

Revised Flora and Fauna Assessment Proposed Subdivision

**Vacenta Pty Ltd,
Lot 682 DP 568678, Lot 705 DP 61385,
and Lot 810 DP 247285,
Manyana.**

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Executive Summary

This assessment was revised on the 22nd of February 2007 at the request of Bronwyn Seiden of Watkinson Apperley Pty Ltd in relation to matters raised by Shoalhaven Council in a letter dated 18th of January 2006. The revisions include the inclusion of *Allocasuarina littoralis* in the flora species list 'Table 4' and the inclusion on the Site Plan of the GPS identified hollow bearing trees and a Glossy Black Cockatoo feeding cone.

This Flora and Fauna Assessment investigates the potential impacts of a proposed residential development upon part of the subject land, Lots 682 (DP 568678), 705 (DP 61385) and 810 (DP 247285) Manyana, on flora and fauna, particularly in regard to threatened species, populations, their habitats and endangered ecological communities.

Surveys were undertaken in December 2004 and January 2005 and revealed that a variety of species were present upon the land, including evidence of the foraging of the Glossy Black Cockatoo, and observations of Grey-headed Flying-fox. Echolocation recordings were also made of four threatened microchiropteran bat species, namely the Eastern Freetail Bat, Eastern Bentwing Bat, Greater Broad-nosed Bat and Eastern False Pipistrelle. The proposed development will result in the removal of an area of foraging habitat for each of these species, however their populations in the local area will not be compromised as a result of the proposed development.

Two distinct vegetation communities were identified upon the land, with parts of these having been disturbed previously. The eastern side of the land is predominantly covered with a community that is floristically similar to the Endangered Ecological Community 'Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions'. The preservation and enhancement of the remaining area of this community, involving regeneration of vegetation on the southeastern area of the property forms part of the proposal and is likely to result in adequate conservation of the community on the subject land.

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1 Introduction

This Flora and Fauna Assessment was prepared by PMA Consulting (Engineering & Environmental) and was commissioned by *Watkinson Apperley Pty Ltd* on behalf of our client, *Vacenta Pty Ltd*, the owners of Lot 682 (DP 568678), Lot 705 (DP 61385) and Lot 810 (DP 247285) Manyana. A residential subdivision is proposed for portions of the land zoned as 2(a1) Residential "A1" Zone under the City of Shoalhaven Local Environmental Plan 1985 (Shoalhaven City Council (SCC), 1985).

This study aims to identify the type and distribution of ecological communities present on the property. The likely impacts of the proposed development on flora and fauna are considered, particularly in relation to species of conservation significance and endangered ecological communities within the region.

The assessment of the study site is based on the results of field surveys conducted on the 7th and 17th of December 2004 and between the 17th-20th January 2005, with nocturnal fauna surveys occurring on the three consecutive nights in January 2005. An additional site visit was undertaken on the 2nd June 2005.

This report aims to:

- Describe the type and distribution of vegetation on the site;
- Describe the fauna habitats constituted by the vegetation, rocky outcrops, drainage routes and soils on the site;
- Identify threatened species that have potential to occur on or utilise the site;
- Provide a list of the flora species and communities on the site;
- Provide a list of fauna recorded on the site;
- Assess the potential impact of the proposed development on threatened species, endangered populations and endangered ecological communities, and their habitats, by applying an 'eight part test' of significance, in accordance with the *Threatened Species Conservation Act 1995*;
- Assess the impact on potential koala habitat, under *State Environmental Planning Policy No. 44 - Koala Habitat Protection 1995*; and
- Make recommendations to minimise the potential impacts of the proposed development on the local flora and fauna.

The following pieces of legislation and environmental planning instruments are referred and adhered to in this report:

- Section 5A of the *Environmental Planning and Assessment Act* (1979);
- The *Threatened Species Conservation (TSC) Act* (1995);
- The *Environment Protection and Biodiversity Conservation Act* (1999);
- *State Environmental Planning Policy No. 44 - Koala Habitat Protection* (1995); and
- *City of Shoalhaven Local Environmental Plan* (with amendments) (1985)

2 Description of Proposal

The **subject land**, Lots 682 (DP 568678), 705 (DP 61385) and 810 (DP 247285), Manyana, form an irregular shaped parcel of land adjacent to the southern edge of the existing residential area of Manyana as designated by the bold line on the Aerial Photo (Appendix 1) and the Site Plan (Appendix 2). These indicate the existing attributes of the land. Parts of the subject land are zoned 2(a1) Residential "A1" Zone under the *City of Shoalhaven Local Environmental Plan 1985* (SCC, 1985) and it is proposed to form residential allotments within this area, which lies adjacent to the southern extent of the existing residential area of Manyana. The outline of the proposed residential allotments and configuration of roads are shown on the Post Development Site Plan (Appendix 3). 71 new residential allotments will be formed within the Residential Zone. A Sewer Pumping Station, which forms part of the Conjola Regional Sewerage Scheme, will be situated with access from Sunset Strip near to the Bulwark. This pumping station and associated structures have been subject to a Flora and Fauna Assessment by *Kevin Mills and Associates* (2004 and 2001). The unformed part of existing roads, 'The Barquette', 'The Bounty', 'Sunset Strip' and Manyana Drive will be extended to access the new residential allotments.

The Proposed Property Titles are indicated in Appendix 4, with the allotments along the western and northern sides to fall under Torrens Title, with those adjacent the residual land on the eastern side to become 'Community Title Neighbourhood Lots'. The residual land will become Community Association Property and as discussed further, this will be subject to a Vegetation Management Plan.

Characteristic of residential development, the proposed residential allotments are likely to be entirely cleared for building envelopes and Asset Protection Zones (APZ's) in accordance with Rural Fire Service Legislation. It is anticipated that the sewerage pumping station will also be cleared of vegetation. The Bushfire Protection Assessment for the proposed development undertaken by *PMA Consulting* (2005) has indicated that the minimum APZs, (consisting of an Inner Protection Area (IPA) and Outer Protection Area (OPA)), required for the proposed dwellings will be 30 m, consisting of an IPA of 20 m with an OPA of 10 m. The approximate extent of this required clearing for APZ's is indicated in the Post Development Site Plan (Appendix 3). These requirements will have an impact on the vegetation directly surrounding the building envelopes, however it must be noted that these APZ's will not necessarily be entirely cleared. According to *Planning for Bushfire Protection* (NSW Rural Fire Service (RFS), 2001), trees and shrubs can be present within the IPA provided that they:

- Do not touch or overhang the building;
- Are well spread out and do not form a continuous canopy;
- Are not species that retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period; and
- Are located far enough away from the house so that they will not ignite the house by direct flame contact or radiant heat emission.

Within the OPA, trees and shrubs should be maintained in such a manner that there is not continuous vegetation.

The remaining portion of land, covering most of the southeastern side of the subject land is to become 'Community Association Property' and proposed to be subject to bushland regeneration, as parts of the land, and subsequently the vegetation, is moderately to highly degraded. Most of this land is part of a regrowth area of the endangered ecological community 'Swamp Sclerophyll Forest on Coastal Floodplains' (as discussed further in this report). A Vegetation Management Plan is to be prepared for the land, with the aim to restore and enhance the disturbed areas of the community, along with protecting and conserving the remaining part of the endangered ecological community. The Community Title Neighbourhood Lots will provide support the ongoing maintenance of this community. Management of the OPA's for the Community Title Lots will be incorporated into the Vegetation Management Plan.

3 Environmental Setting

3.1 Location

The subject land is located at the southern extent of the existing residential area of Manyana at its boundary with Cunjarong Point, approximately 11 km by air north-northeast of Ulladulla on the South Coast of NSW. The subject land lies approximately 300 m west of Manyana Beach.

3.2 Geology and Topography

According to the *Ulladulla 1:250000 Metallogenic Map Sheet* (Harris, 1974), the subject land is underlain by Quaternary alluvium, gravel, swamp deposits, and sand along the eastern side. Undifferentiated Sediments consisting of gravel, sand, clay, quartzite, sandstone and conglomerate including the Titrango Creek Formation cover the remainder of the subject land and much of Manyana.

The topography of the land is very gentle with a drainage line situated along the northeastern side. The land is low-lying and below 20 m above sea level, with parts exposed to erosion and degradation.

3.3 Local Vegetation

The township of Manyana is essentially surrounded by Conjola National Park, which protects extensive areas of eucalypt forest and woodland extending to the north and west of the town. As indicated on the Manyana Aerial Photo (Appendix 1), areas of coastal heath and scrub and open forest extends along the hind dunes behind the beaches.

3.4 Landuse

Walking and vehicular tracks extend throughout the vegetation over the subject land as indicated on the Site Plan and Site Aerial photo (Appendices 1 and 2). A beach access is located at the southeastern boundary of the land, and a number of walking tracks extend towards this area from the northwest, east and south. The southeastern area of the land has been highly degraded through creation and use of "dirt bike" tracks, and this area contains channels and is highly eroded. Most of the vegetation on the land has been cleared at some stage historically and regrowth has occurred over most of the land. Some areas remain quite disturbed, and these areas are indicated on the Site Plan (Appendix 2), with many weed species and patches of bare earth present.

4 Threatened Species Literature Review

A literature review was conducted in an effort to identify threatened plant species or communities that are potentially present on the study site or in the local area, and threatened fauna species that potentially live on the site or at least utilise the site for foraging. Information was sought in regards to the preferred habitat of species of conservation significance including vegetation, topography and home range. A number of reference sources were utilised to gain information about threatened species and the principal references are listed as follows.

- The list of rare or threatened Australian plant species (ROTAP Species) by Briggs and Leigh (1996);
- The *Threatened Species Conservation Act (1995)*;
- The Atlas of NSW Wildlife (Department of Environment and Conservation (DEC) – formerly National Parks and Wildlife Service (NPWS), Data extracted: 7 December 2004); and
- The *Environment Protection and Biodiversity Conservation Act (1999)*.

4.1 Flora

A search of the Atlas of NSW Wildlife was undertaken for threatened plant species recorded within a 10 km radius of the study site. Only one species of conservation significance has been recorded within a 10 km radius of the site, namely the Leafless Tongue Orchid *Cryptostylis hunteriana*. Table 1 below summarises information in regards to this species and more detailed information is contained in Table A6-1 in Appendix 6.

Table 1: Threatened plant species recorded within a 10 km radius of the subject land.

Family	Name	Common Name	Status	ROTAP Code
ORCHIDACEAE	<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	3VC-

4.2 Fauna

A search of the NPWS Atlas of NSW Wildlife was undertaken for Threatened fauna species recorded within a 10 km radius of the subject land. Table 2 summarises species and legal conservation status with Table A6-2 in Appendix 6 providing information regarding the legal status, preferred habitat, known threats and information in regards to these species known distribution and presence within conservation reserves (where available). The table lists species in the following groups: Amphibians; Birds; Mammals (excluding Microchiropteran Bats); Microchiropteran Bats; and Marine Mammals.

Table 2: Threatened fauna recorded within a 10 km radius of the subject land.

