

**Proposed Residential Development of the
Seven Network Site, Mobbs Lane, Epping**

Fauna Survey and Assessment

Prepared For :

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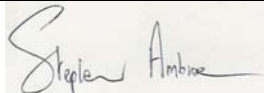
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INTRODUCTION

1.1 INTRODUCTION

The purpose of this report is to provide a fauna assessment of the potential impacts of the proposed residential development of the existing ATN Seven Network site at 61 Mobbs Lane, Epping ("the subject site") in the Parramatta Local Government Area (Parramatta LGA).

In doing so, the assessment fulfils the fauna component of Key Issue No. 8 of the Director General's Requirements (Department of Planning) for environmental impact assessment of the proposed development. This requirement states:

8. Flora & Fauna

The EA shall address impacts on flora and fauna, including threatened species, populations and endangered ecological communities and their habitats and steps taken to mitigate any identified impacts to protect the environment as per Concept Plan MP 05_0086.

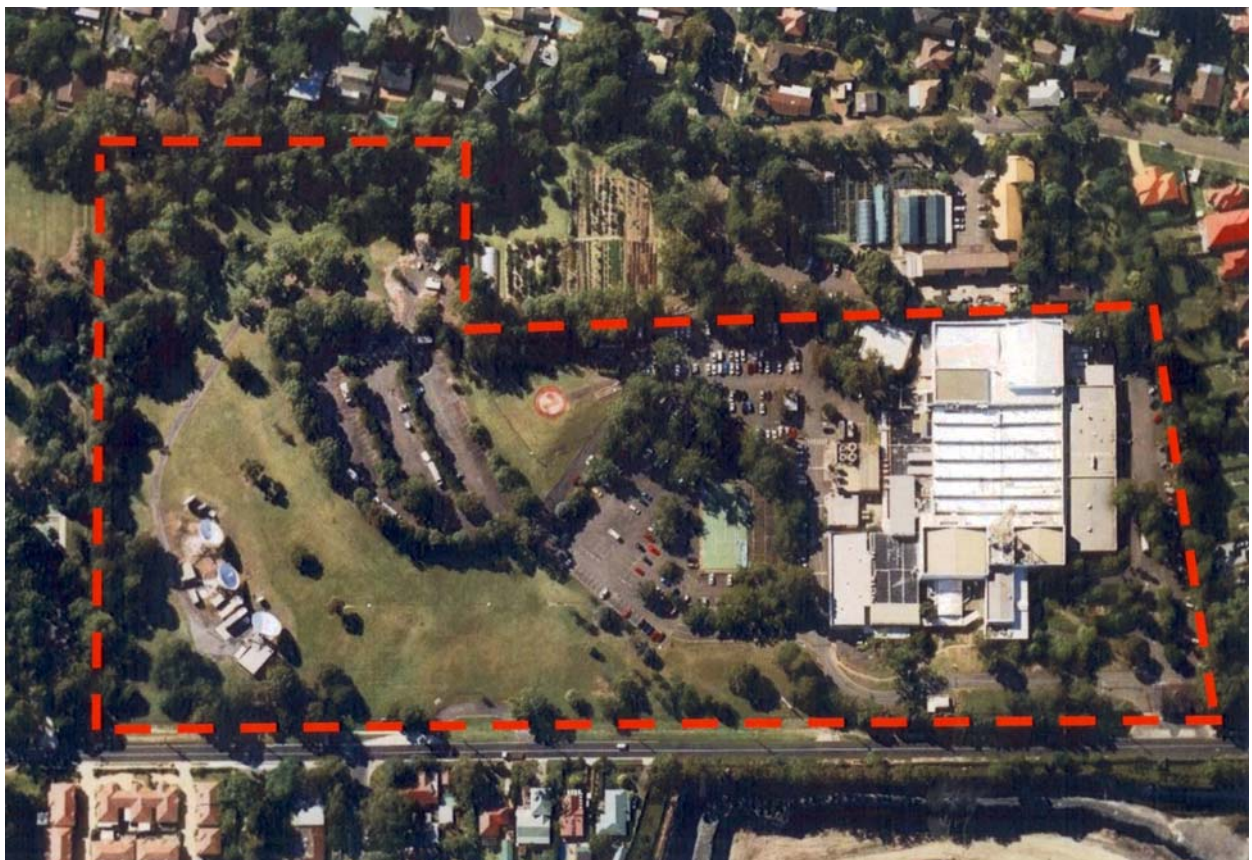
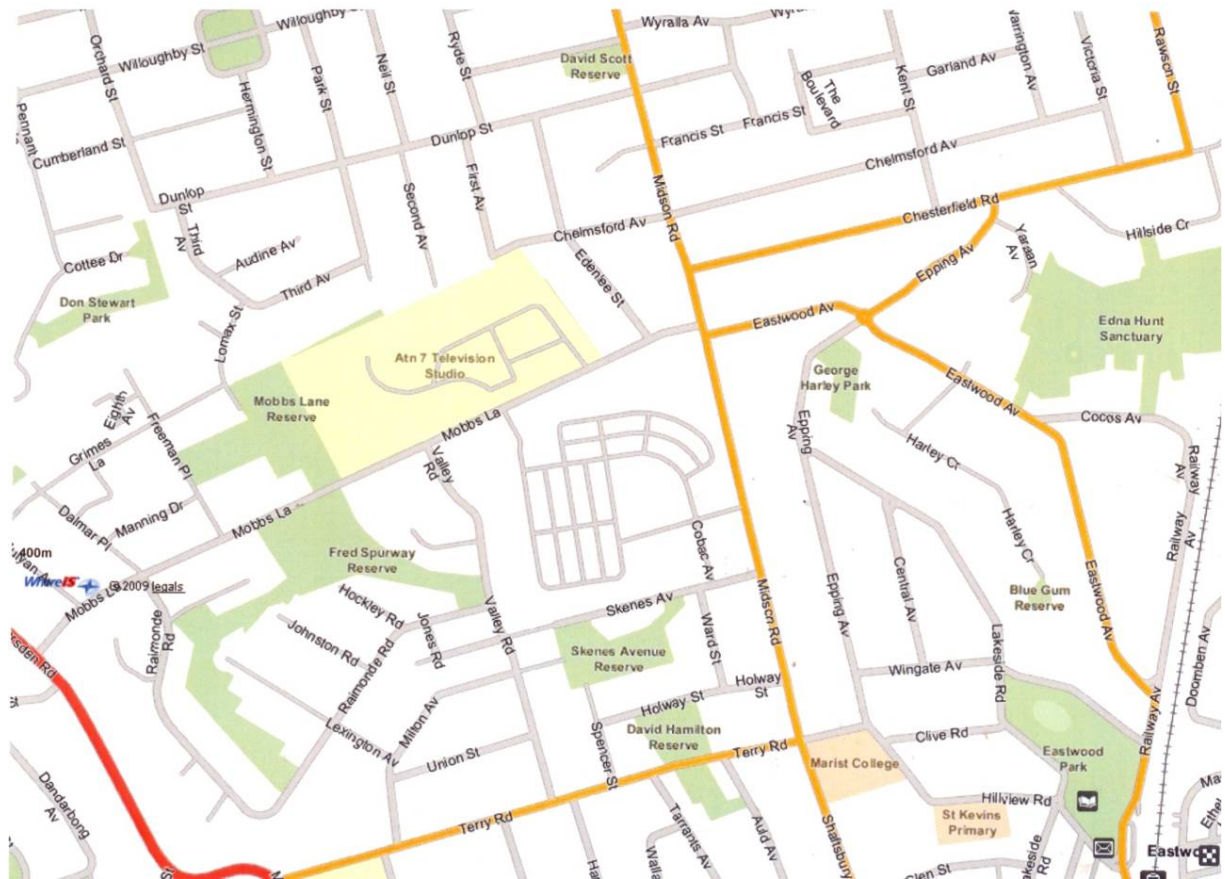
The fauna assessment:

- identifies key fauna habitats within the subject site;
- reviews fauna literature and databases relevant to the subject site;
- describes the methodology and results of the fauna surveys;
- addresses potential impacts on fauna and their habitats resulting from the proposed development;
- proposes appropriate impact mitigation measures; and
- provides an assessment of the likelihood of significant impacts on threatened species and populations, and endangered ecological communities, according to Section 5A of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act), NSW *Threatened Species Conservation Act, 1995* (TSC Act) and Commonwealth *Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act). This was done to determine the need for a Species Impact Statement (SIS) under the TSC Act or an application for development under the EPBC Act.

A comprehensive assessment of the flora and vegetation communities on and adjacent to the subject site is provided by Clements *et al.* (2005 & 2009).

Figure 1

LOCATION AND AERIAL VIEW OF SUBJECT SITE



1.2 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

1.2.1 Existing Conditions

The subject site is about 8.7 ha in area and is bounded by:

- Mobbs Lane Reserve, containing a tributary of Terrys Creek, to the west;
- a TAFE college and residential development to the north;
- residential development to the east;
- the former quarry and brickworks to the south-east; and
- residential development and Fred Spurway Park with the continuation of the tributary to Terrys Creek to the south-west (Figure 1).

The subject site consists of the Seven Network studio complex in the north-eastern half of the site, with extensive associated car parks surrounding the buildings and to the north and west of the complex. A disused tennis court with grandstands is located in the centre of the subject site and there is a helipad at the top of the slope in the north.

A satellite station is located in the south-west of the subject site. The trees on the site consist of landscape plantings along the edges of roads and buildings and bordering the car parks. In the south-western half of the subject site there are extensive mown grassed areas with scattered trees. In the north-western corner of the subject site there is a minor drainage line.

