Proposed subdivision, Lot 2, DP 250984, Grandfathers Gully Road, Lilli Pilli, NSW

Addendum

Biodiversity Assessment

FINAL

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1. INTRODUCTION

This Biodiversity Addendum was commissioned by Mr David Brewer to provide an addendum report to a previous assessment undertaken by PMA Consulting for a proposed subdivision. The original report was commissioned in 2005. Subsequent changes to the assessment process, namely the change from eight part test to the seven part test (or assessment of significance) for threatened species and communities listed under the schedules of the *Threatened Species Conservation Act 1995* (TSC Act) requires this assessment to be updated. This addendum provides an assessment of the likely impacts associated with the proposed development on flora and fauna under the updated legislation and subsequently, a seven part test (or assessment of significance) is provided.

Lot 2, DP 250984 (now referred to as the subject site), consists of both cleared and forested land, with a number of areas also present re-growth vegetation. Historically, the subject site has been used as a deer farm, with much of the original fencing intact.

The subject site is located within the Eurobodalla Local Government Area south of the coastal town of Batemans Bay (refer Figure 1) and is zoned 1c Rural Holdings under the Eurobodalla Shire Council Local Environment Plan.

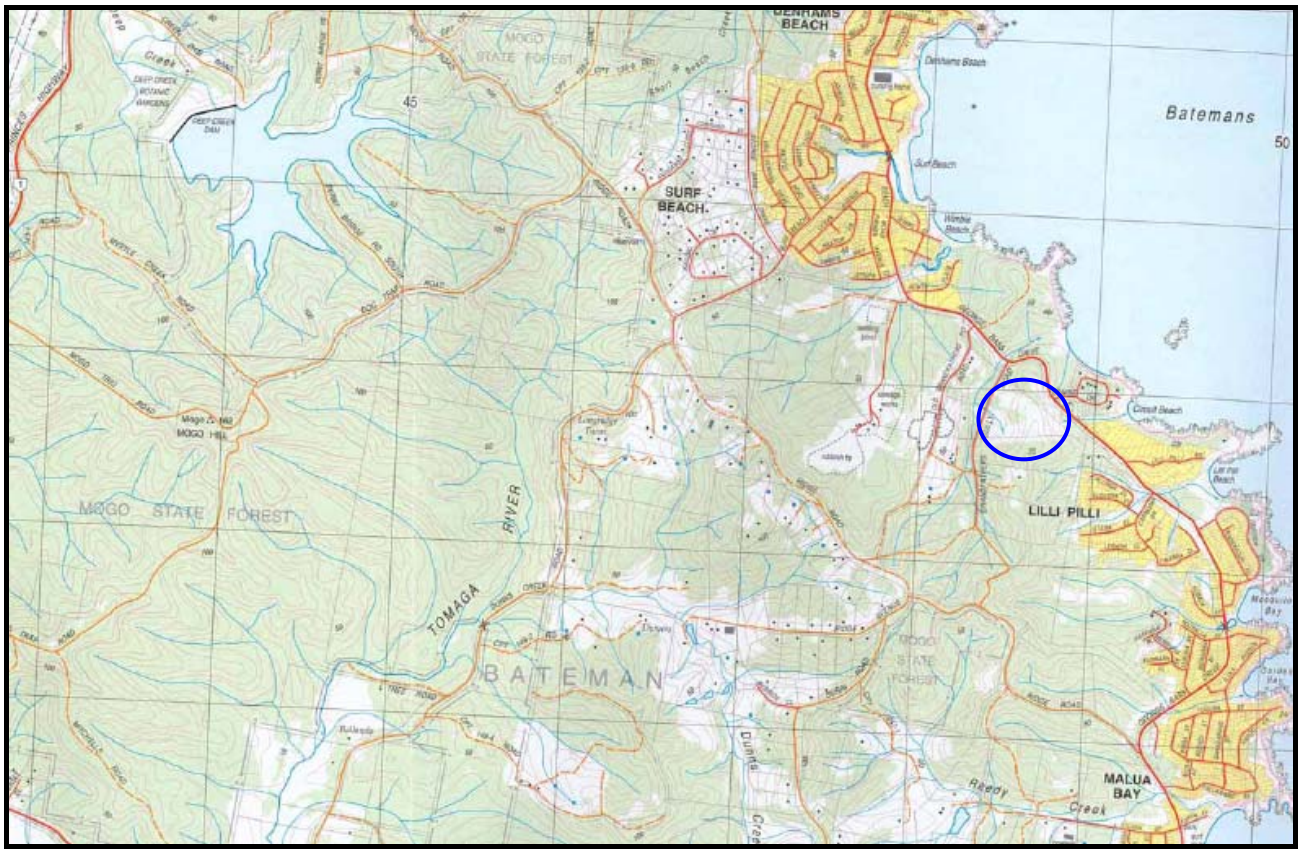

Figure 1: Location Map showing study area (blue circle outline) within the Eurobodalla Local Government Area (Mogo Mapsheet 1:25,000).

2. APPROACH TO THIS ADDENDUM

In compiling this Biodiversity Addendum, the following approach was adopted:

i) Field Work. A site assessment was carried out on the 27th April 2007 by ecologist Steven Sass and Botanist Jackie Miles. The aim of the site assessment was to evaluate the 2005 report by undertaking a flora and fauna survey along with an evaluation of the habitats which could, or were likely to host habitat for threatened species. The field assessment identified vegetation and habitat types within the subject site and focused survey efforts in different habitat types to obtain comprehensive flora and fauna species lists.

ii) Research. This component of the assessment involved sourcing information available on the threatened species, populations, and communities that may be present within the subject site including a review of the assessment undertaken by PMA Consulting in 2005. A search of the threatened flora and fauna records from the Department of Environment and Climate Change, Parks and Wildlife Division (DECC PWD) Wildlife Atlas and the Environmental Reporting Tool database from the commonwealth Department of Environment and Water Resources.

iii) Report Compilation. Following the completion of the field assessment and research, communities were described separately for flora and fauna. The potential impacts of the proposal upon threatened flora and fauna were evaluated. This report concludes with recommendations for minimising environmental impacts, with a focus on threatened species.

3. FLORA

3.1. Methods

The vegetation on the site was surveyed on the 27th April 2007. Species lists were compiled from all areas of the subject site. A full list of species recorded on the site is presented in **Appendix A.**

3.2. Results

3.2.1 Vegetation communities

Much of the site has been cleared (Figure 2, 4), with sparse to medium-dense retained mature canopy and understorey trees, and some patches of retained forest around the edges of the property and in a drainage line on the western side of the central ridge. The site is on Ordovician metasediments and the retained vegetation on the subject site is typical of this part of the south coast on clay soils, being species derived from Coastal Lowlands Cycad Dry Shrub Forest (Forest Ecosystem 9 in Thomas *et al* 2000) on the ridge and upper slopes, tending towards Northern Foothills Moist Shrub Forest (Forest Ecosystem 21) in the gullies and lower parts of the site, such as the south-west corner. In both these communities the dominant tree is spotted gum (*Corymbia maculata*) with blackbutt (*Eucalyptus pilularis*), white stringybark (*E. globoidea*) and grey ironbark (*E. fibrosa*). Small trees consist largely of black sheoak (*Allocasuarina littoralis*) and wattles, *Acacia mabellae, A. longifolia, A. mearnsii* and *A. implexa*. The understorey is drier in the Cycad Dry Shrub Forest and includes burrawang (*Macrozamia communis*) and shrubs including *Acacia stricta, Acacia terminalis, Hibbertia aspera, Daviesia ulicifolia, Leucopogon lanceolatus* and *Bursaria spinosa*. Shrubs are sparse and young (due to repeated slashing) in the cleared areas, to dense in some of the retained forest patches. The groundcover varies from dense tall grasses (mostly native species) in the cleared areas, to quite sparse under trees. In the moister forest type, which occurs on the lower slopes in a few spots around the site edges and in the gully there are tall shrubs including *Acacia longissima, Acacia paradoxa, Acacia longifolia, Leptospermum polygalifolium* and *Ozothamnus diosmifolius*, and a groundcover dominated by grasses *Microlaena stipoides, Entolasia marginata* and graminoids *Lepidosperma urophorum* and *Lomandra* spp.

Most of the site was inspected except for the stands of very dense forest, which will be retained, and it is considered unlikely that any significant species were overlooked, although some species such as spring and summer flowering orchids would not have been detected because of the timing of the survey in autumn.

3.2.2 Disturbance

The site has been partially cleared and operated as a deer farm for a period, but has not been "pasture improved", so that the majority of the species present are native, with the exception of a few small patches where kikuyu or couch grass dominate near the existing house, and an extensive infestation of whisky grass (**Andropogon virginicus*), which was probably established by slashing of the site. The house garden was not surveyed and probably contains more exotic species, some of which, such as the English ivy (**Hedera helix*) recorded by a previous survey, may be environmental weeds. A few Australian native plants which are not naturally occurring in Eurobodalla Local Government Area have been planted below the house, such as willow hakea (*Hakea salicifolia*) and a grevillea species.

Apart from the weedy grasses mentioned there are few exotic plant species present. The only recorded weed listed as noxious in Eurobodalla Local Government Area is a single plant of Pampas grass (**Cortaderia selloana*), a garden escape which is located on the east-facing slope above a small dam. It should be removed and the seed heads bagged for safe disposal.

Figure 2: Much of the subject site is cleared. The forest in the background is not within the subject site, and is not part of the proposed development.

Figure 3 : Cleared upper slopes with *Allocasuarina littoralis* present in the riparian gullies.

Figure 4: The southern section of the subject is also cleared. The forest vegetation visible in the background is outside of the subject site boundaries.

3.2.3 Vegetation Communities and species of regional conservation significance

No plant species which are listed as threatened under the *Threatened Species Conservation Act 1995* or the *Environment Protection and Biodiversity Conservation Act 1999* were found on the site, nor would any be expected from the type of habitat available. No plant communities listed as Endangered Ecological Communities occur on the site.

The only threatened plant species which has been recorded within a 10km radius of the site is the shrub *Correa baeuerlenii* and it does not appear to be present, although some of the denser areas of vegetation were not able to be searched thoroughly. This species is very rare in Eurobodalla Local Government Area and the probability that it is present is very low.

Two species which may be of local conservation significance were seen. *Daviesia ulicifolia* ssp *stenophylla* is uncommon on the South Coast, but has been formally recorded from the Mogo area (Harden, 2002) and is not uncommon between Moruya and Batemans Bay (J. Miles, pers. obs.). Only a few small plants were recorded around the upper edges of the gully on the western slope. *Acacia paradoxa*, a prickly shrub which is widely distributed and not uncommon in NSW and Victoria, but on the NSW south coast appears to be restricted to the Batemans Bay area, where it occurs fairly commonly in moist forest. It is common around the edges of the site, and in some of the patches of retained forest.

The two vegetation types on the site are widespread on the South Coast between about Termeil and Bega and are adequately reserved in National Parks.

Threatened flora recorded in Eurobodalla Local Government Area, extracted from the Wildlife Atlas database held by Parks and Wildlife Division, Department of Environment and Climate Change, include a number of species known only from wetland habitats, from saltmarsh and from high elevations along the top of the coastal escarpments. When these species are excluded, five remain which might possibly occur on the site. Their habitat requirements are outlined in Table 1 below.

Table 1: Threatened Flora recorded from Eurobodalla Local Government Area for which suitable habitat might occur on the site.

Species	**Category***	**Habitat required**
Correa baeuerlenii Shrub, 1m high (Rutaceae).	V, v	This species grows in a range of forested habitats, including rocky and riparian situations. It is not present in the parts of the site which will be developed.
Persicaria elatior Erect forb to 1m high (Polygonaceae).	V, v	Grows in moist situations such as gullies within forest. No natural wetlands occur on the site. The vicinity of the three dams was searched and this species was not found.
Haloragis exalata ssp *exalata* Perennial forb to 1m high (Haloragaceae).	V, v	Grows in a range of situations within forest, often associated with water, either stream beds or around the margins of coastal lakes. Tolerates some types of disturbance. This is a conspicuous species which could not have been overlooked. It is not present.
Thesium australe Sprawling perennial herb to about 40cm high (Santalaceae).	V, v	*Thesium* grows in grassland and woodland, where it is parasitic on grasses, particularly kangaroo grass. It shows a preference for moist areas. The site is formerly forest making it very unlikely that *Thesium* occurs there, although kangaroo grass is common on the site.
Galium australe Perennial forb (Rubiaceae)	E	This is a very inconspicuous species which has been recorded in spotted gum forest (J Miles, pers. obs.). It usually occurs in small numbers and could have been overlooked if present. However, given the level of disturbance of the site, it is very unlikely that it occurs there.

V= listed as Vulnerable in NSW in Schedule 2 of the *Threatened Species Conservation Act*
E = listed as Endangered in NSW in Schedule 1 of the *Threatened Species Conservation Act*
v = listed as nationally vulnerable under the *Environment Protection and Biodiversity Conservation Act*

4. FAUNA

4.1. Methods

A comprehensive fauna study was conducted on the 27th April 2007. The objectives of the fauna survey were to establish the habitat values of the subject site and to determine if any threatened species of fauna were present or likely to utilise the subject site.

Fauna survey techniques used during this assessment included;

a) **Diurnal bird censusing**, Three standard 20 minute searches across each of the two habitat types (giving a total of 120 minutes) targeting threatened species such as Glossy Black Cockatoos and Regent Honeyeaters;

b) **Habitat evaluation.** Additional identification of hollow bearing trees was conducted and assessed for potential to provide den and nest sites for threatened species. In addition, trees that could provide foraging resources for threatened avifauna were also identified;

c) **Diurnal herpetofauna census**, One 30 minute search covering a 0.5 hectare within the two habitat types (a total of 1 hours);

d) **Nocturnal call playback** of four threatened species of owl (Powerful Owl, Masked Owl, Barking Owl and Sooty Owl) and the Yellow-bellied Glider and Squirrel Glider were completed. Total call play back time for each species was 4 minutes of calls, followed by 4 minutes of silence for each species. Total time for nocturnal call playback was 48 minutes over one evening;

e) **Foot based spotlighting** was undertaken, searching for nocturnal, arboreal and scansorial vertebrate fauna directly after the nocturnal call playback session. Stag watching at dusk of hollow bearing trees was also undertaken (specifically targeting Yellow-bellied Gliders, owls (Powerful Owl, Masked Owl and Barking Owl), microbats (roost and maternity sites) and arboreal mammals. Search effort was one person hour within each habitat type, giving a total search effort of two hours.

f) **Scat animal sign searches** at each site would be completed along tracks for predator scats and for 20 minute duration among vegetation in each habitat type.

g) **Threatened Species Desktop evaluation.** Due to the timing of the survey (late Autumn), a desktop search of threatened species in the region was conducted. These species were then evaluated for their potential to utilise the subject site and the potential level of impact from the proposed activity.

