site. No preferred roosting habitat for *C. dwyeri, M. schreibersii oceanensis* and *M. adversus* in the form of caves and similar man made structures was also present. However, *M. adversus* and *Miniopterus schreibersii oceanensis* have also been known to utilise tree hollows on occasions.

Considering the presence of larger areas of suitable habitat in the local area such as Mambo Wetland and taking into account the plan for compensatory habitat the proposal is unlikely to significantly affect the life cycle of these microchiropteran bat species or place any viable local populations of these species at risk of extinction.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of a large portion of hunting habitat for these microchiropteran bat species. This will equate to an area of approximately 10 ha of habitat.

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

No areas of habitat are likely to become fragmented, isolated from other areas of habitat due to the mobility of these bat species.

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

The proposed subdivision and subsequent development will result in the incremental decline in hunting habitat and limited roosting habitat for these microchiropteran bat species however taking the proposal for compensatory habitat offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for these microchiropteran bat species. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site will result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these microchiropteran bat species.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

17. Invertebrates

***Petalura gigantea* (Giant Dragonfly)**

Petalura gigantea (Giant Dragonfly) is a large dragonfly with a wingspan of more than 13cm. The species was known to occur in SE Australia, from Moss Vale to southern Queensland, although the only currently known population of the Giant Dragonfly is at Wingecarribee Swamp south-west of Sydney. It occupies permanent wetlands both coastal and upland. The larvae live in permanent long chambered burrows up to 1.5m long built under swamps and emerge from terrestrial entrances above water level at night to feed. The larval stage is considered to take from 10 to 30 years and the adults emerge from October to November and fly until late January. The adults however have a very limited dispersal due to a poor flying ability.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

No large dragonflies consistent with *Petalura gigantea* (Giant Dragonfly) were noted within the site during incidental surveys. However, it must be noted the survey was undertaken outside the time when this species would not be considered to have emerged from its larval form. The Giant Dragonfly is usually observed between October to late January. The Giant Dragonfly has been recorded nearby in the vicinity of the Horizons Golf Course (DECC Database, 2009). Suitable habitat was considered to be present within the wetter form of in the swamp forest in the north-west of the site.

The proposal subdivision and subsequent development will lead to the removal of virtually all suitable habitat from the site for this Dragonfly species. This will lead to an incremental reduction of habitat in the local area. However, considering the presence of large areas of suitable habitat in the local area and plan for compensatory offset habitat it is unlikely that the proposal would threaten the local population with immediate extinction by disrupting its breeding life-cycle of this Dragonfly species.

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

Not applicable.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all preferred hunting habitat for this Dragonfly bat species. This will equate to an area of approximately 1.2 ha of habitat.

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

No areas of habitat are likely to become fragmented, isolated for this Dragonfly species.

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

The proposed subdivision and subsequent development will result in the incremental decline in habitat for the Giant Dragonfly however taking the proposal for compensatory habitat offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Giant Dragonfly. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this Dragonfly recover in NSW. Actions pertinent to the site include:

- The maintenance of the hydrological regime of Swamp Forest Habitat.
- Prevent erosion and subsequent erosion of suitable habitat.

The proposal does not comply with a number of the priority actions however taking the plan for compensatory offset habitat and recommendations such as erosion and sediment control to protect suitable habitat in Mambo Swamp it is unlikely that the proposal will significantly compromise the Priority Action Plan.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation

from the site will result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this Dragonfly species.

- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees**: No hollow-bearing trees were noted within the site.

Other pertinent threats include the reduction in water quality within swamps the use of chemical such as herbicides or insecticides within or near swamps and grazing by stock within swamps.

Bibliography:

NSW National Parks and Wildlife Service (2002). *Threatened Species of the Upper North Coast of New South Wales*. NSW National Parks and Wildlife Service.

Theischinger, G. & Hawking, J. (2006). *The Complete Guide to Dragonflies of Australia*. CSIRO Publishing.

Wyong Shire Council. (1999). *Flora and Fauna Guidelines for Development*. Prepared by Wyong Shire Council.

17. Endangered Populations

***Dromaius novaehollandiae*—Emu population in the NSW Coast Bioregion and Port Stephens LGA**

The Emu, *Dromaius novaehollandiae,* is a very large flightless bird that is distributed broadly but patchily through NSW and elsewhere in Australia. It occupies a range of predominantly open habitats, including plains, grasslands, woodlands and scrubs, and may occur occasionally in forest. An isolated population of Emus occurs in the NSW North Coast Bioregion and Port Stephens LGA. The population is disjunct from other populations in the Sydney Basin and New England Tableland Bioregion. The population of Emus in the NSW North Coast Bioregion and Port Stephens LGA represents the north-eastern limit of the species in NSW.

Numbers of Emus in the NSW North Coast Bioregion and Port Stephens LGA have declined severely. The habitat of the Emus in the North Coast Bioregion and Port Stephens LGA has been reduced and fragmented as a result of agricultural and urban development, with consequent local extinctions. The population is threatened by further loss and fragmentation of habitat for suburban and rural development, inappropriate fire regimes, deliberate killing, predation of eggs and young by pigs, dogs and foxes, road kill and altered population dynamics.

The population of Emus in the NSW North Coast Bioregion and Port Stephens LGA is of significant conservation value as the last known population in north coastal NSW, and for the role that birds play in dispersing large seeds of native plant species over long distances (McGrath and Bass, 1999).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Not applicable.

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

Dromaius novaehollandiae was not recorded on site during the survey period. Only marginal habitat was considered to be available due to presence of urban development. There is also a lack of recent records of this species in the locality. Considering that only a relatively small amount of marginal habitat will be removed the proposal is considered unlikely to have a significant effect upon the long-term survival of these species within the local area.

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

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

Not applicable.

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

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

The subdivision and subsequent development will result in the removal of virtually all habitat for the Emu. This will equate to an area of approximately 7 ha of habitat.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action as the eastern portion of the site is surrounded by urban development and no additional areas of suitable habitat beside Mambo Wetland in the west occur in close proximity to the site. Additionally as the subsequent development will involve the removal of all suitable habitat from the site no fragments will be left in isolation.

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

The proposed subdivision and subsequent development will result in the incremental decline in marginal habitat for Emu. Taking the proposal for compensatory offsets it is considered that no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the aforementioned species. The proposal is not considered to compromise the Priority Action Statements (PAS) for these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to

the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of the majority of the vegetation from the site which will result in a small incremental reduction of habitat in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to the Emu.
- **Predation by the European Red Fox *Vulpes vulpes:*** *Vulpes vulpes* was observed within the site during the survey. This species would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** One Cat was captured during the trapping component of the survey. It was unclear whether the cat was feral or not, however Feral Cats would be considered likely to have some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.

References:

McGrath, R.J. and Bass, D. (1999). Seed dispersal by Emus on the NSW north-east coast. Emu **99**:248-252

NSW NPWS Scientific Committee (2002). Final Determination to list *Dromaius novaehollandiae* population in the NSW North Coast Bioregion and Port Stephens LGA—Endangered Population at: http://www.nationalparks.nsw.gov.au

APPENDIX B

FLORA SPECIES LIST

FLORA SPECIES LIST

The following list includes all species of vascular plants observed on site during fieldwork. It should be noted that such a list cannot be considered comprehensive, but rather indicative of the flora. It can take many years of flora surveys to record all of the plant species occurring within any area, especially plant species that are only apparent in some seasons such as orchids.

A number of species cannot always be accurately identified during a brief survey, generally due to a lack of suitable flowering and/or fruiting material. Any such species are identified as accurately as possible, and are indicated in the list thus:

* Specimens which could only be identified to genus level are indicated by the generic name followed by the abbreviation "sp.", indicating an unidentified species of that genus;

* Specimens for which identification of the genus was uncertain are indicated by a question mark ("?") placed in front of the generic, which is followed by the abbreviation "sp.";

* Specimens which could be accurately identified to genus level , but could be identified to species level with only a degree of certainty are indicated by a ("?") placed in front of the epithet.

Authorities for the scientific names are not provided in the list. These follow Harden (1991, 1992, 1993 and 2000). Names of families and higher taxa follow a modified Cronquist System (1981).

Introduced species are indicated by an asterisk ("*").