1.2.2 Proposed Development

The NSW Minister for Planning has approved a concept plan for residential development, landscaped open space and associated facilities at the subject site. The consent allows for the following development on the subject site:

- Up to 650 dwellings
- Up to 80,000m² maximum gross floor area equivalent to a maximum floor space ratio of 0.89:1
- Up to 96,000m² total envelope area
- No more than 73 dwellings per hectare on land
- A maximum height number of six storeys and height distribution
- Landscaped public open space (no less than 3.1 hectares) and private open space
- Associated services and infrastructure
- Land use distribution, building heights, dwelling mixes and types
- Strata and torrens title subdivision.

1.3 STATUTORY FRAMEWORK

1.3.1 NSW Legislation

- (a) Environmental Planning and Assessment Act, 1979.

Section 78A of the EP&A Act enables a person to apply to a consent authority to carry out development that is permissible under an environmental planning instrument.

In assessing a development application a consent authority must, pursuant to 79C of the EP&A Act take into consideration, where relevant, the likely impacts of the development on the natural and built environments.

Section 5A of the EP&A Act lists the factors to be taken into consideration in assessing a development application in deciding whether there is likely to be a significant effect on a threatened species or population, endangered ecological community, or their habitats (the Seven-part Test of Significance). If a significant impact is likely to occur then a species impact statement (SIS) must be prepared in accordance with Division 2 of Part 6 of the TSC Act.

An SIS provides a more detailed assessment of threatened biota issues and proposes measures to manage and mitigate adverse impacts on the threatened species, populations or ecological communities, or their habitats, resulting from the proposal.

This report examines the factors, the likely impacts of the proposed development on threatened fauna and their habitats and determines whether or not an SIS is required to be prepared.

(b) Water Management Act, 2000 (WM Act)

Under Part 3 (Approvals), Division 1, Section 91(2), a controlled activity approval confers a right on its holder to carry out a specified controlled activity at a specified location in, on or under waterfront land. Waterfront land is defined as:

- (a) the bed of any river or lake, and any land lying between the bed of the river or lake and a line drawn parallel to, and the prescribed distance inland of:

- ❑ in the case of non-tidal waters, the highest bank or shore above the river or lake, and
- ❑ in the case of tidal waters, the mean high water mark of the river or lake, and

if the regulations so provide, the bed of the coastal waters of the State, and any land lying between the shoreline of the coastal waters and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the coastal waters, where the prescribed distance is 40 metres or (if the regulations prescribe a lesser distance, either generally or in relation to a particular location or class of locations) that lesser distance.

- (b) the erection of a building or the carrying out of work (within the meaning of the EP&A Act), or
- (c) the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or
- (d) the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or
- (e) the carrying out of any other activity that affects the quantity or flow of water in a water source.

A controlled activity approval will not be granted unless the Minister is satisfied that adequate arrangements are in force to ensure that minimal harm will be done to any waterfront land as a consequence of carrying out the proposed controlled activity.

1.3.2 Commonwealth Legislation

The *Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act) regulates the assessment and approval of actions that have a significant impact on matters of national environmental significance. These may include:

- ❑ wetlands protected by international treaty (the Ramsar Convention);
- ❑ nationally listed threatened species and ecological communities; and
- ❑ nationally listed migratory species.

An action that is likely to have a significant impact requires the approval of the Commonwealth Minister for the Environment. Actions are projects, developments, undertakings, activities, series of activities or alteration of any of these actions. Guidelines for assessing the national significance of impacts are presented on the Department of Environment, Water, Heritage and the Arts (DEWHA) website.

This report assesses whether or not the proposed development will significantly impact on matters of national environmental significance. If a significant impact is likely, then the matter needs to be referred to the DEWHA.

1.3.3 Planning Instruments

The planning instrument that is also considered in the present report is State Environmental Planning Policy 44 (SEPP 44) – Koala Habitat Protection.

1.4 STRUCTURE OF REPORT

This report comprises four chapters and one appendix. The contents of subsequent sections of the report are as follows:

Chapter 2 outlines the methods used to survey and assess key fauna habitats within the subject site. This includes reviews of databases and literature, and descriptions of survey techniques and survey effort for fauna species, including threatened species.

Chapter 3 describes the existing fauna and their habitats within the subject site and their overall conditions and conservation significance.

Chapter 4 identifies potential impacts of the proposed development on native fauna and their habitats. It also recommends appropriate measures for avoiding or minimising impacts on fauna and their habitats that may occur as a result of the proposed development.

Appendix A presents the Seven-Part Tests of Significance for threatened and regionally significant fauna species and populations that would be potentially impacted on by the proposed development.

2

METHODOLOGY

2.1 OVERVIEW

Fauna issues relating to the application for development of the subject site were identified by reviewing relevant literature and databases and conducting field surveys. The methods by which this information was collected and analysed are presented below.

2.2 EXISTING RECORDS

Existing literature relevant to the study area, in particular technical environmental reports produced by NPWS, other consultancies and Parramatta City Council, were reviewed to determine the presence of terrestrial and aquatic habitats, and fauna species of conservation significance, within the locality (a 5 km radius around the subject site).

Records of threatened fauna species, listed under the schedules of the TSC and EPBC Acts and species of regional conservation significance, were obtained from databases for the Parramatta LGA. The databases searched were:

- NPWS Wildlife Atlas Database;
- NSW Field Ornithologists' Club Atlas Database;
- Birds Australia Atlas Database (1977-81) and (1998 onwards);
- EPBC database; and
- Australian Museum specimen collection database.

These databases only contain indicative records of fauna species in the locality and are not the result of a systematic fauna survey. Database records for individual species will vary in quality, reliability and accuracy of the geographic co-ordinates. Therefore, some species records are highly accurate in space and time such as the Birds Australia Atlas Database and the Australian Museum Specimen Collection Database. However, others are more tentative or only contain estimates of geographical locations, for instance, records from the NPWS Wildlife Atlas Database have a limited accuracy based on a 1 km² recording grid.

2.3 TAXONOMY

The following references were used to identify and classify animal groups:

- birds - Simpson & Day (1998); Christidis & Boles (2008);
- mammals (excluding bats) - Cronin (2000c), Menkhorst & Knight (2001),
- bats - Richards and Hall (1993), Reinhold *et al.* (2001); Pennay *et al.* (2004);
- amphibians - Cogger (2000), Anstis (2002); and
- reptiles – Cogger (2000), Cronin (2001), Swan *et al.* (2004).

Triggs (1996) was used in the identification of scats, animal tracks and markings.

2.4 FIELD SURVEYS

2.4.1 Overview

Fauna and their habitats on and adjacent to the subject site were surveyed on 1 March 2009. Diurnal surveys (habitat assessment and tadpole, reptile, diurnal bird and mammal surveys) were conducted from 0800 to 1200 hrs and nocturnal surveys (frog, bat, nocturnal bird and arboreal mammal surveys) were conducted from 1800 to 2200 hrs.

Given the site's urban setting, its size and the relatively degraded nature of habitats, this is considered an appropriate amount of search effort required to assess the native fauna and habitat values of the site.

2.4.2 Fauna Habitat Assessment and Survey

(a) Fauna Habitat Assessment

It was not possible to determine with certainty all the fauna that utilise habitats on the subject site. This is because of the likely seasonal occurrences of some fauna species, the occasional occurrence of vagrant species, and because some species are difficult to detect because of their timid or cryptic behaviour. Therefore, fauna investigations comprised an assessment of fauna habitats present on the site and an indication of their potential to support native wildlife populations and, in particular, threatened species.

The assessment criteria included:

Mammals:	extent of ground cover, shrub layer and tree canopy, hollow-bearing trees, substrate type (for burrowing etc), evidence such as droppings, diggings, footprints, scratches on trees, nests, burrow paths and runways.
Birds:	structural features such as the extent and nature of the canopy, understorey and ground strata and flowering characteristics, bird species.
Reptiles and Amphibians:	cover, shelter, suitable substrate, basking and breeding site availability. Reptiles and frogs sought in likely sheltering places.
Invertebrates	logs and other debris, leaf and bark accumulations around bases of trees, grass clumps, loose soil for burrowing.
Wildlife Corridor Values	Importance of the creek systems and riparian vegetation as movement corridors for fauna, especially birds, aquatic fauna, mammals (e.g. microchiropteran bats) & amphibians.

(b) Fauna Survey

A search for fauna species on the subject site was conducted during the diurnal and nocturnal site inspections. Information collected was used in conjunction with other surveys

and records in determining fauna use of the subject site and, in particular, use or potential use of the subject site by threatened species.

Weather conditions were recorded during the time of the survey. Area search surveys and incidental sightings were used to determine faunal assemblages in addition to fauna habitat assessment. These techniques are described in greater detail below:

(i) Bird Surveys

All bird species that were observed or heard during the survey were noted. Area search surveys were conducted in four 2-ha plots within the bushland areas of the subject site, the surveys lasting 30 minutes per plot. All major bird habitats on the subject site were surveyed by the area search method. The surveys involved wandering around each survey plot at a variable speed, stopping at will, and recording each bird species that was encountered. Opportunistic sightings of bird species at other times during the survey period were also recorded.

Owl presence was investigated on both nights by playing the calls of owls that could potentially occur in the locality and subsequently searching for owls that may be responding to these calls. Owl calls were broadcast at four locations on the subject site on 1 March 2009. At each location, a playback trial involved listening/spotlighting for owls for 15 minutes, followed by 5 minutes per owl species of broadcasting and then 10 minutes of listening/spotlighting. This procedure was repeated twice at each point.