Faunal Group	Common Name	Scientific Name	Status
AMPHIBIANS	Green and Golden Bell Frog	<i>Litoria aurea</i>	E1
BIRDS	Barking Owl	<i>Ninox connivens</i>	V
	Brown Treecreeper	<i>Climacteris picumnus</i>	V
	Eastern Bristlebird	<i>Dasyornis brachypterus</i>	E1
	Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	V
	Hooded Plover	<i>Thinornis rubricollis</i>	E1
	Little Tern	<i>Sterna albifrons</i>	E1
	Masked Owl	<i>Tyto novaehollandiae</i>	V
	Northern Giant-Petrel	<i>Macronectes halli</i>	V
	Osprey	<i>Pandion haliaetus</i>	V
	Pied Oystercatcher	<i>Haematopus longirostris</i>	V
	Pink Robin	<i>Petroica rodinogaster</i>	V
	Powerful Owl	<i>Ninox strenua</i>	V
	Regent Honeyeater	<i>Xanthomyza phrygia</i>	E1
	Shy Albatross	<i>Thalassarche cauta</i>	V
	Sooty Owl	<i>Tyto tenebricosa</i>	V
	Sooty Oystercatcher	<i>Haematopus fuliginosus</i>	V
	Sooty Tern	<i>Sterna fuscata</i>	V
	Square-tailed Kite	<i>Lophoictinia isura</i>	V
	Superb Fruit-Dove	<i>Ptilinopus superbus</i>	V
MAMMALS (EXCL MICROCHIROPTERANS)	Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V
	Koala	<i>Phascolarctos cinereus</i>	V
	Long-nosed Potoroo	<i>Potorous tridactylus</i>	V
	Southern Brown Bandicoot (eastern)	<i>Isodon obesulus obesulus</i>	E1

Faunal Group	Common Name	Scientific Name	Status
	Sperm Whale	<i>Physeter macrocephalus</i>	V
	Yellow-bellied Glider	<i>Petaurus australis</i>	V
MICROCHIROPTERAN BATS	Eastern Bent-wing Bat	<i>Miniopterus schreibersii oceanensis</i>	V
	Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V
MARINE MAMMALS	Australian Fur-seal	<i>Arctocephalus pusillus doriferus</i>	V
	Humpback Whale	<i>Megaptera novaeangliae</i>	V
	Southern Right Whale	<i>Eubalaena australis</i>	V

5 Survey Technique

5.1 Flora Survey

5.1.1 Plant Species

Vegetation communities were investigated through traversing the subject land. After initial determination of the vegetation communities present over the land, traverses were undertaken within each community with the aim to identify all plant species present. Voucher specimens were collected of plants unable to be identified on site, and these were subsequently identified using more detailed texts.

The flora survey sought to identify as many species on the subject land as possible. The list compiled from this audit is considered to be reasonably extensive, however cannot be assumed to be definitive. Problems may be encountered in detecting and identification of certain species as fruits, flowering parts and other defining characteristics of certain species are only present at particular times of the year. These factors must be taken into consideration when referring to the species list. Species of Conservation Significance are best targeted at times when they are most likely to be located and identified. Exotic species detected in the surveys are indicated in the species list and throughout the report with an asterisk.

5.1.2 Targeted Orchid Survey

It was confirmed with Mr John Briggs of the Department of Environment and Conservation, Queanbeyan, that the Leafless Tongue Orchid *Cryptostylis hunteriana* had been reported to be flowering in Vincentia, which lies to the north of the subject land near Jervis Bay, in early December 2004 (Pers comm., 6 Dec 2004). A targeted survey for the species was undertaken on the 7th of December and again on the 17th of December. This survey involved searches within the areas proposed to be developed. Random points were selected and recorded with a GPS and the area approximately 5 m surrounding each point was searched for the presence of the species. The orchid was also sought during general flora surveys in January throughout the subject land.

5.2 Habitat Assessment

Assessment of the habitat on the subject land was undertaken with the aim to detect areas of preferred habitat for threatened fauna species. Presence of known 'preferred habitat' can indicate species of threatened fauna and also flora species that may potentially utilise habitat on, or in the vicinity of the subject land even when not detected in surveys. The habitat assessment was used to assist with the consideration and determination of habitat features likely to be significant to the lifecycle requirements of any threatened fauna that may utilise the site.

Habitat features sought on the subject land included feed trees, rocky outcrops, habitat trees (i.e. mature trees exhibiting hollows suitable for bird and mammal occupation), waterways, drainage routes, habitat interconnections, caves, and areas of prolific flowering suitable for birds and small mammals.

5.3 Fauna Survey

The diurnal fauna survey was undertaken concurrently with the flora survey and habitat assessment on the 17th of December 2004 and on the 19th and 20th of January 2005. Nocturnal fauna surveys were undertaken after dark on three consecutive nights on the 17th, 18th and 19th of January 2005. Conditions were clear on the first two nights, with cloud cover present on the third night. Daytime temperature was on average 22°C during the day, falling to 17°C overnight. An additional site visit was undertaken on the 2nd June 2005. Table 3 summarises the survey effort undertaken for the fauna surveys and locations of survey sites are indicated on the Site Plan (Appendix 2).

Table 3: Fauna Survey Effort.

Method	Species Targeted	Date	Survey Effort/Time per day
Census and opportunistic	General: Amphibians, Reptiles, Birds, Mammals	17/12/2004	1.5 hours x 1 person
		18/01/2005	3 hours x 2 people
		19/01/2005	4 hours x 2 people
	Glossy Black-Cockatoo	20/01/2005	0.5 hours x 2 people
		2/6/2005	1 hour x 1 person
Spotlighting	General	17/01/2005	1.5 hours x 2 people
	Arboreal/Nocturnal Mammals	18/01/2005	2 hours x 2 people
	Mammals	19/01/2005	1.5 hours x 2 persons
Call Playback	Masked Owl	17/01/2005	1 hour
	Sooty Owl	18/01/2005	1 hour
	Powerful Owl		
	Barking Owl	19/01/2005	1 hour
Anabat™ II Ultrasonic Detection	Microchiropteran Bats	17/01/2005	Overnight
		18/01/2005	Overnight
		19/01/2005	Overnight
Habitat Searches	General	16/12/2004	1.5 hours x 1 person
	Mammals	18/01/2005	3 hours x 2 people
	Reptiles	19/01/2005	2 hour x 2 people
	Amphibians	2/6/2005	1 hour x 1 person

5.3.1 Amphibians

Amphibians were sought during the diurnal survey and frog calls listened for during the nocturnal surveys near to drainage lines and preferred habitat. The distinctive calls of the Green and Golden Bell Frog were sought in particular near to the drainage line on the northeastern side of the subject land.

5.3.2 Reptiles

Searches for reptiles were undertaken during the diurnal survey amongst leaf litter and around dead wood present on the site.

5.3.3 Birds

A diurnal bird census was undertaken with birds identified by sight or through recognition of their individual distinctive calls. Bird surveys were undertaken in the morning, evening and also opportunistically during the flora survey and habitat assessment over three consecutive days and also during the targeted orchid surveys in December 2004. Crushed cones, indicative of the feeding of Glossy Black Cockatoos were sought around Black She-oak *Allocasuarina littoralis* trees on the land.

Call playback targeting threatened owl species was undertaken over three consecutive evenings after dark. The calls of the Powerful Owl, Barking Owl, Sooty Owl and Masked Owl were each played separately with an interval of five minutes listening between and then replayed with listening repeated. The locations of the call playback sites are indicated on the Site Plan (Appendix 2).

5.3.4 Mammals (excluding bats)

Hollow-bearing trees, fallen trees, leaf litter and other potential habitat elements were investigated on the subject land during the diurnal survey for evidence of mammals including scats, tracks, burrows and diggings indicative of presence of species such as the Southern Brown Bandicoot and the Long-nosed Potoroo.

Call playback was undertaken over three consecutive nights targeting the Yellow-bellied Glider. The territorial calls of the Yellow-bellied Glider were played with an interval of five minutes listening, and then replayed.

Spotlighting was undertaken on foot using 800,000-candlepower spotlights. The approximate extent of spotlighting is shown on the Site Plan (Appendix 2). Potential habitat trees, fallen trees, dead wood and other elements of habitat were targeted.

Trap stations were set up at three non-random locations within the different vegetation communities. At each trap station, large and medium sized Elliot traps were set up. These were baited with a mixture of rolled oats, honey, peanut butter and vanilla essence and lined with nesting material to ensure the comfort of any species potentially trapped.

5.3.5 Microchiropteran Bats

An AnaBat™ II Bat Detector was placed in potential flyways on the subject land on three consecutive nights to record ultrasonic echolocation signals of microchiropteran bats. The position of these flyways is indicated on the Site Plan (Appendix 2).

5.4 Nomenclature

5.4.1 Flora

The botanical nomenclature in this report follows that published by the National Herbarium of New South Wales in the Flora of New South Wales (Harden 1990-93). Additionally current nomenclature was obtained online from PlantNET - The Plant Information Network System of Botanic Gardens Trust (BGT, 2005). Where possible the scientific names have been complimented by common names.

5.4.2 Fauna

Fauna cited in this report follow those in the following texts:

- *The Mammals of Australia* (Strahan, 1995);
- *Reptiles and Amphibians of Australia* (Cogger, 1992); and
- *Taxonomy and Species of Birds of Australia* (Christidis and Boles 1994).

6 Results

6.1 Flora

6.1.1 Plant Species Present

The plant species identified on and near to the subject land during the flora survey are listed in Table 4. No evidence was found of the presence of the Vulnerable Leafless Tongue Orchid *Cryptostylis hunteriana*, however two other members of the genus were found on the subject land as listed in the following table.

Table 4: Flora species discovered on and in the vicinity of the subject land.

Family	Scientific Name	Common Name
ADIANTACEAE	<i>Adiantum aethiopicum</i>	Maidenhair Fern
AGAVACEAE	<i>Agave sp.</i>	-
AIZOACEAE	<i>Carpobrotus glaucescens</i>	Pigface
ALLIACEAE	<i>Agapanthus praecox</i>	African Lily
ANTHERICACEAE	<i>Chlorophytum comosum</i> *	Ribbon Plant
CASUARINACEAE	<i>Allocasuarina littoralis</i>	Black She-oak
APIACEAE	<i>Hydrocotyle bonariensis</i> *	Pennywort
	<i>Trachymene incisa</i>	-
APOCYNACEAE	<i>Parsonsia straminea var. straminea</i>	Monkey Rope
ARACEAE	<i>Monstera deliciosa</i> *	Split Leaf Philodendron
ASPARAGACEAE	<i>Asparagus aethiopicus</i> *	Asparagus Fern
ASTERACEAE	<i>Chrysanthemoides monilifera subsp. rotundata</i>	Bitou Bush
	<i>Conyza sumatrensis</i> *	Tall Fleabane
	<i>Hypochaeris radicata</i> *	Flatweed
BLECHNACEAE	<i>Blechnum cartilagineum</i>	Gristle Fern
CASUARINACEAE	<i>Casuarina glauca</i>	Swamp Oak
CONVOLVULACEAE	<i>Dichondra repens</i>	Kidney Weed
	<i>Ipomoea cairica</i> *	-
	<i>Polymeria calycina</i>	Swamp Bindweed
CYATHEACEAE	<i>Cyathea australis</i>	Tree Fern
CYPERACEAE	<i>Gahnia clarkei</i>	Tall Saw-sedge
	<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge
	<i>Lepidosperma flexuosum</i>	-
	<i>Lepidosperma laterale</i>	Variable Sword-sedge
	<i>Ptilothrix deusta</i>	-
DENNSTAEDTIACEAE	<i>Pteridium esculentum</i>	Bracken
DICKSONIACEAE	<i>Calochlaena dubia</i>	Rainbow Fern
DILLENACEAE	<i>Hibbertia aspera</i>	Rough Guinea Flower
	<i>Hibbertia fasciculata</i>	-
ERICACEAE	<i>Leucopogon muticus</i>	Blunt Beard-heath
	<i>Monotoca scoparia</i>	-
EUPHORBIACEAE	<i>Breynia oblongifolia</i>	Coffeebush
	<i>Omalanthus populifolius</i>	Bleeding Heart
EUPOMATIACEAE	<i>Eupomatia laurina</i>	Bolwarra