4.2. Results

4.2.1 Habitat Types

The site provides a number of fauna habitat resources. Two general fauna habitat types were identified at the site. These are detailed below:

Cleared land with scattered trees – This habitat type dominates the subject site (Figures 2, 4). The cleared land is a result of past land use, including deer farming, where much of the original vegetation has been cleared. Despite this heavy disturbance, the cleared land provides an additional component of habitat that compliments some species, predominately generalists or species considered 'open space' dwellers such as Australian Magpies and Eastern Grey Kangaroos. One of the scattered trees, provides a medium sized hollow suitable for hollow-dependant fauna such as birds or microbats. Considering its isolation from other vegetation, this hollow is not considered potential habitat for Squirrel or Yellow-bellied glider, nor would its opening (~10cm) be suitable for threatened owls. Further, no 'white wash' or surface scratches were evident.

This habitat type was also devoid of shrubby vegetation that would provide any potential habitat for bandicoots. Although a small area of dense bracken in the south-eastern corner is extremely marginal habitat, its isolation and extent ensures that the only species likely to utilise the habitat resource are small birds such as scrub-wrens and fairy wrens which were present.

The scattered trees across the subject site consisted of spotted gum, which are known to provide an important food resource for Swift Parrots when they migrate through the region during the winter months. Whilst this tree species is common across the Eurobodalla Shire and greater south coast region, any loss of this tree species contributes to the loss of this important habitat resource.

Two small dams were located within the cleared area. The southern dam provided habitat to a number of frog species.

Vegetated areas and riparian gullies – Although much of the original vegetation has been cleared, the remaining areas of vegetation provide potential habitat for a variety of species including threatened fauna (Figure 3). Much of the riparian gullies were dominated by *Allocausarina littoralis*, which is the known feeding tree for Glossy Black Cockatoo. Many of the trees were showing excellent seeding, however, there was no evidence of feeding signs present. Although this habitat provides a feeding resource for this species, there were no signs of it being exploited at this time. A lineal strip of these feed tree species were also found on the western boundary (Figure 6).

Two additional hollow bearing trees were located within the riparian area. Despite no sap trees or feeding trees being identified across the site, these hollow bearing trees and associated vegetation have the potential to provide habitat for threatened fauna such as Squirrel Glider and Yellow-bellied Glider. The vegetation within the riparian gullies provided a habitat corridor from the hollow-bearing trees within the subject site to the wider locality which is well vegetated. However, none of these threatened arboreal mammals were recorded suggesting that if the subject site is utilised by these species, that it is only part of a wider foraging regime or as a potential movement corridor between other areas of native vegetation in the wider locality. Additionally, these areas of habitat offers valuable food resources for threatened gliders in the form of flowering eucalypt species, in particular, spotted gum.

Fallen timber and leaf litter is considered relatively common throughout this habitat type. These resources are considered important habitat components for a variety of fauna including reptiles (Sass 2003), amphibians (Wassens et al. 2004) and small to medium sized mammals (Mac Nally et al. 2001).

Two dams were located in succession along this gully. Both dams provided continuous fringe vegetation which suggests that they may support numerous frog species (Figure 5). However, the presence of the Plague Minnow (*Gambusia holbrooki*) in at least one of these dams is likely to have impacted on the quality of this habitat for frogs. This fish species is known to eat frog spawn and tadpoles (Morgan & Buttemer 1996). Plague Minnow are also listed as a Key Threatening Process under Schedule 3 of the *Threatened Species Conservation Act 1995* (DEC 2006) and are considered to be one cause for decline of frog species, in particular the threatened Green and Golden Bell Frog at some locations throughout its range (Daly & Senior 2003).

Despite the presence of black she-oak and a number of Acacia species within the riparian areas, the absence of conical shaped diggings suggests that this habitat does not provide the thick understorey preferred by bandicoot or potoroo species.

4.2.2 Survey results

The fauna survey of the subject site revealed 38 species. This consisted of 26 bird species, five species of frog, five species of mammal and one species of reptile and fish respectively. Due to the relatively limited fauna survey and the cryptic nature of many species this is unlikely to be a complete list of the species which could be expected to occur across the subject site. An assessment of the importance of the subject site for fauna therefore needs to rely heavily on the presence of habitat attributes and fauna records from the NSW Atlas of Wildlife database (TSC Act) and other relevant sources such as the Environmental Reporting Tool (EPBC Act) and other biodiversity reports in the locality.

When considering the location of the subject site in a landscape context, it becomes evident that the Lilli Pilli area is likely to provide regional connectivity between the coast and mountains in a coastal plain that is fragmented by development and subsequent habitat modification. The importance of habitat corridors to maintain biodiversity values is generally well documented across the scientific literature, and is an important component of maintaining genetic exchange to prevent local extinctions. In a local context, the significance of such fauna movement corridors is highlighted across a number of reports eg, Gellie 2001 & Gaia Research 2001. More specifically, Andrews (2006) in a report to Eurobodalla Shire Council recognises the potential of the Grandfathers Gully area as an important fauna corridor for regional biodiversity. However, with the past clearing and land use practices of the vast majority of the subject site, only the riparian gullies and the vegetation flanking the northern and western boundaries are likely to contribute to faunal movement.

Table 2: GPS location, species type, dimensions and attributes of hollow-bearing habitat trees within the subject site

					No. of hollows			
Easting	**Northing**	**Height (m)**	**dbh (m)**	**Species**	**Sml**	**Med**	**Lge**	**Comments**
248590	6037563	30+	1.3	*C.maculata*	-	1	-	Spout hollow. No evidence of possums or gliders. Tree is in moderate condition.
248407	6037657	25	1.0	*C.maculata*	-	1	-	Trunk hollow, some scratch marks evident. Tree appears in good condition.
248368	6037717	20	1.3	*C. maculata*	1	-	-	Trunk hollow, tree appears in good condition.

The fauna survey revealed one species that is considered locally significant due to its rare occurrence. The Greater Glider is more often regarded as a mountain species, with only a few records existing on the coastal plains on the south coast of NSW (DEC 2006a). Recently, **ngh**environmental has recorded this species at nearby Surf Beach (Sass & Miles 2007) and Broulee (Sass & Marshall 2007). However, this species is not listed under the TSC Act 1995 or the EPBC Act 1999.

The subject site supports a moderate avian diversity with almost 30 species recorded. Species ranged from small tree canopy insectivores (whistlers, treecreepers), nest predators (currawongs and butcherbirds), parrots (Rainbow Lorikeets and Australian King Parrots) and ground dwelling species such as thornbills, scrub wrens and fairy wrens. Such a diversity of birds suggests that the subject site could be considered of moderate quality and provides a diverse range of resources for avifauna.

The mammal diversity of the subject site was also considered moderate. As previously discussed, the presence of the Greater Glider on the coastal floodplain is considered locally significant. Regular sightings of Swamp Wallabies and Red-necked Wallabies confirm that the site is regularly utilised by these species. A large group (at least 6 individuals) of Sugar Gliders was observed within the vegetation on the northern boundary.

Amphibian habitat within the subject site is in moderate condition, with four small dams revealing five species. However, species abundance across the subject site was marginally poor, with only a few individuals of all species heard calling. It could be suggested that the subject site supports only minimal frog populations as a result of the presence of the introduced fish *Gambusia holbrooki.* These were observed within at least one dam. The presence of this fish has been recognised as a potential threat to amphibian populations and is listed as a *Key Threatening Process* under schedule 3 of the *Threatened Species Conservation Act 1995.*

Reptile searches revealed the presence of just one species. However, the timing of the survey (Autumn) is likely to be the limiting factor in this result. Surveys for reptiles across the coastal plain in spring or summer are likely to reveal at least 10 common species (Sass, pers.obs).

Figure 5: Fringe vegetation around the northern most dam.

Figure 6: *Allocasuarina littoralis* on the western boundary of the subject site.

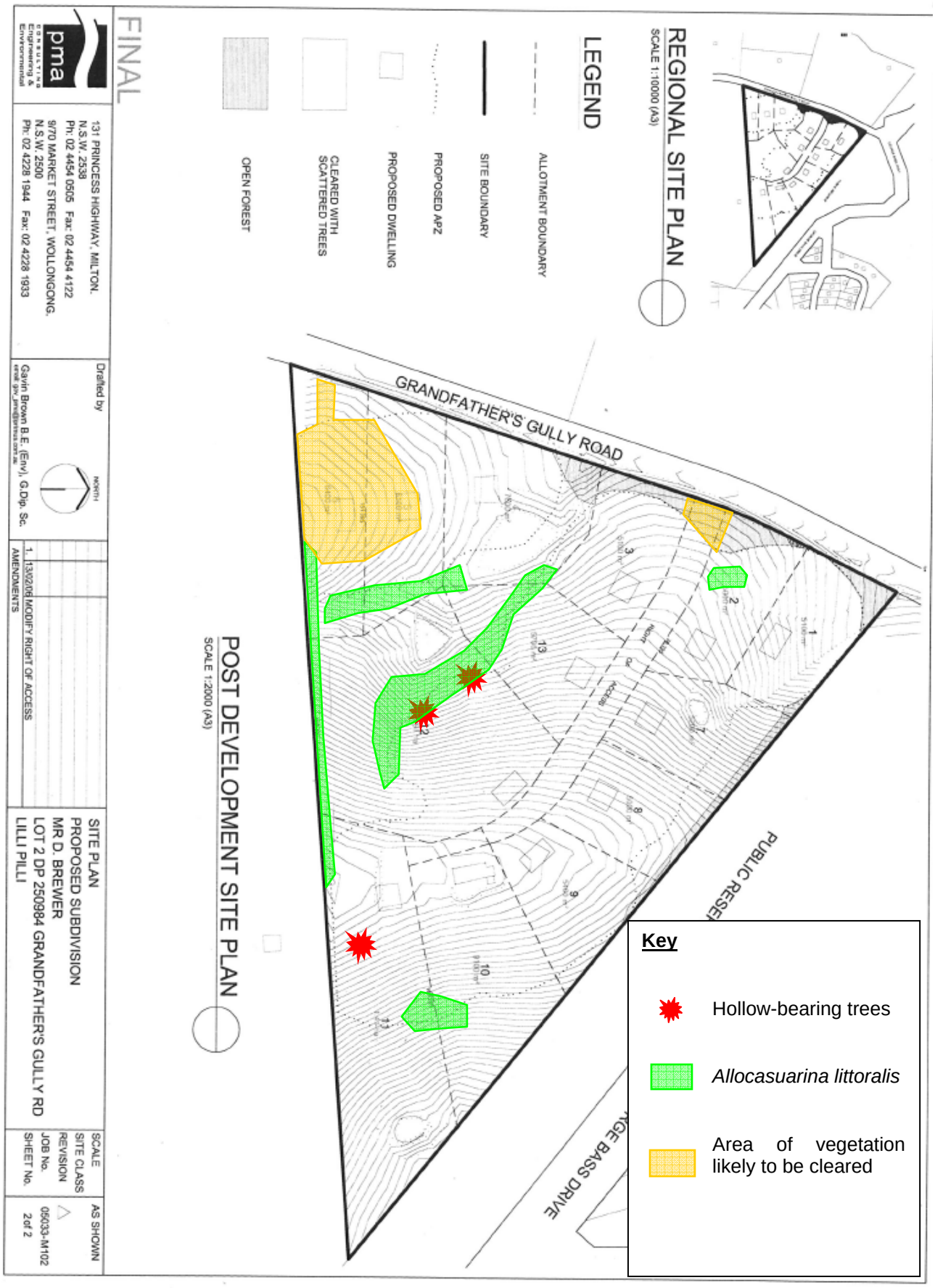

Figure 7: Approximate location of hollow-bearing trees, extent of potential feeding trees (*Allocasaurina littoralis*) for Glossy Black Cockatoos and vegetation to be cleared within the subject site.

Although some areas supported habitat resources suited to reptile fauna, the past clearing of vegetation and previous grazing intensity (Sass 2003) and natural distribution patterns (Sass 2006) of reptile communities is likely to impact on the reptile diversity of the subject site.

4.2.3 Eurobodalla Shire Council Policy on Yellow-bellied Gliders

The Eurobodalla Shire Council, in collaboration with the NSW National Parks & Wildlife Service, developed a Policy for the Conservation of the Yellow-bellied Glider in the Broulee Area (ESC 2002). The document generally recommends that hollow-bearing trees and feed trees be maintained on land proposed for development, along with maintaining sufficient trees to allow connectivity between they key resources. Despite this policy applying to a specific area of land at Broulee, the policy aims to provide a platform for a Shire-wide approach to Yellow-bellied Glider management.

In accordance, with section 4 of this policy, the minimum standards for developments apply:

1. Retention of all sap-trees;
2. Retention of all large hollow-bearing trees (>50cm dbh), except where it can be demonstrated that Yellow-bellied Gliders do not utilise the hollow-bearing tree;
3. Clearing of vegetation around these retained habitat features must not inhibit access of Yellow-bellied Gliders to these resources;
4. Retained vegetation must be configured to allow movement of Yellow-bellied Gliders across the property and onto suitable habitat on adjoining properties.

The proposed activity within the subject site complies with the minimum standards outlined within this policy.

4.2.4 SEPP 44: Koala Habitat Protection

State Environmental Planning Policy No. 44 encourages the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range across 107 council areas. The policy applies to Eurobodalla Shire Council.

No tree species listed under Schedule 2 of the State Environmental Planning Policy No. 44 (Koala Habitat Protection) are present within the subject site. As a consequence, Core Koala Habitat is unlikely to be present. The closest historical records exist approximately 20kms to the south-west in Deua National Park and 20kms to the north-west near Nelligen both from the mid 1960's.

As a result, SEPP44 would not apply to the subject site.