The following standard abbreviations are used to indicate subspecific taxa:

ssp. - subspecies
var.- variety
× - hybrid between the two indicated species

FAMILY *Scientific Name*	Common Name
SELAGINELLACEAE	
Selaginella uliginosa	
CLASS FILICOPSIDA (FERNS)	
BLECHNACEAE	
Blechnum indicum	Bungwall Fern
DAVALLIACEAE	
**Nephrolepis cordifolia*	Fishbone Fern
DENNSTAEDTIACEAE	
Histiopterus incisa	Batswing Fern
Pteridium esculentum	Bracken
DICKSONIACEAE	
Calochlaena dubia	False Bracken Fern
GLEICHENIACEAE	
Gleichenia microphylla	Coral Fern
SCHIZAEACEAE	
Cheilanthes sieberi ssp. *sieberi*	Mulga Fern
CLASS MAGNOLIOPSIDA (FLOWERING PLANTS)	
SUBCLASS LILIIDAE (Monocotyledons)	
ANTHERICACEAE	
Tricoryne elatior	Yellow Rush Lily
COMMELINACEAE	
Commelina cyanea	Scurvy Weed
CYPERACEAE	
Caustis recurvata var. *recurvata*	
**Cyperus eragrostis*	Umbrella Sedge
Cyperus gracilis	Small Sedge
Gahnia clarkei	Saw Sedge
Gahnia sieberana	Red Fruit Saw-sedge
Lepidosperma flexuosum	Rapier Sedge
Lepironia articulata	Lepironia
Leptocarpus tenax	
LOMANDRACEAE	
Lomandra glauca	
Lomandra longifolia	Spiny Mat Rush
PHORMACEAE	
Dianella caerulea var. *producta*	Blue Flax Lily

POACEAE	
**Andropogon virginicus*	Whisky Grass
**Anthoxanthum odoratum*	Sweet Vernal Grass
**Axonopus affinis*	Narrowleaf Carpet Grass
**Briza maxima*	Quaking Grass
**Chloris gayana*	Rhodes Grass
**Cortaderia selloana*	Pampas Grass
Cynodon dactylon	Common Couch
Entolasia marginata	
**Eragrostis curvula*	African Lovegrass
Imperata cylindrica var. *major*	Blady Grass
**Panicum maximum*	Guinea Grass
**Paspalum dilatatum*	Paspalum
**Paspalum urvillei*	Vasey Grass
**Pennisetum clandestinum*	Kikuyu
**Melinis repens*	Red Natal Grass
Setaria sp.	Pigeon Grass
Themeda triandra	Kangaroo Grass
RESTIONACEAE	
Baloskion tetraphyllum ssp. *meiostachyum*	Tassel Cord-rush
XYRIDACEAE	
Xyris complanata	Feathered Yellow-eye

SUBCLASS MAGNOLIIDAE (Dicotyledons)

APIACEAE	
Actinotus helianthi	Flannel Flower
Centella asiatica	
**Hydrocotyle bonariensis*	Kurnell Curse
Hydrocotyle peduncularis	
Trachymene incisa ssp. *incisa*	
Xanthosia pilosa	Woolly Xanthosia
APOCYNACEAE	
Parsonsia straminea var.*straminea*	Monkey Rope
ASCLEPIADACEAE	
**Gomphocarpus fruticosus*	Narrow-leaf Cotton Bush
ASTERACEAE	
**Acanthospermum australe*	Starburr
**Ambrosia artemisiifolia*	Annual Ragweed
**Bidens pilosa*	Cobbler's Pegs
**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
**Cirsium vulgare*	Spear Thistle
**Conyza bonariensis*	Flaxleaf Fleabane
**Coreopsis lanceolata*	Coreopsis
**Gazania linearis*	Gazania
**Hypochoeris radicata*	Cat's Ear
**Senecio madagascariensis*	Fireweed
**Soliva pterosperma*	Bindii
**Sonchus oleraceus*	Common Sowthistle
**Tagetes minuta*	Stinking Roger

**Taraxacum officinale*	Dandelion
BIGNONIACEAE	
Pandorea pandorana	Wonga Vine
CAESALPINIACEAE	
Senna pendula	
CASSYTHACEAE	
Cassytha pubescens	Common Devil's Twine
CASUARINACEAE	
Allocasuarina littoralis	Black She-oak
Casuarina glauca	Swamp Oak
DILLENIACEAE	
Hibbertia fasciculata	
Hibbertia riparia	
Hibbertia scandens	Golden Guinea Flower
DROSERACEAE	
Drosera spathulata	Common Sundew
EPACRIDACEAE	
Astroloma pinifolium	Pine Heath
Brachyloma daphnoides	Daphne Heath
Epacris obtusifolia	
Epacris microphylla var. microphylla	Coral Heath
Epacris pulchella	Coral Heath
Leucopogon ericoides	Bearded Heath
Leucopogon lanceolatus	Lance Beard-heath
Monotoca elliptica	Tree Broom-heath
Sprengelia incarnata	Pink Swamp Heath
EUPHORBIACEAE	
Omalanthus populifolius	Bleeding Heart
Ricinocarpus pinifolius	Wedding Bush
FABACEAE	
Aotus ericoides	Aotus
Bossiaea heterophylla	Variable Bossiaea
Bossiaea rhombifolia ssp. *rhombifolia*	
Dillwynia retorta	Heathy Parrot Pea
Glycine clandestina	Love Creeper
Hardenbergia violacea	False Sarsaparilla
Kennedia rubicunda	Dusky Coral Pea
Phyllota phylicoides	Heath Phyllota
**Trifolium repens*	White Clover
Viminaria juncea	Golden Spray
HALORAGACEAE	
Gonocarpus teucrioides	Germander Raspwort
LAURACEAE	
**Cinnamomum camphora*	Camphor Laurel

LOBELIACEAE	
Pratia purpurascens	White Root
MALVACEAE	
**Sida rhombifolia*	Paddy's Lucerne
MENYANTHACEAE	
Villarsia exaltata	Erect Marsh Flower
MIMOSACEAE	
Acacia decurrens	Sydney Green Wattle
Acacia irrorata ssp*. irrorata*	
Acacia longifolia	Sydney Golden Wattle
Acacia saligna	Golden Wreath Wattle
Acacia suaveolens	Sweet-scented Wattle
Acacia ulicifolia	Prickly Moses
MYRTACEAE	
Angophora costata	Smooth-barked Apple
Callistemon citrinus	Crimson Bottlebrush
Callistemon pachyphyllus	Wallum Bottlebrush
Eucalyptus pilularis	Blackbutt
Eucalyptus robusta	Swamp Mahogany
Euryomyrtus ramosissima ssp. *ramosissima*	Rosy Baeckea
Kunzea ambigua	Tick Bush
Leptospermum polygalifolium	Lemon-scented Tea-Tree
Leptospermum juniperinum	Prickly-leaved Tea-tree
Leptospermum laevigatum	Coastal Tea-tree
Leptospermum liversidgei	
Leptospermum trinervium	Paperbark Tea-tree
Melaleuca quinquenervia	Broad-leafed Paperbark
Melaleuca thymifolia	Thyme Honey-myrtle
OLEACEAE	
**Fraxinus* sp.	
ONAGRACEAE	
**Ludwigia longifolia*	Long-leaf Willow Primrose
**Oenothera stricta* ssp. *stricta*	Common Evening Primrose
PITTOSPORACEAE	
Billardiera scandens var. scandens	Apple Berry
PLANTAGINACEAE	
**Plantago lanceolata*	Ribwort / Lamb’s Tongues
PROTEACEAE	
Banksia integrifolia	Coastal Banksia
Banksia robur	Swamp Banksia
Banksia serrata	Old Man Banksia
Conospermum taxifolium	Conospermum
Hakea teretifolia	Dagger Hakea
Isopogon anemonifolius	Drum Sticks
Persoonia lanceolata	Geebung
Persoonia levis	Smooth Geebung

RUBIACEAE	
Pomax umbellata	Pomax
RUTACEAE	
Boronia parviflora	Swamp Boronia
Eriostemon australasius	Pink Wax Flower
Zieria laevigata	Zieria
SANTALACEAE	
Exocarpus cupressiformis	Cherry Ballart
Leptomeria acida	Native Current
SAPINDACEAE	
Dodonaea triquetra	Common Hop Bush
SOLANACEAE	
**Solanum nigrum*	Blackberry Nightshade
THYMELAEACEAE	
Pimelea linifolia ssp*. linifolia*	Rice Flower
VERBENACEAE	
**Lantana camara*	Lantana
**Verbena bonariensis*	Purple Top
VITACEAE	
Cayratia clematidea	Native Grape

APPENDIX C

VEGETATION TRANSECT & PLOT DATA

C1.0 TRANSECT METHODOLOGY

Three walking transects were undertaken within the bounds of the site to provide detail on the floral assemblages occurring therein. The location of transects are shown in Figure C1.