Family	Scientific Name	Common Name
FABACEAE-CAESALPINOIDEAE	<i>Senna pendula</i> *	Senna
FABACEAE-FABOIDEAE	<i>Glycine microphylla</i>	Small-leaf Glycine
	<i>Pultenaea retusa</i>	-
	<i>Trifolium repens</i>	White Clover
FABACEAE-MIMOSOIDEAE	<i>Acacia falcata</i>	-
	<i>Acacia longifolia</i>	Sydney Golden Wattle
	<i>Acacia maidenii</i>	Maidens Wattle
	<i>Acacia myrtifolia</i>	Myrtle Wattle
	<i>Acacia parramattensis</i>	Parramatta Wattle
	<i>Acacia suaveolens</i>	Sweet Wattle
GENTIANACEAE	<i>Centaurium tenuiflorum</i> *	-
GERANIACEAE	<i>Geranium solanderi</i> var. <i>solanderi</i>	Cutleaf Cranesbill
GLEICHENIACEAE	<i>Gleichenia dicarpa</i>	Pouched Coral Fern
GOODENIACEAE	<i>Goodenia paniculata</i>	Branched Goodenia
IRIDACEAE	<i>Patersonia glabrata</i>	Leafy Purple-flag
JUNCACEAE	<i>Juncus pallidus</i>	-
LAURACEAE	<i>Cassytha pubescens</i>	Devil's Twine
LILIACEAE	<i>Blandfordia nobilis</i>	Christmas Bells
	<i>Thysanotus tuberosus</i>	Fringe Lily
LINDSAEACEAE	<i>Lindsaea linearis</i>	Screw Fern
LOMANDRACEAE	<i>Lomandra longifolia</i>	Spiny-headed Mat Rush
MENISPERMACEAE	<i>Stephania japonica</i>	Snake Vine
MYRTACEAE	<i>Corymbia gummifera</i>	Red Bloodwood
	<i>Eucalyptus botryoides</i>	Bangalay
	<i>Eucalyptus imitans</i>	Illawarra Stringybark
	<i>Eucalyptus pilularis</i> subsp. <i>pilularis</i>	Blackbutt
	<i>Eucalyptus sclerophylla</i>	Hard-leafed Scribbly Gum
	<i>Kunzea ambigua</i>	Tick Bush
	<i>Leptospermum continentale</i>	Prickly Teatree
	<i>Melaleuca ericifolia</i>	Swamp Paperbark
	<i>Melaleuca hypericifolia</i>	-
	<i>Syncarpia glomulifera</i>	Turpentine
OLEACEAE	<i>Ligustrum sinense</i> *	Small-leaf Privet
	<i>Notelea longifolia</i>	Mock Olive
ORCHIDACEAE	<i>Cryptostylis erecta</i>	Bonnet Orchid
	<i>Cryptostylis subulata</i>	Large Tongue Orchid
	<i>Dipodium punctatum</i>	-
PHORMIACEAE	<i>Dianella caerulea</i>	Blue Flax Lily
PINACEAE	<i>Pinus radiata</i> *	Radiata Pine
PITTOSPORACEAE	<i>Pittosporum revolutum</i>	Rough-fruit Pittosporum
	<i>Pittosporum undulatum</i>	Sweet Pittosporum
PLANTAGINACEAE	<i>Plantago lanceolata</i> *	Plantain
POACEAE	<i>Andropogon virginicus</i> *	Whisky Grass
	<i>Anisopogon avenaceus</i>	Oat Speargrass
	<i>Aristida vagans</i>	Three-awn Speargrass

Family	Scientific Name	Common Name
	<i>Austrodanthonia caespitosa</i>	Ringed Wallaby Grass
	<i>Briza maxima</i> *	Giant Shivery Grass
	<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	Bushy Hedgehog Grass
	<i>Ehrharta erecta</i> *	Panic Veldtgrass
	<i>Entolasia stricta</i>	Wiry Panic
	<i>Microlaena stipoides</i>	Weeping Grass
	<i>Oplismenus aemulus</i>	-
	<i>Panicum simile</i>	Two Colour Panic
	<i>Paspalum dilatatum</i>	Paspalum
	<i>Pennisetum clandestinum</i> *	Kikuyu
	<i>Themeda australis</i>	Kangaroo Grass
PROTEACEAE	<i>Banksia integrifolia</i>	Coastal Banksia
	<i>Banksia spinulosa</i> subsp. <i>spinulosa</i>	Hairpin Banksia
	<i>Hakea sericea</i>	Needlebush
	<i>Persoonia levis</i>	Broad-leaved Geebung
	<i>Persoonia linearis</i>	Narrow-leaved Geebung
	<i>Xylomelum pyriforme</i>	Woody Pear
RHAMNACEAE	<i>Alphitonia excelsa</i>	Red Ash
ROSACEAE	<i>Rubus discolor</i> *	Blackberry
	<i>Rubus laciniatus</i> *	Cut-leaf Blackberry
	<i>Rubus parvifolius</i>	Native Raspberry
	<i>Rubus ulmifolius</i> *	Blackberry
RUBIACEAE	<i>Coprosma repens</i> *	Mirror bush
SAPINDACEAE	<i>Dodonaea triquetra</i>	Large-leaf Hop-bush
VERBENACEAE	<i>Lantana camara</i> *	Lantana
	<i>Verbena bonariensis</i> *	Purpletop
ZINGIBERACEAE	<i>Hedychium gardnerianum</i> *	Ginger Lily

* Exotic Species

6.1.2 Vegetation Description

The vegetation covering the northern and eastern sections of the subject land is variable, but largely dominated by Bangalay *Eucalyptus botryoides* in association with Swamp Oak *Casuarina glauca* and Coastal Banksia *Banksia integrifolia*. The dominant vegetation is present to a height of 10-15 m with cover 30-70%. Some patches of this vegetation are completely dominated by Swamp Oak *C. glauca*, whereas in other areas Swamp Paperbark *Melaleuca ericifolia* forms almost pure stands. There were also some areas that were lacking in a dominant tree layer, predominantly consisting of Spiny-headed Mat-rush *Lomandra longifolia* and Tall Saw Sedge *Gahnia clarkei*.

In the areas with a tree layer dominated by Bangalay *Eucalyptus botryoides*, Coastal Banksia was a common associate, with occasional Parramatta Wattle *Acacia parramattensis* also present. Sweet Pittosporum *Pittosporum undulatum* is occasionally present in the shrub layer, along with Sydney Golden Wattle *Acacia longifolia* and Large-leaf Hop-bush *Dodonaea triquetra* with Slender Rice Flower *Pimelea linifolia* and *Pultenaea retusa* in the small shrub layer. Both Snake Vine *Stephania japonica* and Monkey Rope *Parsonsia straminea* were common vines, climbing throughout the vegetation in this area. Parts of the understorey were dominated by Tall Saw Sedge *Gahnia clarkei* and Treeferns *Cyathea australis*. were also present occasionally within the more dense areas of vegetation. The ground layer was largely dominated by Ivy Leaved Violet *Viola hederacea* and Maidenhair Fern *Adiantum aethiopicum* with Cutleaf

Cranesbill *Geranium solanderi* and White Root *Pratia purpurascens* also present along with various grasses including Forest Hedgehog Grass *Echinopogon ovatus* and Basket Grass *Oplismenus aemulus*. Spiny-headed Mat Rush *Lomandra longifolia* and Bracken *Pteridium esculentum* were very common throughout areas of the understorey. Weed species were present along the tracks leading throughout the vegetation and also at the edges, the most common of these included *Briza maxima**, Plantain *Plantago lanceolata**, *Paspalum dilatatum**, Ginger Lily *Hedichyum gardnerianum**, Blackberry *Rubus discolor** and Pennywort *Hydrocotyle bonariensis**

Parts of the vegetation on the southeastern side of the subject land have been disturbed and cleared bare areas subject to erosion are present, and these have been further degraded through use of the area as a public walkway and use for dirt bike or bicycle tracks. Only scattered clumps of vegetation are present between the bare areas, largely consisting of dominant Black She-oak *Casuarina glauca*, with only very occasional eucalypts including Scribbly Gum *Eucalyptus sclerophylla* and Bangalay *E. botryoides*. Small Turpentine *Syncarpia glomulifera* and Coastal Banksia *Banksia integrifolia* were also present in these patches with Tick Bush *Kunzea ambigua* common surrounding all patches. Dagger Hakea *Hakea teretifolia* was also present in the shrub layer occasionally along with Narrow-leaved Geebung *Persoonia linearis* with the Bracken *Pteridium esculentum* and Spiny-headed Mat-rush *Lomandra longifolia* in the ground layer, with some patches consisting of just these two species. Vegetation was present along the coastal strip to the east of the disturbed area with Bangalay *E. botryoides* again present along with Red Bloodwood *Corymbia gummifera* and Blackbutt *E. pilularis* with *Melaleuca hypericifolia*, Narrow-leaved Geebung *Persoonia linearis* and Hair-pin Banksia *Banksia spinulosa* in the shrub layer. Beyond the eastern boundary of the subject land dune vegetation is present consisting largely of Sydney Golden Wattle *Acacia longifolia*.

The vegetation on the western portion of the subject land is adjacent the established residential development along Palisade Avenue. Vegetation along the edges of the residential area has largely been cleared of understorey with only a few scattered trees including Blackbutt *Eucalyptus pilularis* and Swamp Oak *Casuarina glauca* in this section along with planted species including Radiata Pine *Pinus radiata* and Cootamundra Wattle *Acacia baileyana*. A variety of weeds and garden escapes were present along this section of the vegetation including Ribbon Weed *Chlorophytum comosum**, Giant Shivery Grass *Briza maxima**, *Centaureum tenuiflorum** and Whisky Grass *Andropogon virginicus**. Predominant in the vegetation to the south extending behind this cleared area is an open forest dominated by Blackbutt *Eucalyptus pilularis* and Red Bloodwood *Corymbia gummifera* along with Illawarra Stringybark *Eucalyptus imitans*. Dominant in the understorey were Black She-oak *Allocasuarina littoralis*, with other understorey species such as Bleeding Heart *Omalanthus populifolius*.

Although no specific surveys were carried out beyond the southern boundary of the subject land, the land was traversed and the vegetation in the area to the south of the western side consists of a Hard-leaved Scribbly Gum *Eucalyptus sclerophylla* woodland. East of this, the vegetation becomes a open scrub dominated by mallee Red Bloodwood *Corymbia gummifera*. A strip of coastal vegetation extends along the hind dune as described above.

6.1.3 Vegetation Communities

Swamp Sclerophyll Forest – Bangalay/Swamp Oak

The vegetation community present on the eastern side of the subject land is floristically similar to the endangered ecological community "Swamp Sclerophyll Forest on Coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions" This community generally occurs below 20 m above sea level with an open forest structure, however disturbance may reduce the canopy to only scattered trees, or be reduced to scrub. The community includes areas of tall reedland or sedgeland where trees are very sparse or absent. According to information in regards to this community from DEC, less than 1000 ha of this community is present in the South Coast region. According to *Conjola and Morton National Parks Vegetation Survey and Mapping* (NGH Environmental, 2004), previous mapping of

'Forest Ecosystem' vegetation in Conjola National Park there appeared to be some inaccuracies in mapping of this (and other) vegetation community in the National Park, particularly due to the previous description of the community as part of Sydney Coastal Estuary Swamp Forest Complex (a previously listed Endangered Ecological Community) which was noted to be generally dominated by Swamp Mahogany *Eucalyptus robusta* as at the time of reporting no Forest Ecosystem type included Bangalay *Eucalyptus botryoides* as a dominant species.

According to the above report, a few occurrences of this community are located around the northwestern end of Swan Lake, and extensive patches were mapped from new aerial photo interpretation, although ground-truthing has not occurred. Small areas of this community are contained within existing conservation reserves along the NSW Coastline including Bungawalbin, Tuckean and Moonee Beach Nature Reserves, and Hat Head, Crowdy Bay, Aallingat, Myall Lakes and Garigal National Parks.

Blackbutt/Red Bloodwood Open Forest

The vegetation just to the south of the western portion of the subject land is a Blackbutt *Eucalyptus pilularis* – Red Bloodwood *Corymbia gummifera* open forest. This community is reasonably common throughout the region and found within Conjola National Park. This vegetation community grades into a Scribbly Gum *Eucalyptus sclerophylla* woodland to the south of the boundary of the subject land. This community extends further south, with Hard-leaved Scribbly Gum becoming the dominant tree over the southern boundary of the subject land.

6.2 Habitat Description

Size

The subject land has an area of approximately 9.56 ha with the proposed development to be situated within an area of approximately 6.49 ha.

Connectivity

As indicated on the Aerial Photo (Appendix 1), the vegetation on the subject land extends along the edge of the residential area of Manyana and is presently only directly connected to a small area of vegetation to the south. This adjoins a larger area of vegetation further to the west, and also extends along the coast to Cunjarong Point. A narrow strip of vegetation is present along the dunes and hind-dune areas along the coast.

Significant Species

Only one species of threatened flora has been recorded within 10 km of the subject land. Suitable habitat is present on the site for the Leafless Tongue Orchid *Cryptostylis hunteriana* although it was not found during targeted surveys. Two other members of the same genus were found in flower on the subject land in both December 2004 and in January 2005.