4.2.5 Threatened species

During the survey, no threatened fauna species were recorded. However, an evaluation of threatened species known from the locality (NSW Atlas of Wildlife Database, Department of Environment & Climate Change and Environmental Reporting Tool, EPBC Act, Department of Environment & Water Resources) determined that several species have potential to be present at the subject site. Based on the ecology of all these species, the habitat components of the subject site, the likelihood of occurrence within the subject site and the degree of anticipated impact from the proposed activity, threatened species (*TSC Act* and *EPBC Act*) and migratory species listed under the *EPBC Act 1999* were assigned to four impact categories; unlikely, low, moderate or high (Table 3).

Table 3: An evaluation of the likelihood and extent of impact to threatened fauna recorded from the Batemans Bay 1:100,000 map sheet by DECC, Wildlife Atlas (05/05/07) and the Environmental Reporting Tool by Department of Environment & Water Resources (EPBC Act). Marine mammals and littoral species have been excluded.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
AVES			
Australasian Bittern *Botaurus poiciloptilus* V TSC	This species is considered widespread in their distribution, however, they are uncommon in south-eastern Australia (DEC 2006k). They are known to inhabit permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (Typha spp.) and spikerushes (Eleoacharis spp.) (DEC 2007k).	The existence of four small dams provide potential habitat for this species. Further, the presence of continuous fringe vegetation in the form of spikerushes also suggests that suitable habitat may be present. However, the extant of this habitat is very small, and it is unlikely that this species would use the subject site considering the extant of coastal wetlands of much larger area throughout the region. Historically, individual sightings have been recorded near Congo, on Montague Island and Tilba (DEC 2007a). More recently, a record exists near Durras (DEC 2007a).	Unlikely, as all four dams will not be removed by the proposed activity.
Australasian Painted Snipe V EPBC M EPBC	This species is a small freshwater wader, with a long bill that droops slightly at the tip. They prefer fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. It will nest on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	Although four small dams are present, suitable areas along the fringe of the dams are not. Additionally, shallow water suitable for this species to forage does not appear present.	None.
Barking Owl *Ninox connivens* V TSC	This is a species that, although is found throughout Australia except for the central arid regions and Tasmania, it is rarely recorded in the in coastal and escarpment forests (NPWS 2003c). The species can be found in open forests and woodlands and along watercourses. During the day, Barking owls will roost along creeklines, especially where Acacia forms dense thickets (NPWS 2003c). They live alone or in pairs and occupy territories from 30 to 200 hectares where birds are present all year round (NPWS 2003c	Whist much of the subject site consists of cleared areas, the riparian areas do provide moderately dense thickets where this species may roost during the day. This species has been recorded just north of Batemans Bay and near Bodalla (DEC 2007a).	Unlikely, the vegetation within the riparian area will not be cleared.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Black Bittern *Ixobrychus flavicollis* V TSC	This species is known from a wide distribution from southern NSW north to Cape York and along the north coast to the Kimberley region. However, In NSW, records are sporadic along the east coast, rarely being recorded south of Sydney or inland (DEC 2007l). They can be found in both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation (DEC 2007l). In the case that permanent water is present, the species may occur in flooded grassland or adjacent forest and woodland where it will often roost whilst feeding in more suitable areas (DEC 2007l).	The existence of four small dams provide potential habitat for this species. Further, the presence of continuous fringe vegetation in the form of spikerushes also suggests that suitable habitat may be present. However, the extant of this habitat is very small, and it is unlikely that this species would use the subject site considering the extant of coastal wetlands of much larger area throughout the region. The only recent record for this species is near Durras in 2000 (DEC 2007a). The remaining records are in the early 80's in the hinterland of the Eurobodalla local government area.	Unlikely, as all four dams will not be removed by the proposed activity.
Black-faced Monarch *Monarcha melanopsis* M EPBC	This species damp vegetation in gullies, forests and rainforests. Summer migrant to SE Australia and returning to PNG in Autumn-Winter.	Although forest is present, the damp, gully vegetation is likely to provide suitable habitat for this species.	Unlikely, as potential habitat for this species will be retained.
Black-tailed Godwit *Limosa limosa* V TSC	This species is a migratory wading bird that breeds in the northern hemisphere, visiting Australia during summer and leaving in March (NSW NPWS 1999a). It is primarily found on coastal sandspits, mudflats and lagoons and prefers shallow water where it feeds on a variety of invertebrates.	No suitable habitat present onsite.	None.
Bush-stone Curlew *Burhinus grallarius* E TSC	This is a species of open woodland and forest throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range (NPWS 2003b). This species is rarely encountered in the locality with records around Narooma and Bermagui in the south (DEC 2007a).	Fallen timber is absent over much of the site, as is a sparse grassy understorey as the remaining vegetation is quite dense. These habitat attributes are ecological requirements for this species and they are not present on the subject site. Therefore, no suitable habitat exists for this species at the subject site.	None.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Brown Treecreeper *Climacteris picumnus* V TSC	This species is found in a variety of eucalypt woodlands (including Box-Gum Woodland and River Red Gum) and dry open forest across the inland slopes and plains west of the Great Dividing Range where it enjoys an open grassy understorey. The presence of fallen timber is an important habitat component for foraging for this species. It is less commonly recorded on the coastal plains and ranges in similar woodland habitats (DEC 2007c).	Although past clearing of the land has provided vast areas of grasses, the site could not be considered to provide an open grassy understorey within a woodland habitat. Therefore, no suitable habitat exists for this species at the subject site.	None.
Diamond Firetail *Stagonopleura guttata* V TSC	This species is considered to be found across most of NSW with a concentration of these records on the western slopes of the Great Dividing Range (DEC 2007n). It is generally found in grassy eucalypt woodlands such as box-gum woodlands and snow gum woodlands (DEC 2007n). It can often be seen around riparian areas and lightly wooded agricultural areas (DEC 2007n).	The subject site is not considered to be grassy eucalypt woodland. Therefore, no suitable habitat for this species in present on the subject site. One record exists west of Moruya (DEC 2007a).	None.
Eastern Ground Parrot *Pezoporus wallicus wallicus* V TSC	This species is known to occur in high rainfall coastal and near coastal low heathlands and sedgelands, generally below one metre in height and very dense (up to 90% projected foliage cover) (DEC 2007i). These habitats provide a high abundance and diversity of food, adequate cover and suitable roosting and nesting opportunities for the Ground Parrot, which spends most of its time on or near the ground (DEC 2007i).	The subject site does not contain low coastal heath or sedgelands. This species prefers vegetation under one metre in height. A small area of bracken in the south-east corner is the only area of vegetation that would fit into this category. However, this vegetation type is not considered as habitat for this species and the very small extant (less than 100m2) suggests that it would not provide habitat for this species within he subject site.	None

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Freckled Duck *Stictonetta naevosa* V TSC	This species can be found primarily in south-eastern and south-western Australia, otherwise occurring as a vagrant (DEC 2007j). They have a preference for permanent freshwater swamps and creeks with a heavy growth of Cumbungi, Lignum or Tea-tree (DEC 2007j). During drier periods, they have been known to move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds (DEC 2007j).	The existence of four small dams may provide potential habitat for this specie in drier times when this species is known to move into coastal areas. Further, the presence of continuous fringe vegetation in the form of spikerushes also suggests that suitable habitat may be present. However, the extant of this habitat is very small, and it is unlikely that this species would use the subject site considering the extant of coastal wetlands of much larger area throughout the region. Two records for this species exist near Moruya since 1982 (DEC 2007a).	Unlikely, as all four dams will not be removed by the proposed activity
Gang Gang Cockatoo *Callocephalon fimbriatum* V TSC	This species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. It occurs at lower altitudes in drier, more open eucalypt forests and woodlands (particularly box-ironbark assemblages) (Shields and Crome 1992). This species requires large hollows in which to breed (Gibbons 1999, Gibbons and Lindenmayer 2000).	The existing hollow-bearing trees do not provide the large hollows that this species requires for breeding.	None.
Glossy Black Cockatoo *Calyptohynchus lathami* V TSC	This is a species of open forests and woodland, dependent mainly on the seeds of Allocasuarina trees as a food source (Blakers *et al*. 1984). Large trees with hollows are required for breeding sites (Emison *et al*. 1987, DEC 2007d). Competition for hollows increases with openness of habitat and can be a threat to this species.	Contrary to the previous report by PMA consulting, feed trees for this species are present within the subject site. Primarily, these exist within the riparian gullies and on the western boundary of the subject site and scattered amongst the cleared areas.	Low, although the vegetation within the riparian area will be retained. However, four fence lines from allotments will run through this vegetation, potential clearing some feed tree species.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Great Knot *Calidris tenuirostris* V TSC	This species is predominantly coastal, and rare on the southern half of the continent. It has been sighted as far south as Narooma (Smith 1991; Higgins & Davies 1996). Preferred habitat includes intertidal mudflats and sand flats, in bays, estuaries and lagoons, even inland lakes. In these habitats it uses its long bill to forage for aquatic invertebrates.	No suitable habitat is present within the subject site.	None.
Hooded Robin *Melanodryas cucullata* V TSC	This species is rarely found on coastal plains, preferring lightly wooded country, but often in cleared areas (DEC 2007o). The species requires structurally diverse habitats with shrubs, forbs, fallen timber and leaf litter to provide adequate hunting and foraging areas where it consumes invertebrates (DEC 2007o). This species is known to occupy territories ranging from approximately 10 ha during the breeding season, to 30 ha in the non-breeding season (DEC 2007o).	The subject site does not contain lighted wooded habitat, generally supporting either cleared areas and forest, with the subject site considered unsuitable for the residency of this species. Only one record exists for this species in the Eurobodalla LGA west of Broulee in the 1970's (DEC 2007a). Most sightings on the south coast are in the Bega Valley LGA.	None.
Hooded Plover *Thinornis rubricollis* E TSC E EPBC	This species is non migratory although individuals can travel several hundred kilometres. They prefer sandy surf beaches backed by dunes rather than by cliffs (Birds Australia n.d).	No suitable habitat exists within the subject site.	None.
Lesser Sand Plover *Charadrius mongolus* V TSC	This species breeds in eastern Siberia, southern Mongolia, western China and the Himalayas, then migrates to the coasts of countries including Australia (Pringle 1985). Foraging ground in Australia includes beaches, mudflats, mangroves (Pizzey & Knight 2003), estuaries and rocky shores (Smith 1991; Marchant & Higgins 1993). Diet includes marine invertebrates and seeds (Dementev *et al.* 1951).	No suitable habitat exists within the subject site	None.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Masked Owl *Tyto novaehollandiae* V TSC	This species forages in a range of forest and woodland types but requires large tree hollows for nesting. Forested areas adjacent to areas of dense and sparse ground cover within close proximity are required for foraging (Garnett 1992 & Peake *et al.* 1993). Also occurs in fragmented forest-pastoral land usually near creek lines and in open grassy woodland (Kavanagh 2004). This owl forages on ground-dwelling prey, particularly Bush Rats, introduced Black Rat and House Mouse.	It is likely that this owl species may use the cleared areas of the subject site as part of a larger home range. The hollow-bearing trees do not provide hollows large enough to support this species. However, the presence of a large cleared area, for which this species has been known to forage, will be impacted by a small area for 13 building envelopes. Additionally, the vegetation within the riparian gullies is likely to support prey items for this species such as Bush Rats.	Low, 13 small building envelopes will remove potential foraging habitat .Suitable habitat is widespread in the Eurobodalla in the form of agricultural farms and cleared land.
Olive Whistler *Pachycephala olivacea* V TSC	In coastal areas, this species strongly favours moist forest and riparian thickets, especially teatree thickets (Blakers *et al.* 1984, Emison *et al.* 1987).	Although riparian gullies do exist within the site, the density of suitable trees species (teatree) is very low. Therefore, it is considered that no suitable habitat present onsite.	None
Orange-bellied Parrot *Neophema chrysogaster* E TSC CE EPBC M EPBC	The Orange-bellied Parrot breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia and southern Victoria. There are occasional reports from NSW, with the most recent records from Shellharbour in 2003. Typical winter habitat is saltmarsh and strandline/foredune vegetation communities either on coastlines or coastal lagoons. Diet mainly comprises seeds and fruits of sedges and salt-tolerant coastal and saltmarsh plants.	No suitable habitat is present.	None.
Osprey *Pandion hallaetus* V TSC M EPBC	This species is found around the Australian coast line, except for Victoria and Tasmania. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia (DEC 2007h). This species favours coastal areas, in particular, the mouths of rivers, lagoons and coastal lakes where it hunts for fish (DEC 2007h). The species will breed within one kilometre of the coast where it will nest high up in dead trees or in dead crowns of live trees (DEC 2007h).	Although the subject site is within one kilometre of the coast, it does not appear to support suitable nesting sites for this species at the present time. No evidence of nesting was observed within the subject site.	Unlikely, no known nest or potential nest trees occur within the subject site.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Pied Oystercatcher *Haematopus longirostris* V TSC	This species is found in association with beaches and bays (Blakers *et al.* 1984). It occasionally travels up estuaries and mudflats in search of food,	No suitable habitat present within the subject site.	None.
Pink Robin *Petroica rodinogaster* V TSC	In NSW, this species is found it the south-east as far north as Bombala (DEC 2007g). However, this species is known to disperse into more open habitats in Winter as far north as the central coast (DEC 2007g).	The subject site is beyond the known distribution of this species, however, recent records around the south coast (DEC 2007a) suggest that it may use this area to disperse into over the winter months. Records in the region include Montague Island, Bodalla and Lake Conjola (DEC 2006a). The subject site does provide suitable habitat for this species in the form of open fields.	Low, 13 small building envelopes will removed potential foraging habitat .Suitable habitat is widespread in the Eurobodalla in the form of agricultural farms and cleared land.
Powerful Owl *Ninox strenua* V TSC	This species is dependent on large territories in coastal and mountain eucalypt forest (Blakers *et al.* 1984). Territories are usually centred around gullies, with roost and nest site located centrally (Fleay 1968). Large tree hollows are required in which to nest (Emison *et al.* 1987). Abundant arboreal mammals (which form about 80% of the diet of this species) are a requirement of this species (Blakers *et al.* 1984). Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400-1450 ha.	The subject site provides no potential roost or nesting habitat and limited habitat for prey items. However, this species may use the site for foraging as part of a larger home range as it prefers coastal and mountain forests, which are present in small areas on the site and adjacent areas. However, no observations of 'owl wash' were made during these surveys. Recent records of this species in the Eurobodalla Shire confirm these habitat requirements (DEC 2007a).	Unlikely, as most hollow-bearing trees suitable for arboreal mammals (food) are to be retained.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Regent Honeyeater *Xanthomyza Phrygia* E TSC E EPBC M EPBC	This species inhabits eucalypt forests and woodlands (Blakers *et al.* 1984). It is highly nomadic and relatively large numbers can arrive at and vacate areas depending on local and regional flowering of favoured species. It feeds mostly on the flowers of eucalypts (particularly box and ironbark species), but also eats invertebrates and exotic fruits (Blakers *et al.* 1984). Although formerly recorded in areas where favoured food trees were relatively scarce (Blakers *et al.* 1984), this species is now almost completely restricted to a few relatively intact extensive stands of its favoured tree species, mostly on the inland side of the Great Dividing Range (Garnett 1992).	Marginal foraging resources are available for this species (eg. Flowering eucalypts) in the riparian gullies and scattered spotted gum. However, spotted gum forest community is widespread across the Eurobodalla region, and the riparian gullies will be retained. Recent records for this species occur around Mossy Point and Batehaven (DEC 2007a).	Unlikely, potential habitat exists at the subject site and across the wider locality, however, much of the on-site vegetation will be retained.
Rufous Fantail *Rhipidura rufifrons* M EPBC	This species is found in a variety of habitats including eucalypt woodlands and watercourses where it nests in a horizontal fork of a tree up to 12m from the ground. Breeds in southern Australia, but is known to migrate to inland Australia, PNG, Solomon Islands, New Caledonia and Indonesia.	The cleared areas do not provide habitat for this species. However, the riparian gullies do provide potential habitat.	Unlikely, as potential habitat will be retained.
Sanderling *Calidris alba* V TSC	This species breeds in the northern hemisphere. It prefers coastal areas on low beaches, near reefs, inlets, mudflats and lagoons (Pizzey and Knight 2003). They forage in these areas for small invertebrates.	No suitable habitat present within the subject site.	None.
Satin Flycatcher *Myiagra cyanoleuca* M EPBC	Normally found in heavily vegetated gullies in forests, woodlands wherever a shrub layer is present. During migration it is often found in coastal forests. This species breeds mostly in south-east Australia, and usually departs in March to winter in northern QLD, PNG and the Torres Strait Islands. Occasional vagrant to New Zealand.	The riparian area provides potential habitat for this species.	Unlikely, as much of the riparian vegetation will be retained.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Sooty Owl *Tyto tenebricosa* V TSC	Pairs of this species establish large permanent territories in rainforest and wet eucalypt forest (Blakers *et al.* 1984). Within these forests they prey mostly on a variety of small to medium terrestrial and arboreal mammals (Blakers *et al.* 1984). The Sooty Owl may also nest in dry sclerophyll forest, adjacent to moister forests, if trees with suitable hollows are present.	The subject site does not contain rainforest or wet eucalypt forest. Although a small section of the subject site (the riparian gully) could be considered as potential marginal habitat, however, it is such a small extent; it is unlikely that suitable habitat exists for this species within the subject site. Records for this species exist in more suitable habitat north of Batemans Bay and in the hinterlands (DEC 2007a).	Unlikely, marginal potential habitat in riparian zone would be retained.
Sooty Oyster-catcher *Haematopus fuliginosus* V TSC	This is a coastal species, foraging on rocky shorelines and in estuaries (Simpson & Day 1989) for molluscs and other invertebrates.	No suitable habitat is present within the subject site.	None.
Superb Fruit-Dove *Ptilinopus superbus* V TSC	The species is predominately found between north-eastern Queensland to north-eastern NSW. However, It is much less common further south, where it is largely confined to pockets of suitable habitat (DEC 2007m). It can be found in rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. It is believed that much of the population is at least, partly nomadic, with many birds, particular, juveniles observed moving south from Sydney particularly during the cooler months (DEC 2007m).	Although it is suggested that this species may forage in eucalypt woodland, the preferred habitat of this species is rainforest and other closed forest types. Therefore, it is unlikely that suitable habitat for this species is found within the subject site. It is likely that this species may use the subject site as a 'fly over' to more preferred habitat types. There are a small number of records for this species on the south coast, mostly from the 1980's and 90's, one of these being near Rosedale (DEC 2007a).	Unlikely, if this species does use the subject site, it would be as a temporary stopover on their way to more suitable habitat and preferred food sources.
Striated Field wren *Calamanthus fuliginosus* V TSC	This species is found in the coastal swamp heaths and tussock fields of south-eastern NSW, into southern Victoria and the south-east of South Australia (DEC 2007b). A sub-species occurs in inhabits parts of western NSW in arid and semi-arid gibber and shrublands (DEC 2007b). They forage through low undergrowth, feeding on insects and seeds.	As the subject sites consists primarily cleared areas, with some riparian gullies, it is unlikely that no suitable habitat for this species is present. Locally, the species has been recorded north in Durras in 2001 and near Potato Point (east of Bodalla) in 1996 (DEC 2006a).	None.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Swift Parrot *Lathamus discolour* E TSC E EPBC M EPBC	This species breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland (DEC 2007e). In NSW, Swift Parrots mostly occur on the coast and south west slopes with the majority of records occurring in these areas (DEC 2007a).	Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia aculate*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Marginal foraging resources are available for this species (eg. Flowering eucalypts) in the riparian gullies and scattered trees in cleared areas. However, the spotted gum forest community is widespread across the Eurobodalla region, and the riparian gullies will be retained. There are recent records of this species across the coastal plain of Eurobodalla Shire Council (DEC 2007a).	Unlikely, potential habitat exists at the subject site and across the wider locality, however, much of the on-site vegetation will be retained.
Square-tailed Kite *Lopoitinia isura* V TSC	This species' preferred habitat is open eucalypt forest and woodland (DEC 2006f, Schodde & Tidemann 1995). Here it predates in forest canopy (Klippel 1992) and builds large stick nests in tall trees. Resident pairs have territories of greater than 100 km². The species is believed to be nomadic (Slater *et al.* 1986).	Potential foraging resources are present onsite however no evidence of nesting was observed during the survey. If this species utilises the subject site, it is likely for foraging only.	Unlikely.
Turquoise Parrot *Neophema puchella* V TSC	This species is generally considered to have a wide distribution, being found from the coastal plains to the western slopes (DEC 2007p). They are usually found around riparian areas and adjacent clearings of eucalypt woodlands and heathlands (DEC 2007p).	Although this species has been recorded near Durras in the 1990's (DEC 2007a), the subject site is not considered to be eucalypt woodland or heathland. Therefore, no suitable habitat for this species exists within the subject site.	None.
White-bellied sea eagle *Haliaeetus leucogaster* M EPBC CAMBA	This species occurs around coastal areas, islands and estuaries, but is also found in inland areas where it is known from large rivers, wetlands and reservoirs.	Potential nesting sites occur in the mature trees present. Although four dams, exist, these are very small and could not be considered foraging habitat.	Unlikely, more preferred habitat closer to foraging areas is found on the coastline.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
MAMMALIA			