(ii) Reptiles and Amphibians

Reptiles and amphibians were identified using indirect observation methods. Species were searched for in fallen logs, suitable rock basking substrates, underneath other fallen material and along creek banks. During the nocturnal surveys, responses to playback recordings, together with spotlighting, helped identify frog species that occurred within the pond near the northern boundary of the subject site (west of the helipad) and along the Terry's Creek tributary in Mobbs Lane Reserve.

(iii) Microchiropteran Bats

Microchiropteran bats often fly through woodland or forest habitats by moving along creeks and open areas of forest. They are most easily detected around dusk when they emerge from their day-time roosts and begin to actively forage for food. A hand-held Anabat II Bat Detector (Titley Electronics) was used on the subject site from 1900 to 2100 hrs on 1 March 2009 to record the ultrasonic calls of bats that may have been in or near the subject site.

A stationary anabat recorder was also left overnight near the pond on the subject site to record the calls of bats that may have been attracted to aerial insects on or near the pond surface. This recorder operated from that location from 1845 hrs on 1 March to 0730 hrs on 2 March 2009.

Bat calls that are recorded during surveys are routinely identified with the assistance of Anabat 6.3 Software (Titley Electronics), Pennay *et al.* (2004), Richards *et al.* (1993) and Reinhold *et al.* (2001).

(iv) Other Mammals

Opportunistic observations were recorded if mammals were seen at night during spotlighting surveys and during the day when searching for other fauna.

2.4.3 Species of Conservation Significance

Native fauna species and populations considered threatened in New South Wales are listed in Schedules 1 and 2 of the *Threatened Species Conservation (TSC) Act 1995*. A Seven-Part Test of Significance was conducted for all those threatened species detected on a site or for those considered likely to occur there due to the availability of habitat.

2.5 ASSESSMENT OF CONSERVATION VALUE

2.5.1 Conservation Value Parameters

The conservation value of fauna habitats on the subject site was determined by reference to the following criteria:

- *representativeness* - whether the vegetation communities of the site are unique, typical or common in the bioregion. In addition, the criteria takes into account whether or not such vegetation units are presently held in conservation reserves;
- the presence of threatened or regionally significant species on the site;
- The extent of human influence on the natural environment of the site and the condition of habitats (e.g. the presence of weeds, fire frequency etc.);
- the uniqueness of the natural values of the site;
- the amount of native vegetation to be cleared or modified by the proposed development in relation to what remnant vegetation will remain in the locality; and
- the relative importance of a site as a corridor for the movement of wildlife.

2.6 KOALA HABITAT ASSESSMENT

An assessment of Koala habitat on the subject site, according to the *State Environment Planning Policy No. 44 – Koala Habitat Protection (SEPP 44)*, was completed on 1 March 2009 as part of the overall fauna survey and assessment.

It is necessary to identify whether the site consists of *potential* and/or *core* Koala habitat as defined under SEPP 44 when seeking development consent in local government areas to which the policy applies.

Potential Koala habitat is defined as “*areas of native vegetation where the trees of the types listed in Schedule 2 (of SEPP 44) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component*”. Trees listed in Schedule 2 are presented in Table 2.1

Core Koala habitat means “an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings and historical records of a Koala population”. The subject site in the present study is not Potential or Core Habitat according to these definitions.

Table 2.1 TREES LISTED IN SCHEDULE 2 OF SEPP 44

Scientific Name	Common Name
<i>Eucalyptus albens</i>	White Box
<i>Eucalyptus camaldulensis</i>	River Red Gum
<i>Eucalyptus haemastoma</i>	Broad-leaved Scribbly Gum
<i>Eucalyptus microcorys</i>	Tallowwood
<i>Eucalyptus populnea</i>	Bimble Box
<i>Eucalyptus punctata</i>	Grey Gum
<i>Eucalyptus robusta</i>	Swamp Mahogany
<i>Eucalyptus signata</i>	Scribbly Gum
<i>Eucalyptus tereticornis</i>	Forest Red Gum
<i>Eucalyptus viminalis</i>	Ribbon Gum

3

RESULTS

3.1 OVERVIEW

This chapter describes the native fauna and their habitats on the subject site. It assesses the conservation values of these habitats and discusses the possibility of threatened and locally significant fauna species occurring on the subject site.

3.2 VEGETATION COMMUNITIES

The floristic diversity and structure of vegetation communities on the subject site are described in detail by Clements *et al.* (2005 and 2009).

3.3 FAUNA

3.3.1 Fauna Habitats

There are three main habitats for native fauna on or adjacent to the subject site:

- ❑ Forest remnants;
- ❑ Landscape Areas/Grassland/Cleared lands; and
- ❑ Aquatic/riparian habitats.

Each of these habitats is discussed in detail below.

(a) Forest Remnants (Plates 1 & 2)

Occurrence: Along the western boundary of the subject site, the part of the northern boundary that is adjacent to Grimes Lane, and in Mobbs Lane Reserve.

Habitat Elements: The tree canopy has the potential of producing seeds, nectar and/or fruits for nectarivorous and frugivorous birds and bats, and arboreal mammals. It also provides potential nesting and roosting sites for common native birds (e.g. honeyeaters, pardalotes, gerygones, thornbills, corvids and artamids) and for some arboreal mammals (e.g. possums). There is one large tree in the north-eastern corner of the subject site and two trees near the north-eastern corner of the helipad with hollows that could potentially be used as roosting and/or nesting sites by common urban bird species that are present on the site (e.g. Rainbow Lorikeets, Eastern Rosellas and Laughing Kookaburras), microchiropteran bats, reptiles and arboreal mammals (e.g. Brush-tailed Possums) (Plates 3 and 4). No other trees with substantial hollows were detected on the subject site.

A moderate amount of leaf litter and fallen timber (branches and twigs) along the northern and western boundaries of the subject site, and in Mobbs Lane Reserve, provide potential foraging habitat for ground-foraging birds (e.g. fairy-wrens, thornbills and scrubwrens) and mammals (e.g. bush rats) and shelter and refuge areas for reptiles (e.g. skinks and geckoes).

Plate 1 Forested Area Along Northern Boundary of Subject Site



Plate 2 Forested Area in Mobbs Lane Reserve, Beyond the Western Boundary of Subject Site.



This microhabitat is largely absent in the landscaped parkland/garden areas of the subject site.

The forested areas of Mobbs Lane Reserve, the western boundary of the subject site, and the part of the northern boundary that is adjacent to Grimes Lane, form an important wildlife corridor that links up with the Terrys Creek wildlife corridor.

Disturbance: Forested areas of the Mobbs Lane Reserve, particularly along the creek banks, are badly infested with weeds and other exotic plants. These weeds have spread from the Reserve into the forested areas of the subject site along both the northern and western boundaries.

(b) Landscaped Area/Grassland/Cleared Land (Plates 5 & 6)

Occurrence: Over much of the subject site, except the forested areas along the northern and western boundary areas of the site.

Habitat Elements: Grassed areas of the subject site provide potential foraging habitat for common ground-foraging bird species, such as Masked Lapwings (*Vanellus miles*), Galahs (*Cacatua roseicapilla*), Red-rumped Parrots (*Psephotus haematonotus*), Australian Pipits (*Anthus australis*), Australian Ravens (*Corvus coronoides*), Magpie-larks (*Grallina cyanoleuca*) and Australian Magpies (*Gymnorhina tibicen*).

Landscape trees and bushes provide potential foraging and roosting sites for urban-tolerant native birds [e.g. Rainbow Lorikeets (*Trichoglossus haematodus*), Red Wattlebirds (*Anthochaera carunculata*) and Pied Currawongs (*Strepera graculina*)], exotic birds [e.g. Indian Mynahs (*Acridotheres tristis*)] and arboreal mammals [e.g. Common Brushtail Possum (*Trichosurus vulpecula*)].

Disturbance: Artificially created habitats with low native biodiversity value.

(c) Aquatic/Riparian Habitat (Plate 7)

Occurrence: Artificial wetland near the north-western boundary of the subject site and the ephemeral creekline in Mobbs Lane Reserve.

Habitat Elements: The water bodies provide potential calling, breeding and foraging habitat for adult frogs and foraging habitat for tadpoles. The artificial wetland in the subject site also provides potential foraging habitat for some small waterfowl species (e.g. grebes and ducks), gallinules (coots, swamphens and moorhens), rails and crakes, and wading birds (egrets and herons), and drinking and bathing habitat for bushland birds.

Disturbance: The artificial wetland in the subject site has extensive algal growth as a result of eutrophication. This is likely to be as a result of runoff of fertilisers and pesticides from surrounding landscape areas. The creekline in Mobbs Lane Reserve is heavily overgrown with weeds, limiting its suitability as habitat for native aquatic fauna species.