Due to the open and reasonably young nature of much of the vegetation on the subject land, most of the trees do not provide suitable breeding or roosting habitat in the form of hollows, with more mature trees identified to the south of subject land in a Scribbly Gum *Eucalyptus sclerophylla* Woodland. Approximately one third of the vegetation will be protected on the subject land, and this will continue to provide foraging habitat for a variety of species in the local area.

Significant Vegetation Communities/Habitats

The communities detected on the subject land were probably once contiguous with other eucalypt forests within the region, however fragmentation has occurred due to clearing, largely for residential development. Swamp Sclerophyll Forest dominated by Bangalay *Eucalyptus botryoides* was identified on the eastern side of the subject land, parts of which have been subject to continued disturbance over a number of years. The presence of the Endangered Ecological Community on the subject land is due partly the underlying geology and topography

of the site. Similar geology is situated at the mouth of the Clyde River near Batemans Bay and also at the mouth of the Moruya River and it is likely that similar communities would occupy these areas. The vegetation community is found to the north of the subject land near to Swan Lake, and additionally patches of the community are found alongside swamps and estuaries in the region, including along Currambene Creek, near Huskisson, north of the subject land.

Ecological Integrity

It appears that most of the vegetation on the subject land has been cleared previously and regrowth has occurred over the majority of the land. Parts of the vegetation on the study site still demonstrate this previous disturbance, with a variety of exotic weed species present throughout the vegetation, although more prevalent towards the outer edges of the vegetation or in disturbed areas. As such, the vegetation communities have displayed reasonably good resilience and a variety of species have re-established, although cleared and highly disturbed patches remain along the southeastern area of the subject land. Potential exists with removal of disturbance factors for regeneration of the vegetation community in this disturbed area.

Diversity

There is a reasonably high diversity of plant species across the site, although part of this increase in diversity has resulted from the presence of exotic species. The study area is covered in two vegetation communities with transitional and disturbed areas present as indicated on the Site Plan (Appendix 2). Variations in the structure of the vegetation and the understorey are related to previous clearing and disturbance, geology and topography.

Significant Trees

There were no large hollow-bearing trees present on the subject land however some larger trees with hollows were noted within the woodland to the south of the western side of the land, in the vicinity of the proposed road "The Bounty". Hollow-bearing trees are considered to be of habitat significance, as they have potential to provide shelter for a variety of species for roosting or breeding. Additionally trees such as the Black She-oak *Allocasuarina littoralis* provide foraging area for the Glossy Black Cockatoo feeding and these were also found on the southwestern area of the subject land.

6.3 Fauna

6.3.1 Amphibians

As a result of the fauna survey one species of amphibian was detected on the subject land during the surveys and identified as listed in Table 5.

Table 5: Amphibians detected on the subject land.

Scientific Name	Common Name	Call	Sight
<i>Crinia signifera</i>	Common Eastern Froglet	X	

No evidence was found along the drainage line of the presence of the Green and Golden Bell Frog on the subject land.

6.3.2 Reptiles

Reptiles identified on the subject land are listed in Table 6 below.

Table 6: Reptiles detected during the survey.

Scientific Name	Common Name
<i>Lampropholis delicata</i>	Garden Skink

6.3.3 Birds

A number of birds were observed or calls identified during the study. These are listed in Table 7.

Table 7: Birds detected during the survey (species of conservation significance in bold print).

Scientific Name	Common Name	Call	Sight	Evidence
<i>Acanthiza katherina</i>	Brown Thornbill	X	X	
<i>Anthochaera carunculata</i>	Red Wattle Bird	X	X	
<i>Cacatua roseicapilla</i>	Galah	X	X	
<i>Callocephalon fimbriatum</i>	Gang Gang Cockatoo			X
<i>Calyptorhynchus funereus</i>	Yellow Tailed Black Cockatoo	X	X	
<i>Calyptorhynchus lathami</i>	Glossy Black Cockatoo			X
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	X		
<i>Eopsaltria australis</i>	Eastern Yellow Robin	X	X	
<i>Gymnorhina tibicen</i>	Australian Magpie	X		
<i>Malurus cyaneus</i>	Superb Fairy Wren	X	X	
<i>Meliphaga lewinii</i>	Lewins Honey Eater	X	X	
<i>Ninox novaeseelandiae</i>	Southern Boobook		X	
<i>Pachycephala rufiventris</i>	Rufus Whistler	X	X	
<i>Phylidonyris nigra</i>	White Cheeked Honey Eater	X	X	
<i>Platycercus eximius</i>	Eastern Rosella		X	
<i>Podargus strigoides</i>	Tawny Frogmouth		X	
<i>Psophodes olivaceus</i>	Eastern Whip Bird	X	X	
<i>Ptilonorhynchus violaceus</i>	Satin Bower Bird	X	X	
<i>Rhipidura fuliginosa</i>	Grey Fantail	X	X	
<i>Rhipidura leucophrys</i>	Willie Wag Tail		X	
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet		X	

Evidence was found under a number of Black She-oak *Allocasuarina littoralis* of the foraging remains of crushed cones indicative of the feeding of the Glossy Black Cockatoo.

6.3.4 Mammals (excluding bats)

Mammals detected during the survey are listed in Table 8 below.

Table 8: Mammals identified during the survey (species of Conservation Significance in bold print).

Scientific Name	Common Name	Sighting	Evidence (scats, diggings, burrows)	Call Detection
<i>Macropus giganteus</i>	Eastern Grey Kangaroo		X	
<i>Oryctolagus cuniculus</i>	Rabbit		X	
<i>Perameles nasuta</i>	Long-nosed Bandicoot		X	
<i>Pteropus poliocephalus</i>	Grey Headed Flying Fox	X		
<i>Trichosurus vulpecula</i>	Common Brush tail Possum	X	X	
<i>Vombatus ursinus</i>	Common Wombat		X	

On all three survey nights Grey Headed Flying Fox were seen heading north, with one individual observed landing to roost on the subject land.

Diggings were identified over the subject land in both surveys in January and in June 2005. Evidence of rabbits including diggings and scats were found over the subject land. Conical diggings were also found, evidence of the presence of Bandicoots utilising parts of the subject land for foraging. No animals were trapped during the surveys in January 2005, however scats found near to diggings were sent to Barbara Triggs of 'Dead Finish' for analysis. Analysis of grooming hairs in the scats revealed that the bandicoot diggings were that of a Long-nosed Bandicoot.

6.3.5 Microchiropteran Bats

Data from the Anabat™ II Ultrasonic Detector was sent to Glenn Hoyer of 'Fly by Night Bat Surveys Pty Ltd' for analysis. These results are indicated in Table 9 below. Confidence levels for the identification of calls are indicated in the three levels: C = Confident; P = Probable; Po = Possible.

Table 9: Microchiropteran Bats detected on the site (species of Conservation Significance in bold print)

Scientific Name	Common Name	17/1/05	18/1/05	19/1/05
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	C	P	C
<i>Chalinolobus morio</i>	Chocolate Wattled Bat		P	P
<i>Falsistrellus tasmaniensis</i>	Eastern Falsistrelle	Po		
<i>Miniopterus schreibersii</i>	Eastern Bent-wing Bat	P		P
<i>Mormopterus nofolkensis</i>	Eastern Freetail Bat	Po		
<i>Mormopterus sp. 2</i>	Little Freetail Bat			C
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat			Po
<i>Scotorepens orion</i>	Eastern Broad-nosed Bat	P		
<i>Vespadelus darlingtoni</i>	Large Forest Bat	Po		
<i>Vespadelus vulturnus</i>	Little Forest Bat	C	C	C

A number of microchiropteran bats were observed during the surveys, with ten different species identified from the recordings to various confidence levels. The first two nights were recorded from the eastern side of the subject land, with the third night recorded from the open forest along the southern boundary of the subject land. The majority of the passes were recorded from the last survey night. There were four species of threatened microchiropteran bats recorded to 'Probable' and 'Possible' confidence levels, namely the Eastern Falsistrelle (Possible), Eastern Bent-wing Bat (Probable), Eastern Freetail Bat (Possible) and the Greater Broad-nosed Bat (Possible), and for the purposes of this study all of these threatened species are presumed to forage over the subject land.

6.3.6 Summary

The subject land provides foraging area for variety of different species, with a range of species present on, and in the vicinity of the study site. As a result of the fauna survey six fauna species of conservation significance have been identified as potentially foraging over the subject land, namely the Glossy Black Cockatoo, the Grey Headed Flying Fox and four microchiropteran bat species: the Eastern Falsistrelle, Eastern Bent-wing Bat, Eastern Freetail Bat and the Greater Broad-nosed Bat.

In reviewing the results of this fauna survey it must be taken into consideration that the more time spent in the field and the larger the range of detection techniques used, the greater the probability of finding more species. Other techniques available for fauna survey include the laying of box traps, pitfall traps and hair tubes, the use of harp traps and the analysis of predator scats. In relation to the probability of finding threatened species at a given time it was considered that the techniques utilised produced an appropriate fauna survey for the species targeted. A definitive list of fauna present on a site will only be produced following an extensive survey that covers all seasons and climatic periods.

7 Potential Impacts on Threatened Species

The subject land provides some habitat features suitable for a number of threatened species recorded within a 10 km radius of the site, although the vegetation was disturbed in patches and no tree hollows or suitable roosting sites were noted over the subject land. Larger trees were identified south of the western side of the subject land and a few of these may be impacted by the construction of 'The Bounty'. This section indicates species for which suitable habitat is thought to be available and which may utilise the site at least from time to time, based on number and location of records obtained from the NPWS Atlas of NSW Wildlife, information from the Literature Review (Section 4), undertaking a Habitat Assessment on site and the consultant's knowledge of the area. Potential impacts of the proposed development on these species are considered further in this section. Impacts on threatened species detected on the site are considered in the Eight Part Test (Section 9).

7.1 Flora

7.1.1 *Cryptostylis hunteriana*

Records exist within a 10 km radius of the subject land for the Leafless Tongue Orchid *Cryptostylis hunteriana*. The targeted survey undertaken for the species did not reveal its presence, however two other species from the same genus, namely Large Tongue Orchid *Cryptostylis subulata* and the Bonnet Orchid *Cryptostylis erecta* were found both in flower on the subject land and also within vegetation to the south of the land. As the species was not found in its flowering time in a reported year of flowering, it is not expected that the species is present on the subject land, therefore no harm is expected. Potential habitat for the species will remain situated on the eastern side along with the adjacent scrub and woodland south of the subject land.

7.2 Fauna

7.2.1 *Long Nosed Potoroo*

The Long-nosed Potoroo has been recorded from within a 10 km radius of the subject land and there is some potential that the species may occasionally forage in vegetation in the Manyana area, including on the subject land. The proposed development will reduce the amount of foraging area along the extent of the present developed areas of Manyana; however will not remove a large extent of their available habitat in the local area. It is thus not expected that the proposed development will impact this species if present in the local area.

7.2.2 *Owl Species*

Four owl species of conservation significance have been recorded in the area, the Powerful, Masked, Sooty and Barking Owl, and there is potential for the subject land to form part of the foraging area for these species. There were no trees suitable for roosting or breeding for either the owl species or many of their prey species on the subject land, however the Common Brushtail Possum was observed in trees to the south of the subject land. The proposal will not result in the removal of potential breeding sites for the owls, and it is thus unlikely that the proposed development will impact these species and they can remain foraging over the subject land post development.

8 SEPP 44: Koala Habitat Protection

State Environmental Planning Policy (SEPP) 44-Koala *Habitat Protection* was introduced in 1995 in an effort to better manage the dwindling numbers of Koalas in NSW. SEPP 44 applies to land in which a development application has been made that has an area of more than one hectare or has together with any adjoining land in the same ownership, an area of more than one hectare (whether or not the DA applies to the whole or part of the land).

SEPP 44 aims to identify areas of '*potential*' and '*core*' Koala Habitat. These are described as follows:

- *Potential Koala Habitat* is defined as areas of native vegetation where the trees listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component; and
- *Core Koala Habitat* is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females, and recent and historical records of a population.