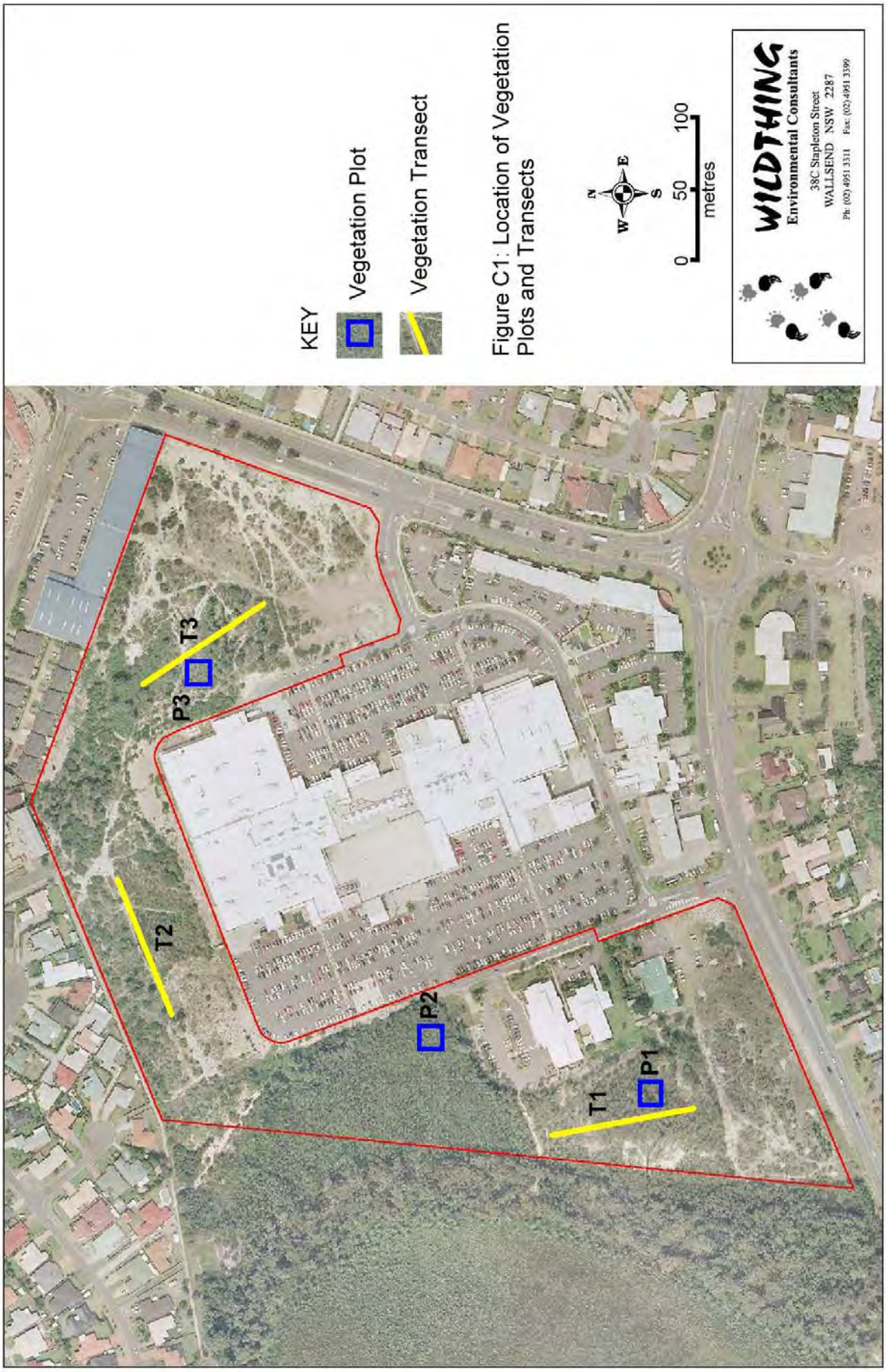
TRANSECT 1

*Community – Swamp Forest - Subject to less frequent inundation. West of Library

*Length – 100m
*Canopy – to 8m
*Aspect – level ground
*Soil Type - Sandy

Species Recorded –

Epacris pulchella	Coral Heath
Melaleuca quinquenervia	Broad-leafed Paperbark
Tricoryne elatior	Yellow Rush-lily
Gleichenia microphylla	Coral Fern
Caustis recurvata var*. recurvata*	
Angophora costata	Smooth-barked Apple
Eucalyptus robusta	Swamp Mahogany (seedling)
Dodonaea triquetra	Common Hop Bush
Xanthosia pilosa	Wooly Xanthosia
Epacris obtusifolia	
**Andropogon virginicus*	Whisky Grass
Leucopogon lanceolatus	Lance Beard-heath
Acacia longifolia	Sydney Golden Wattle
Callistemon pachyphyllus	Wallum Bottlebrush
Dillwynia retorta	Heathy Parrot Pea
Bossiaea rhombifolia ssp*. rhombifolia*	
Banksia serrata	Old Man Banksia
Gahnia clarkei	
Lepidosperma flexuosum	Rapier Sedge
Themeda triandra	Kangaroo Grass
Leptocarpus tenax	
Banksia integrifolia	Coastal Banksia
Leucopogon ericoides	Bearded Heath
Pimelea linifolia ssp*. linifolia*	Rice Flower
Xyris complanata	Feathered Yellow-eye


KEY
Vegetation Plot
Vegetation Transect
Figure C1: Location of Vegetation Plots and Transects
N
E
S
W
0
50
100
metres
WILDTHING
Environmental Consultants
38C Stapleton Street
WALLSEND NSW 2287
Ph: (02) 4951 3311 Fax: (02) 4951 3399
T1
T2
T3
P1
P2
P3

TRANSECT 2

*Community – Coastal Sand Woodland
*Length – 100m
*Aspect – level ground
*Soil Type - Sandy

Species Recorded –

**Andropogon virginicus*	Whisky Grass
Themeda triandra	Kangaroo Grass
**Melinis repens*	Red Natal Grass
Tricoryne elatior	Yellow Rush-lily
**Gazania linearis*	Gazania
**Axonopus affinis*	Narrowleaf Carpet Grass
Brachyloma daphnoides	Daphne Heath
Leptospermum laevigatum	Coastal Tea-tree
**Eragrostis curvula*	African Lovegrass
**Anthoxanthum odoratum*	Sweet Vernal Grass
**Coreopsis lanceolata*	Coreopsis
Ricinocarpus pinifolius	Wedding Bush
Bossiaea rhombifolia ssp*. rhombifolia*	
Persoonia lanceolata	Geebung
Allocasuarina littoralis	Swamp She-oak
Acacia longifolia	Sydney Golden Wattle
**Chloris gayana*	Rhodes Grass
**Oenothera stricta* ssp. *stricta*	Common Evening Primrose
Acacia saligna	Golden Wreath Wattle
Dodonaea triquetra	Common Hop Bush
**Briza maxima*	Quaking Grass
**Conyza bonariensis*	Flaxleaf Fleabane
**Hypochoeris radicata*	Cat's Ear
Acacia ulicifolia	Prickly Moses
**Chrysanthemoides monilifera* ssp*. rotundata*	Bitou Bush
Melaleuca quinquenervia	Broad-leafed Paperbark
Lomandra longifolia	Spiny Mat Rush
Pomax umbellata	Pomax
Entolasia marginata	
Callistemon pachyphyllus	Wallum Bottlebrush
Actinotus helianthi	Flannel Flower
**Acanthospermum australe*	Starburr
Leucopogon ericoides	Bearded Heath
Leptospermum trinervium	Paperbark Tea-tree
Glycine clandestina	Love Creeper
Eucalyptus robusta	Swamp Mahogany
Monotoca elliptica	Tree Broom-heath
Cheilanthes sieberi ssp. *sieberi*	Mulga Fern
Epacris pulchella	Coral Heath
Xanthosia pilosa	Woolly Xanthosia
Acacia suaveolens	Sweet-scented Wattle
Pteridium esculentum	Bracken
Billardiera scandens var. scandens	Apple Berry
Pimelea linifolia ssp*. linifolia*	Rice Flower
Dianella caerulea var*. producta*	Blue Flax Lily
**Lantana camara*	Lantana

TRANSECT 3

*Community – Coastal Sand Woodland.
*Length – 100m
*Aspect – level ground
*Soil Type - Sandy

Species Recorded –

**Chrysanthemoides monilifera* ssp*. rotundata*	Bitou Bush
**Melinis repens*	Red Natal Grass
Persoonia lanceolata	Geebung
Acacia ulicifolia	Prickly Moses
**Acanthospermum australe*	Starburr
Leptospermum laevigatum	Coastal Tea-tree
**Hypochoeris radicata*	Cat's Ear
Acacia saligna	Golden Wreath Wattle
Leucopogon ericoides	Bearded Heath
Leucopogon lanceolatus	Lance Beard-heath
**Andropogon virginicus*	Whisky Grass
**Chloris gayana*	Rhodes Grass
Bossiaea rhombifolia ssp*. rhombifolia*	
Themeda triandra	Kangaroo Grass
Eriostemon australasius	Pink Wax Flower
Acacia suaveolens	Sweet-scented Wattle
**Axonopus affinis*	Narrowleaf Carpet Grass
Monotoca elliptica	Tree Broom-heath
**Eragrostis curvula*	African Lovegrass
**Oenothera stricta* ssp. *stricta*	Common Evening Primrose
Lomandra longifolia	Spiny Mat Rush
**Conyza bonariensis*	Flaxleaf Fleabane

C2.0 PLOT METHODOLOGY

Three plot-based vegetation surveys were undertaken within the bounds of the site to provide additional detail on the flora assemblages present (Figure C1). The plot was 20 × 20m in area. All species observed within the quadrat were recorded, with the dominant species in each stratum being duly noted. A modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927, with selected modifications sourced from Poore 1955 and Austin *et al*. 2000) was used to estimate cover-abundances of all plant species within each plot. The cover-abundance categories are shown in Table C1.