Plates 3 & 4 Examples of Tree Hollows North-east of the Heliport

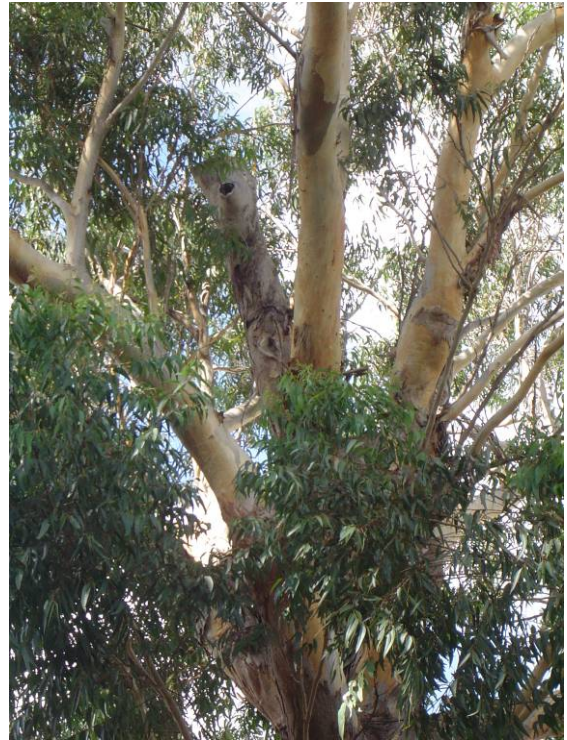


Plate 5 Landscaped Area Near Centre of Subject Site



Plate 6 Landscaped Area Near Southern Boundary of Subject Site



Plate 7 Creekline in Mobbs Lane Reserve, West of the Subject Site



3.3.2 Fauna

Forty-three fauna species (three frog species, five reptile species, 28 bird species and seven mammal species) were recorded on the subject site or in Mobbs Lane Reserve (Table 3.1). All these species are relatively mobile and are likely to occur in both Mobbs Lane Reserve and on the subject site.

Forty-two of these species are common urban-generalist species that have a widespread distribution throughout the Sydney metropolitan area. One species, the Grey-headed Flying-fox (*Pteropus poliocephalus*), although common in the Sydney metropolitan area, is listed as Vulnerable under the schedules of the TSC Act.

Six fauna species (14.3% of the total number of species observed) are exotic species, whereas the other 36 species (75.7%) are native species.

3.3.3 Threatened and Regionally Significant Fauna

(a) Threatened Species

Threatened fauna species that have been detected in the locality, their habitat requirements, and their likelihood of occurring on the subject site are shown in Table 3.2.

One threatened fauna species, a single Grey-headed Flying-fox was observed flying over the subject site during the nocturnal survey period on 1 March 2009. There are no communal roosts of Grey-headed Flying-foxes on the subject site or in Mobbs Lane Reserve.

Potential habitat also occurs on the subject site for eight additional threatened fauna species that have been recorded in the locality. These are the Green and Golden Bell Frog (*Litoria aurea*), Barking Owl (*Ninox connivens*), Powerful Owl (*Ninox strenua*), Regent Honeyeater (*Anthochaera phrygia*), Eastern Freetail Bat (*Mormopterus norfolkensis*), Eastern Bentwing-bat (*Miniopterus schreibersii*), Large-footed Mouse-eared Bat (*Myotis adversus*) and Greater Broad-nosed Bat (*Scoteanax ruepelli*).

The subject site is outside the usual range of the Regent Honeyeater and is only likely to occur there as an occasional vagrant. The proposed development would not significantly limit resources to the extent that it would place the species or locally viable populations at risk of extinction, and is, therefore, not considered further in the present assessment. Potential impacts of the proposed development on the status of the other eight threatened species and their habitats, are discussed in Chapter 4 and in Appendix A.

3.3.4 Regionally-significant Fauna Species

Fauna species that are considered rare in forested and woodland areas of the Western Sydney region include the Buff-rumped Thornbill (*Acanthiza reguloides*), White-winged Chough (*Corcorax melanorhamphos*), Eastern Grey Kangaroo (*Macropus giganteus*), Swamp Wallaby (*Wallabia bicolor*) and Red-necked Wallaby (*Macropus rufogriseus*). No regionally significant species were observed during the field surveys and are unlikely to ever occur on the subject site.

Table 3.1 FAUNA SPECIES RECORDED ON THE SUBJECT SITE AND IN MOBBS LANE RESERVE, 1 MARCH 2009

Methods of Detection:

A: Anabat detection.

C: Call identification.

O: Observation.

Sc: Scat, track or sign.

Sp: Spotlighting

Species in bold italics are listed as threatened under the schedules of the TSC and/or EPBC Acts.

Family	Scientific Name	Common Name	Methods of Detection	Subject Site	Mobbs Lane Reserve
AMPHIBIANS					
Myobatrachidae	<i>Crinia signifera</i>	Common Eastern Froglet	C, Sp	X	X
	<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	C, Sp	X	X
Hylidae	<i>Litoria peronii</i>	Peron's Tree Frog	C		X
REPTILES					
Gekkonidae	<i>Phyllurus platurus</i>	Broad-tailed Gekko	O	X	
Scincidae	<i>Lampropholis guichenoti</i>	Grass Sun-skink	O	X	X
	<i>Eulamprus quoyi</i>	Eastern Water Skink	O	X	X
	<i>Ctenotus taeniolatus</i>	Copper-tailed Skink	O	X	
	<i>Tiliqua scincoides</i>	Eastern Blue-tongue	O	X	
BIRDS					
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing	O, C	X	
Columbidae	<i>Streptopelia chinensis</i> *	Spotted Pouter	O, C	X	X
	<i>Ocyphaps lophotes</i>	Crested Pigeon	O	X	X
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	O, C	X	
	<i>Cacatua roseicapilla</i>	Galah	O, C	X	

Family	Scientific Name	Common Name	Methods of Detection	Subject Site	Mobbs Lane Reserve
Psittacidae	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	O, C	X	X
	<i>Platycercus elegans</i>	Crimson Rosella	O, C	X	
	<i>Platycercus eximius</i>	Eastern Rosella	O, C	X	X
	<i>Ninox novaeseelandiae</i>	Southern Boobook	Sp	X	
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth	Sp	X	
Halcyonidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	O, C	X	X
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner	O, C	X	X
	<i>Anthochaera carunculata</i>	Red Wattlebird	O, C	X	X
	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	O	X	
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren	O, C	X	X
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren	O, C		X
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote	O, C	X	
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail	O, C	X	X
	<i>Rhipidura leucophrys</i>	Willie Wagtail	O, C	X	X
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	O	X	
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow	O	X	
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird	O, C	X	
	<i>Strepera graculina</i>	Pied Currawong	O, C	X	X
	<i>Gymnorhina tibicen</i>	Australian Magpie	O, C	X	X
Corvidae	<i>Corvus coronoides</i>	Australian Raven	O, C	X	X
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye	O, C	X	X
Sturnidae	<i>Acridotheris tristis</i> *	Indian Mynah	O, C	X	X
	<i>Sturnus vulgaris</i> *	Common Starling	O, C	X	
MAMMALS					
Phalangeridae	<i>Trichosurus vulpecula</i>	Brushtail Possum	Sp	X	X
Pseudocheiridae	<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	Sp	X	X
Muridae	<i>Rattus norvegicus</i> *	Brown Rat	Sc		X
Canidae	<i>Vulpes vulpes</i> *	European Red Fox	Sc	X	

Family	Scientific Name	Common Name	Methods of Detection	Subject Site	Mobbs Lane Reserve
Felidae	<i>Felis catus</i> *	Cat	O, Sp	X	
Pteropidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	O	X	X
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	An	X	X

Table 3.2 THREATENED FAUNA SPECIES RECORDED IN LOCALITY

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Habitat Requirements and Likelihood of Occurrence	Seven-Part Test required?
AMPHIBIANS					
<i>Litoria aurea</i>	Green and Golden Bell Frog	V*	E	Large permanent swamps and ponds with plenty of emergent vegetation, especially bulrushes. In areas free of the Mosquito Fish (<i>Gambusia affinis</i>). 10 Green and Golden Bell Frog records occur from within the locality (5 km radius of the subject site). Potential habitat occurs within pond located near the north-west corner of the subject site. Not recorded on subject site.	Yes
BIRDS					
<i>Ninox connivens</i>	Barking Owl		V	Inhabits forest, woodland and most common in savannah. Potential foraging habitat occurs in the forested areas of the subject site. Two Barking Owl records occur from within the locality (5 km radius of subject site). Treed areas of the site provide potential foraging habitat for Barking Owls. There are no potential nesting hollows for this species on the subject site or in Mobbs Lane Reserve. Not recorded on subject site.	Yes
<i>Ninox strenua</i>	Powerful Owl		V	Wet sclerophyll forest along coast hills and Great Dividing Range. More recently observed in urban areas where they search for common prey items such as possums and flying foxes. Three Powerful Owl records occur from within the locality (5 km radius of subject site). Treed areas of the site provide potential foraging habitat for Powerful Owls. There are no potential nesting hollows for this species on the subject site or in Mobbs Lane Reserve. Not recorded on subject site.	Yes
<i>Anthochaera phrygia</i>	Regent Honeyeater	E*	E	Semi-nomadic, occurring in temperate eucalypt woodland forest in south-eastern Australia. Most records are from box-ironbark forests dominated by Swamp Mahogany, Spotted Gum and Riverina Casuarina woodlands. Marginal foraging habitat occurs in Blue Gum High Forest. There are two Regent Honeyeater records from within the	No