Only one record exists for a Koala within a 10 km radius of the subject land and no evidence was found of their presence on the land. No preferred Koala feed trees were present on the subject land. There is thus neither *potential* nor *core* Koala habitat on the subject land and no impacts to the species are considered likely as a result of the proposed development.

9 Eight Part Test

The Eight Part Test is the informal title for the process set out in Section 5A of the *Threatened Species Conservation Act* 1995. It details how to determine where there is likely to be a 'significant effect' on threatened species, endangered populations or communities or their habitats. If a 'significant effect' is forecast a more specific Species Impact Statement report will be required.

- A. *In the case of threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population is likely to be placed at risk of extinction.*

Evidence was found on the subject land indicating that the Glossy Black Cockatoo utilises the Black She-oak *Allocasuarina littoralis* found only on the southwestern portion of the subject land as part of their food source. There are potential nesting sites for the species in hollow-bearing trees situated within the Scribbly Gum *Eucalyptus sclerophylla* woodland vegetation to the south of the western side of the subject land. Some of these trees may be impacted by development of The Bounty, although it is expected that suitable hollow trees will remain in this vegetation along with an adequate supply of Black She-oak *A. littoralis* – a common understorey species in the area and also within Conjola National Park. It is thus not expected that the proposed development will result in the extinction of the local population of the Glossy Black-Cockatoo.

A total of 22 Grey Headed Flying Fox were recorded over three nights, generally heading in a northerly direction, however it is likely that many more passed overhead during the evening. Grey-headed Flying Foxes are known to roost during the daytime in large roost sites known as "camps". Breeding occurs at the "camp" site, and this is a critical resource for the lifecycle of the species. The species travels approximately 15-50 km from the camp to forage over a variety of trees, their diet including nectar and pollen and fruits of both native and exotic trees. Their natural diet is derived from natives however they are known to feed on cultivated fruit crops and in planted fruit trees in residential areas. The survey, carried out in the daytime did not reveal the presence of a camp site on the study site. The proposed development will result in the reduction in foraging area for the species however, the species will be able to continue foraging over the vegetation remaining subject land and within the surrounding area including Conjola National Park post development and it is not expected that the proposed development will result in the extinction of the local population Grey-headed Flying Fox.

Ten different microchiropteran bat species were identified from the AnaBat™ recordings with four threatened species recognised as potentially foraging over the subject land, namely the Eastern Freetail Bat, Eastern Bentwing Bat, the Eastern False Pipistrelle and the Greater Broad-nosed Bat. Each of these bats has similar habitat preferences, and all are dependant on the availability of hollow-bearing trees or similar structures in which to roost.

The Eastern Freetail bat has mostly been recorded from dry eucalyptus forest and woodland east of the Great Dividing range, and although little is known of his reproductive cycle, it is thought that the sexes may separate at certain times of the year, likely for breeding purposes. The Eastern Freetail Bat is predominantly tree dwelling. The proposed development will result in the removal of areas of vegetation along the existing residential area of Manyana. Larger trees are situated along the southwestern area of the land, and further south of this within woodland vegetation. Most of these trees will not be impacted as a result of this development and it is thus not expected that the local population of the Eastern Freetail Bat will be placed at risk of extinction as a result of the proposed development.

The Eastern Bentwing Bat is known to roost in various places such as caves, hollow trees, and also manmade structures including old mines and stormwater channels. The species is typically found to forage above the tree canopy in well-timbered valleys. In more favourable conditions there are large colonies and the species travels large distances between different roosts, and in the southeast the species hibernates during winter. In spring the females move to specific 'nursery caves' in which to breed, after which they disperse in late summer. The species depends on relatively few nursery caves, and protection of these caves is essential for their lifecycle. No such cave structures were found on the subject land, and the hollow bearing trees found along the southwestern boundary, along with the vegetation beyond this will provide foraging habitat for the species. The proposed development is not expected to result in the local population of the Eastern Bentwing Bat being placed at risk of extinction.

Little is known of the biology of the Eastern False Pipistrelle which was identified as foraging over the land during the surveys, although it has been found in low numbers throughout its range. It is thought to hibernate during the winter months, and thus is likely to roost in hollow trees, caves and similar structures. The species is expected to be highly mobile and have a large foraging range, foraging over the forest canopy in open woodland or over water. The proposed development may result in a small reduction in the foraging area of the species, and potential removal of some trees over the southwestern boundary of the land, however a large area of vegetation will remain over which the species can forage, and no impacts to the species population in the local area is expected as a result of the proposed development.

The Greater Broad-nosed Bat is mostly recorded from gullies and river systems draining to the Great Dividing Range, although it extends to the coast over all of its range – from NE Victoria to the Atherton Tableland in Queensland. The species inhabits a variety of habitats from woodland through moist and dry eucalypt forest to rainforests, and prefers open areas, which suit its direct flight pattern. The 'possible' recording of the species from along a cleared track within open forest corresponds to this habitat preference. Although little is known of the species reproductive cycle, the females congregate at maternity sites located in suitable trees, and the species roosts in tree hollows or sometimes equivalent manmade structures. As most of the habitat in the local area suitable for this species will be retained, and suitable hollow trees will be situated beyond the southwestern boundary of the site and also within vegetation in Conjola National Park, the species is not expected to be placed at risk of extinction as a result of the proposed development.

B.

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

No Endangered Populations have been declared on the site.

- C. *In relation to the regional distribution of the habitat of threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.*

The proposed development will result in the removal of vegetation within proposed residential allotments. Additionally, the road "The Bounty" will result in additional clearing along the southern boundary of the subject land. Conjola National Park which lies in close proximity to the subject land along with the adjacent Cudmirrah National Park, protect an area of 11,063 ha of vegetation in the local area, and in relation to this the area to be impacted as a result of the proposed development is not considered to be a significant area of the known habitat of any of the threatened species identified on the subject land.

The proposed development will have an impact on part of the Endangered Ecological Community 'Swamp Sclerophyll Forest on Coastal Floodplains'. The proposed development will extend along the northern and western sides of the community, leaving a core area along with patches of the community that have been consistently disturbed at the southern boundary. Portions of the community are also present over the eastern boundary of the land, and these will remain connected to the area to be retained. Swamp Sclerophyll Forest on Coastal Floodplains is found on similar low-lying areas along the coast, and although a considerable area of the community will be impacted on the subject land as a result of the proposed development, a core part of community will be conserved post-development and subject to a Vegetation Management Plan. Part of this will involve the removal of weeds and regeneration of the disturbed area on the southeastern side of the subject land. Conservation and enhancement through considerate management of the remaining part of the community will retain this area of the community on the subject land under dedicated Community Title. In relation to the area of this community located in the region it is not considered that a significant area of this community will be modified or removed as a result of the proposed development.

- D. *Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for threatened species, population or ecological community*

The subject land adjoins the presently developed residential area of Manyana and extends the present level of residential development. The Endangered Ecological Community 'Swamp Sclerophyll Forest on Coastal Floodplains' was found in the low-lying area on the eastern side of the land, is by its nature isolated from other patches of this vegetation community. The proposed development will not sever the connection of this community to proximate areas of vegetation. As indicated on the Aerial Photo (Appendix 1) the subject land is connected to vegetation in the south and extending to the west. The proposed development will not result in areas of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for threatened species, populations or ecological communities.

- E. *Whether critical habitat will be affected*

No listed critical habitat is present within the subject land.

- F. *Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or similar protected areas) in the region.*

Glossy Black Cockatoos have been recorded as occurring in numerous reserves along the east coast. The species has been recorded in Murramarang, Meroo, Morton, Jervis Bay, Conjola, and Budawang National Parks and Yadbora, South Brooman, and Boyne State Forests. The species has adequate habitat reserved within surrounding conservation reserves in the region.

Grey Headed Flying Fox are documented as occurring in Murramarang, Meroo, Morton, Monga, Budawang and Seven Mile Beach National Parks, Narrawallee Creek and Comerong Island Nature Reserves. The local population of the Grey Headed Flying Fox is believed to be migratory and a roost is recorded in nearby Yatte Yattah Nature Reserve.

A variety of records exist for the microchiropteran bat species identified on the subject land. The Eastern Freetail Bat has been recorded near to the edge of Murramarang National park, as well as within Jervis Bay National Park and Narrawallee Creek Nature Reserve. The Eastern Bentwing Bat has been recorded from the edges of Jervis Bay National Park and Narrawallee Creek Nature Reserve. The Eastern False Pipistrelle is recorded from Jervis Bay National Park near St Georges Basin, and near to Conjola National Park and Murramarang National Park. The Greater Broad-nosed Bat has been recorded from the edge of Murramarang national Park as well as from Meroo, Conjola and Jervis Bay National Parks. These and other reserves in the area provide foraging habitat for all the species, along with potential roosting sites within hollow trees and other structures. Maternity caves may be located within more rugged terrain in areas such as Murramarang National Park, and along the edge of the Great Dividing Range within reserves such as Morton National Park.

The Endangered Ecological Community, 'Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions' has been extensively cleared and modified with less than 30% of its original extent remaining. The community is known to occur in Murramarang and Conjola National Parks and other various coastal reserves in NSW. Additionally, due to its presence on low-lying areas, the community is also likely to be present within buffer areas surrounding land protected under SEPP 14 – Coastal Wetlands.

- G. *Whether the development or activity is of a class of development or activity that is recognised as a threatening process.*

Schedule 3 of the *Threatened Species Conservation Act* (1995), lists processes considered threatening.

Clearing of native vegetation has been identified as a key threatening process. The proposed development will result in clearing along areas adjacent to the established residential area of Manyana to incorporate residential development. The removal of this vegetation is not likely to result in the increased chance of extinction of any of the threatened species recorded in the area. The proposed development will result in clearing and modification to part of an Endangered Ecological Community 'Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions'. The remainder of this community will be managed and areas which have previously been disturbed will be regenerated. This will result in conservation and enhancement of the remainder of the community and the proposed development is not thought to constitute a threat to this community as community will remain functional post-development.

- H. *Whether any threatened species, population or ecological community is at the limit of its known distribution.*

None of the threatened species identified on the subject land are known to be at the limit of their known distribution.

The results from this Eight Part Test indicate that the proposed subdivision of Lot 682 (DP 568678), Lot 705 (DP 61385) and Lot 810 (DP 247285), Manyana, will not have a significant effect on threatened species, populations or communities or their habitats. Threatened species recorded on the subject land during this survey and previously recorded the vicinity of the subject land will be able to maintain their populations in the local area and vegetation retained on the site will provide suitable breeding and foraging areas for threatened species in the area. Additionally the endangered ecological community 'Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions' is likely to remain viable post-development.

10 Conclusions

The Eight Part Test carried out as part of this report was based on field surveys undertaken in December 2004 and January 2005 on the study area, Lot 682 (DP 568678), Lot 705 (DP 61385) and Lot 810 (DP 247285) Manyana, and has established that the proposed development will not have a significant effect on any threatened species, populations or communities, or their habitats. It is therefore concluded that a Species Impact Statement will not be required for this proposal.

Two vegetation communities were situated on the subject land, parts of which have been cleared previously. An open forest of Blackbutt and Red Bloodwood was situated behind established and cleared residential lots on the western side of the land, with the eastern side largely covered with a Bangalay Low Open forest also known as 'Swamp Sclerophyll Forest on Coastal Floodplains' an endangered ecological community on the North Coast, Sydney Basin and Southeastern Corner Bioregions. The northern and western edges of the community will be impacted as a result of the proposed development. Although a number of walking tracks have been cleared through the vegetation it appears to be in reasonably good condition apart from the area along the southern boundary which has been consistently disturbed and is highly eroded. Preservation and enhancement of the remaining area of this community will occur through ongoing management of the community under a Community Title Vegetation Management Plan.

Due to the presence of reasonably young trees over the land, most of the vegetation was of low habitat value for lifecycle elements of a number of the species recorded in the local area, although some trees with hollows were found beyond the southern boundary on the western side of the land in the open forest area. There is potential that some of these trees may be impacted by development of a public road, however many of these trees will remain post development. Additionally it is likely that there are other suitable roosting trees preserved in Conjola National Park in the vicinity of the subject land to the west and north.