Table C1: Modified Braun-Blanquet Crown Cover-abundance Scale

Class	Cover - Abundance	Notes
1	Few individuals (less than 5% cover)	Herbs, sedges and grasses: < 5 individuals Shrubs and small trees: 5 or more individuals
2	Many individuals (less than 5% cover)	Herbs, sedges and grasses: 5 or more individuals Medium-large over hanging tree
3	5 – < 20% cover	-
4	20 – < 50% cover	-
5	50 – < 75% cover	-
6	75 – 100% cover	-

PLOT 1

Community – Swamp Forest - Subject to less frequent inundation

*Aspect – Relatively Flat

*Structural Components –

Canopy	(to 8m)	%coverage = 40%
Shrub Layer	(to 3m)	%coverage = 35%
Ground Cover	(to 1m)	%coverage = 20%

*Species Recorded –

Canopy Dominants		
Melaleuca quinquenervia	Broad-leafed Paperbark	2
Shrub Layer Dominants		
Leptospermum juniperinum	Prickly-leaved Tea-tree	2
Epacris obtusifolia		2
Leucopogon lanceolatus	Lance Beard-heath	1
Persoonia lanceolata	Geebung	2
Ground Cover Dominants		
Tricoryne elatior	Yellow Rush-lily	2
Additional Species Recorded		
Leucopogon lanceolatus	Lance Beard-heath	1
Gonocarpus teucrioides	Germander Raspwort	1
Dodonaea triquetra	Common Hop Bush	1
Acacia longifolia	Sydney Golden Wattle	1
Acacia saligna	Golden Wreath Wattle	1
Pteridium esculentum	Bracken	1
Billardiera scandens var. scandens	Apple Berry	1
Pimelea linifolia ssp. *linifolia*	Rice Flower	1
Entolasia marginata		1
Drosera spathulata	Common Sundew	1
Callistemon pachyphyllus	Wallum Bottlebrush	1
Caustis recurvata var. *recurvata*		1
Gahnia clarkei		1
Xanthosia pilosa	Woolly Xanthosia	1
Cassytha pubescens	Common Devil's Twine	1
Boronia parviflora	Swamp Boronia	1
Euryomyrtus ramosissima ssp. *ramosissima*	Rosy Baeckea	1
Acacia ulicifolia	Prickly Moses	1
Themeda triandra	Kangaroo Grass	1
Leptocarpus tenax		1
Actinotus helianthi	Flannel Flower	1
Acacia suaveolens	Sweet-scented Wattle	1
Epacris pulchella	Coral Heath	1

PLOT 2

*Community – Swamp Forest - Subject to frequent and prolonged inundation.

*Aspect – Relatively Flat

*Structural Components –

Canopy	(to 8m)	%coverage = 30%
Shrub Layer	(to 3m)	%coverage = 70%
Ground Cover	(to 1m)	%coverage = 20%

*Species Recorded –

Canopy Dominants		
Melaleuca quinquenervia	Broad-leafed Paperbark	2
Shrub Layer Dominants		
Callistemon pachyphyllus	Wallum Bottlebrush	1
Ground Cover Dominants		
Gleichenia microphylla	Coral Fern	3
Gahnia sieberana	Swordrush	3
Baloskion tetraphyllum ssp. *meiostachyum*	Plume Rush	2
Additional Species Recorded		
Leptospermum juniperinum	Prickly-leaved Tea-tree	1
Hakea teretifolia	Dagger Hakea	1
Acacia longifolia	Sydney Golden Wattle	1
Leptocarpus tenax		1
Blechnum indicum	Bungwall Fern	1
Villarsia exaltata	Erect Marsh Flower	1
Baumea juncea		

PLOT 3

*Community – Coastal Sand Woodland

*Aspect – Relatively Flat

*Structural Components –

Canopy	(to 8m)	%coverage = 10%
Mid Layer	(to 4m)	%coverage = 5%
Shrub Layer	(to 2m)	%coverage = 15%
Ground Cover	(to 1m)	%coverage = 40%

*Species Recorded –

Canopy Dominants		
Eucalyptus robusta	Swamp Mahogany	1
Mid Layer Dominants		
Eucalyptus robusta	Swamp Mahogany	1
Melaleuca quinquenervia	Broad-leafed Paperbark	1
Shrub Layer Dominants		
Persoonia lanceolata	Geebung	2
Bossiaea rhombifolia ssp*. rhombifolia*		2
Ground Cover Dominants		
Themeda triandra	Kangaroo Grass	2
**Andropogon virginicus*	Whisky Grass	2
Pteridium esculentum	Bracken	4
Additional Species Recorded		
Tricoryne elatior	Yellow Rush-lily	1
Lomandra longifolia	Spiny Mat Rush	1
Pimelea linifolia ssp*. linifolia*	Rice Flower	1
Xanthosia pilosa	Woolly Xanthosia	1
Brachyloma daphnoides	Daphne Heath	1
Epacris pulchella	Coral Heath	1
Entolasia marginata		1
Leucopogon ericoides	Bearded Heath	1
Actinotus helianthi	Flannel Flower	1
Lomandra glauca		1
**Axonopus affinis*	Narrowleaf Carpet Grass	1
Astroloma pinifolium	Pine Heath	1
Acacia ulicifolia	Prickly Moses	1
Acacia saligna	Golden Wreath Wattle	1

APPENDIX D:
FAUNA LIST FOR THE STUDY AREA

EXPECTED FAUNA SPECIES LIST

Family sequencing and taxonomy follow for each fauna class:

Birds - Pizzey and Knight (1997).

Herpetofauna - Cogger (1996), Ehmann (Ed) (1997) and Barker, Grigg and Tyler (1995).

Mammals - Strahan (Ed) (1995) and Churchill (1998).

- Species observed or indicated by scats, tracks etc. on site during this investigation.

@ - Species recorded during previous surveys – Wildthing Environmental Consultants (1998).

#(?) - Indicates a species identified without certainty or to a Genus level only.

* - Indicates an introduced species.

Threatened species addressed within this assessment appear in **bold** font.

	SCIENTIFIC NAME	COMMON NAME
	Family Phasianidae - True Quails	
	Coturnix ypsilophora	Brown Quail
	Family Anatidae - Ducks, Swans and Geese	
	Cygnus atratus	Black Swan
	Anas castanea	Grey Teal
	Anas gracilis	Chestnut Teal
	**Anas platyrhynchos*	Mallard
	Anas superciliosa	Pacific Black Duck
	Chenonetta jubata	Australian Wood Duck
	Family Anhingidae - Darter	
	Anhinga melanogaster	Australian Darter
	Family Pelecanidae- Pelican	
	Pelecanus conspicillatus	Australian Pelican
	Family Ardeidae - Herons, Egrets and Bitterns	
	Ardea ibis	Cattle Egret
	Ardea alba	Great Egret
	Ardea intermedia	Intermediate Egret
	Botaurus poiciloptilus	**Australasian Bittern**
	Egretta novaehollandiae	White-faced Heron
	Ixobrychus flavicollis	**Black Bittern**
	Family Threskiornithidae - Ibises and Spoonbills	
	Platalea regia	Royal Spoonbill
#	*Threskiornis molucca*	Sacred Ibis
	Threskiornis spinicollis	Straw-necked Ibis
	Family Ciconiidae - Storks	
	Ephippiorhynchus asiaticus	**Black-necked Stork**
	Family Accipitridae - Osprey, Hawks, Eagles and Harriers	
	Accipiter fasciatus	Brown Goshawk
	Accipiter cirrhocephalus	Collared Sparrowhawk
	Accipiter novaehollandiae	Grey Goshawk
	Aquila audax	Wedge-tailed Eagle
	Aviceda subcristata	Pacific Baza
	Elanus notatus	Black-shouldered Kite
	Haliaeetus leucogaster	White-breasted Sea-Eagle

	SCIENTIFIC NAME	COMMON NAME
	Haliastur sphenurus	Whistling Kite
	Hieraaetus morphnoides	Little Eagle
	Pandion haliaetus	**Osprey**
	Family Falconidae - Falcons	
	Falco berigora	Brown Falcon
	Falco cenchroides	Nankeen Kestrel
	Falco longipennis	Australian Hobby
	Falco peregrinus	Peregrine Falcon
	Family Rostratulidae-Painted Snipe	
	Rostratula benghalensis australis	**Painted Snipe**
	Family Charadriidae - Plovers, Dotterels and Lapwings	
#	*Vanellus miles*	Masked Lapwing
	Family Columbidae - Pigeons, Doves	
	Chalcophaps indica	Emerald Dove
	Columba leucomela	White-headed Pigeon
	**Columba livia*	Feral Pigeon
	Geopelia humeralis	Bar-shouldered Dove
	Geopelia striata	Peaceful Dove
	Leucosarcia melanoleuca	Wonga Pigeon
	Lopholaimus antarcticus	Topknot Pigeon
#	*Macropygia amboinensis*	Brown Cuckoo-Dove
	Ocyphaps lophotes	Crested Pigeon
	Phaps chalcoptera	Common Bronzewing
@	**Streptopelia chinensis*	Spotted Turtle-Dove
	Family Cacatuidae - Cockatoos and Corellas	
#	*Cacatua galerita*	Sulphur-crested Cockatoo
#	*Cacatua roseicapilla*	Galah
	Cacatua sanguinea	Little Corella
	Cacatua tenuirostris	Long-billed Corella
#	*Calyptorhyncus funereus*	Yellow-tailed Black-Cockatoo
	Family Psittacidae - Parrots, Rosellas and Lorikeets	
	Alisterus scapularis	King Parrot
	Glossopsitta pusilla	Little Lorikeet
	Glossopsitta concinna	Musk Lorikeet
	Lathamus discolor	**Swift Parrot**
	Neophema pulchella	**Turquoise Parrot**
	Platycercus elegans	Crimson Rosella
#	*Platycercus eximius*	Eastern Rosella
#	*Trichoglossus chlorolepidotus*	Scaly-breasted Lorikeet
#	*Trichoglossus haematodus*	Rainbow Lorikeet
	Family Cuculidae - Cuckoos	
	Chrysococcyx basalis	Horsefield's Bronze-Cuckoo
	Chrysococcyx lucidus	Shining Bronze-Cuckoo
	Cuculus pallidus	Pallid Cuckoo
	Cacomantis flabelliformis	Fan-tailed Cuckoo
	Cacomantis variolosus	Brush Cuckoo
	Eudynamys scolopacea	Common Koel
	Scythrops novaehollandiae	Channel-billed Cuckoo
	Family Centropodidae - Pheasant Coucal	