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Habitat Requirements and Likelihood of Occurrence	Seven-Part Test required?
				locality (5 km radius of subject site). Regent Honeyeaters may occur as occasional vagrants on the subject site during peak flowering periods. The proposed development is unlikely to limit resources available for this species, either at a local, regional or state-wide level. Therefore, development is unlikely to impact upon the overall status of this species.	
MAMMALS					
<i>Dasyurus maculates</i>	Spotted-tailed Quoll	V*	V	Wet and dry sclerophyll forests, rainforests, woodlands and coastal heaths. There are two Spotted-tail Quoll records from within the locality (5 km radius of the subject site). It is unlikely to occur on the subject site because of the modified nature of the landscape, lack of suitable dens and the presence of introduced potential predators (foxes and cats). Not detected on the subject site.	No
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox		V	Wet and dry sclerophyll forests, rainforests, paperbark swamps and mangroves to 700 m elevation. There are 12 Grey-headed Flying-fox records from within the locality. Treed areas of the site provide potential foraging and shelter habitat for this species. One Grey-headed Flying-fox was observed flying over the subject site during the nocturnal survey period on 1 March 2009. There are no communal Grey-headed Flying-fox roosts on the subject site or in the adjoining Mobbs Lane Reserve.	Yes
<i>Mormopterus norfolkensis</i>	Eastern Freetail Bat		V	Sclerophyll forests, woodlands and, occasionally, rainforests. There is one Eastern Freetail Bat record from within the locality (5 km radius of subject site). Potential foraging habitat occurs within the treed areas of the subject site. Not detected on site.	Yes
<i>Miniopterus schreibersii</i>	Eastern Bentwing-bat		V	From Kimberly to the Top End and from Cape York Peninsula on eastern side of the Great Dividing Range through to the south-east corner of South Australia. Found in rainforest, wet and dry sclerophyll forests, woodland and grasslands. Roosts in culverts and mines. There is one Eastern Bentwing-bat record from within the locality (5 km radius of subject site). Potential foraging and roosting	Yes

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Habitat Requirements and Likelihood of Occurrence	Seven-Part Test required?
				habitat occurs within the treed areas of the subject site. Not detected on site.	
<i>Myotis adversus</i>	Large-footed Mouse-eared Bat		V	Sclerophyll forests, mangroves, paperbark swamps, woodlands and rainforests near slow-moving creeks, lakes and estuaries. There is one Large-footed Mouse-eared Bat record from within the locality (5 km radius of subject site). Potential foraging and roosting habitat occurs within the treed areas of the subject site. Not detected on site.	Yes
<i>Scoteanax ruepellii</i>	Greater Broad-nosed Bat		V	Found in sclerophyll forests, rainforests, woodlands and moist gullies below 500 m above sea level. There is one Greater Brpad-nosed Bat record from within the locality (5 km radius of subject site). Potential foraging and roosting habitat occurs within the treed areas of the subject site. Not detected on site.	Yes
INVERTEBRATES					
<i>Meridolum corneovirens</i>	Cumberland Land Snail		E	Restricted to the Cumberland Plain and Castlereagh Woodlands of Western Sydney and also along the fringes of River Flat Forest, especially where it meets Cumberland Plain Woodland. There is one record of the Cumberland Land Snail from within the locality. There is no suitable habitat for this species on the subject site because of the replacement of native habitat with landscaped gardens.	No

Notes: *Habitat requirements for birds taken from Simpson & Day (1996).*

Habitat requirements for reptiles and amphibians taken from Cogger (2000) and Cronin (2001).

Habitat requirements for mammals taken from Cronin (2000b) and Menkhorst & Knight (2001).

* = Listed under the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).

E1 = Endangered under Schedule 1 of the NSW Threatened Species Conservation Act 1995 (TSC Act).

E4 = Presumed Extinct under Schedule 1 of the NSW Threatened Species Conservation Act 1995 (TSC Act).

E1* = Endangered under Schedule 1 of the TSC Act and EPBC Act.

E4* = Presumed Extinct under Schedule 1 of the NSW Threatened Species Conservation Act 1995 (TSC Act).

V = Vulnerable under Schedule 2 of the TSC Act.

V* = Vulnerable under Schedule 2 of the TSC Act and EPBC Act

3.3.5 Listed Migratory Species

Migratory species that are protected under the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) and Republic of Korea-Australia Migratory Agreement (ROKAMBA) are listed under the schedules of the EPBC Act.

The Black-faced Monarch (*Monarcha melanopsis*), Satin Flycatcher (*Myiagra cyanoleuca*), Rufous Fantail (*Rhipidura rufifrons*) and Regent Honeyeater, may occasionally forage within tree canopies on the subject site. Latham's Snipe (*Gallinago hardwicki*), Cattle Egrets (*Ardea ibis*) and Great Egrets (*Ardea alba*) may occasionally forage in the disturbed, cleared areas of the subject site. Fork-tailed Swifts (*Apus pacificus*) and White-throated Needletails (*Hirundapus caudacutus*) may occasionally fly high over the subject site. The areas of habitat on the subject site are negligible amounts available to these species. .

3.4 KOALA HABITAT ASSESSMENT

There are no known records of Koalas occurring on the subject site or in adjoining bushland areas. There is no potential habitat for Koalas on the subject site because there are no listed food and roost tree species of Koalas under Schedule 2 of SEPP 44.

No Koala scats or tree scratchings were observed on or near trees within the subject site, suggesting that Koalas do not use the site. Koalas are most unlikely to occur on the subject site because of the modified landscape (including busy roads), the site's isolation from known Koala habitat and the lack of recent records of Koalas occurring in the locality in recent times.

4

IMPACTS AND RECOMMENDATIONS

4.1 OVERVIEW

This chapter evaluates if the proposed development will significantly impact on ecological processes and the conservation value of the subject site and neighbouring bushland areas, especially with respect to threatened fauna and listed migratory species, and their habitats, and on the ecological integrity of the landscape. It also recommends ways in which impacts can be minimised or avoided.

The potential impacts may be grouped into the following categories:

- ❑ loss of fauna habitat;
- ❑ impacts on wildlife corridor;
- ❑ impacts on threatened biota and migratory species; and
- ❑ impacts on the aquatic environment.

Each of these impacts already exist on the subject site and in neighbouring areas of bushland to a significant extent. However, each of these categories is discussed in detail below with respect to the proposed development.

4.2 IMPACTS

4.2.1 Loss of Terrestrial Flora and Fauna Habitat

Biodiversity is the diversity and richness of living things. This includes the variety of plant communities and animal habitats, and the number of different species. Most natural areas support a complex mixture of different species and plant communities. Biodiversity in disturbed areas is generally lower than in more pristine areas. An awareness of native biodiversity emphasises the conservation of the variety of native life, rather than just rare or threatened species.

There are three important principles associated with ESD. These are:

- ❑ maintenance of native biodiversity;
- ❑ erring on the side of caution when assessing and taking risks with the biological environment; and
- ❑ passing on to future generations a natural environment that is at least as good and enjoyable as our own.

Many species of woodland and forest fauna are threatened both nationally and within New South Wales. This is largely as a result of the clearing of this native habitat.

The proposed development is unlikely to result in the loss of biodiversity at a local, regional, state or national level. This is because treed areas, particularly along the northern and western boundaries of the subject site (representing the most valuable fauna habitat on the subject site for native fauna) will be retained, fauna species that occur on the subject site are urban-tolerant species that have a widespread distribution through the Sydney Basin Bioregion and the unlikelihood of the local, regional or state-wide status of threatened, regionally-rare or nationally-listed migratory species, or their habitats, being significantly impacted.

The subject site will also be planted with locally-native plant species as part of its landscaping plan, which will also provide habitat for native fauna species that are present in the locality.

4.2.2 Impacts on Wildlife Corridor

The wildlife corridor along and adjacent to Mobbs Lane Reserve will not be impacted upon if the forested areas along the western boundary of the subject site and along the section of the northern boundary that is adjacent to Grimes Lane are retained.

4.2.3 Impacts on Threatened Biota

Seven-part tests for the Green and Golden Bell Frog, Barking Owl, Powerful Owl, Grey-headed Flying-fox and threatened microchiropteran bat species (Appendix A) concluded that the proposed development would not significantly impact on threatened fauna or their habitats. Therefore, Species Impact Statements are not required for these species.

One nationally vulnerable fauna species, the Grey-headed Flying-fox, may potentially use the forested areas of the subject site for foraging or roosting. Under the EPBC Act, a nationally vulnerable species is significantly impacted on if a proposal is likely to:

- ❑ lead to a long-term decrease in the size of an important population of a species; or
- ❑ reduce the area of occupancy of an important population; or
- ❑ fragment an existing important population into two or more populations; or
- ❑ adversely affect habitat critical to the survival of a species; or
- ❑ disrupt the breeding cycle of an important population; or
- ❑ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; or
- ❑ result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or
- ❑ interfere substantially with the recovery of a species.

The Grey-headed Flying-fox is a highly mobile species and the proposed development would not hinder the movement of this species to the extent that a population would be fragmented. The proposed development would not remove known breeding or roosting habitat, or other habitat that is critical to the survival of the Grey-headed Flying-fox.

4.2.4 Impacts on Migratory Species

Under the EPBC Act, a migratory species is significantly impacted on if a proposal will or is likely to:

- ❑ substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species; or
- ❑ result in invasive species that are harmful to the migratory species becoming established in an area of important habitat of the migratory species; or
- ❑ seriously disrupt the life cycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

The Black-faced Monarch, Satin Flycatcher, Rufous Fantail and Regent Honeyeater, may occasionally forage within tree canopies on the subject site. Latham's Snipe, Cattle Egrets and Great Egrets may occasionally forage in the disturbed, cleared areas of the subject site. Fork-tailed Swifts and White-throated Needletails may occasionally fly high over the subject site. The areas of habitat on the subject site are negligible amounts available to these species. Therefore, the proposed development is unlikely to have a significant impact on the status of migratory species.

4.2.5 *Impacts on the Aquatic Environment*

Potential impacts on the creekline and its riparian zone in Mobbs Lane Reserve include changes in drainage, runoff from construction sites, buildings and landscape surfaces, erosion and sedimentation during construction, and contamination from acid sulfate soils, nutrients, oils and heavy metals. These impacts would be avoided or minimised if the recommendations in Section 4.3 are implemented.