A variety of species were recorded over the subject land including evidence of the foraging of the Glossy Black Cockatoo and observations of a number of Grey Headed Flying Fox. Both of these species may utilise the subject land from time to time, however are not solely dependant on the area for their survival in the region. Four threatened microchiropteran bat species were identified on the subject land to various confidence levels, namely the Eastern Freetail Bat, the Eastern Bentwing Bat, the Eastern False Pipistrelle and the Greater Broad-nosed Bat, and records, indicate these species forage both within the open woodland and along the cleared edges of the scrub at the south of the land. Hollow trees identified to the southwest of the subject land may provide some roosting habitat for the species, although none of them are expected to be exclusively reliant on the habitat provided on the subject land for the species survival.

The common species detected during the surveys are likely to persist in the area.

Recommendations to reduce impacts of the proposed development on threatened and other species on the site are detailed in Section 11.

11 Recommendations

- A Vegetation Management Plan to be prepared for the remaining area of the Endangered Ecological Community 'Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions' should outline techniques to be employed in regeneration and rehabilitation of the land along the southern boundary, and also indicate bushland regeneration techniques to be undertaken including seed collection of local provenance species, or sourcing of species, outline options such as creating a minimum number of access walks and closing off existing tracks through this vegetation. This plan could be undertaken in association with Shoalhaven City Council or alternatively with DEC. Ongoing reporting indicating the progress of the management plan should be undertaken at six monthly periods. Bushland regeneration could be undertaken in consultation with council in regard to the existing tracks through Crown Land located to the south of the subject land and the beach access track located beyond the southeastern corner of the land;
- Construction of The Bounty should aim to retain as many large trees as possible in the woodland to the south of the subject land;
- Measures should be put in place to minimise erosion and sedimentation which may occur as a result of construction, particularly in regard to retaining water quality;
- Cleared vegetation should not be pushed onto or dumped on adjacent bushland;
- Vehicles, machinery and building refuse associated with the development should remain within disturbed areas and not impinge on areas of adjacent bushland. Also they should not be parked or stored in the vicinity of natural vegetation to be retained. This will prevent compaction of the soil and mechanical damage to trees; and
- Clearing of native vegetation outside Rural Fire Service requirements should be avoided where possible. Consideration should be given to planting of local provenance species in planning future gardens or landscaping. Use of fertilisers and pesticides should be kept to an absolute minimum;

The findings contained within this report are the result of discrete/specific methodologies used in accordance with recognised practices. To the best of our knowledge they represent a reasonable interpretation of the general conditions of the site.

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Appendix 1

PMA CONSULTING



SUBJECT SITE

AERIAL PHOTO MANYANA (JAN 2002)

Appendix 2

PMA CONSULTING



AMENDMENT	SITE PLAN	SCALE
1. ADD ON PLAN HOLLOW BEARING TREES & BLACK COCKATOO FEED TREE LOCATIONS FROM GPS POINTS	22/02/07	1:2000 on A3
2.	PROPOSED SUBDIVISION VACENTA Pty Ltd	SITE CLASS N/A
3.	LOTS 682, 705 & 810 MANYANA DRIVE	JOB No. 04185
4.	MANYANA	SHEET No. 3 of 5
		REVISION .

Appendix 3

PMA CONSULTING

7

SET



WATKINSON APPERLEY PTY LIMITED
SURVEYORS & ENGINEERS

A 2541

00 on A3

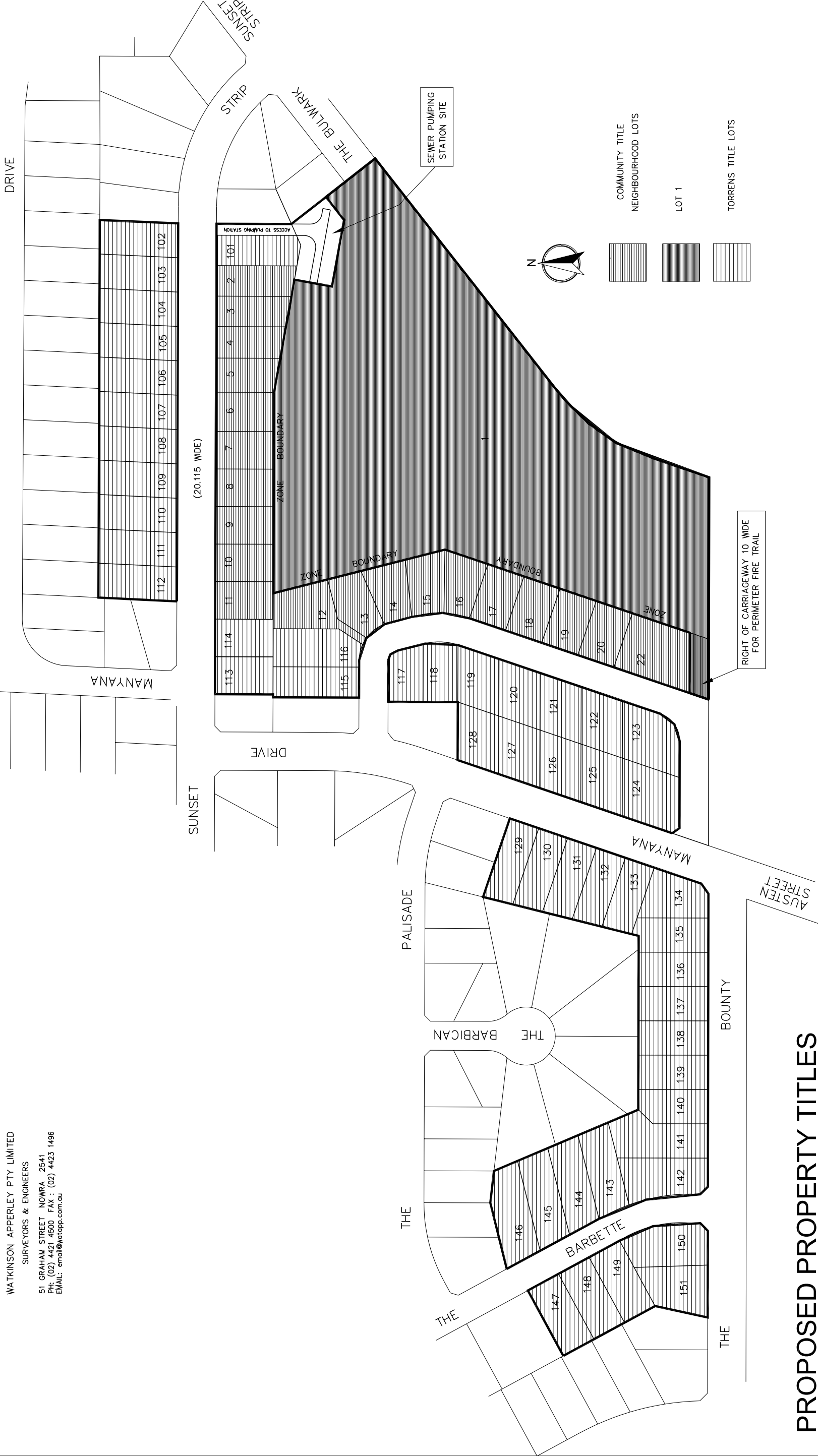
C

Appendix 4

PMA CONSULTING

BASE MAP SOURCED FROM:

WATKINSON APPERLEY PTY LIMITED
SURVEYORS & ENGINEERS
51 GRAHAM STREET NOWRA 2541
PH: (02) 4421 4500 FAX : (02) 4423 1496
EMAIL: email@watapp.com.au



PROPOSED PROPERTY TITLES

SCALE 1:2000 on A3



131 PRINCES HIGHWAY,
MILTON, N.S.W. 2538
Ph: 02 4454 0505
Fax: 02 4454 4122
9/70 MARKET STREET,
WOLLONGONG, N.S.W. 2500
Ph: 02 4228 1944
Fax: 02 4228 1933

Drafted by

27/05/05

Gavin Brown B.E. (Env), G.Dip. Sc.
email: gav_pma@iprimus.com.au

AMENDMENT

- 1.
- 2.
- 3.
- 4.

SITE PLAN

PROPOSED SUBDIVISION

VACENTA Pty Ltd
LOTS 682, 705 & 810 MANYANA DRIVE
MANYANA

SCALE

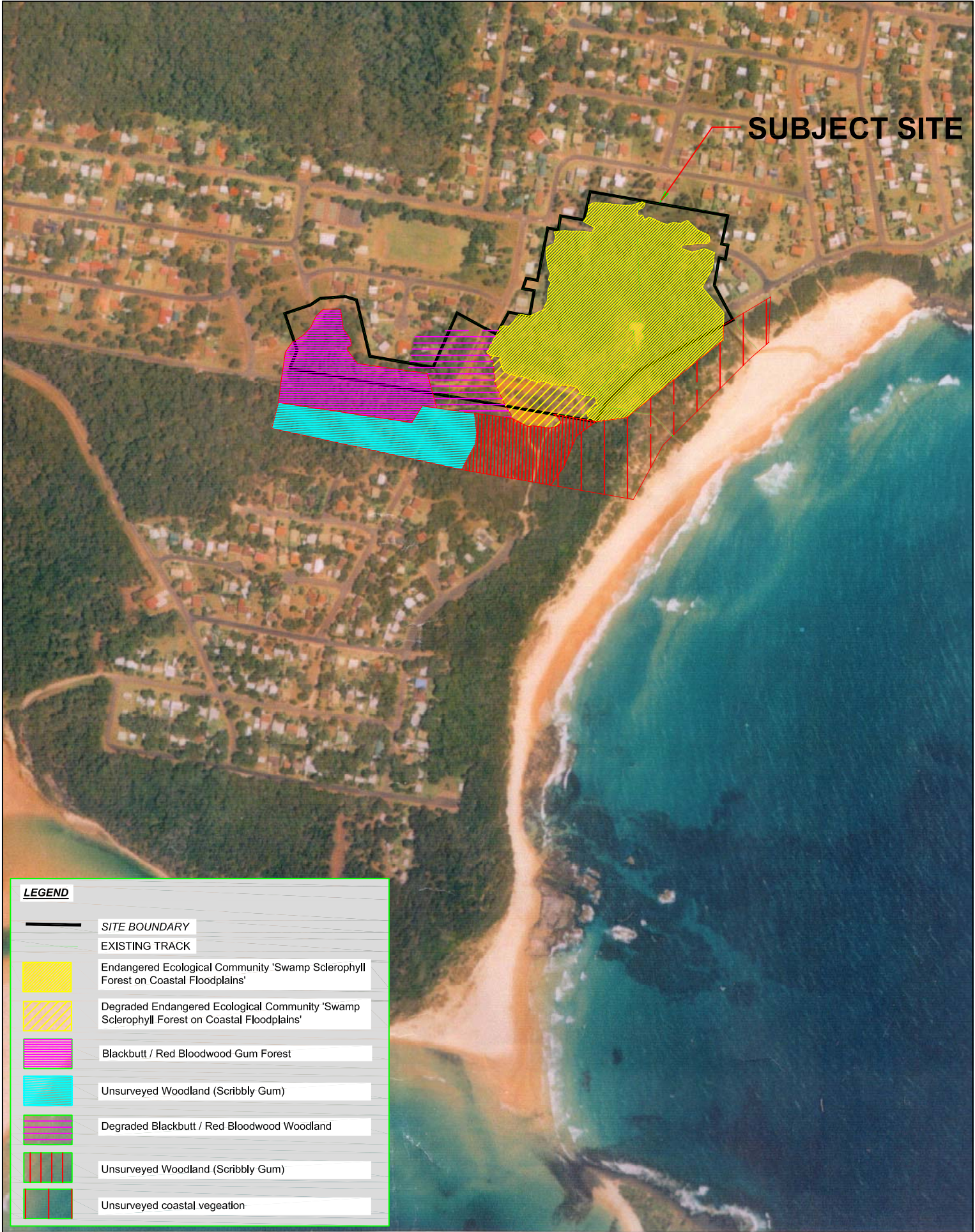
SITE CLASS

JOB No. 04185
SHEET No. 2 of 5
REVISION .