	SCIENTIFIC NAME	COMMON NAME
	Centropus phasianinus	Pheasant Coucal
	Family Tytonidae - Barn Owls	
	Tyto alba	Barn Owl
	Tyto novaehollandiae	**Masked Owl**
	Family Strigidae - Hawk-Owls	
	Ninox connivens	**Barking Owl**
	Ninox boobook	Southern Boobook
	Ninox strenua	**Powerful Owl**
	Family Podargidae - Frogmouths	
	Podargus strigoides	Tawny Frogmouth
	Family Caprimulgidae - Nightjars	
	Eurostopodus mystacalis	White-throated Nightjar
	Family Aegothelidae - Owlet Nightjars	
	Aegotheles cristatus	Australian Owlet Nightjar
	Family Apodidae - Swifts	
	Apus pacificus	Fork-tailed Swift
	Hirundapus caudacutus	White-throated Needletail
	Family Alcedinidae - River Kingfishers	
	Ceyx azurea	Azure Kingfisher
	Family Halcyonidae - Tree Kingfishers	
#	*Dacelo novaeguineae*	Laughing Kookaburra
	Todiramphus sancta	Sacred Kingfisher
	Family Coraciidae - Rollers	
	Eurystomus orientalis	Dollarbird
	Family Pittidae - Pittas	
	Pitta versicolor	Noisy Pitta
	Family Climacteridae - Treecreepers	
	Climacterus picumnus victoriae	**Brown Treecreeper**
#	*Cormobates leucophaea*	White-throated Treecreeper
	Family Maluridae - Fairy-Wrens and Emu-Wrens	
	Malurus assimilis	Variegated Fairy-Wren
	Malurus cyaneus	Superb Fairy-Wren
	Family Pardalotidae - Pardalotes, Gerygones, Scrubwrens, Heathwrens and Thornbills	
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill
	Acanthiza lineata	Striated Thornbill
#	*Acanthiza nana*	Yellow Thornbill
#	*Acanthiza pusilla*	Brown Thornbill
	Acanthiza reguloides	Buff-rumped Thornbill
	Gerygone mouki	Brown Gerygone
	Gerygone olivacea	White-throated Gerygone
#	*Pardalotus punctatus*	Spotted Pardalote
	Pardalotus striatus	Striated Pardalote
	Sericornis citreogularis	Yellow-throated Scrubwren
	Sericornis frontalis	White-browed Scrubwren

	SCIENTIFIC NAME	COMMON NAME
	Sericornis magnirostris	Large-billed Scrubwren
	Family Meliphagidae - Honeyeaters	
	Acanthorhynchus tenuirostris	Eastern Spinebill
#	*Anthrochaera carunculata*	Red Wattlebird
#	*Anthrochaera chrysoptera*	Brush Wattlebird
	Entomyzon cyanotus	Blue-faced Honeyeater
	Lichenostomus chrysops	Yellow-faced Honeyeater
	Lichenostomous leucotis	White-eared Honeyeater
	Lichmera indistincta	Brown Honeyeater
#	*Manorina melanocephala*	Noisy Miner
	Manorina melanophrys	Bell Miner
	Meliphaga lewinii	Lewin's Honeyeater
	Melithreptus brevirostris	Brown-headed Honeyeater
	Melithreptus lunatus	White-naped Honeyeater
	Myzomela sanguinolenta	Scarlet Honeyeater
#@	*Philemon corniculatus*	Noisy Friarbird
	Phylidonyris novaehollandiae	New Holland Honeyeater
#@	*Phylidonyris nigra*	White-cheeked Honeyeater
	Plectorhyncha lanceolata	Striped Honeyeater
	Xanthomyza phrygia	**Regent Honeyeater**
	Family Petroicidae - Robins and Jacky Winter	
	Eopsaltria australis	Eastern Yellow Robin
	Microeca leucophaea	Jacky Winter
	Petroica rosea	Rose Robin
	Tregellasia capito	Pale-Yellow Robin
	Family Cinclosomatidae - Whipbird and Quail-thrushes	
	Psophodes olivaceus	Eastern Whipbird
	Family Neosittidae - Sitellas	
	Daphoenositta chrysoptera	Varied Sitella
	Family Pachycephalidae - Whistlers, Shrike-tit and Shrike-thrushes	
@	*Colluricincla harmonica*	Grey Shrike-thrush
	Falcunculus frontatus	Crested Shrike-tit
#	*Pachycephala pectoralis*	Golden Whistler
	Pachycephala rufiventris	Rufous Whistler
	Family Dicruridae - Monarchs, Flycatchers, Fantails, Drongo and Magpie-Lark	
	Dicrurus megarhynchus	Spangled Drongo
	Monarcha melanopsis	Black-faced Monarch
	Monarcha trivirgatus	Spectacled Monarch
	Myiagra cyanpleuca	Satin Flycatcher
	Myiagra inquieta	Restless Flycatcher
	Myiagra rubecula	Leaden Flycatcher
	Rhipidura fuliginosa	Grey Fantail
#	*Rhipidura leucophrys*	Willie Wagtail
	Rhipidura rufifrons	Rufous Fantail
#	*Grallina cyanoleuca*	Magpie-lark
	Family Campephagidae - Cuckoo-shrikes and Trillers	

	SCIENTIFIC NAME	COMMON NAME
#	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
	Coracina tenuirostris	Cicadabird
	Lalage leucomela	Varied Triller
	Family Oriolidae - Orioles and Figbird	
	Oriolus sagittatus	Olive-backed Oriole
	Sphecotheres viridus	Figbird
	Family Artamidae - Wood-swallows, Butcherbirds, Magpie and Currawongs	
@	*Artamus cyanopterus*	Dusky Woodswallow
	Artamus leucorhynchus	White-breasted Woodswallow
	Cracticus nigrogularis	Pied Butcherbird
#	*Cracticus torquatus*	Grey Butcherbird
#@	*Gymnorhina tibicen*	Australian Magpie
#	*Strepera graculina*	Pied Currawong
	Family Paradiseaidae - Birds of Paradise	
	Ptiloris paradiseus	Paradise Riflebird
	Family Corvidae - Crows, Raven	
#	*Corvus coronoides*	Australian Raven
	Family Corcoracidae - Mudnest-builders	
	Corcorax melanorhamphos	White-winged Chough
	Family Ptilinorhynchidae - Bowerbirds	
	Ptilinorhynchus violaceus	Satin Bowerbird
	Family Motacillidae - Pipits and Wagtails	
	Anthus novaseelandiae	Richard's Pipit
	Family Passeridae - Sparrows, Grassfinches, Mannikins	
#	*Neochmia temporalis*	Red-browed Finch
	Lonchura castaneothorax	Chestnut-breasted Mannikin
	**Passer domesticus*	House Sparrow
	Poephila bichenovii	Double-barred Finch
	Poephila guttata	Zebra Finch
	Family Fringillidae - Other Finches	
	**Carduelis carduelis*	European Goldfinch
	Family Dicaeidae - Flowerpeckers	
	Dicaeum hirundinaceum	Mistletoebird
	Family Hirundinidae - Swallows and Martins	
	Cecropis ariel	Fairy Martin
	Cecropis nigricans	Tree Martin
#	*Hirundo neoxena*	Welcome Swallow
	Family Sylvidae - Old World Warblers	
	Cisticola exilis	Golden-headed Cisticola
	Megalurus gramineus	Little Grassbird
	Megalurus timoriensis	Tawny Grassbird
	Family Zosteropidae - White-eyes	
	Zosterops lateralis	Silvereye

	SCIENTIFIC NAME	COMMON NAME
	Family Muscicapidae - Thrushes	
	Zoothera lunulata	Bassian Thrush
	Zoothera heinei	Russet-tailed Thrush
	Family Sturnidae - Starlings and Mynas	
#	**Acridotheres tristis*	Common Myna
	**Sturnus vulgaris*	Common Starling
	AMPHIBIANS	
	Family Myobatrachidae - 'Southern Frogs'	
#@	***Crinia tinnula***	**Wallum Froglet**
#	*Crinia signifera*	Common Eastern Froglet
	Limnodynastes dumerilii	Eastern Banjo Frog
	Limnodynastes ornatus	Ornate Burrowing Frog
#	*Limnodynastes peronii*	Striped Marsh Frog
	Limnodynastes tasmaniensis	Spotted Grass Frog
	Mixophyes fasciolatus	Great Barred Frog
#	*Paracrinia haswelli*	Haswell's Froglet
	Pseudophryne bibronii	Brown Toadlet
	Pseudophryne coriacea	Red-backed Toadlet
	Uperoleia fusca	
	Uperoleia laevigata	Smooth Toadlet
	Family Hylidae - Tree Frogs	
	Litoria aurea	**Green and Golden Bell Frog**
	Litoria caerulea	Green Tree Frog
	Litoria chloris	Red-eyed Green Tree Frog
	Litoria dentata	Bleating Tree Frog
	Litoria fallax	Dwarf Tree Frog
	Litoria freycineti	Freycinet's Frog
	Litoria gracilenta	Dainty Tree Frog
#	*Litoria jervisensis*	Jervis Bay Tree Frog
	Litoria latopalmata	Broad-palmed Frog
	Litoria lesueuri	Lesueur's Frog
	Litoria nasuta	Rocket Frog
#	*Litoria peronii*	Peron's Tree Frog
	Litoria phyllochroa	Green Leaf Tree Frog
@	*Litoria tyleri*	Tyler's Tree Frog
	Litoria verreauxii	Verreaux's Tree Frog
	REPTILES	
	Family Chelidae - Tortoises	
	Chelodina longicollis	Eastern Snake-necked Tortoise
	Family Gekkonidae - Geckoes	
	Diplodactylus vittatus	Wood Gecko
	Oedura lesueurii	Lesueur's Velvet Gecko
	Underwoodisaurus milii	Thick-tailed Gecko
	Family Pygopodidae - Legless Lizards	
	Lialis burtonis	Burton's Snake-lizard
	Pygopus lepidopus	Common Scaly-foot
	Family Agamidae - Dragons	
	Amphibolurus muricatus	Jacky Lizard
	Physignathus lesuerii	Eastern Water Dragon