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Brush-tailed Phascogale *Phascogale tapoatafa* V TSC	This species is found in a variety of forest types. Preferred habitat is likely to be open dry sclerophyll forest with little ground cover on ridges up to 600 metres (Cuttle 1983). It is predominantly carnivorous, foraging on arthropods, invertebrates, small vertebrates and nectar (Strahan 1995). It requires tree hollows in which to nest.	The cleared areas do not provide any potential habitat. Further, the riparian gullies provide an understorey which is moderate. This would suggest that the subject site does not provide any suitable habitat for this species. This species has been recorded near Durras, west of Mogo, near Bodalla and further south in the Bega Valley LGA (DEC 2007a).	Unlikely, as marginally potential habitat exists within riparian gullies which will be retained.
Eastern Bent-wing Bat *Miniopterus schreibersii oceanensis* V TSC	This species is a common although a vulnerable species that is likely to be widely distributed throughout the region. It roosts and raises its young in caves and mine tunnels (Strahan 1995). The species appears to forage above the forest canopy in a diverse range of forest types (Strahan 1995).	Potential foraging habitat is present within the subject site. However, no potential maternity sites were identified.	Unlikely
Eastern Freetail-bat *Mormopterus norfolkensis* V TSC	This elusive, arboreal bat prefers wet sclerophyll forest and woodland. It roosts by day in tree hollows and cracks (Klippel, 1992).	Potential foraging habitat is present and hollow bearing trees provide potential roost sites. This species was recorded at nearby Surf Beach (Sass & Miles 2006). Several sightings in late 2005 (DEC 2006a) in the Surf Beach locality suggest the locality provides additional habitat for the species.	Unlikely, as all hollow-bearing trees will be retained.
Eastern False Pipistrelle *Falsistrellus tasmaniensis* V TSC	Little is known of the habitat requirements of this species. It is found in a range of habitats including dry and wet sclerophyll forest but appears to prefer wet sclerophyll forest (Hall & Richards 1979). This species roosts in tree hollows (Phillips & Inwards 1985).	Potential roost sites occur within the subject site and the gully vegetation provides potential habitat.	Unlikely, preferred habitat (gully vegetation) and hollow-bearing trees will be retained.
Eastern Pygmy-possum *Cercartetus nanus* V TSC	Feeding largely on nectar, and insects, the species is found from rainforest through sclerophyll forest to tree heath. *Banksias* and myrtaceous shrubs and trees are favoured as food sources (Turner & Ward from Strahan 1995). Its small size allows it to nest in very small spaces during the day, and hollows in trees are favoured (Turner & Ward from Strahan 1995).	With an absence of banksias as a preferred food source, it is unlikely that the site provides suitable habitat for this species.	Unlikely.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Golden-tipped Bat *Kerivoula papuensis* V TSC	Most records of this species in southern New South Wales are from sclerophyll forest, in proximity to rainforest patches (Walton *et al.* 1992). This species has also been recorded in recently logged dry sclerophyll forest in southern NSW (Churchill 1998). This bat preys on spiders (Churchilll 1998). Abandoned nests of scrubwrens and gerygones form roost sites. These nests are generally domed shaped and are constructed from bark, moss and lichen and hang from branches and thin vines (Churchill 1998).	Rainforest patches exist within the locality, but not in close proximity to the subject site. It is unlikely that potential habitat is present within the subject site.	Unlikely.
Greater Broad-nosed Bat *Scoteanex rueppellii* V TSC	This species is recorded from a range of habitats, from woodland to rainforest (Hall & Richards 1979). It is known to roost in tree hollows (Richards 1983) but has also been found in roof spaces. Its diet includes slow-flying insects. It may prefer riparian areas adjacent to cleared areas in which to forage.	The site provides potential habitat in the form of riparian gullies and three hollow bearing trees.	Unlikely, preferred habitat (gully vegetation) and hollow-bearing trees will be retained.
Grey-headed Flying-fox *Pteropus poliocephalus* V TSC V EPBC	This species roosts in large camps, generally in wetter vegetation such as rainforest or swamp forest. Groups fly out at night to feed on fruit, nectar and blossom, particularly of *Eucalyptus, Melaleuca* and *Banksia*. This species shows fidelity to roosting areas but may feed in orchards. It appears to be showing increasing tolerance to human disturbance.	This species has been recorded along the south coast, more specifically numerous records exist near the subject site (DEC 2007a). Marginal roosting habitat does occur within the subject site in the riparian zone. However, no evidence of a roost camp was identified (either current or past).	Unlikely, riparian zone will be retained. However, the original report did consider this species in an 8 part test, so this addendum will consider this species in the 7 part test.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Koala *Phascolarctos cinereus* V TSC	This species utilises a wide range of forest and woodland types. However in this district they are generally seen only in large areas of continuous forest. They are solitary with distinct home ranges (Strahan 1995) and must utilise a diverse range of eucalypt trees typically present on high nutrient soils (Klippel 1992). On the south coast *Eucalyptus tereticornis, E.amplifolia* and *E.viminalis* are the preferred feed tree species (NPWS 2003d).	No koala feed tree species as identified under SEPP 44 Koala Habitat Protection were recorded on the subject site. However, one species of supplementary feed tree was recorded (White Stringybark, *E.globoidea*) under the Koala Management Area No. 3 (south coast). Although this presence does suggest that the subject site may be considered as possible habitat, only a few individual trees of this species were present. Therefore, the subject site could not be considered as providing habitat for this species.	Unlikely.
Large-footed Myotis *Myotis adversus* V TSC	This species forages on the surface of water bodies such as rivers, lakes and swamps and roosts in caves, mine, tunnels and old buildings (Hall & Richards 1979).	Although four dams exists on the site, the presence of aquatic vegetation make them unlikely for this species to forage on the surface of these water bodies.	Unlikely, marginal habitat, and all dams will be retained.
Long-nosed Potoroo *Potorous tridactylus* V TSC V EPBC	This species occurs in coastal heath, dry and wet sclerophyll forest and requires thick contiguous undergrowth. Individuals are generally concentrated where soil is light and sandy (Johnston 1983).	This species has been recorded at a number of locations in the Eurobodalla Shire, none being recent (DEC 2007a). However, it is unlikely that this species would utilise the subject site due to its cleared state. Marginal habitat exists within the riparian gullies, however, the small extant of this habitat makes it unlikely for this species to be present.	Unlikely, however, marginal habitat in riparian gullies to be retained.
Southern Brown Bandicoot (eastern) *Issodon obesulus obesulus* E TSC E EPBC	Scrubby habitat with low ground cover occasionally burnt out is preferred by this species (Braithwaite 1983). A preference for thick undergrowth can also provide protection from predators such as foxes (Lobert & Lee 1990).	This species has been recorded in the locality in the late 90's (DEC 2007a). Although the majority of the subject site is cleared, the vegetated gullies were searched. However, no concical diggings were observed suggesting that bandicoot species are not using the subject site.	Unlikely.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
Squirrel Glider *Petaurus norfolcensis* V TSC	This species is found in dry sclerophyll woodland, preferring dense, white-barked eucalyptus country (Klippel 1992) and is generally absent from closed forest (Menkhorst *et al.,* 1988). A mix of eucalypts, banksias and acacias including some winter flowering species and abundant hollows are required by this species. Fragmentation, predation by foxes and cats and inappropriate fire regimes are listed as threats to this species (NSW NPWS 1999b*).*	This species has been recorded north of Batemans Bay with occasional records in the Bega Valley (DEC 2007a), although these are outside their usual distribution. The subject site provides a number of hollow bearing trees therefore potential den habitat is available. The extensive clearing over the site for farming, has seen a massive reduction in potential habitat.	Low, All hollow bearing trees will be retained providing potential den sites. The riparian gullies provide a potential foraging source for this species, much of which will be retained. Four fence lines will traverse this section of habitat, therefore, removing potential habitat for this species.
Spotted-tail Quoll *Dasyurus maculatus* V TSC E EPBC	Sclerophyll forest, rainforest in mountainous country, and coastal habitats can be utilised by this species (Le Souef & Burrell 1926). Habitat attributes which are likely to be critical to the life cycle for the Tiger Quoll are large areas of undisturbed habitat which provide a variety of key food and other resources such as large hollow logs, or small caves (dens) at ground level for denning. Quolls appear to be most abundant in areas with few roads and where foxes are either absent or kept in check by dingoes (Resource and Conservation Assessment Council, 1996). Fleming (1996) suggests that foxes may be a threat to Tiger Quolls through predation and competition.	This species has been recorded in numerous locations across the region including South Moruya Heads and Long Beach (DEC 2007a). However, with a lack of potential den sites, potential habitat for this species is not present.	None.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
White-footed Dunnart *Sminthopsis leucopus* V TSC	Research on this species in a recently logged area near Bega suggests that preferable habitat is treeless ridges and mid slopes with sparse ground cover of less than 51% (Lunney *et al.* 1989). The study suggested that it seeks "initial seral stages of forest regenerating from gross disturbance" (Lunney *et al.* 1989). It constructs a bark nest beneath fallen timber or dense litter (Menkhorst and Knight 2001).	This species has been recorded in Eurobodalla and Murramarang National Parks, however, no records exist between these two protected areas (DEC 2007a). Although much of the subject site provides treeless ridges due to the previous clearing for farming, the ground cover is dense grasses and regenerating shrubs, including a massive infestation of the introduced Whisky grass, make it highly unlikely habitat would be present.	Unlikely.
Yellow-bellied Glider *Petaurus australis* V TSC	This species is restricted to tall mature eucalypt forest (Russell 1983), where it uses tree hollows for shelter and feeds on a range of plant and insect exudates and arthropods, collected mostly under exfoliating bark. It may prefer forest of high species diversity. Eucalypts that provide hollows, sap flow and flower in winter are preferred by this species. These include *Eucalyptus viminalis*, *Corymbia gummifera* and winter flowing ironbarks.	Although no evidence of Yellow-bellied Gliders could be found to suggest that this species is resident of the subject site, the availability of potential denning sites, and connectivity of the subject site to surrounding areas of habitat suggest that the Yellow-Bellied Glider may utilise the subject site from time to time. Recent records (2005) suggest that this species is still found in the Surf Beach locality (DEC 2007a). Conversely, this species may colonise the subject site in the future as areas of habitat are cleared in the surrounding landscape for development or logging that may support populations.	Low, All hollow bearing trees will be retained providing potential den sites. The riparian gullies provide a potential foraging source for this species, much of which will be retained. Four fence lines will traverse this section of habitat, therefore, removing potential habitat for this species.