4.3 RECOMMENDATIONS

The present report has responded to the requirements of the Director-General's Key Issue No. 8. It has addressed the potential impacts to fauna and has recommended the following steps be taken to mitigate the potential impacts of the development

It is recommended that as many remnant trees on the subject site as practical be retained, particularly those that occur along the western boundary of the site and along the section of the northern boundary that is adjacent to Grimes Lane. Retention of trees along these two boundary areas will ensure that the wildlife corridor through and adjacent to Mobbs Lane Reserve will be maintained at its maximum width.

If possible, the three hollow-bearing trees that are known to occur on the subject site (two near the north-eastern corner of the helipad, and one near the north-eastern corner of the subject site) should be retained. If one or more of these trees need to be removed, then appropriately-placed and sized nest boxes should be used on the subject site to compensate for the loss of tree hollows. A suitably-qualified and experienced ecologist must decide on the numbers, locations and types of nest boxes that may be used on the subject site.

Silt fences and sediment ponds should be appropriately placed around construction areas on the subject site to prevent runoff of sediment and nutrient-enriched waters into nearby drainage lines and bushland areas. The effectiveness of these traps should be closely monitored during construction, ensuring that treated site run-off meets EPA guidelines.

REFERENCES

- Anstis, M. (2002). *Tadpoles of South-eastern Australia: A Guide With Keys* (Reed New Holland, Sydney).
- Christidis, L. & Boles, W.E. (2008). *Systematics and Taxonomy of Australian Birds* (CSIRO Publishing, Collingwood).
- Clements, A., Rodd, J., Rodd, Wilkins, S. & Kemp, H. (2005). Flora Assessment and Tree Survey: Mobbs Lane, Epping. Report prepared for Rebel Property Group (dated 30 June 2005).
- Clements, A., Rodd & J., Rodd (2009). Response to Director-General's Requirements: Mobbs Lane, Epping. Report Prepared for McLachlan Lister Pty Ltd (dated 4 March 2009).
- Cogger, H.G. (2000) *Reptiles and Amphibians of Australia* (Reed Books, Chatswood).
- Cronin, L. (2000b). *A Field Guide to Mammals of Australia* (Envirobooks, Annandale, NSW)
- Cronin, L. (2001). *Key Guide to Australian Reptiles and Amphibians* (Envirobooks, Annandale, NSW).
- Menkhorst, P. and Knight, F. (2001). *A Field Guide to the Mammals of Australia* (Oxford University Press, Melbourne).
- National Parks & Wildlife Service (NPWS) (1997). *Urban Bushland Biodiversity Survey Stage 1: Western Sydney* (National Parks and Wildlife Service, Hurstville).
- Pennay, M., Law, B. & Reinhold, L. (2004). *Bat Calls of NSW: Region-based Guide to the Echolocation Calls of Microchiropteran Bats* (NSW Department of Environment & Conservation, Hurstville).
- Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001). *Key to the Bats of South-east Queensland and North-east New South Wales*. Report prepared by Queensland Department of Natural Resources and Mines, State Forests of New South Wales, University of Southern Queensland and NSW National Parks and Wildlife Service).
- Simpson, K. and Day, N. (2004). *A Field Guide to Birds of Australia* 7th Ed (Viking Press, Sydney).
- Swan, G., Shea, G. and Sadlier, R. (2004). *A Field Guide to Reptiles of New South Wales* (Reed New Holland, Sydney).

Appendix A

Seven-part Tests of Significance

APPENDIX A

SEVEN-PART TESTS OF SIGNIFICANCE

INTRODUCTION

The Seven-Part Test is a standard set of questions devised by the Scientific Committee established under the *Threatened Species Conservation Amendment Act 2002*. The Test should be applied individually to all threatened species, populations and ecological communities and their habitats that are to be, or likely to be, on the site to be developed.

The results of a Seven-Part Test help determine the nature and significance of impacts of the proposed development or activity on threatened species, populations or ecological communities, or their habitats, and whether the preparation of *Species Impact Statement* (SIS) is required.

An SIS provides a more detailed assessment of threatened biota issues and proposes measures to manage and mitigate adverse impacts on the threatened species, populations or ecological communities, or their habitats, resulting from the proposal.

Appendix A provides Seven-part tests for the following threatened fauna in relation to the proposed residential development of the ATN Seven Network Site at Mobbs Lane.

Frogs:

- ❑ Green and Golden Bell Frog (*Litoria aurea*).

Birds:

- ❑ Barking Owl (*Ninox connivens*);
- ❑ Powerful Owl (*Ninox strenua*);

Bats:

- ❑ Grey-headed Flying-fox (*Pteropus poliocephalus*);
- ❑ Eastern Freetail Bat (*Mormopterus norfolkensis*);
- ❑ Eastern Bentwing-bat (*Miniopterus schreibersii*);
- ❑ Large-footed Mouse-eared Bat (*Myotis adversus*); and
- ❑ Greater Broad-nosed Bat (*Scoteanax ruepelli*).

GREEN AND GOLDEN BELL FROG (*Litoria aurea*)

1. SPECIES PROFILE

The following profile summarises information provided in the Draft Recovery Plan for the Green and Golden Bell Frog in NSW (DEC 2005).

Description

The Green and Golden Bell Frog is a relatively large frog with a stout body form. Adult size ranges from approximately 45 to 100 mm snout to vent length (SVL), with most individuals being in the 60 to 80 mm size class. Males are generally smaller than females (maximum size 70 mm) and when mature, tend to have a yellowish darkening of the throat area. Males also develop nuptial pads on the inner finger and appears as a brown pigmented patch. Mature females are larger bodied (maximum size 90 to 100 mm) (White and Pyke 1996).

The dorsal coloration is quite variable being a vivid pea green splotched with an almost metallic brass brown or gold. The backs of some individuals may be almost entirely green while in others the golden brown markings may almost cover the dorsum. When the frogs are inactive coloration can darken to almost black. A glandular creamish white stripe extends from behind the eye almost to the groin. The lower margin of this dorso-lateral stripe is black or dark brown, the upper margin is edged gold.

The belly is usually an immaculate granular creamish white. The lateral margins of the body are adorned with raised glandular creamish spots of irregular size. Legs are a variegated green and gold with the groin area and inside leg a brilliant electric blue. The fingers and toes have expanded terminal pads but are rarely wider than the toe/finger itself. The toes are heavily webbed. The eye has a horizontal elliptical pupil and a golden yellow iris. Juveniles are similar to adults and metamorphose at 25 to 30 mm SVL.

Tadpoles are relatively large, reaching 65 to 80 mm. They are deep bodied and possess long tails with a high fin that extend almost to mid-body. They swim actively and evade capture. As tadpoles become larger, the golden dorso-lateral stripe and a green tinge to the back can be observed just before the limb growth commences (White 1995).

Distribution

The Green and Golden Bell Frog was formerly distributed from the NSW north coast near Brunswick Heads southwards along the NSW coast to Victoria where it extends into Queensland (White & Pyke 1996; Gillespie 1996), west to Bathurst, Tumut and the ACT (Moore 1961, Osborne *et al.* 1996). There are records from the NSW tableland areas such as Armidale/Ulong (New England Tableland) and Canberra, Cobargo and Jindabyne (Monaro Tableland).

In the 1960s the species was considered widespread, abundant and commonly encountered. Declines were noticed in the 1970s and became severe in the 1980s such that today the species exists as a series of isolated populations within its former known range. Since 1990 there have been approximately 50 locations in NSW where the species is confirmed to still exist (only 11 in conservation reserves). There are six populations of substantial size (numbers over 300); two are located in the Sydney metropolitan area, two in the Shoalhaven area, and two on the mid north coast (White and Pyke 1996).

Habitat

The habitat preference and requirements of the Green and Golden Bell Frog is not well understood and the species has, on occasions, turned up in the most unlikely locations. It inhabits marshes, dams and stream sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water bodies which are unshaded, free of the predatory fish *Gambusia holbrooki*, have a grassy area nearby and diurnal sheltering sites such as vegetation and/or rocks (White and Pyke 1996). Some sites, particularly in the Greater Sydney region, are in highly disturbed areas such as disused industrial sites, brick pits, landfill areas and cleared land.

Refuge habitat is least well understood, but is required by the species during periods of metabolic quiescence, particularly during cooler parts of the year ("over-wintering habitat") and at other times when not diurnally active or seeking shelter from adverse conditions or predators. Types of refuge habitats that have been identified include dense tussock-forming vegetation (Hamer 1998; Patmore 2001), deep fissures in mud (M. Christy, cited by Patmore 2001), among rocks (White & Pyke 1996; Hamer 1998), within rotting logs or under embedded logs and timber piles (Pyke & White 2001) and other human refuse, e.g. sheet iron, fibro, bricks, etc. (Pyke & White 2001).

Reproduction

The Green and Golden Bell Frog is frequently active by day and usually breeds in summer when conditions are warm and wet (Cogger 2000). Males call while floating in water and females produce a raft of eggs which initially float before settling to the bottom, often among the vegetation (Harrison 1922). Tadpoles take approximately six weeks to develop, though this varies considerably and is dependent on temperature and other conditions (Pyke and White 1996). Tadpoles feed on algae and other vegetative matter while adults are voracious insectivores and will also readily eat other frogs and juveniles of their own species. They are preyed upon by snakes and various wading birds, and are presumably fed on as larvae by eels, other fish and tortoises.

Predator/Prey Relationships

Adult Green and Golden Bell Frogs are known to feed on a range of aquatic and terrestrial invertebrates (e.g. insect larvae), crickets, cockroaches, dragonflies, earthworms, flies, grasshoppers, mosquito wrigglers, isopods, freshwater crayfish and slugs) and frogs (especially tadpoles).