	SCIENTIFIC NAME	COMMON NAME
	Pogona barbata	Eastern Bearded Dragon
	Family Varanidae - Monitors	
	Varanus gouldii	Gould's Monitor
	Varanus varius	Lace Monitor
	Family Scinidae - Skinks	
	Carlia tetradactyla	Rainbow Skink
	Carlia vivax	Tussock Rainbow Skink
	Cryptoblepharus virgatus	Wall Lizard
#	*Ctenotus robustus*	Striped Skink
#	*Ctenotus taeniolatus*	Copper-tailed Skink
#	*Egernia major*	Land Mullet
	Egernia modesta	
	Egernia saxatilis	Black Rock Skink
	Eulamprus heatwolei	Southern Water Skink
	Eulamprus quoyii	Eastern Water Skink
	Eulamprus tenuis	
	Hemisphaeriodon gerrardii	Pink-tongued Lizard
#	*Lampropholis delicata*	Grass Skink
	Lampropholis guichenoti	Garden Skink
	Lygisaurus foliorum	
	Pseudomoia platynota	Red-throated Skink
	Saiphos equalis	Three-toed Skink
	Saproscincus mustelinus	Weasel Skink
	Tiliqua scincoides	Eastern Blue-tongued Lizard
	Family Typhlopidae - Blind Snakes	
	Ramphotyphlops nigrescens	
	Ramphotyphlops proximus	
	Ramphotyphlops wiedii	
	Family Boidae - Pythons	
	Morelia spilota	Carpet (Diamond) Python
	Family Colubridae	
	Boiga irregularis	Brown Tree Snake
	Dendralaphis punctulata	Green Tree Snake
	Family Elapidae - Venomous Snakes	
	Acanthopis antarcticus	Death Adder
	Cacophis krefftii	Dwarf Crowned Snake
	Cacophis squamulosus	Golden Crowned Snake
	Demansia psammophis	Yellow-faced Whip Snake
	Furina diadema	Red-naped Snake
	Hemiaspis signata	Black-bellied Swamp Snake
	Notechis scutatus	Eastern Tiger Snake
	Pseudechis guttatus	Spotted Black Snake
	Pseudechis porphyriacus	Red-bellied Black Snake
	Pseudonaja textilis	Eastern Brown Snake
	Rhinoplocephalus nigrescens	Eastern Small-eyed Snake
	Vermicella annulata	Bandy Bandy
	MAMMALS	
	Family Tachyglossidae - Echidna	
	Tachyglossus aculeatus	Echidna

	SCIENTIFIC NAME	COMMON NAME
	Family Dasyuridae - Dasyurids	
#	*Antechinus stuartii*	Brown Antechinus
	Planigale maculata	Common Planigale
	Phascogale tapoatafa	**Brush-tailed Phascogale**
	Sminthopsis murina	Common Dunnart
	Family Peramelidae - Bandicoots	
	Isoodon macrourus	Northern Brown Bandicoot
	Perameles nasuta	Long-nosed Bandicoot
	Family Phascolarctidae - Koala	
#	***Phascolarctos cinereus***	**Koala**
	Family Petauridae - Gliders	
	Petaurus australis	**Yellow-bellied Glider**
	Petaurus breviceps	Sugar Glider
	Petaurus norfolcensis	**Squirrel Glider**
	Family Pseudocheiridae - Ringtail Possums and Greater Glider	
	Petauroides volans	Greater Glider
	Pseudocheirus peregrinus	Common Ringtail Possum
	Family Acrobatidae - Feathertail Glider	
	Acrobates pygamaeus	Feathertail Glider
	Family Phalangeridae - Brushtail Possums	
	Trichosurus vulpecula	Common Brushtail Possum
	Family Burramyidae	
	Cercartetus nanus	**Eastern Pygmy Possum**
	Family Macropodidae - Kangaroos, Wallabies	
	Macropus giganteus	Eastern Grey Kangaroo
	Macropus rufogriseus	Red-necked Wallaby
	Thylogale thetis	Red-necked Pademelon
	Wallabia bicolor	Swamp Wallaby
	Family Pteropodidae - Fruit Bats	
	Pteropus poliocephalus	**Grey-headed Flying-fox**
	Pteropus scapulatus	Little Red Flying-fox
	Family Rhinolophidae - Horseshoe-bats	
	Rhinolophus megaphyllus	Eastern Horseshoe-bat
	Family Emballonuridae - Sheathtail-bats	
	Saccolaimus flaviventris	**Yellow-bellied Sheathtail-bat**
	Family Molossidae - Freetail-bats	
	Mormopterus norfolkensis	**Eastern Freetail-bat**
	Mormopterus sp.	Freetail-bat sp.
	Nyctinomus australis	White-striped Freetail-bat
	Family Vespertilionidae - Plain-nosed Bats	
	Chalinolobus dwyeri	Large-eared Pied Bat
#	*Chalinolobus gouldi*	Gould's Wattled bat
#?	*Chalinolobus morio*	Chocolate Wattled Bat
	Falsistrellus tasmaniensis	**Eastern Falsistrelle**
	Miniopterus australis	**Little Bentwing-bat**

	SCIENTIFIC NAME	COMMON NAME
	Miniopterus schreibersii oceanensis	**Large Bentwing-bat**
	Myotis adversus	**Large-footed Myotis**
	Nycticeius greyii	Little Broad-nosed Bat
	Nyctophilus geoffroyi	Lesser Long-eared Bat
	Nyctophilus gouldii	Gould's Long-eared Bat
	Scoteanax rueppellii	**Greater Broad-nosed Bat**
	Scotorepens orion	Eastern Broad-nosed Bat
	Vespadelus darlingtoni	Large Forest Bat
	Vespadelus pumilus	Eastern Forest Bat
	Vespadelus regulus	Southern Forest Bat
	Vespaledus vulturnus	Little Cave Bat
	Family Muridae - Rodents	
	Hydromys chrysogaster	Water Rat
	Melomys burtoni	Grassland Melomys
#	**Mus musculus*	House Mouse
	Rattus fuscipes	Southern Bush Rat
#	*Rattus lutreolus*	Swamp Rat
	**Rattus norvegicus*	Brown Rat
	**Rattus rattus*	Black Rat
	Pseudomys novaehollandiae	New Holland Mouse
	Family Canidae	
@	**Vulpes vulpes*	Red Fox
#	**Canis familiaris*	Dog
	Canis familiaris dingo	Dingo
	Family Felidae	
#	**Felis catus*	Cat
	Family Leporidae	
	**Lepus capensis*	European Hare
	** Oryctolagus cuniculus*	European Rabbit

APPENDIX E:

ECOLOGICAL OFFSETS

1.0 INTRODUCTION

The ecological impact of the proposed subdivision, clearing and development of an area of Swamp Sclerophyll Forest Endangered Ecological Community (EEC) on Lot 284 has been seen to have the potential to be ameliorated by the provision of ecological offsets on other land controlled by Port Stephens Council. This Appendix is intended to investigate this offset possibility and to apply a rigorous process that will indicate the validity of the offset proposal.

As described in the main body of the report, Lot 284 supports approximately 3 ha of Swamp Sclerophyll Forest. It is intended to offset the loss of this EEC by the dedication of mature, functioning and good condition EEC on a nearby parcel of land (Lot 21 DP1044009) on the southern side of Salamander Way.

1.1 BACKGROUND TO BIODIVERSITY OFFSETS

The philosophical basis of a 'biodiversity offset' lies in the amelioration of the ecological impact of an activity by the preservation and perpetual management of an area of land that provides an equivalent (or better) ecological asset. The land offered as an offset is not land already preserved through being National Park of Ecological Reserve.

In a land development context, this has been espoused in the biobanking approach being established by the Department of Environment and Climate Change (DECC). Biobanking is intended to provide a means to purchase offset 'credits' on areas of land not owned by the developer requiring the offset.

In this case Port Stephens Council has available land, held by it in fee simple on Lot 21, which supports an extensive area of vegetation mapped as the same EEC as that proposed to be cleared (National Parks and Wildlife Service, date).

1.2 PRINCIPLES OF IMPACT AMELIORATION BY PROVISION OF OFFSETS

There are 13 principles promoted by DECC as being applicable to the consideration of the amelioration of ecological impact by the provision of offsets. These principles have been applied to this proposal below in Section XX.

2.0 EVALUATION OF THE IMPACTED SITE

2.1 DESCRIPTION OF LOT 284

A detailed description of the land subject to impact (Lot 284) and its ecological attributes has been given in the main body of the report. That description leads to a classification of the areas of the EEC present according to their condition.