Species and Status*	Ecology	Presence of Habitat	Potential impact rating
AMPHIBIA			
Giant Burrowing Frog *Heleioporus australiacus* V TSC V EPBC	This species can be found in a range of forest types on the coast and adjacent ranges including riparian and moist forests dry sclerophyll and woodlands (Gillespie 1990). It has also been recorded in roadside drains and near slow-flowing creek pools with fringing fern and sedge vegetation. Breeds summer and autumn, apparently in burrows in creek banks, favouring deep loam soils.	This species has been recorded near Ulladulla and west of Bermagui (DEC 2007a). Generally, this species is not found in areas that have been logged or grossly disturbed in the last 10-20 years (G. Gillespie, pers. comm.). State Forests research have associated it with drainage lines in wet forests with a dense understorey. It is very unlikely that suitable habitat exists within the site.	Unlikely, the subject site has been disturbed by past clearing. Marginally potential habitat may occur within the riparian zone which will remain intact
Green & Golden Bell Frog *Litoria aurea* E TSC E EPBC	This species is known to inhabit marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.) (Cogger 2000). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available (DEC 2007q).	This species has been recorded near Durras and Bodalla within the last 10 years (DEC 2007a). However, targeted surveys on the south coast did not record this species in the Eurobodalla LGA (Daly & Senior 2003). Although four small dams are present, which vary from partially shaded to unshaded, the presence of the predatory fish *Gambusia holbrooki* suggests that it is highly unlikely that potential habitat for species exists at the subject site.	Unlikely.
Stuttering Frog *Mixophyes balbus* E TSC V EPBC	This species was once distributed from east of the Great Divide and extended from Gippsland in north-eastern Victoria to the upper northern catchment of the Clarence River north-east of Tenterfield, NSW. The species occurs only at high altitude in the north of its range but both upland and lowland populations have been recorded in the south. This species is known from rainforest and wet sclerophyll forests (Cogger 2000), requiring freshwater streams and riparian vegetation for breeding and habitation. They have not been recorded in riparian habitat that has been disturbed (Mahony *et al.* 1996).	Within the southern portion of its range, the Stuttering Frog appears to have declined dramatically in recent times. Targeted surveys by Daly *et al.* (2000) from south of Sydney to Victoria found only two locations where frogs remain: around Narooma on the south coast and near Macquarie Pass. Although the gully vegetation provides potential habitat at the subject site, disturbance of the site is likely to have substantially decreased the existence of potential habitat. Since the surveys of Daly, it is now suggested that this species could be locally extinct in the south coast region (David Hunter, DEC, pers comm., Sept 2006).	Unlikely, the subject site has been disturbed by clearing. Marginally potential habitat may occur within the riparian zone which will remain intact.

V TSC	Listed as Vulnerable under the *NSW Threatened Species Conservation Act, 1995*
E TSC	Listed as Endangered under the *NSW Threatened Species Conservation Act, 1995*
V EPBC	Listed as Vulnerable under the *Environmental Protection Biodiversity Conservation Act, 1999*
E EPBC	Listed as Endangered under the *Environmental Protection Biodiversity Conservation Act, 1999*
M EPBC	Listed as Migratory under the *Environmental Protection Biodiversity Conservation Act, 1999*

Of the 55 threatened and migratory fauna species recorded from the area (DECC PWD Wildlife Atlas Batemans Bay 1:100,000 map sheet and Environmental Reporting Tool which covers the subject site) (Table 3) and 5 flora species (Table 1), 5 species were categorised as having a potential impact from the proposed activity. One additional species, identified in the previous report by PMA Consulting, will also be considered in this assessment. As such, an Assessment of Significance, which has been completed in accordance with section 5A of the *Environmental Planning and Assessment Act 1979,* was undertaken on these species.

5. ASSESSMENT OF SIGNIFICANCE

The following Assessment of Significance has been completed in accordance with section 5A of the *Environmental Planning and Assessment Act 1979*. Seven factors are to be considered when determining if the proposed activity '*is likely to have a significant effect on the threatened species, populations or ecological communities, or their habitats'* that are listed as threatened by the *Threatened Species Conservation Act 1995.* These seven factors must be taken into account by the consent or determining authority when considering a development proposal or development application. This enables a decision to be made as to whether there is likely to be a significant effect on the species and hence if a Species Impact Statement is required (NSW NPWS, 1995).

This assessment should be read in conjunction with the evaluation carried out in Table 1 & 3, which considers the ecology of the species, the likelihood of occurrence within the subject site and the anticipated impacts from the proposed activity. As a consequence, an assessment of significance was undertaken on six species (Glossy Black Cockatoo, Masked Owl, Pink Robin, Squirrel Glider, Yellow-bellied Glider and Grey-headed Flying fox).

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

Glossy Black Cockatoo

The Glossy Black Cockatoo is distributed across the eastern half of New South Wales. It is found in eucalypt forests and woodland, usually near concentrations of Allocasuarina trees; since it feeds almost exclusively upon the seeds of these trees (Blakers *et al.* 1984). Glossy Black Cockatoos nest in tree hollows, usually at considerable heights (Emison *et al.* 1987), so the presence of large eucalypts with hollows is a key habitat requirement, at least during the breeding season. On the New South Wales south coast *A. littoralis* is probably the main food tree (Blakers *et al.* 1984). Clout (1989) studied Glossy Black Cockatoos within the Eden region. This study found that the Glossy Black Cockatoo is very selective in its preference for specific Allocasuarina trees, sampling a wide range of Allocasuarina in order to obtain the preferred trees. Thus they do not appear to use stands of this species uniformly. Selection of trees appears to be related to the concentration of nitrogen in the seeds (Clout 1989). It can be assumed that this species' lifecycle is reliant on an abundance of Allocasuarina feed trees and large trees containing potential nest sites (hollows).

The tree *Allocasuarina littoralis* is found throughout the riparian gullies, on the western boundary (northern section) and as scattered trees throughout the subject site. All of the trees identified appear to be 'coning' well, however, no signs of recent feeding were evident. The allotment placement provides four fence lines that will cross through potential feed trees for this species.

Whilst three hollow-bearing trees were identified within the subject site, none could be considered to be able to provide hollows large enough for this species and therefore, it is considered unlikely that they would provide nesting or roosting site for this species. However, as the age of these trees increase, potential sites may become available.

Whilst some removal of Allocasuarina trees will be required for the construction of the allotment fencing, no other clearing of this tree species should occur within the subject site. If the proposed

activity occurs in a manner that retains all other Allocasuarina trees throughout the subject site, and provides compensatory planting of the same species where removal for fence line construction is required, and the hollow-bearing trees identified are retained, then the proposed activity should not place any viable local populations of this species at risk of extinction.

Masked Owl

This species is widely but sparsely distributed over much of Australia in a range of forest and woodland habitats. It is considered to be principally a bird of forest margins, although it has been found within large forest stands, and in sparsely treed areas. The main prey appears to be terrestrial mammals up to the size of a rabbit or potoroo, but it also takes arboreal prey up to common ringtail possum size, and birds. Nesting is in large tree hollows. Its habitat requirements are similar to those of the Powerful Owl, with the exception that it relies less heavily on arboreal prey. Fauna surveys at the subject site have determined that suitable prey is present onsite for this species (bush rats, house mice, bandicoots and rabbits).

Possible impacts on this species could be minimised by retaining hollow-bearing trees, by maintaining as much vegetation as possible within the riparian zone. These measures are likely to ensure that if this species utilises the subject site, that the proposed activity should not place any viable local populations of this species at a risk of extinction.

Squirrel Glider

This species is listed as Vulnerable, under the *TSC Act.* It is found in dry sclerophyll woodland, prefers dense, white-barked eucalyptus country (Klippel 1992) and is usually absent from wetter forest types. It is sparsely distributed along the east coast of New South Wales. This species is reliant on hollow-bearing trees in which to den and a mix of eucalypts, acacias and banksias on which to forage. Heavily winter flowering eucalypts such as spotted gums are a critical foraging resource over winter (NSW NPWS 1999e). This species also feeds on plant exudates (sap and gum from eucalypts and acacias respectively), nectar, pollen and invertebrates, foraging in the upper canopy as well as the lower shrub understorey.

The site provides potential denning and foraging resources for this species in the form of hollow-bearing trees and riparian vegetation. These resources will be retained by the proposal, however, four fence lines appear to traverse this vegetation, and subsequently potential habitat for this species. Andrews (2006) in a report to Eurobodalla Shire Council identified the Grandfathers Gully area as a potential fauna movement corridor for aboreal mammals. Clearing of vegetation for fence lines should be limited to understorey species, to enable a continuous canopy for this species to move through this habitat should it be present.

Therefore, it seems likely that with the retention of the riparian gully, including understorey vegetation where not impeded by a fence line and maintaining a continuous canopy (where possible) and the retention of hollow-bearing trees, the proposed activity is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction in concurrence with the recommendations in this report.

Yellow-bellied Glider

The Yellow-bellied Glider has a wide distribution along the east coast and adjacent ranges from north Queensland to western Victoria. Its occurrence within its range is patchy however, and population density generally very low. Several studies on this species are reported in Goldingay & Kavanagh (1991) and an intensive study of their feeding behaviour and habitat requirements in the Bombala area in Kavanagh (1987). The important factor of most studies on this species is that they exploit a range of plant exudates including sap, manna (a substance formed by exudation of sap at the site of insect damage on branchlets and foliage of eucalypts and angophoras) and nectar of eucalypt flowers; honeydew (excretions of certain sap-sucking insects) and obtain protein by foraging for insects and other invertebrates mostly under the peeling bark of smooth-barked eucalypts, and by consuming pollen when it is available in eucalypt blossom (Kavanagh 1987).

The proportion of the diet obtained from the different sources varies from time to time within an area as different resources become available in the forest. Source of diet therefore depends on the annual cycles of flowering and bark shedding of the different eucalypt species present. Diet also

varies from area to area. Studies near Batemans Bay (Goldingay & Kavanagh, 1990) showed that in this area eucalypt flowering was sufficiently reliable that the animals could rely heavily on this resource and derived most of their protein requirements from pollen. Other studies have found sap and insects gleaned from under bark to be the most important resources, with blossom providing a crucial part of the diet only in winter (Kavanagh 1987).

Because Yellow-bellied Gliders exploit food resources which are largely ephemeral in nature they require large home ranges compared with similar sized animals which feed on foliage. Kavanagh (1987) found that they spend all night out of their dens, and in this time they spend 90% of the time foraging. This is the highest proportion of waking hours spent foraging known for any mammal (Kavanagh 1987). Because of the ephemeral and widely distributed nature of their food resources they need to be very mobile animals, and they are known to be capable of glides of more than 100 metres length, and to cover large distances between den sites and feeding areas. However, at times when other food resources are limited they can be heavily dependent on eucalypt sap, which is licked and chewed from incisions in the bark of selected trees.

Most studies have found that the number of sap feeding trees within a home range is quite small, between 3 and 10 trees. However, Nicholas Graham-Higgs & Associates (1996) in a survey of glider den sites and sap feed trees in the Pambula area found 119 trees with evidence of feeding by gliders, within a small area near Pambula Beach. However only 21 of these appeared to be moderately to heavily used. Individual trees may be used for sap feeding by gliders for many years with no apparent ill-effect (Kavanagh 1987). When gliders are feeding largely on sap they may spend the whole night feeding on a single tree (Goldingay & Kavanagh 1991).