Tadpoles predominantly graze on algal, bacterial scum or other vegetative matter growing on submerged rocks or other substrata. Occasionally, they may scavenge or become carnivorous on other aquatic organisms.

They are preyed upon by snakes, various wading birds, large invertebrates (e.g. water beetles, water scorpions), occasionally by raptors, and are presumably fed on as larvae by eels, other fish (e.g. Plague Minnow) and tortoises.

Threats to Status of Green and Golden Bell Frogs

Threats to this species include:

- ❑ Habitat loss, modification and disturbance (including the Key Threatening Processes “clearing of native vegetation” and “alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands”).
- ❑ Fragmentation and isolation of habitat.
- ❑ Road mortality where populations are already small due to other threats (Daly 1996).
- ❑ Predation by exotic fish, particularly the Plague Minnow *Gambusia holbrooki* (a Key Threatening Process).
- ❑ Infection of frogs by amphibian chytrid fungus that causes the disease chytridiomycosis (a Key Threatening Process).
- ❑ Water pollution.
- ❑ Predation by feral animals such as foxes and cats (a Key Threatening Process).

1. SEVEN-PART TEST

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

The subject site is outside the Key Population areas of the Green and Golden Bell Frog within the Sydney region, as identified in the Draft Recovery Plan for the Green and Golden Bell Frog (see Figure A1 of present report). The nearest records of Green and Golden Bell Frogs are at North Ryde (near Macquarie University) and along the tributaries of the Lane Cove River, but these are occasional records, rather than those associated with key population areas.

Potential habitat for the Green and Golden Bell Frog occurs within the small pond, near the north-western corner of the subject site. However, it was not detected there, despite targeted surveys for them. They are unlikely to occur there because of the degraded quality of the aquatic environment, including extensive eutrophication that has probably resulted from nutrient and pesticide runoff from the surrounding parkland landscape. The Plague Minnow (*Gambusia holbrooki*), an introduced predator of the Green and Golden Bell Frog, is also present in large numbers within the pond. There are no recent records of Green and Golden Bell Frogs occurring in the creek in Mobbs Lane Reserve, and are unlikely to occur there because of the ephemeral nature of the creek, turbidity of temporary pools of water and high infestation of weeds.

It is proposed to retain the pond and the vegetation immediately surrounding it as part of the development. Therefore, the proposed development is unlikely to have a significant impact on the status of this species to such an extent that a locally viable population is placed at risk of extinction.

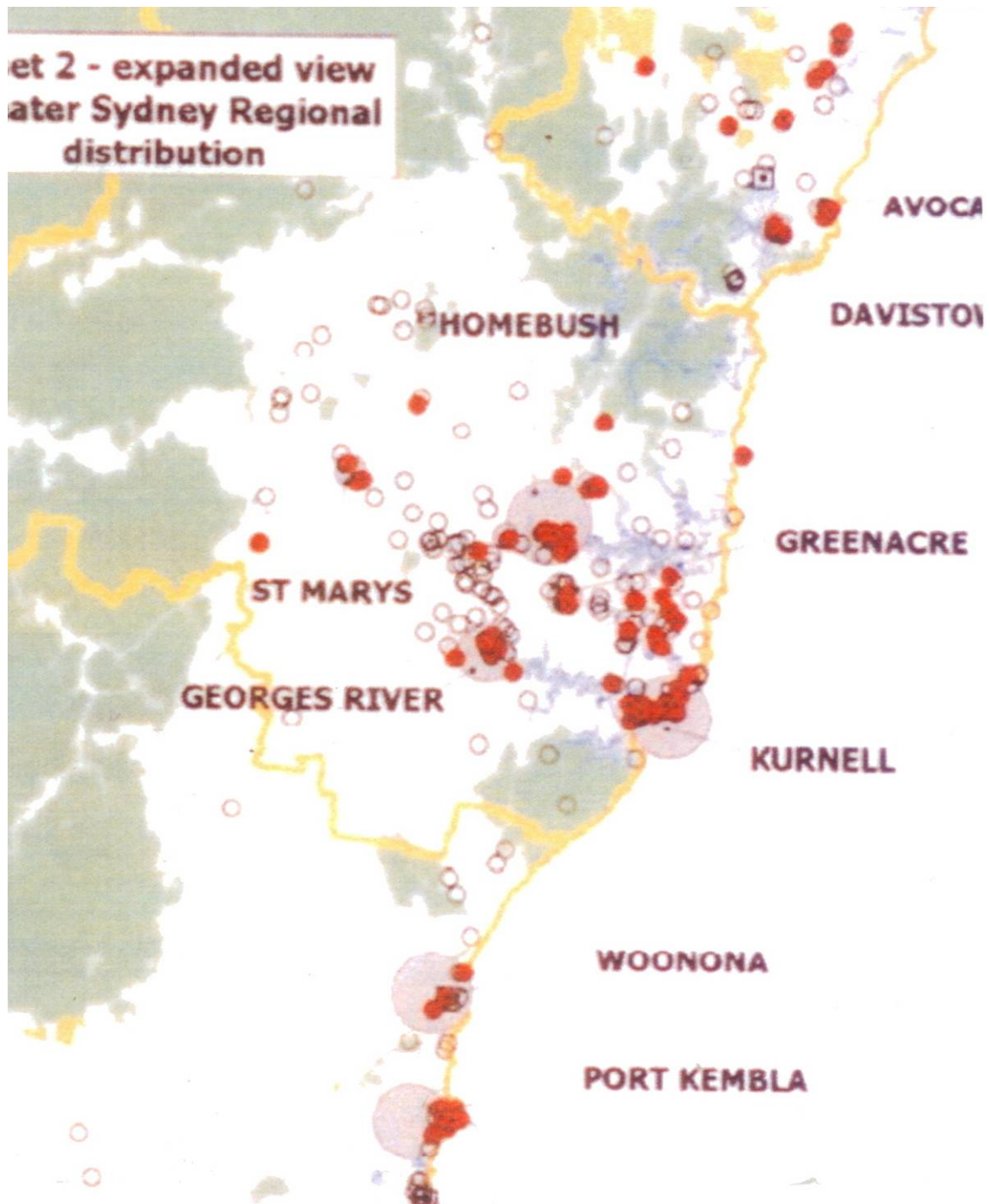
- (b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

There are no listed endangered populations of the Green and Golden Bell Frog in the locality.

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

Figure A1 DISTRIBUTION OF KNOWN POPULATIONS OF THE GREEN AND GOLDEN BELL FROG IN THE GREATER SYDNEY AREA (extracted from DEC 2005)

Red dots = recent records (< 17 years old). White dots = pre-1990 records. Light brown areas = expected range of extant population.



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

Not applicable. The Green and Golden Bell Frog is listed as a threatened species rather than as an endangered or critically endangered ecological community.

- (d) In relation to a 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.**

- (i) No potential habitat for the Green and Golden Bell Frog will be removed or modified as part of the proposed development, provided that the pond on the subject site is retained and there is no sediment or contaminant runoff into it during construction.
- (ii) No area of habitat will be isolated or fragmented as a result of the proposed development.
- (iii) No Green and Golden Bell Frogs were detected on the subject site, despite targeted surveys for them. They are unlikely to occur there because of the degraded quality of the aquatic environment, including extensive eutrophication that has probably resulted from nutrient and pesticide runoff from the surrounding parkland landscape. The Plague Minnow (*Gambusia holbrooki*), an introduced predator of the Green and Golden Bell Frog, is also present in large numbers within the pond. There are no recent records of Green and Golden Bell Frogs occurring in the creek in Mobbs Lane Reserve, and are unlikely to occur there because of the ephemeral nature of the creek, turbidity of temporary pools of water and high infestation of weeds. The subject site is not within a Key Sydney Population area of Green and Golden Bell Frogs.

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

No critical habitat for Green and Golden Bell Frogs occurs in the locality.

- (f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

The specific objectives of the draft Green and Golden Bell Frog draft recovery plan (February 2005) are to:

- increase the security of key Green and Golden Bell Frog (GGBF) populations by way of preventing further loss of GGBF habitat at key populations across the species' range and where possible secure opportunities for increasing protection of habitat areas;

- ❑ ensure extant GGBF populations are managed to eliminate or attenuate the operation of factors that are known or discovered to be detrimentally affecting the species;
- ❑ implement habitat management initiatives that are informed by data obtained through investigations into the general biology and ecology of the GGBF through a systematic and coordinated monitoring program;
- ❑ establish, within more than one institution, self-sustaining and representative captive populations (particularly 'at risk' populations) of the GGBF for the primary purpose of maintaining 'insurance' colonies for re-establishment and supplementation of populations of the species; and
- ❑ increase the level of regional and local awareness of the conservation status of the GGBF and provide greater opportunity for community involvement in the implementation of the recovery plan.

The proposed development of the subject site is consistent with the objectives of this recovery plan.

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

The Draft Green and Golden Bell Frog Recovery Plan lists the following Key Threatening Processes (KTPs), from Schedule 3 of the TSC Act 1995, as threats to the status of the Green and Golden Bell Frog:

- ❑ Predation by the introduced plague Minnow or Mosquito Fish (*Gambusia holbrooki*).
- ❑ Alteration to the natural flow regimes of rivers and streams and their floodplains and their wetlands.
- ❑ Infection of frogs by amphibian chytrid fungus that causes the disease chytridiomycosis.
- ❑ Clearing of native vegetation (destruction of habitat, fragmentation of vegetation and degradation of riparian zone vegetation).
- ❑ Predation by the European Red Fox (*Vulpes vulpes*).