1:2000 on A3

Appendix 5

PMA CONSULTING



SUBJECT SITE

LEGEND

	SITE BOUNDARY
	EXISTING TRACK
	Endangered Ecological Community 'Swamp Sclerophyll Forest on Coastal Floodplains'
	Degraded Endangered Ecological Community 'Swamp Sclerophyll Forest on Coastal Floodplains'
	Blackbutt / Red Bloodwood Gum Forest
	Unsurveyed Woodland (Scribbly Gum)
	Degraded Blackbutt / Red Bloodwood Woodland
	Unsurveyed Woodland (Scribbly Gum)
	Unsurveyed coastal vegetation

AERIAL PHOTO AND MAPPED VEGETATION MANYANA (JAN 2002)

Appendix 6

PMA CONSULTING

Table A6-1: Threatened plant species recorded within a 10 km radius of the subject land.

Family/Name	Species Information	Occurrences in Conservation Areas
ORCHIDACEAE <i>Cryptostylis hunteriana</i> Leafless Tongue Orchid Vulnerable ROTAP: 3VC-	▪ Saprophytic terrestrial herb with no leaf ▪ Flowers Dec-Feb ▪ Grows in swamp-heath on sandy soils, chiefly in coastal districts. Favours dry sclerophyll forests, heaths, dunes (including stabilised sands), riparian (stream-side) areas, swampy forests, swampy areas and wetlands ▪ Infrequently found due to cryptic nature ▪ Flowering occurs during summer. Flowers are green, red, black, and are carried on an axillary (lateral) raceme ▪ Foliage is absent or reduced and apparently absent, and the leaves are scales	Recorded in Flat Rock State Forest; Meroo NP; Barnunj State Conservation Area; Conjola NP; Morton NP, Gibraltar Range NP, Ku-Ring-Gai Chase NP, Ben Boyd NP, Croajingalong NP, William Hunter FR

Table A6-2: NSW NPWS Atlas data of Threatened Species found within a 10 km radius of the subject land. (Sources: NSW Wildlife Atlas, 2004; NPWS, 2003, Cogger, 2000; Strahan, 1995; IUCN, 2004; Gillespie 1996; Lewis, 2003).

	Name	Species Information	Threats	Known in Conservation Reserves
Amphibians	Green and Golden Bell Frog <i>Litoria aurea</i> Endangered	- Found among vegetation within or at the edges of permanent water – streams, swamps, lagoons, farm dams and ornamental ponds - Often found under debris on low oft-flooded river flats. - Frequently active by day – is one of only a few frogs known to bask in the sunlight - They are mostly nocturnal but also active by day, rarely climbing up vegetation - Inhabits marshes, dams and streamsides, particularly those containing bulrushes Typha species or Spikerushes <i>Eleocharis</i> species - Optimum habitat includes water bodies which are unshaded, free of predatory fish <i>Gambusia holbrooki</i>, have a grassy area nearby and diurnal sheltering sites available such as vegetation and/or rocks - Has been associated with almost every type of water body except fast flowing streams - Some sites (particularly in the Greater Sydney region, are in highly disturbed areas such as disused industrial sites, brick pits, landfill areas and even cleared land (NPWS, 2003) - Show some tolerance to pollutants and salinity - All habitats are characterised by stationary water - Virtually all isolated water bodies are free of native fish species and typically have dense emergent vegetation - Can be found in a diversity of terrestrial habitats including lowland forest, <i>Banksia</i> woodland, wet heathland, riparian scrub complex, riparian shrubland, riparian forest, damp forest, shrubby dry forest and cleared pastoral lands (Gillespie 1996)	- Alteration of drainage patterns and stormwater runoff - Fungal pathogen - Water quality changes - Predation by feral animals - Herbicides and other weed control measures - Road mortality - Predation by exotic fish - Loss of suitable breeding habitat through alteration by infilling and destruction of wetlands	National Parks Ben Boyd, Botany Bay, Hat Head, Jervis Bay, Kooragang Island, Myall Lakes, *Royal, Seven Mile Beach, Yuragir Nature Reserves Nadgee, Towra Point, *Tyagarah. State Recreation Areas Killalea

	Name	Species Information	Threats	Known in Conservation Reserves
Birds	Barking Owl <i>Ninox connivens</i> Vulnerable	- Most common in woodlands, although they inhabit well-forested hill and riverine woodlands and partially cleared areas also appearing occasionally near or in rural towns and well-treed suburbs - Ideal habitat is open country with a choice of large trees for roosting and nesting in - In the southern districts creeks and rivers are preferred, particularly with River Red Gums, isolated stands of trees and open woodland - Often return to same roost for months or years - Nest in large hollows up to 30 m above the ground, in trunks or large limbs of trees - Occasionally nest in deep tree forks, rock crevices and rabbit burrows	- Habitat loss and degradation - Predation by feral species - Clearing of forest and woodlands - Logging and firewood harvesting	Numerous Reserved areas including: National Parks Meroo, Murramarang, Scheyville, Dharug, Wollemi, Lane Cove, Garigal (others listed in Recovery Plan)
	Brown Treecreeper <i>Climacteris picumnus</i> Vulnerable	- Eucalypt woodlands, particularly open woodland lacking a dense understorey - Nests in tree hollows within permanent territories, breeding in pairs or communally in small groups. - Birds forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae - Appears unable to maintain viable populations in remnants less than 200 ha and its abundance decreases as remnant size decreases	- Threatened by clearance and fragmentation of woodland habitat including removal of dead timber - Increased isolation decreases treecreeper vagility and increases the vulnerability of populations to extinction as a result of stochastic events - Fragmentation leads to a skewed sex because female birds are unable to disperse to isolated remnants, increasing the chance of local extinctions - Habitat degradation, including loss of hollow bearing trees - Grazing by stock in woodland areas leads to a decrease the diversity of ground-dwelling invertebrates decreasing the availability of food - Increased competition with aggressive honeyeater species and increased levels of nest predation that are a consequence of fragmentation of habitat	National Parks Murramarang Nature Reserves Munghorn Gap (near Mudgee) – known here

Name	Species Information	Threats	Known in Conservation Reserves
Eastern Bristlebird <i>Dasyornis brachypterus</i> Endangered	- Cover-dependent - Fire sensitive - Inhabits a wide range of vegetation communities including rainforest, eucalypt forest, woodland, mallee, shrubland, swamp, heathland and sedgeland where there is low dense cover - Individuals have a home range of more than 10 ha and are presumed to be sedentary - Nests are elliptical domes constructed in low dense vegetation, usually in tufted plants	- Loss of habitat, including indirect loss due to unsuitable fire regimes - Fragmentation of habitat and isolation - Predation by native and introduced species - Road kills - Grazing by livestock resulting in trampling of habitat	National Parks New England, Nightcap, Border Ranges, Budderoo, Morton, Jervis Bay Nature Reserves Nadgee, Barren Grounds
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i> Vulnerable	- Forests on sites with low soil nutrient status, generally reflecting the distribution of key Allocasuarina spp. on which they feed - Drier forest types with intact and less rugged landscapes preferred	- Habitat fragmentation - Loss of habitat through clearing and associated activities - Logging of nest trees within the proximity of food resources - Inappropriate fire regimes	Likely to be reserved locally in nearby national parks including National Parks Murramarang, Meroo, Morton, Jervis Bay, Conjola, Budawang State Forests Yadboro, South Brooman, Boyne
Hooded Plover <i>Thinornis rubricollis</i> Endangered	- Sandy beaches, rarely on coastal lakes - Inland salt lakes - Species occurs along the coast from Jervis Bay to the western Eyre Peninsula in South Australia, along the coast of Tasmania and in the Bass Strait islands and on south Western Australian Coast - Within NSW occurs along the southern coast to Jervis Bay with occasional vagrants sighted further north at Wollongong - Found most often on long stretches of sandy shore with wide wave-wash zone, backed by tussock and creeper covered dunes with seaweed for feeding and backed by sparsely vegetated sand dunes for shelter and nesting - Species is both diurnal and nocturnal	- Artificially high populations of Silver Gulls around human settlements leading to increased predation - Predation by foxes and raptors - Loss of habitat - Human disturbance, particularly during the breeding season - Destruction of nests by stock	National Parks Ben Boyd, Mimosia Rocks, Bournda, Eurobodalla, Murramarang Nature Reserves Nadgee, Narrawallee Creek

Name	Species Information	Threats	Known in Conservation Reserves
Little Tern <i>Sterna albifrons</i> Endangered	- Migratory/partly migratory, breeding in spring and summer along the entire east coast from Tasmania to North Queensland - Almost exclusively coastal, prefers sheltered environments - May occur several kilometres from sea in harbours, inlets and rivers - Occasionally in offshore islands or coral cays. - Nests in small scattered colonies on sandy beaches or shingle pits	- Nesting at flood prone locations - Predation on eggs and chicks - Human disturbance - Coastal developments including sand and rubble mining and establishment of waste disposal dumps and construction - Modification of drainage patterns including damming of tidal creeks, intertidal area reclamation, destruction of seagrass beds, mangroves and saltmarshes - Potentially susceptible to pesticides and contamination of estuaries by oil spills and heavy metals	World Heritage Areas Lord Howe Island National Parks Broadwater, Eurobodalla, Bongil Bongil, Booti Booti, Mimosa Rocks, Myall Lakes, Bournda, Yuragir, Bundjalung Nature Reserves Nadgee, Wyrabalong, Comerong Island, Towra Point, Moon Island, Kooragang, Narrawallee
Masked Owl <i>Tyto novaehollandiae</i> Vulnerable	- Forest and open woodland - Also found in treeless country where cave shelters are available - Roosts in the day in tree hollows, caves or heavy foliage	- Inappropriate fire regimes reducing prey - Conversion of native forests to plantations - Habitat destruction and fragmentation - Loss of tree hollows for breeding	National Parks Blue Mountains; Conjola; Deua; Jervis Bay; Monga; Murrumbidgee; Morton; Nattai; Seven Mile Beach; South East Forest; Wadbilliga; Meroo State Forests Dampier; Currowan; Boyne; Moruya State Conservation Areas Bungonia Various other reserves in NSW
Northern Giant-Petrel <i>Macronectes halli</i> Vulnerable	- Circumpolar pelagic distribution - Provenance and breeding in NSW waters is restricted to Macquarie Island - Recorded on the south-east coast during winter and autumn	- Mortality via longline fishing - Predation from black rats and feral cats - Habitat degradation from rabbits - Loss of cuttlefish populations, illegal longline fishing and oil spills	Species is migratory, breeding area Macquarie Island is a World Heritage Area
Pied Oystercatcher <i>Haematopus longirostris</i> Vulnerable	- Coastal areas throughout Australia apart from areas of unbroken sea-cliffs - Prefers mudflats, sandbanks and sandy ocean beaches - Less common along rocky or shingle coastlines	- Predation on nest sites - Loss of habitat	National Parks Seven Mile Beach; Comerong Island; Jervis Bay; Conjola; Murrumbidgee; Eurobodalla; Mimosa Rocks