Kavanagh (1987) found that gliders selectively foraged in larger trees of more than 80 cm diameter. Only when foraging for insects under bark did they utilise smaller (<40 cm diameter) trees; for all other food resources they preferred large trees. They also require large trees to provide the hollows in which they shelter during the day. On Bournda Downs it would appear they are more flexible in their feeding habits since there are few trees of >80 cm diameter. There are however, many trees between 50-60 cm diameter.

There are two main habitat requirements for this species, large old trees containing hollows to provide den sites, and a sufficient diversity of eucalypt species to provide them with the range of food resources they require throughout the year. Large trees are also preferred for most feeding activities. Particular individual trees are heavily used as sap feeding trees and these individual trees may be crucial to the survival of each glider group within its home range.

Impacts of development on the gliders on this site may come about by removal of individual trees which contain their dens or which are favoured sap feeding trees, and the potential to disrupt movement corridors through the removal of vegetation. These factors would constitute a serious threat to the persistence of the group(s) of gliders that are likely to use this site, considering the distribution of this species in the locality. Removal of other large trees which are favoured for feeding but are not either den or sap feed trees may also be deleterious, given the species preference for feeding in larger trees. Kavanagh (1987) found however, that logging did not affect a population of gliders he was studying, because neither their den nor sap feed trees were removed and the logged area constituted only one third of their home range. Because scattered trees were left in the logged area they continued to be able to move from tree to tree through it to forage further a field.

In a recent study of Yellow-bellied gliders in the Eurobodalla Shire, it was found that Yellow-bellied gliders were likely to use corridors of vegetation to move through to areas of greater habitat quality (nghenvironmental 2006). The retention of potential movement corridors provides an opportunity to maintain genetic exchange of individuals, and to allow individuals and groups present in the locality to exploit the subject site and the surrounding area. Andrews (2006) in a report to Eurobodalla Shire Council identified the Grandfathers Gully area as a potential fauna movement corridor.

Therefore, it seems likely that with the retention of the riparian gully (including understorey vegetation where not impeded by a fence line and maintaining a continuous canopy (where possible) and the retention of hollow-bearing trees that the proposed activity is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction in concurrence with the recommendations in this report.

Pink Robin

The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. The species normally inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies, however, when dispersing in winter, they have been recorded around Narooma and Montague Island in open farmland and maritime grassland.

Although the cleared areas of the subject site provide potential foraging for this species, the creation of 13 building envelopes could potentially reduce winter habitat for this species. In addition, the vegetation within the ephemeral gully could also provide potential shelter during winter visits to more open country in the subject site. The removal of potential foraging habitat (twelve building envelopes, ~0.5 hectare) should be regarded as very minor considering their ecology and movement across southern eastern Australia.

The nature of the proposal, will undoubtedly lead to development of residential dwellings at the subject site. However, the general activities associated with this development are likely to result in continued slashing of vegetation around the dwellings. Considering this species prefers open habitat with shorter grasses, the development has the potential to enhance remaining habitat for this species. These measures are likely to ensure that if this species utilises the subject site, that the proposed activity should not place any viable local populations of this species at a risk of extinction in concurrence with the recommendations outlined in this report.

Grey-headed Flying-fox

This species roosts in large camps, generally in wetter vegetation such as rainforest or swamp forest. Groups fly out at night to feed on fruit, nectar and blossom, particularly of *Eucalyptus, Melaleuca* and *Banksia*. This species shows strong fidelity to roosting areas but may feed in orchards. It appears to be showing increasing tolerance to human disturbance. No roosting or feeding evidence of this species was observed at the subject site, however, this species was identified during surveys by PMA Consulting.

No roosting or feeding evidence of this species was observed at the site, however the site does contain marginal foraging resources within riparian gullies, and scattered eucalypt trees.

The proposal should not place any viable local populations of this species at a risk of extinction in concurrence with the recommendations outlined in this report be present in the study area.

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

No listed endangered populations occur within the subject site.

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

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

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

There are no endangered ecological communities or critically endangered ecological communities within the subject site.

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

- **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,**

The proposed activity will involve the clearing of less than 0.5 hectare of vegetation through the right of access into the development, and building envelopes and access into Lots 4, 5 and 6. Much of this vegetation consists of regrowth, with the trees providing little in terms of habitat values. The three hollow-bearing habitat trees that were identified were found outside of areas of vegetation that will be removed.

The retention of vegetation with the riparian gullies will ensure that any areas of habitat adjacent to the site, or in fact within the site, retain connectivity and therefore, do not become isolated as a result of the proposed activity.

Whilst less than 0.5 hectare of potential habitat will be removed, the vegetation to be retained within the riparian gullies, the three hollow-bearing trees and the vegetation in the surrounding locality provides a wide area of habitat for threatened species. Habitat components with the highest quality of the site in its present form (three hollow bearing trees and Allocasuarina trees) within the subject site will be retained and will not be removed. However, some Allocasuarina will be removed for the construction of fence lines across the riparian gullies. Although this habitat is considered of high quality, the small amount that would be removed for fence line construction would not be considered of high importance to species in the locality. Further, it is recommended that the any removal of Allocasuarina be replaced by compensatory planting across the subject site.

The retention of quality habitat and movement corridors, along with some additional planting of Allocasuarina suggest that is it unlikely that the proposed activity will affect habitat that is important to the long-term survival of any of the threatened species in the locality.

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

There is no critical habitat as listed by the TSC Act 1995, found within the subject site. Therefore, the proposed activity is unlikely to have an adverse effect on critical habitat (either directly or indirectly).

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

Of the threatened species assessed in this report, only one species has a Recovery Plan; the Yellow-bellied Glider.

Key objectives of the recovery plan for the Yellow-bellied Glider recommend that assessment of impacts for proposed developments that are relevant to this proposal, should account for the following:

- **Protection of yellow-bellied glider habitat types and sap trees** – All potential habitat (hollow-bearing trees) have been identified as part of this assessment. However, all of these hollow bearing trees will be retained. Additionally, vegetation with the riparian gullies will be retained which could provide potential habitat for this species.
- **Size and shape of corridors, reduce edge effects, increase the types of resources available, fragmentation effects** – Whilst the clearing of vegetation will occur over approximately 0.5 hectares, the highest quality components of the subject site, the riparian gullies, will be retained. The retention of this vegetation is likely to facilitate movement between the subject site and surrounding areas of habitat where this species is known to occur.

At the time of writing, an additional recovery plan was in 'draft' form; 'Large Forest Owls'. The recommendations within this report, are consistent with the objectives of these draft recovery plans. This includes habitat protection (large hollow-bearing trees, riparian zone vegetation) and weed management.

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

In its determination of key threatening processes by the Scientific Committee it was found that:

Clearing of native vegetation is recognised as a major factor contributing to the loss of biological diversity. Clearing of any area of native vegetation, including areas less than two hectares in extent, may have significant impacts on biological diversity,

Impacts from clearing often result in fragmentation. Fragmentation impacts include the creation of small isolated populations with limited gene flow between populations, leading to inbreeding depression and reduced potential to adapt to environmental change. Fragmentation also leads to the loss or severe modification of the interactions between species, including those interactions that are important for the survival of species.

Clearing of native riparian vegetation has led to bank erosion, reduced nutrient filtering capacity and changes to stream behaviour. Aquatic communities throughout catchments and in coastal waters have been impacted by sedimentation and other changes following clearing of native vegetation.

The proposal would involve removal of 0.5 hectares of vegetation within the subject site to create the right of access and building envelopes and access into lots 4, 5 and 6. This area of vegetation

appears to consist of regrowth forest, with no hollow bearing trees present. In addition, higher quality habitat, such as the vegetation within the riparian gullies and all hollow-bearing trees will be retained.

Conclusion

This Assessment of Significance has determined that the proposed activity is *'unlikely'* to have a *'significant effect'* on the following threatened species: Glossy Black Cockatoo, Masked Owl, Pink Robin, Grey-headed Flying-fox, Squirrel Glider and Yellow-bellied Glider in concurrence with the recommendations outlined in this report.

6. EPBC ASSESSMENT OF SIGNIFICANCE

The site contains potential habitat for one species listed as vulnerable under the *EPBC Act 1999*, the Grey-headed Flying-fox. The following assessment assesses the significance of the proposal's impact upon this species.

Will the action lead to a long-term decrease in the size of a population of a species?

It is unlikely that the development would reduce a population of this species in the long-term. Whilst the Grey-headed Flying-fox was not observed, it was recorded in a previous survey by PMA Consulting. They are also known from recent local observations (DEC 2007a). The eucalypt trees that are present are likely to provide a foraging resource for this species. Given that these species shows some regularity in its migration to foraging locations, the observation of some individuals in a previous survey suggests that the subject site may be used as a regular 'flight-over' to feeding grounds. Further, high site fidelity to roost camps and the absence of such a camp, or evidence of a previous camp, suggests that the subject site does not provide specific resources required to support a roost camp of this species. As this species can travel in large groups, the impact to these species may be greater as an entire group would be impacted by a small reduction (~0.5 hectare) in onsite resources resulting from site development. However, it is unlikely that the site's resources are highly important to a group of these species, and considering their high mobility, it is unlikely that such an impact could result in a long-term decrease in the size of a population of the Grey-headed Flying-fox.

Will the action reduce the area of occupancy of the species?

Potential foraging habitat for this species would be removed as part of the proposal. Although the area is very small (~0.5 ha in total), it does constitute a reduction in the potential area of occupancy of the species.

Will the action fragment an existing population into two or more populations?

Given the high mobility of this species, the location of the site, and the proponent maintain corridors of habitat within the riparian gullies, the proposal does not represent a barrier to dispersal.

Will the action adversely affect habitat critical to the survival of a species?

Due to the high mobility of this species and Spotted gum forest types are widespread in the region and still relatively unaffected by clearing. Thomas, Gellie and Harrison (2000) estimate that 86% of the pre-European extent of this community (64,500 hectares) is still present, the potential habitat within the study area is not considered to represent habitat critical for survival of the Grey-headed Flying-fox.

Will the action disrupt the breeding cycle of a population?

This species uses roosting camps, which are found in gullies, close to water, or in vegetation with a dense canopy with often thousands of animals present. Site fidelity to these camps is very strong, with some camps being used for over 100 years. No such roost camp was evident within the subject site, nor was the evidence of a past roost camp. However, the vegetation within the riparian gullies may provide potentially marginal vegetation suitable for a small roost camp in the future. Much of the riparian gully vegetation will be retained by this proposal. Post development, four fence lines with traverse this area with a very small extent of vegetation to be removed. Considering the extant of this vegetation (ie shape, and narrow width) the proposal is considered unlikely to reduce the area available to nest and breed for a population of this species. Therefore, considering the breeding cycle and the small area that would be impacted by this proposal, it is considered unlikely to disrupt the breeding cycle of either species.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. Equally suitable adjacent habitat is present and likely to be preferred, given recorded observations. Clearing and fragmentation are key threats to both species, however and as such site development potentially contributes to these root causes of decline.

Will the action result in invasive species that are harmful to a critically endangered or endangered/vulnerable species becoming established in the endangered or critically endangered species/vulnerable habitat?

The proposal may increase the abundance of weeds in the area. Weed establishment however, is not likely to adversely impact the quality of the site for this species.

Will the action interfere with the recovery of the species?

Given the small area of the site in comparison to the home range of this species, it is unlikely that the proposal would have an impact on the recovery of the Grey-headed Flying-fox.

Conclusion

The nature of the proposal is coincident with the root causes of decline for this species, in that it will contribute to habitat reduction and modification in a locality where the species has been recorded previously. However given the minor nature of the works and based on the above assessment, it is unlikely that Grey-headed Flying-fox will be significantly impacted by the proposal. The level of impact is likely to be further reduced by the proponent maintaining vegetated links to larger areas of contiguous forest within the western and eastern areas of the site.

Therefore, the proposed activity will not require referral to the Commonwealth Minister.

7. CONCLUSION AND RECOMMENDATIONS

7.1. Key issues

Although the subject site has had a high history of disturbance such as clearing over much of the site, it continues to provide a valuable contribution to the biodiversity of the locality. Although the vegetation communities within the subject site are not poorly represented on a regional or local basis, there are numerous issues that need to be highlighted to maintain habitat heterogeneity, fauna movement corridors and habitat quality across the subject site. Key issues are summarised below:

- The subject site is likely to be part of an important corridor for fauna movement. It is imperative that corridors for movement be maintained. These corridors are identified as the vegetation within the riparian gullies. Retention of the riparian vegetation will lead to maintenance of movement of fauna in a local context.
- The site contains three hollow-bearing habitat trees (see Figure 7). These resources are particularly important for hollow-dependant fauna.
- Potential threatened fauna habitat is present at the site. However the Assessment of Significance or seven part test has identified that the development should not significantly impact on threatened species in concurrence with the recommendations outlined below in section 7.2.

7.2. Recommendations

This section proposes amelioration measures that should be implemented to ensure that no *'significant effect'* would occur upon any threatened biota, or their habitats that are known to occur or could potentially occur within the subject site. These measures would also ensure that the impacts upon other native flora and fauna and the general environment of the subject site would be minimised.

The following recommendations are based purely on the information gathered pertaining to this site and through discussions with relevant experts and literature.

1. An erosion and sediment control plan is implemented to prevent erosion and subsequent siltation of the riparian gullies and small dams.
2. Feeding trees for Glossy Black Cockatoos have been identified within the riparian gullies, along the western boundary and as scattered trees across the subject site (see Figure 7). Although no direct evidence of feeding this season was observed, these trees are in excellent condition with abundant seed cones and provide an important resource for this species. The proponent should maintain all trees of this species within these areas. Where this is not possible, such as where fencelines for numerous lots run through this habitat, compensatory plantings of Black She-oak (*Allocasuarina littoralis*), should be undertaken at the ratio of 6 trees planted to each one removed.
3. Three hollow-bearing habitat trees were identified within the subject site (see Figure 7). These trees provide important habitat for hollow-dependant fauna and should be retained.
4. Any native vegetation that is to be removed as a result of this proposed activity should be utilised as potential habitat for a variety of fauna and left in-situ throughout the subject site *wherever possible* without creating a fire hazard. Coarse and fine woody debris provide essential habitat for a wide variety of native animals and are important to the functioning of many ecosystems. Alternatively, this resource could be used within the locality in habitat restoration projects if any existed. It is recommended that the local catchment management authority or landcare groups should be contacted to ascertain the need for this resource. However, it is acknowledged that some vegetation may need to be mulched. If this is to occur, then mulch should be utilised within the study area or the locality wherever possible.
5. Removal of any trees should only occur between February to July to avoid the breeding season of bats, birds or arboreal fauna. A suitably qualified person (ecologist/zoologist)

should be on hand at the time of tree removal to check for the presence of fauna and ensure that any fauna found is properly relocated to nearby habitat.