2.2 CONDITION OF THE VEGETATION

Perceptions of the condition of bushland may be subjective and an assessment of condition in this context must be based upon reproducible criteria. The hydrological and edaphic conditions present in wallum country often impose limitations on the growth of *Eucalyptus robusta* and *Melaleuca quinquenervia,* with indications, such as stunting and die-back, that the trees are subject to high levels of stress. This poor condition of the most obvious plants in the Swamp Sclerophyll Forest does not reflect the ecological condition of the EEC. The distribution and condition of these trees represent the dynamic hydrology of the locality. They may flourish during drought years only to succumb to the permanent waterlogging of wetter years. Similarly their distribution may expand and contract reflecting a cycle of natural physical and ecological changes such as bushfire.

Other factors may have a level of impact on the biodiversity and should be considered in any evaluation of the condition the EEC, such as the quality of the water entering the wallum swamp as run off from developed areas and the incursion of weed species.

It is therefore proposed that an evaluation of the condition of the EEC on Lot 284 be based on the size and shape of the remnant, connectivity, degree of recent anthropogenic disturbance, input water quality and weed incursion.

The vegetation and habitat assessments in Sections 4.1 and 4.2.1 of the main report indicate that the swamp sclerophyll Forest present could be readily divided into three classifications:
<u>Swamp Forest – Subject to frequent and prolonged inundation.</u>

- Triangular, approximately 1.1ha in area, located to the north of the library carpark.
- Connected to similar habitat along the western and southern sides.
- Frequent inundation by runoff from Salamander Centre parking area.
- Runoff water probably contaminated by hydrocarbons etc.

- Minor weed incursion.
- Low, dense stand of *Melaleuca quinquenervia* (Broad-leaved Paperbark)
- Flora restricted to hydrophytic species, diversity moderate.
- Probably cleared in 1980's.
- Habitat for a wide range of swamp-dwelling fauna including Wallum Froglet.

Biodiversity classification of 'Good' applied to this area.

Swamp Forest – Subject to less frequent inundation

- Trapezoid, approximately 1.9ha to the west and south-west of the library.
- Connected to similar habitat along the western and northern sides.
- Dominated by a low relatively dense stand of *M. quinquenervia.*
- Moderately open, diverse understorey.
- No noticeable weed presence.
- Cleared in 1980's.
- Habitat for Wallum Froglet and narrow range of fauna

Although the vegetation did not appear to be as lush or dense as the Swamp Forest undergoing more frequent inundation, this area was floristically more diverse and has been given the same biodiversity condition classification of "good'.

Swamp Forest – Open Forest

- Small areas of Open Swamp Forest occurring on higher ground beside car park.
- Connected to similar habitat to west.
- Dominated by taller specimens of *M. quinquenervia* than other areas of swamp Forest.
- Minor weed incursion.
- Diverse understorey.
- Probably cleared in 1980's.
- Habitat for a wide range of swamp-dwelling fauna including Wallum Froglet.
- Presence of *E. robusta* indicates preferred Koala habitat.

Being of diverse structure and composition, this small area has been classified as being of 'Very Good' condition.

3.0 EVALUATION OF THE OFFSET SITE

3.1 DESCRIPTION OF LOT 21

Lot 21 consists of approximately 93 ha of land lying south of residential development along salamander Way. It contains remnants of aeolian Pleistocene dunes interspersed with acidic swamps. Some of the remnant dunes were mined for mineral sands prior to the 1970's but this activity generally did not have a great effect on the wetlands. Some areas of this land presently show some anthropogenic impact through the dumping of refuse and extending gardens into the bushland but these are mostly limited to land immediately adjacent to residential development.

3.2 CONDITION OF THE VEGETATION

The REMS vegetation mapping shows considerable areas of this Lot as a community that may be interpreted as Swamp Sclerophyll Forest however, this mapping was seen to be inaccurate and the site has been remapped by interpretation of current air photos and ground truthing. The type and distribution of the Endangered Ecological Communities comprising these wetlands are given in FigureE1.

While the vegetation communities present show the effects of continuing inundation noted in Section A2.2 above, these wetlands are considered to be in pristine condition. Photos of the wetland communities on the site are given in Figures E2 – E5.

It is estimated that this site supports approximately 40 ha of Swamp Sclerophyll Forest and 8 ha of associated Fresh Water Wetland.

This land is rectangular in shape being approximately 1,700 m long by an average of 550 m wide. It adjoins similar land, making the habitats on the site contiguous with similar habitat over more than 2,000 m of the southern and eastern boundaries.

4.0 APPLICATION OF THE PRINCIPLES OF OFF BIODIVERSITY OFFSETS

The potential to ameliorate the impact of the proposed development on lot 284 has been investigated by the application of the principles of offsets described in Section A1.2 above. Each of these principles is given below in italics followed by a statement indicating how this proposal is seen to address this principle.

Figure E1 – Distribution of Endangered ecological communities on lot 21 DP1044009

Figure E2 – Freshwater Wetland

Figure E3 – Swamp Sclerophyll Forest

Figure E4 – Regenerating Swamp Sclerophyll Forest

Figure E5 – Possibly planted Swamp Sclerophyll Forest

1. Impacts must be avoided first by using prevention and mitigation measures. Offsets are then used to address remaining impacts.

Lot 284 has been zoned for commercial purposes for over 25 years. It represents the only land providing for viable commercial development in the locality. Consideration was given to the possibility of developing part of Lot 284, leaving the Swamp Forest. This would mean that the existing unsatisfactory disposal of storm water from the parking area into the Swamp Forest, and subsequently into Mambo Wetland would continue. The loss of the small area of Swamp Forest on Lot 284 is seen a small sacrifice which would provide an opportunity to correct the storm water disposal regime at the time of the development of the land according to its zoned purpose.

2. All regulatory requirements must be met.

All regulatory requirements with regard to the EPA Act, TSC Act and the NV Act have been met.

3. Offsets must never reward ongoing poor performance

This proposal is not seen to represent poor performance in planning, ecology or engineering. It is rather seen to be addressing past mistakes.

4. Offsets will complement other government programs.

The perpetual preservation of the wetlands on Lot 21 is seen to complement programs designed to protect threatened and migratory species covered by State and Federal legislation.

5. Offsets must be underpinned by sound ecological principles.

This proposal is based upon the retention of areas of habitat that are of crucial importance to native species generally and threatened species in particular by the preservation of a broad area of wetland habitat with substantial connectivity to adjoining similar habitat

6. Offsets should aim to result in a net improvement in biodiversity over time.

It is believed that this proposal will enforce the management of an ecological asset producing a net improvement in biodiversity.

7. Offsets must be enduring , they must offset the impact of the development for the period that the impact occurs.

This offset arrangement is intended to be perpetual.

8. Offsets should be agreed prior to the impact occurring.

This is the case

9. Offsets must be quantifiable; the impacts and benefits must be reliably estimated.

This has been done

10. Offsets must be targeted. They must offset impacts on the basis of like-for-like or better conservation outcome.

The offsets proposed represent the preservation of the same vegetation community and habitat as that to be impacted. The quality of the habitat offered as offset is slightly better than that to be impacted and it is recommended that the area offered be 4 times that to be impacted i.e. 8 ha as an offset for 2 ha to be impacted.

11. Offsets must be located appropriately.

Lot 21 is close by Lot 284 and both constitute a part of the one contiguous area of habitat divided only by a road (salamander Way)

12. Offsets must be supplementary.

This offset represents the preservation of an area of land constrained by supporting an EEC but not otherwise excluded from development.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

The offsets offered will be enforceable.

4.1 AREA TO BE PRESERVED AS AN OFFSET

The 'Biometric' program used as a tool to determine the biodiversity in property vegetation plans (Gibbons *et al*, 2005) provides a means of determining the amount of land required as an offset for development. The Biometric tool appears to be designed for broad scale

clearing, is complex and requires substantial data input that is unwieldy in application to small areas. In conjunction with others the authors of the Biometric tool have published a simpler method (Gibbons *et al*, 2009) more appropriate to small sites, particularly where a 'like for like' offset is available. Their determination of the area to be provided as offset as a multiplier of the area to be cleared is given graphically in Figure E1 below.

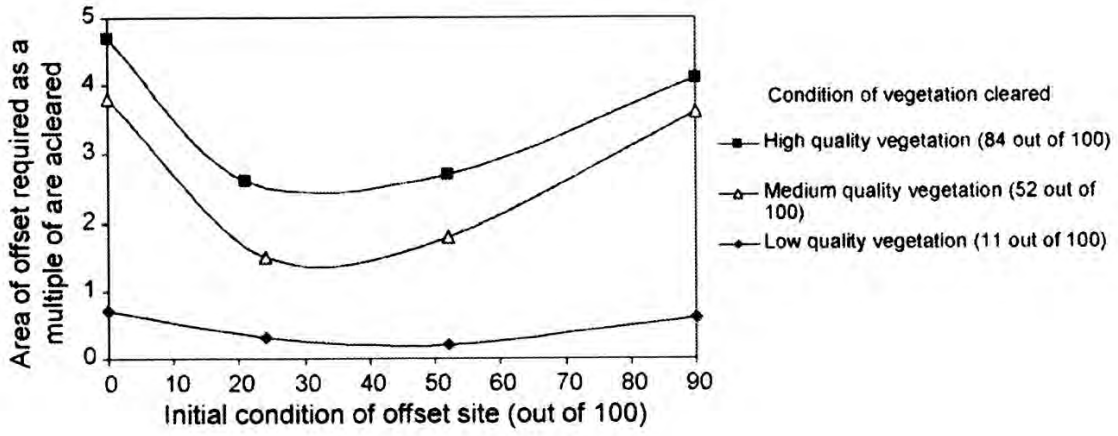


Figure E1 – The area of offset required as a multiple of the area cleared (Gibbons *et al*, 2009)

As may be seen from this figure, for a site with a very high vegetation condition (*x* axis), an offset of similarly high quality requires a multiplier of 4 times the area to be cleared (*y* axis). As a consequence it is proposed that the 3 ha of Swamp Sclerophyll Forest on proposed lots 2, 3 and 4 be offset by the preservation of 12 ha of the same community on Lot 21. It is not proposed that any offset is required for the remaining 9 ha of disturbed vegetation on Lot 284.