Name	Species Information	Threats	Known in Conservation Reserves
Pink Robin <i>Petroica rodinogaster</i> Vulnerable	- Dense gullies of tall open forest - Disperse to more open forest autumn-winter	Loss of habitat	National Parks Montague Island; Georges River State Forests Nalbaugh Other Reserves Tennyson Creek Flora Reserve
Powerful Owl <i>Ninox strenua</i> Vulnerable	- Wet, hilly sclerophyll forest with dense gullies adjacent to more open forest - Also occurs in smaller, drier forest, as long as there are some large tree hollows and an adequate supply of prey - Nests in large, vertical hollows e.g. broken-off trunk and horizontal/sloping spouts often in very old large eucalypts	- Inappropriate fire regimes reducing prey - Conversion of native forests to plantations - Habitat destruction and fragmentation - Loss of tree hollows for breeding	National Parks Murramarang; Meroo; Deua State Forests Boyne; Currowan; Mogo; Moruya; North Brooman Other various reserves in NSW
Regent Honeyeater <i>Xanthomyza phrygia</i> Endangered	- Temperate eucalypt woodland and open forest - Mostly recorded from box-ironbark eucalyptus associations and we lowland coastal forests dominated by Swamp Mahogany, Spotted Gum, and riverine Casuarina woodland - Remnant timber stands, roadside reserves, travelling stock reserves, and street trees also provide habitat at certain times - Nests frequently located in Red Ironbark and Red River Gum but also may be in other eucalypts, mistletoe clumps and Casuarinas	- Loss and fragmentation of habitat through clearing - Reduction in large flowering eucalyptus in woodlands - Grazing by domestic stock and rabbits preventing habitat regeneration - Competition with other honeyeaters	National Parks Yengo, Warrumbungle, Wollemi, Scheyville, Goulburn River, Broadwater, Bundjalung, Yuragir, Nattai, Brisbane Waters, Ingalba, Hat Head, Royal, Seven Mile Beach Nature Reserves Munghorn Gap, Pilliga, Cocklebay, The Charcoal Tank
Shy Albatross <i>Diomedea cauta</i> Vulnerable	- Migratory species with circumpolar distribution - Known to breed on islands off Australia and New Zealand - Along the eastern coastline this species is relatively rare north of Sydney but is commonly found off the NSW South Coast - Nests area located on rocky islets and stacks lacking vegetation and soil	- Long-line fishing - Predation and disturbance by introduced predators - Pollution from plastics, chemicals, oils and other refuse - Historically feather collection affected breeding populations of this species	National Parks Ben Boyd
Sooty Owl <i>Tyto tenebricosa</i> Vulnerable	- Deep gullies in eucalypt forest usually with big, old, smooth-barked gums and an understorey of treeferns and Lilly Pilly - May move into drier forest to hunt	- Clearing and fragmentation of habitat - Short rotation of logging cycles (<80 years) reducing the number of nesting sites	National Parks Deua; Murramarang; State Forests Bolaro; Mogo; Buckenbowra Other various reserves in NSW

Name	Species Information	Threats	Known in Conservation Reserves
Sooty Oystercatcher <i>Haematopus fuliginosus</i> Vulnerable	- Concentrated in areas such as the Bass Strait Islands and Illawarra - Nest on offshore islands that are free from predators such as foxes, cats, dogs and people	- Predation on nest sites - Nest disturbance	National Parks Murramarang, Conjola, Meroo, Jerivs Bay Nature Reserves Narawallee Creek, Seven Mile Beach, Comerong Island Important breeding sites are the Five Islands off Port Kembla, Bowen Island, Brush and Blowla Islands and Tollgate Island. Important breeding sites are the Five Islands off Port Kembla, Bowen Island, Brush and Blowla Islands and Tollgate Island.
Sooty Tern <i>Sterna fuscata</i> Vulnerable	- Widespread in tropics with occasional sightings on the west and east coasts. - Forages offshore usually only observed onshore breeding or forced in by stormy weather	- Disturbance to breeding colonies - Predation of eggs by humans - Predation of eggs and chicks by cats, rats and other birds - Infestation of colonies by virus infected ticks	Has been recorded in Lord Howe Island World Heritage Area
Square-tailed Kite <i>Lophoictinia isura</i> Vulnerable	- Coastal forested and wooded lands of tropical and temperate Australia - May be recorded inland along timbered watercourses. - Absent from waterless desert - In NSW associated with ridge and gully forests dominated by Woollybutt <i>Eucalyptus longiflora</i>, Spotted Gum <i>E. maculata</i> or Peppermint Gum <i>E. elata</i>, <i>E. smithii</i> - Has been sighted in forests containing other eucalypts, <i>Angophora</i> spp. And <i>Callitris</i> spp. with a shrubby understorey and Box-Ironbark woodland - Appears to have a large hunting range, hunting in morning and afternoons or evenings	- Loss of habitat through clearing and associated activities, particularly along water courses in the west - Illegal shooting - Disturbance to nest trees - Inappropriate fire and/or grazing regimes that reduce nesting and feeding resources	Nature Reserves Nocoleche, Morrisons Lake Macquarie Marshes National Parks Mount Kaputar, Ingalba Mootwingee, Ben Boyd State Recreation Areas -
Superb Fruit-Dove <i>Ptilinopus superbus</i> Vulnerable	- Summer visitor to drier types of rainforest, regrowth and adjacent vegetation - Generally seen alone or in pairs but sometimes groups gather at fruit trees - Spend most of the time in upper foliage of rainforest, however the nest is often placed a few metres above the ground	Poor recovery potential	National Parks Brisbane Water; Sydney Harbour; Nature Reserves John Gould Other Reserves Berowra Valley Regional Park

Name	Species Information	Threats	Known in Conservation Reserves
Koala <i>Phascolarctos cinereus</i> Vulnerable	- Eucalypt forest and woodland depending on tree size and species present, soil nutrients, climate, rainfall and size and distribution history of habitat patches - Have been recorded as feeding on approximately 70 species of eucalypt and 30 non eucalypt species however selective within an area (See Section 8 for detail regarding SEPP 44 – Koala Habitat Protection)	- Destruction of habitat by clearing for urban development, agriculture and mining, particularly on high nutrient content soils - Fragmentation of habitat by roads, urban development and agriculture - Mortality from attacks by dogs, road fatalities, fires, drought and other natural disasters particularly in fragmented landscapes without suitable refuge areas - Degradation of habitat by fire, weed invasion, removal of important habitat trees and climate change - Infection by <i>Chlamydia</i>	National Parks Morton, Deua State Forests Bodalla Other various reserves throughout NSW
Long-nosed Potoroo <i>Potorous tridactylus</i> Vulnerable	- Coastal heath of wet eucalyptus forest - Moderately dry grassy woodland to wet dense scrub - Nocturnal - Main components of diet are underground fungi which are dug up - Highest concentrations are found on sandy soils with an annual rainfall exceeding 750 mm	- Clearing of bush areas - Predation by foxes and cats - Inappropriate fire regimes	National Parks Brisbane Waters, Barrington Tops, Morton, Conjola Nature Reserves Cambewarra Range State Forests Bodalla

Mammals (Excl Bats)	Name	Species Information	Threats	Known in Conservation Reserves
	Southern Brown Bandicoot <i>Isodon obesulus obesulus</i> Endangered	- Historically distributed along southeastern seaboard of Australia, however now is patchily distributed and has contracted at both ends of its range by 50-90% since European settlement - Species currently appears to be restricted to areas around Sydney and the far southeast of the state - Inhabits heat, heathy forest, shrubland and woodland which is usually supported by well-drained soils. - Mosaic of post-fire vegetation is an important habitat component - Shelters in a concealed nest which is usually a shallow depression in the ground lined with grass, leaves, and other plant material during the day - Species is nocturnal and feeds mainly on earthworms and other invertebrates - Apparently solitary in the wild with home ranges as large as 7 ha	- Loss of habitat through clearing - Predation by foxes - High fire frequency reducing availability of dense ground cover - Genetic insecurity of remnant populations	National Parks Blue Mountains, Bournda, Budderoo, Garrigal, Ku-ring-gai Chase, Morton, Myall Lakes, South East Forests Nature Reserves Nadgee
	Yellow-bellied Glider <i>Petaurus australis</i> Vulnerable	- Tall mature forest in regions of high rainfall - Productive tall open sclerophyll forests with mature trees to provide shelter and nesting hollows and all year food resources from eucalypts - Critical elements include sap-site trees, winter flowering eucalypts, mature trees, den site and a mosaic of different forest types. Known feed trees include <i>Corymbia gummifera</i>, <i>Eucalyptus maculata</i>, <i>E. viminalis</i>, <i>E. ovata</i>, <i>E. cypellocarpa</i>, <i>E. obliqua</i>, <i>E. propinqua</i>, <i>E. punctata</i> dydyma, <i>E. fastigata</i>, <i>E. radiata</i>, <i>E. intermedia</i>, <i>E. globoidia</i>, <i>E. muellerana</i>, <i>E. agglomerata</i>, <i>E. bosistoana</i>, <i>E. elata</i>, <i>E. signata</i>, <i>E. tereticornis</i>, <i>E. amgophioides</i>, <i>E. pilularis</i> <i>E. maidenii</i> and <i>Acacia spp</i>	- Loss and fragmentation of habitat through clearing and associated activities - Removal of hollow bearing nesting trees through logging of old growth elements - Reduction in food resources and isolation of populations through inappropriate fire regimes - Predation by feral animals	National Parks Monga; Deua; Murramarang; Morton; Kanangra; Boyd State Forests Flat Rock Other various reserves in NSW
	Grey-headed Flying-fox <i>Pteropus poliocephalus</i> Vulnerable	Subtropical and temperate rainforests, tall sclerophyll forest and woodland, heaths and swamps	- Loss and Fragmentation of habitat through clearing and associated activities - Inappropriate fire regimes may deplete food resources and isolate populations - Making them susceptible to regional catastrophic events - Predation by foxes and cats	National Parks Murramarang, Buddawang, Monga, Meroo, Morton, Seven Mile Beach Nature Reserves Narawallee Creek , Comerong Island

	Name	Species Information	Threats	Known in Conservation Reserves
Microchiropteran Bats	Eastern Bent-wing Bat <i>Miniopterus schreibersii oceanensis</i> Vulnerable	- Found in naturally-formed caves and human made structures including stormwater channels, mines and road culverts - Wet and dry sclerophyll forest, open woodland, paperbark forests, rainforest and open grassland - Forages above tree canopy - Travels large distances between different roosts according to changing seasonal needs, age, and reproductive status - May live greater than 17 years - Preyed upon by owls, pythons, feral cats and occasionally foxes	- Disappearance of mature trees containing suitable hollows for nesting - Inappropriate logging cycles not allowing time for tree hollows to form - Habitat destruction/fragmentation - Land degradation - Reduction in prey abundance - Frequent disturbance of roosts used for hibernation seriously increases winter mortality - Disturbance to maternity caves	National Parks Eurobodalla; Murrumbidgee; Jervis Bay Gulaga; Royal; Ku-ring-gai chase State Forests Kiola; Bodalla; Other various reserves in NSW
	Eastern Freetail-bat <i>Mormopterus norfolkensis</i> Vulnerable	- Tree hollows or under loose bark of trees in open forests in small colonies - Most records from dry eucalypt forest and woodland east of the Great Dividing Range - Some individuals caught over a rocky river through rainforest and we sclerophyll forest	- Disappearance of mature trees containing suitable hollows for nesting - Inappropriate logging cycles not allowing time for tree hollows to form - Habitat destruction/fragmentation - Land degradation - Reduction in prey abundance	National Parks Eurobodalla; Monga; Bugong; Blue Mountains State Forests Bodalla
	Large-footed Myotis <i>Myotis adversus</i> Vulnerable	- Occur near bodies of water, ranging from rainforest streams to large lakes and reservoirs - Forage over the water on aquatic insects	Loss of habitat	National Parks Royal; Blue Mountains; Jervis Bay; Meroo/ Wadbilliga; Eurobodalla State Conservation Areas Burrangorang Other various reserves in NSW
Marine Mammals	Australian Fur-seal <i>Arctocephalus pusillus subsp. doriferus</i> Vulnerable	- Preys predominately on squid and school fish, and occasionally on octopus, crustaceans and bottom dwelling fish. - Associated with rocky islands, shore platforms, reefs, boulder stacks and caves close to the sea that are used as haul-out sites. - Breeds only at ten locations within Bass Strait. - NSW habitats and resources remain important for non-breeding individuals.	- Prior to 1923 commercial sealing depleted the population, thus leaving it more susceptible to other threatening processes. - Commercial and recreational fishing operations, especially as a result of by-catch mortality. - Fishing operations may also reduce the size, and thus availability, of prey populations. - Entanglement and ingestion of plastic bags and other human refuse that has been discarded inappropriately. - Local populations are susceptible to stochastic events such as oil spills.	Montague Island NR, Booderee NP, Nadgee NR

Name	Species Information	Threats	Known in Conservation Reserves
Humpback Whale <i>Megaptera novaeangliae</i> Vulnerable	- Found in coastal waters off Australian coasts - Migrates annually along both east and west coasts of Australia. Spends summer in Antarctic waters before traveling north to breed during the winter months	Population has been reduced due to previous exploitation to recover meat and oil products	Marine Reserves along the coast