6. Although few weed species were observed, a high infestation of whisky grass was prevalent at the site. This species is easily spread by 'slashing' across the subject site. One noxious weed, Pampas grass was observed, and should be managed according to regulation. The clearing of vegetation has the potential to create more habitat for weed species. The proponent should ensure that all weed species are managed to disrupt potential spread across the site and beyond.

7.3. Conclusion

This assessment has described the biodiversity values of the site and recommended measures to reduce the level of impact of the proposed activity on these values. The subject site harbours a number of important habitat components and adds to the known biodiversity values of the Grandfathers Gully area as a movement corridor. This report has identified that the subject site may provide suitable habitat for a number of threatened species that occur, or are likely to occur.

The subject site consists predominately of cleared land which has been used for deer farming, however, the vegetation within the riparian gullies, the north-east corner and the Glossy Black Cockatoo feed trees are likely provide potentially important habitat areas for the biodiversity of the locality.

The assessment of significance (TSC Act and EPBC Act) has determined that the proposed activity is unlikely to have a significant impact on threatened species in concurrence with the recommendations outlined in this report.

8. REFERENCES

Andrews, N (2006) Flora and Fauna study, Grandfathers Gully, Lilli Pilli. A report to Eurobodalla Shire Council.

Blakers, M., Davies, S.J.J.F. & Reilly, P. N. (1984). *The Atlas of Australian Birds*. Royal Australasian Ornithologists Union, Melbourne.

Braithwaite, R.W. 1983, Southern Brown Bandicoot *Isoodon obesulus,* in *The Australian Museum Complete Book of Australian Mammals*, ed. R. Strahan Angus & Robertson, Sydney.

Brereton, R. 1996, The Swift Parrot *Lathamus discolor* Recovery Plan, Draft, prepared for the Parks and Wildlife Service Department and Land Management.

Bromham, L., Cardillo, M., Bennett, A.F. & Elgar, M.A. 1999, 'Effects of grazing by stock on the ground invertebrate fauna of remnant woodland.' *Australian Journal of Ecology*, Vol. 24, pp. 199-207.

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

Cuttle P. 1983, Brush-tailed Phascogale, *Phascogale tapoatafa* in *The Australian Museum Complete Book of Australian Mammals*, ed. R. Strahan, Angus & Robertson, Sydney.

Daly, G . (2000) Island Populations: Reptiles and Amphibians of the Jervis Bay Region on the south coast of New South Wales.

Daly, G & Senior, C. (2003) Surveys for and habitat assessment of the Green and Golden Bell Frog *Litoria aurea* on the Far South Coast of New South Wales. *Herpetofauna* **33** (2) : 86-102.

Daly, G., Pennay, M. and Coombes, D. (2000). Targeted surveys for the Stuttering Frog *Mixophyes balbus* on the south coast of New South Wales. Report to New South Wales NPWS.

Debus, S.J.S. & Rose, A.B. (1993) The Masked Owl *Tyto novaehollandiae* in New South Wales. **Aust. Birds 27:** in press.

DEC (2007a) NSW Atlas of Wildlife Database. NSW National Parks and Wildlife Service, Hurstville. Public edition accessed at http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/.

DEC (2007b)Threatened Species Profile : Striated Grass Wren *Calamanthus fuliginosus*. Department of Environment & Conservation, Hurstville.

DEC (2007c) Threatened Species Profile : Brown Treecreeper *Climacteris picumnus*. Department of Environment & Conservation, Hurstville.

DEC (2007d) Threatened Species Profile : Glossy Black Cockatoo Calyptorhynchus lathami. Department of Environment & Conservation, Hurstville.

DEC (2007e) Threatened Species Profile : Swift Parrot *Lathamus discolour*. Department of Environment & Conservation, Hurstville.

DEC (2007f) Threatened Species Profile : Square-tailed Kite Lophoictinia isura. Department of Environment & Conservation, Hurstville.

DEC (2007g) Threatened Species Profile : Pink Robin *Petroica rodinogaster*. Department of Environment & Conservation, Hurstville.

DEC (2007h) Threatened Species Profile : Osprey *Pandion hallaetus*. Department of Environment & Conservation, Hurstville.

DEC (2007i) Threatened Species Profile : Eastern Ground Parrot *Pezoporus wallicus wallicus*. Department of Environment & Conservation, Hurtsville.

DEC (2007j) Threatened Species Profile : Freckled Duck *Stitonetta naevosa.* Department of Environment & Conservation, Hurstville.

DEC (2007k) Threatened Species Profile : Australasian Bittern *Botaurus poiciloptilus*. Department of Environment & Conservation, Hurstville.

DEC (2007l) Threatened Species Profile : Black Bittern *Ixobrychus flavicollis.* Department of Environment & Conservation, Hurstville.

DEC (2007m) Threatened Species Profile : Superb Fruit-Dove *Ptilinopus superbus*. Department of Environment & Conservation, Hurstville.

DEC (2007n) Threatened Species Profile : Diamond Firetail *Stagonopleura guttata.* Department of Environment & Conservation, Hurstville.

DEC (2007o) Threatened Species Profile : Hooded Robin *Melanodryas cucullata.* Department of Environment & Conservation, Hurstville.

DEC (2007p) Threatened Species Profile : Turquoise Parrot *Neophema pulchella.* Department of Environment & Conservation, Hurstville.

DEC (2007q) Threatened Species profile : Green and Golden Bell Frog *Litoria aurea*. Department of Environment & Conservation, Hurstville.

Dementev G.P., Gladkov N.A. & Spandenberg E.P. (1951). *Birds of the Soviet Union*. 3. (English Translation, Israel Program for Scientific Translations, Jerusalem 1969).

Emison, W.B., Beardsell, C.M., Norman, F.I., Loyn, R.H. & Bennett, S. (1987). *Atlas of Victorian Birds*. Department of Conservation, Forests and Lands and Royal Australasian Ornithologists Union, Melbourne.

ESC (2002) Policy for the Conservation of the Yellow-bellied Glider in the Broulee Area. Eurobodalla Shire Council, Moruya.

Fleay, D. (1968). *Nightwatchmen of Bush and Plain*. Jacaranda Press, Brisbane.

Fleming, P.J.S. (1996), 'Ground-placed Baits for the Control of Wild Dogs: Evaluation of a Replacement-baiting Strategy in North-eastern New South Wales'. *Wildlife Research*, 23, 729-40.

Ford, H.A., Noske, S. and Bridges, L. (1986). Foraging of birds in eucalypt woodlands in north-eastern New South Wales. Emu 86, 168-179.Garnett, S. 1993, Threatened and extinct birds of Australia. Royal Australasian Ornithologists Union and Australian National Parks and Wildlife Service, Report 82.

Garnett, S. 1992. Threatened and extinct birds of Australia. Royal Australasian Ornithologists Union and Australian National Parks and Wildlife Service, Report 82.

Gaia Research (2001) Assessment of fauna habitat linkages and considerations for Management: Select rural residential areas, Eurobodalla Shire. Report for Eurobodalla Shire Council.

Gellie, N (2001) A summary report on vulnerable ecosystems and landscape planning in the Eurobodalla Shire. A report to Eurobodalla Shire Council.

Gibbons P (1999) Habitat-tree retention in wood production forests. PhD thesis. Australian National University, Canberra

Gibbons P, Lindenmayer D (2000) 'Tree Hollows and Wildlife Conservation in Australia'. (CSIRO Publishing: Canberra)

Gillespie, GR (1990) Distribution, habitat and conservation status of the giant burrowing frog, Heleioporus australiacus (Myobatrachidae), in Victoria. Victorian Naturalist.

GHD (2006) Potential Development of Lot 1 DP 594657 and Lot 21 DP 714404, Ecological Constraints and Opportunities Report, GHD Pty. Ltd, Belconnen ACT.

Hall, L.S. & Richards, G.C. (1979). Bats of eastern Australia, Queensland Museum Booklet 12. 66pp.

Harden, G.J. (ed) **Flora of New South Wales.** Vols 1-4. (1990-95). New South Wales University Press.

Harden, G. J. (2002) Flora of New South Wales, vol 2, revised edition.

Hero, J.M., Littlejohn, M. & Marantelli, G. (1991). *The Frogwatch Guide to Victorian Frogs*. Department of Conservation and Environment, Melbourne.

Higgins P.J. & Davies S.J. (Eds) (1996). Handb*ook of Australian, New Zealand and Antarctic Birds.* Volume 3: Snipe to Pigeons. Oxford University Press, Melbourne.

Johnston, P.G. (1983), Long-nosed Potoroo, *Potorous tridactylus*, in *Complete Book of Australian Mammals* ed. R. Strahan, Angus and Robertson, Sydney.

Kavanagh, R. (2004). Nocturnal birds and arboreal mammals, State Forest of NSW, Eden Wildlife School Notes, 8-11tth June 2004.

Klippel, K. (1992). *Wildlife Data Search: Threatened Animal Species of New South Wales*, Breakout Press, NSW.

Le Souef, A.S. & Burrell, H. (1926). *The Wild Animals of Australasia*, Harrap Sydney.

Lobert, B. & Lee, A. K. (1990), Reproduction and life history of *Isoodon obesulus* in Victorian heathland, in *Bandicoots and Bilbies*, (Seebeck ed), Surrey Beatty & Sons.

Lunney, D., OConnell, M. & Sanders, J. 1989, 'Habitat of the White-Footed Dunnart *Sminthopsis leucopus* (Gray) (Dayuridae,Marsupiala) in a logged Burnt Forests Near Bega New South Wales', *Ecology*, 14, 335-344.

Mac Nally R, Parkinson A, Horrocks G, Conole L, Tzaros C. (2001) Relationships between terrestrial vertebrate diversity, abundance and availability of coarse woody debris on south-eastern Australian floodplains. *Biological Conservation*.(**99**) : 191-205.

Mahony, M., Knowles, R. and Pattinson, L. (1996). Stuttering Barred Frog. In 'Threatened Frogs of New South Wales: Habitats, Status and Conservation'. (Ed. H. Ehmann.) pp. 65-71. (Frog and Tadpole Study Group of NSW Inc: Sydney).

Marchant S. M. & Higgins, P. J. (1990). *Handbook of Australian, New Zealand and Antarctic Birds*. Vol 1A. Oxford University Press.

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

Menkhorst P.W., Weavers B.W. and Alexander J.S.A. 1988. 'Distribution, Habitat and Conservation Status of the Squirrel Glider *Petaurus australis* (Petauridae: Marsupialia) in Victoria'. *Australian Wildlife Research* 15: 59-71.

Menkhorst P.W. & Knight, F., 2001. *A field guide to the Mammals of Australia*. Oxford University Press.

Morgan, L.A & Buttemer, W.A. (1996) Predation by the non-native fish *Gambusia holbrooki* on small *Litoria aurea* and *L.dentata* tadpoles. *Australian Zoologist* **30** (2) : 143-149.

NSW NPWS (1999b), Threatened species Information: Squirrel Glider *Petaurus norfolcensis*, Hurstville 1999, http://www.nationalparks.nsw.gov.au/PDFs/tsprofile_squirrel_glider.pdf

NSW NPWS (2003a). Recovery Plan for the Yellow-bellied Glider *Petaurus australis.* NSW National Parks and Wildlife Service, Hurstville.

NSW NPWS (2003b) Draft Recovery Plan for the Bush Stone-curlew (*Burhinus grallarius*). NSW NPWS, Sydney.

NPWS (2003c). *Draft Recovery Plan for the Barking Owl*. New South Wales National Parks and Wildlife Service, Hurstville, NSW.

NPWS (2003d) *Draft Recovery Plan for the Koala.* New South Wales National Parks and Wildlife Service, Hurstville, NSW.

Peake, P., Conole, L.E., Debus, S.J.S., McIntyre, A. & Bramwell, M. (1993) The Masked Owl *Tyto novaehollandiae* in Victoria. **Aust. Bird Watcher 15:** pp.125-136

Phillips, W.R. and S.J. Inwards, (1985), 'The Tasmanian Pipistrelle*: Pipistrellus tasmaniensis* Gould 1858: Annual activity and breeding cycles', *Macroderma* 1, 2-11.

Phillips, S.S (2000), Tree species preferences of the Koala *Phascolarctos cinereus* as a basis for the delineation of management areas for recovery planning in New South Wales. Draft report to NSW National Parks and Wildlife Service.

Pizzey, G. (1980). *A Field Guide to the Birds of Australia*, Collins, Sydney.

Pizzey, G. & Knight, F. (2003). *A Field Guide to the Birds of Australia*, Collins, Sydney.

PMA Consulting. (2005). Flora and Fauna Assessment, Proposed Subdivision, Lot 2 DP 250984, Grandfathers Gully Road, Lilli Pilli. Prepared by PMA Consulting for Mr & Mrs D Brewer.

Pringle, J.D.(1985). *The Shorebirds of Australia,* North Ryde: Angus & Robertson.

Resource and Conservation Assessment Council (1996), Regional Report of Upper North East New South Wales Volume 4, Biodiversity Attributes, RCAC, Sydney.

Richards, G.C. (1983), Greater Broad-nosed Bat, in *Complete Book of Australian Mammals,* (R. Strahan ed), Angus and Robertson, Sydney.

Russell, R. (1983), Yellow-bellied Glider *Petaurus australis* in *The Australian Museum Complete Book of Australian Mammals,* (R. Strahan ed), Angus and Robertson, Sydney.

Sass S. (2003) A survey of the reptiles of Wagga Wagga, New South Wales. *Herpetofauna*.(**33**) 1 : 18-23.

Sass, S (2006) The reptile fauna of Nombinnie Nature Reserve and State Conservation Area. *Australian Zoologist* 33 (4): 511-518.

Sass, S & Marshall, B (2006) A strategy for Yellow-bellied Glider, Lot 2 Candlagan Drive, Broulee, A report prepared for Planning Initiatives by **ngh**environmental, Bega.

Sass, S & Miles, J (2006) Flora and Fauna impact assessment, Proposed Bulky Goods Centre, Surf Beach. A report prepared for Eurobodalla Shire Council by **ngh**environmental, Bega.

Schodde, R. & Tidemann, S.C. (eds.) (1995). *Readers Digest Complete Book of Australian Birds*. 2nd. edn. Readers Digest Services, Sydney.