5.0 SUMMARY OF ASSESSMENT

The basic aim of providing an offset is to provide a result that is seen to be a 'same or better' ecological outcome. In this case the offset has been determined to be of similar geomorphology, hydrology, and soil. The offset entails the preservation of very similar land and habitat, in equivalent or better condition, with similar connectivity for significant flora and fauna to the impacted land, and the offset area being 4 times the area of the impacted land. The two sites are in close proximity to each other and are likely to support similar

populations of native flora and fauna.

It has been demonstrated that the principles of biodiversity offsets have been addressed. In particular, it is seen that Principle 10, the requirement for a 'like-for-like' or better conservation outcome has been satisfied.

Lot 21 supports much more of the habitat subject to this offset than is required in this instance. The excess of Swamp Sclerophyll Forest beyond that required for this offset and the Fresh Water Wetland should be regarded as an ecological banking available for other offsets.

6.0 CONCLUSION

It is believed that this proposal represents reasonable, appropriate and effective conservation planning. It demonstrates that the proposed compensatory offset meets the "improve or maintain" outcome for biodiversity values.

To give effect to this offset proposal, it will be necessary to prepare a legal means of ensuring the preservation of the offset land agreement in the form of a Voluntary Planning Agreement (VPA) or Deed of Agreement may be between the Council and DECC to give effect to the offset. This agreement would relate to issues concerning the form of preservation of the offset land and the mechanism for utilising the remaining EEC credits.

APPENDIX F

SEPP 71 POLICY AIMS

The aims of SEPP 71 as stated in clause 2 of the policy are:

(a) *to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast, and*

(b) *to protect and improve existing public access to and along coastal foreshores to the extent that this is compatible with the natural attributes of the coastal foreshore, and*

(c) *to ensure that new opportunities for public access to and along coastal foreshores are identified and realised to the extent that this is compatible with the natural attributes of the coastal foreshore, and*

(d) *to protect and preserve Aboriginal cultural heritage, and Aboriginal places, values, customs, beliefs and traditional knowledge, and*

(e) *to ensure that the visual amenity of the coast is protected, and*

(f) *to protect and preserve beach environments and beach amenity, and*

(g) *to protect and preserve native coastal vegetation, and*

(h) *to protect and preserve the marine environment of New South Wales, and*

(i) *to protect and preserve rock platforms, and*

(j) *to manage the coastal zone in accordance with the principles of ecologically sustainable development (within the meaning of section 6 (2) of the Protection of the Environment Administration Act 1991), and*

(k) *to ensure that the type, bulk scale and size of development is appropriate for the location and protects and improves the natural scenic quality of the surrounding area, and*

(1) *to encourage a strategic approach to coastal management.*

APPENDIX G:

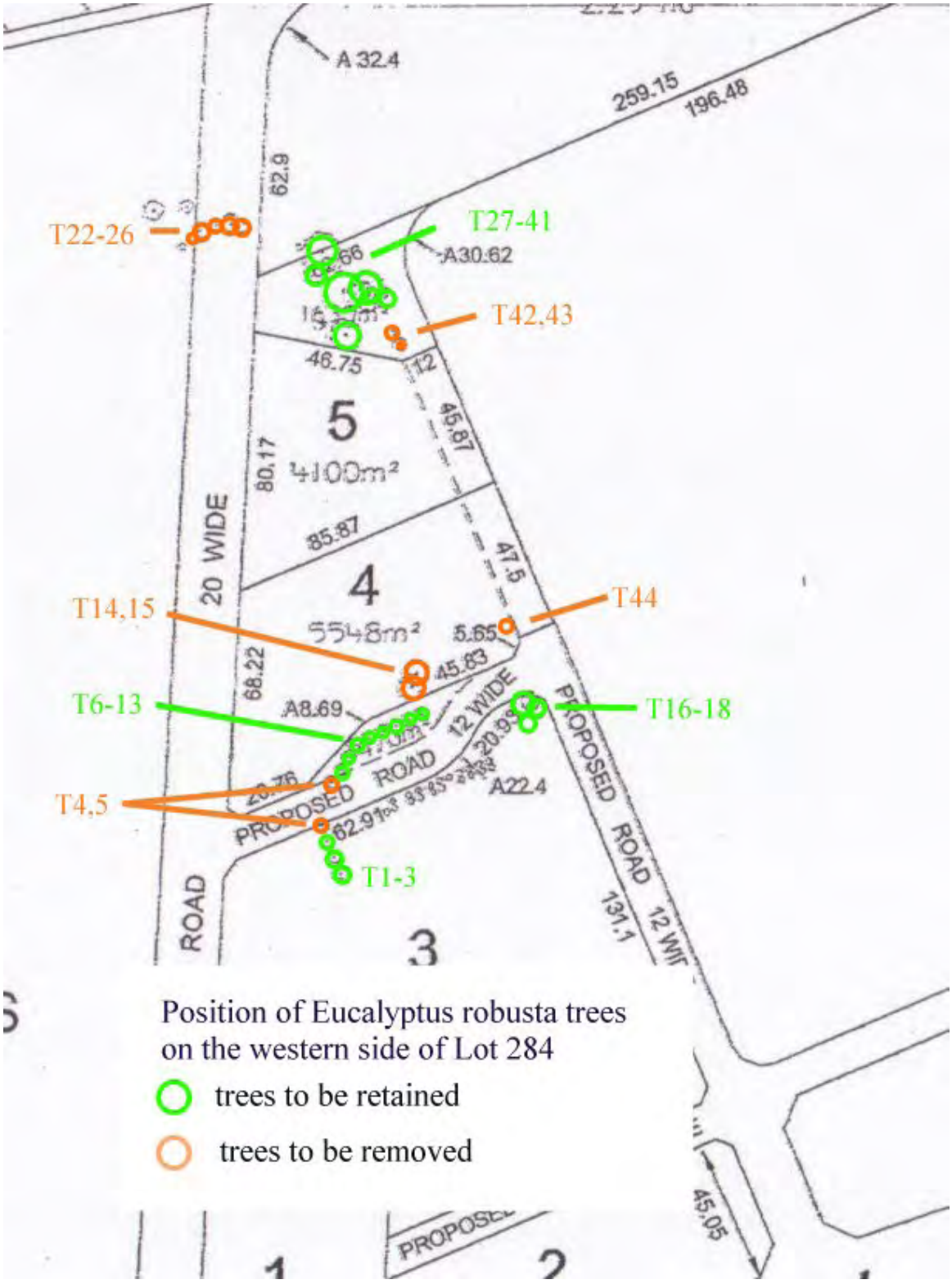
MAPPING OF *E. robusta* TREES

SALAMANDER BAY

TREES

TREE No	HEIGHT (M)	DBH (MM)	SPREAD (M)	POSITION
1	4.5	200	2	LIBRARY CAR PARK
2	6.5	300	3	
3	3.5	100	1.5	
4	6	200	2	
5	5.5	150	2.5	
6	5.5	200	3	
7	4	150	1.5	
8	5.5	250	3	
9	5.5	250	2.5	
10	5	250	3	
11	5	150	2.5	
12	4	150	2	
13	3.5	150	2.5	
14A	9	250	3.5	SWAMP NEAR CAR PARK
14B		200		
15A	8.5	250	5	
15B		200		
15C		150		
15D		100		
16	6	200	3.5	BESIDE ROAD
17	6	250	3	
18	5.5	300	2	
19	3	50	1.5	SWAMP AT NORTH-WESTERN END OF SITE(starting at extreme north-western corner)
20	5	200	2	
21	4.5	150	1.5	
22	4.5	50	1	
23	5	150	1.5	
24A	3.5	50	1.5	
24B	3.5	50		
25	4	150	1.5	
26A	4	200	2	
26B	3.5	150		

27A	3.5	50	1	
27B	3.5	50		
28	3.5	150	1.5	
29	3	50	1	
30	6	300	2.5	
31	6	400		
32A	6.5	450	3.5	
32B	6.5	300		
33	5.5	200	2.5	
34	5.5	150	2	
35	5.5	150	2	
36A	6.5	400	3	
36B	6.5	300		
37A	5	50	1.5	
37B	5	100		
38A	6	250	3	
38B	6	250		
39	6	200	1.5	
40	6	400	3	
41	5.5	200	2.5	
42	5	150	2	
43	4	50	1	
44	3	100	2	SOUTH OF DRAIN


A 32.4
259.15
196.48
62.9
T22-26
T27-41
A30.62
T42.43
46.75
5
4100m²
80.17
45.87
85.87
20 WIDE
4
5548m²
47.5
T14.15
T44
5.65
45.63
68.22
T6-13
A8.69
12 WIDE
T16-18
PROPOSED ROAD
20.99
A22.4
T4.5
PROPOSED
62.91
T1-3
ROAD
131.1
3
Position of Eucalyptus robusta trees
on the western side of Lot 284
trees to be retained
trees to be removed
45.05
PROPOSED
1
2