Shields J, Chrome F (1992) 'Parrots and Pigeons of Australia.' (Angus and Robertson: Sydney)

Simpson, K. & Day, N. (1989). *Field Guide to the Birds of Australia*. Viking O'Neil.

Slater, P. Slater, P. & Slater R. (1986). *The Slater Field Guide to Australian Birds*, Rigby Publishers, Australia.

Smith P. 1990. *The Biology and Management of the Little Tern* Sterna albifrons *in NSW*. NPWS, Hurstville.

Smith P. 1991. *The Biology and Management of Waders (Suborder Charadrii) in NSW*. NPWS, Hurstville.

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

Tanton, M.T. (1994) *Fauna Impact Statement - Appendix 1 in the* ***Environmental Impact Statement – Proposed Forestry Operations in Eden Management Area***, State Forests.

Thomas, V., Gellie, N. & Harrison, T. 2000, Forest ecosystem classification and mapping for the Southern CRA region, Volume II Appendices. NSW National Parks & Wildlife Service, Southern Directorate. A report undertaken for the NSW CRA/RFA Steering Committee.

Walton, D., Busby, J., & Woodside, D. 1992, 'Recorded and predicted distribution of the Golden-tipped Bat *Phoniscus papuensis* in Australia'. *Australian Zoologist* 28, 52-54.

Wassens, S., Sass, S., Swan, G. & Thompson, L. (2004). Frog diversity in the Murrumbidgee Irrigation Area: a baseline survey. Charles Sturt Unviversity. The Johnstone Centre. Wagga Wagga. A report for Murrumbidgee Irrigation Pty.Ltd.

APPENDICES

APPENDIX A: FLORA

A.1 Flora species list

Relative abundance is given by a cover abundance scale (modified Braun-Blanquet):

1 1 to a few individuals present, less than 5% cover

2 many individuals present, but still less than 5% cover

3 5 - < 20% cover

4 20 - < 50% cover

5 50 - < 75% cover

6 75 - 100% cover

Cover/abundance scores relate to general abundance over the entire site, not to representative quadrats.

*Introduced species and Australian natives which have been planted are preceded by an asterisk.

Scientific name	Common name	Family	Abundance
TREES			
Acacia implexa	lightwood or hickory	Fabaceae	1
Acacia longifolia ssp *longifolia*	Sydney golden wattle	Fabaceae	0-3
Acacia mabellae		Fabaceae	1
Acacia mearnsii	black wattle	Fabaceae	1
Allocasuarina littoralis	black sheoak	Casuarinaceae	0-5
Corymbia maculata	spotted gum	Myrtaceae	1-4
Elaeocarpus reticulatus	blueberry ash	Elaeocarpaceae	1
Eucalyptus fibrosa	grey ironbark	Myrtaceae	1
Eucalyptus globoidea	white stringybark	Myrtaceae	0-3
Eucalyptus pilularis	blackbutt	Myrtaceae	0-3
Pittosporum undulatum	sweet pittosporum	Pittosporaceae	1
SHRUBS			
Acacia longissima		Fabaceae	0-4
Acacia paradoxa	hedge wattle	Fabaceae	0-3
Acacia stricta		Fabaceae	0-2
Acacia terminalis	sunshine wattle	Fabaceae	0-4
Acacia ulicifolia	prickly wattle	Fabaceae	1
Babingtonia plurifolia	tall baeckea	Myrtaceae	1
Bursaria spinosa ssp *lasiophylla*	blackthorn	Pittosporaceae	1
Callistemon ?citrinus	crimson bottlebrush	Myrtaceae	1
Daviesia ulicifolia ssp *stenophylla*		Fabaceae	1

Exocarpus strictus	pale fruited ballart	Santalaceae	1
**Grevillea* sp.		Proteaceae	1
Hakea sericea	prickly hakea	Proteaceae	1
**Hakea salicifolia*	willow hakea	Proteaceae	0-3
Hibbertia aspera	guineaflower	Dilleniaceae	2
Hibbertia diffusa	guineaflower	Dilleniaceae	1
Indigofera australis	austral indigo	Fabaceae	1
Leptospermum polygalifolium ssp *polygalifolium*	yellow teatree	Myrtaceae	1
Leucopogon lanceolatus		Epacridaceae	1
Macrozamia communis	burrawang	Zamiaceae	0-2
Notelaea longifolia forma *longifolia*	large mock olive	Oleaceae	1
Notelaea venosa	veined mock olive	Oleaceae	1
Ozothamnus diosmifolius	everlasting, tickbush	Asteraceae	1
Pimelea linifolia ssp *linifolia*	rice-flower	Thymeleaceae	1
Pultenaea daphnoides		Fabaceae	1
Rubus parvifolius	small-leaved bramble	Rosaceae	1
**Solanum mauritianum*	wild tobacco bush	Solanaceae	1
**Westringia* sp.		Lamiaceae	1
FERNS			
Adiantum aethiopicum	maidenhair	Adiantaceae	1
Calochlaena dubia	common ground fern	Dicksoniaceae	1
Cheilanthes sieberi ssp *sieberi*	rock or mulga fern	Sinopteridaceae	1
Doodia aspera	prickly rasp fern	Blechnaceae	1
Lindsaea microphylla	lacy wedge fern	Lindsaeaceae	1
Pellaea falcata	sickle fern	Sinopteridaceae	1
Pteridium esculentum	bracken	Dennstaedtiaceae	0-6
VINES AND TWINERS			
Cassytha pubescens	devil's twine	Lauraceae	1
Cissus hypoglauca	native grape, water vine	Vitaceae	1
Clematis glycinoides	old man's beard	Ranunculaceae	1
Eustrephus latifolius	wombat berry	Luzuriagaceae	1
Geitonoplesium cymosum	scrambling lily	Luzuriagaceae	1
Glycine clandestina	twining glycine	Fabaceae	1
Hardenbergia violacea	native sarsaparilla	Fabaceae	1
Hibbertia dentata	guinea flower	Dilleniaceae	0-3
Hibbertia scandens	guinea flower	Dilleniaceae	1

Marsdenia rostrata	milk vine	Asclepidiaceae	1
Pandorea pandorana	wonga vine	Bignoniaceae	1
**Passiflora edulis*	passionfruit	Passifloraceae	1
Passiflora herbertiana		Passifloraceae	1
Rubus moluccanus var. *trilobus*	molucca bramble	Rosaceae	1
Smilax glyciphylla	native sarsaparilla	Smilacaceae	1
FORBS			
**Anagallis arvensis*	scarlet pimpernel	Primulaceae	1
Brunoniella pumilio	small trumpet flower	Acanthaceae	1
Centella asiatica	pennywort	Apiaceae	1
**Cirsium vulgare*	black or spear thistle	Asteraceae	1
**Conyza albida*	fleabane	Asteraceae	1
Daucus glochidiatus	native carrot	Apiaceae	1
Desmodium gunnii	southern tick trefoil	Fabaceae	2
Dianella caerulea	blue flax lily	Phormiaceae	1
Dianella revoluta	blue flax lily	Phormiaceae	1
Dichondra repens	kidney weed	Convolvulaceae	2
**Dittrichia graveolens*	stinkwort	Asteraceae	1
**Erigeron karvinskianus*	seaside daisy	Asteraceae	1
Euchiton gymnocephalus	slender cudweed	Asteraceae	2
Galium binifolium		Rubiaceae	1
Galium propinquum	bedstraw	Rubiaceae	1
**Gnaphalium coarctatum*	cudweed	Asteraceae	1
Gonocarpus teucrioides	raspwort	Haloragaceae	1
Goodenia ovata		Goodeniaceae	2
Hydrocotyle acutiloba	forest pennywort	Apiaceae	2
Hydrocotyle ?peduncularis		Apiaceae	0-3
Hypericum gramineum	native St Johns wort	Clusiaceae	1
**Hypochaeris radicata*	cat's ear, flatweed	Asteraceae	2
Lagenifera stipitata	blue bottle daisy	Asteraceae	1
**Leontodon taraxacoides*	lesser hawkbit	Asteraceae	1
Opercularia aspera	stinkweed	Rubiaceae	1
Oxalis ?perennans	native oxalis	Oxalidaceae	2
Phyllanthus hirtellus	thyme spurge	Euphorbiaceae	2
Plantago debilis	native plantain	Plantaginaceae	1
**Plantago lanceolata*	plantain	Plantaginaceae	1
Pomax umbellata		Rubiaceae	1
Poranthera microphylla		Euphorbiaceae	1

Pratia purpurascens	whiteroot	Lobeliaceae	2
Pseuderanthemum variabile	pastel flower	Acanthaceae	1
Rumex brownii	native dock	Polygonaceae	1
Schelhammera undulata	lilac lily	Uvulariaceae	1
Senecio hispidulus var. *hispidulus*	hill fireweed	Asteraceae	1
Sigesbeckia orientalis	Indian weed	Asteraceae	1
Solanum opacum		Solanaceae	1
Solanum pungetium	prickly nightshade	Solanaceae	2
Stackhousia monogyna	creamy candles	Stackhousiaceae	1
Vernonia cinerea		Asteraceae	2
Veronica plebeia	common speedwell	Scrophulariaceae	2
Viola hederacea	ivy-leafed violet	Violaceae	2
Vittadinia cuneata var. *cuneata* forma *cuneata*	fuzzweed	Asteraceae	1
Wahlenbergia ?gracilis	sprawling bluebell	Campanulaceae	1
GRASSES			
**Andropogon virginicus*	whisky grass	Poaceae	0-4
Aristida vagans	three awn grass	Poaceae	0-4
Austrodanthonia pilosa var. *pilosa*	wallaby grass	Poaceae	1
Austrodanthonia tenuior	wallaby grass	Poaceae	1
Austrostipa ?pubescens		Poaceae	1
Austrostipa rudis		Poaceae	1
**Cortaderia selloana*	pampas grass	Poaceae	1
Cymbopogon refractus	barbed wire grass	Poaceae	1
Cynodon dactylon	couch grass	Poaceae	0-4
**Dactylis glomerata*	cocksfoot	Poaceae	1
Digitaria ramularis		Poaceae	0-4
Echinopogon ovatus	hedgehog grass	Poaceae	2
Entolasia marginata	bordered panic	Poaceae	1
Entolasia stricta	wiry panic	Poaceae	2
Eragrostis leptostachya	paddock lovegrass	Poaceae	0-4
Imperata cylindrica var. *major*	blady grass	Poaceae	0-5
Microlaena stipoides	weeping grass	Poaceae	0-5
Notodanthonia longifolia	curly wallaby grass	Poaceae	0-2
Oplismenus imbecillis	basket grass	Poaceae	1
Panicum simile	two colour panic	Poaceae	2
**Paspalum dilatatum*	paspalum	Poaceae	1

**Paspalum urvillei*	Vasey grass	Poaceae	1, DA
**Pennisetum clandestinum*	kikuyu	Poaceae	0-5
Poa meionectes		Poaceae	1
**Setaria* sp.	pigeon grass	Poaceae	1
**Sporobolus africanus*	Parramatta grass	Poaceae	2
Themeda triandra	kangaroo grass	Poaceae	0-5
GRAMINOIDS			
Cyperus sphaeroideus		Cyperaceae	1, DA
Eleocharis sphacelata	tall spike-rush	Cyperaceae	0-5, DA
Gahnia melanocarpa	black fruited saw-sedge	Cyperaceae	1
Juncus usitatus	common or tussock rush	Juncaceae	1, DA
Juncus sp.		Juncaceae	1, DA
Lepidosperma laterale	variable sword-sedge	Cyperaceae	1
Lepidosperma urophorum	rapier sedge	Cyperaceae	0-4
Lomandra confertifolia ssp *rubiginosa*		Lomandraceae	1
Lomandra confertifolia ssp *similis*		Lomandraceae	1
Lomandra filiformis ssp *filiformis*		Lomandraceae	1
Lomandra glauca		Lomandraceae	1
Lomandra longifolia	spiny matrush	Lomandraceae	2
Lomandra multiflora ssp *multiflora*		Lomandraceae	1
Typha orientalis	cumbungi	Typhaceae	0-3, DA

APPENDIX B: FAUNA

B.1 Fauna species list

*denotes introduced species

COMMON NAME	*SCIENTIFIC NAME*
Birds	
Australian King Parrot	*Alisterus scapularis*
Australian Magpie	*Gymnorhina tibicen*
Australian Raven	*Corvus coronoides*
Brown Thornbill	*Acanthiza pusilla*
Common Bronzewing	*Phaps chalcoptera*
Crimson Rosella	*Platycercus elegans*
Eastern Spinebill	*Acanthorhynchus tenuirostris*
Eastern Yellow Robin	*Eopsaltria australis*
Fan-tailed Cuckoo	*Cacomantis flabelliformis*
Golden Whistler	*Pachycephala pectoralis*
Grey Butcherbird	
Grey fantail	*Rhipidura fuliginosa*
*Indian Myna	*Acridotheres tristis*
Lewins Honeyeater	*Meliphaga lewinii*
Pied Currawong	*Strepera graculina*
Rainbow Lorikeet	*Trichoglossus haematodus*
Red-browed firetail	*Neochmia temporalis*
Red Wattlebird	*Anthochaera carunculata*
Satin Bowerbird	*Ptilonorhynchus violaceus*
Striated Thornbill	*Acanthiza lineata*
Sulphur-crested Cockatoo	*Cacatua galerita*
Superb Fairy-wren	*Malurus cyaneus*
White-browed Scrubwren	*Sericornis frontalis*
White-plumed Honeyeater	*Lichenostomus penicillatus*
White-throated Treecreeper	*Cormobates leucophaeus*
Yellow-faced Honeyeater	*Lichenostomus chrysops*
Mammals	
Eastern Grey Kangaroo	*Macropus giganteus*
Greater Glider	*Petauroides volans*
Red-necked Wallaby	
Sugar Glider	*Petaurus breviceps*
Swamp Wallaby	*Wallabia bicolor*
Reptiles	
Delicate Skink	*Lampropholis delicata*
Frogs	
Bibrons Toadlet	*Pseudophryne bibronii*
Eastern Froglet	*Crinia signifera*
Haswells Toadlet	*Paracrinia haswellii*
Jervis Bay Tree Frog	*Litoria jervisiensis*
Verreauxs Tree Frog	*Litoria verreauxii*
Fish	
*Plague Minnow	*Gambusia holbrookii*