The proposed development is unlikely to significantly increase these Key Threats.

2. CONCLUSION

The proposed residential development of the ATN Seven Network site in Epping will not significantly impact on the status of the Green and Golden Bell Frog or its habitats. Therefore, a Species Impact Statement is NOT required for this species in relation to this development.

3. REFERENCES

Barker, J. and Grigg, G. (1977). *A Field Guide to Australian Frogs*. Rigby, Adelaide.

- Berger, L. and Speare, R. (1998). Chytridiomycosis - a new disease of amphibians. *ANZCCART News*. 11(4): 1-3.
- Clancy, G.P. (1996). The Green and Golden Bell Frog *Litoria aurea* in the Station Creek area of Yuraygir National Park. *Australian Zoologist*. 30: 214-7.
- Cogger, H.G. (2000). *Reptiles and Amphibians of Australia*. 6th ed (Reed New Holland, Sydney).
- Cogger, H.G., Cameron, E.E. & Cogger, H.M. (1983). Zoological Catalogue of Australia. Vol. 1 Amphibia and Reptilia. Australian Government Publishing Service : Canberra.
- Daly, G. (1995). Observations of the Green and Golden Bell Frog (*Litoria aurea*) (Anura: Hylidae) in southern NSW. *Herpetofauna*. 25: 1-9.
- Daly, G. (1996). Some problems in the management of the Green and Golden Bell Frog *Litoria aurea* (Lesson, 1829) (Anura: Hylidae) at Coomonderry Swamp in the south coast of NSW. in Victoria. *Australian Zoologist*. 30: 233-6.
- Davies, M. (1991). Descriptions of the tadpoles of some Australian limnodynastine leptodactylid frogs. *Transactions of the Royal Society of South Australia* 115: 67-76.
- DEC (2005). Draft Recovery Plan for the Green and Golden Bell Frog *Litoria aurea* (Lesson 1829) (Department of Environment and Conservation, Hurstville). Report dated February 2005.
- Gillespie, G.R. (1996). Distribution, habitat and conservation status of the Green and Golden in Victoria. *Australian Zoologist*. 30: 199-207.
- Goldingay, R.L. (1996). The Green and Golden Bell Frog *Litoria aurea* -from riches to ruins: conservation of a formerly common species. *Australian Zoologist*. 30: 248-57.
- Hamer, A. (1998). Aspects of the ecology of the Green and Golden Bell Frog (*Litoria aurea*) on Kooragang Island, New South Wales, Australia. *Major Project Report, M. Environmental Studies, University of Newcastle*.
- Harrison, L. (1922). On the breeding habits of some Australian frogs. *Australian Zoologist*. 3: 17-34.
- Mahony, M.J. (1993). The status of frogs in the Watagan Mountains area of the Central Coast of New South Wales. Pp. 257-264 In Lunney, D. and Ayers, D. (eds), *Herpetology in Australia. A diverse discipline*. (Royal Zoological Society of New South Wales: Mosman). 414pp.
- Moore, J.A. (1961). The frogs of eastern New South Wales. *Bull. Amer. Mus Nat. Hist.* 121: 141-386.
- Morgan, L.A. and Buttemer, W.A. (1996). Predation by the non-native fish *Gambusia holbrooki* on small *Litoria aurea* and *L. dentata* tadpoles. *Australian Zoologist*. 30: 143-9.
- NPWS (1999). *Atlas of NSW Wildlife* (National Parks and Wildlife Service, Hurstville).
- Osborne, W.S., Littlejohn, M.J and Thomson, S.A. (1996). Former distribution and apparent disappearance of the *Litoria aurea* complex from the Southern Tablelands of New south Wales and the Australian Capital Territory. *Australian Zoologist*. 30: 190-8.
- Patmore, S.R. (2001). Distribution, habitat use and movement patterns of the Green and Golden Bell Frog, *Litoria aurea* (Anura: Hylidae) on the Upper Molongolo River, NSW. *B. Appl. Sc. Honours Thesis, University of Canberra*.

- Pyke, G.H. and White, A.W. (1996). Habitat requirements for the Green and Golden Bell Frog *Litoria aurea* (Anura: Hylidae). *Australian Zoologist*. 30: 224-32.
- Robinson, M. (1995) A Field Guide to Frogs of Australia. From Port Augusta to Fraser Island including Tasmania. Australian Museum/Reed Books.
- Tyler, M.J. (1997). The Action Plan for Australian Frogs, Environment Australia, Canberra.
- Watson, G.F., and Martin, A.A. (1973). Life history, larval morphology and relationships of Australian leptodactylid frogs. *Transactions of the Royal Society of South Australia* 97 : 33-45.
- Webb, G.A. (1983). Diet in a herpetofaunal community on the Hawkesbury Sandstone Formation in the Sydney Area. *Herpetofauna*. 14: 87-91.
- White, A.W. (1995). The Green and Golden Bell Frog (*Litoria aurea*). *Frog Facts*. 5: 1-4 (Frog and Tadpole Study Group, Sydney).
- White, A.W. and Pyke, G.H. (1996). Distribution and conservation status of the Green and Golden Bell Frog *Litoria aurea* in New South Wales. *Australian Zoologist*. 30: 177-89.

BIRD SPECIES

1. SPECIES PROFILES

Barking Owl (*Ninox connivens*)

This species is a medium-sized robust owl, smoky-brown above with large white spots on the wings, whitish below with dark grey to rusty streaks, feathered legs and powerful feet. Males grow larger than females. It typically roosts by day in pairs in leafy trees, sometimes in exposed conditions (Pizzey and Doyle, 1996). They are usually found in pairs which occupy 30 - 2000 hectare territories all year round (Schodde and Tiedemann, 1993). This species is fairly widespread in NSW, except the far north-west of the state, and it is rare east of the divide (Pizzey and Doyle, 1996). It is distributed in well-forested hills and flats, eucalypt savannah and riverine woodland in coastal and sub-coastal eastern, northern and south-western mainland Australia.

The Barking Owl breeds from July to November and nests in an open hollow 10 - 250 centimetres deep in a trunk or spout of a tree at 3 - 30 m above ground. The chief prey are mammals and birds and it also feeds on insects and other invertebrates. It also takes young hares, rats, mice, occasional small bats and some marsupials, including possums. Birds up to the size of magpies and Tawny Frogmouths are also dietary items (Schodde and Tiedemann, 1993).

Much of the habitat of the southern subspecies of the Barking Owl has been cleared (Silveira *et al.* 1997; Higgins 1999; NPWS 1999). Forestry practices, particularly those that include the felling of old-growth forests or over-mature trees, further threaten the species by reducing the availability of nesting and roosting hollows and shelter for breeding season prey (Kavanagh *et al.* 1995; Taylor & Kirsten 2000). On private land, much of the remaining habitat is fragmented and subject to further clearing, firewood collection and grazing, and there has been little regeneration (Barrett *et al.* 1994; Robinson & Traill 1996; Debus 1997, NPWS 1999).

Powerful Owl (*Ninox strenua*)

The Powerful Owl (*Ninox strenua*) is the largest (600 to 660 mm) of Australia's owls. It is readily located from its call, and identified by its large size and bold chevrons on the underparts. Males are somewhat larger than females (Schodde and Tiedemann, 1993). The Powerful Owl is generally found in the coastal forests and ranges of eastern and south-eastern Australia, within 200 kilometres of the coast. The species has been recorded from the Dawson River in Queensland to south-western Victoria and at Mount Burr in South Australia (Blakers *et al.*, 1984)

The Powerful Owl inhabits a range of vegetation types showing a preference for stands with dense canopy such as rainforests and is a generalist predator feeding mainly on arboreal mammals, but will also take ground dwelling mammals. The species roosts by day in dense foliage often within ridges covered by eucalypt forest. The species depends upon large mature hollow eucalypts for nesting, generally in areas with a range of vegetation communities that sustains a high diversity of ground dwelling mammals and avifauna (Debus and Chafer, 1994).

The Powerful Owl has been recorded throughout the Sydney region but most frequently in the forests north of Batemans Bay, which may be due to a greater sampling effort in this area.

The life cycle of the Powerful Owl is likely to be disrupted if:

- ❑ large areas of habitat are cleared or modified;
- ❑ fire regimes are altered and remove vegetation providing habitat for owl prey;
- ❑ predation pressure from introduced feral carnivores (cat and fox) significantly decrease the abundance of ground dwelling mammals (potential owl food) in preferred foraging and nesting sites of the owl; and
- ❑ mature eucalypts with hollows are disturbed or removed.

2. SEVEN-PART TEST

(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.

There are no tree hollows on the subject site that are large enough for use by Barking Owls or Powerful Owls as nesting sites.

The subject site provides potential foraging habitat for the Barking Owl and the Powerful Owl, but none were detected there, despite targeted surveys for them.

Barking Owls are usually found in pairs, which occupy 300-2000 ha territories all year round (Higgins 1999). The nearest known Barking Owl record from within the locality is in Lane Cove National Park, North Ryde. The subject site is 8.7 ha in area, representing only between 0.4 and 2.7% of the size of a potential territory of a single pair of birds. The proposed development will be landscaped with trees, which will still attract potential prey items of the Barking Owl (rats, mice, occasional small bats and some marsupials, including possums).

Powerful Owls are also usually found in pairs, which occupy 300-1500 ha territories all year round (Higgins 1999). The local population occurs mostly in the Lane Cove River valley, including Lane Cove National Park, and associated bushland areas. The nearest known record for this species within the locality is Devlin Creek in Beecroft. Therefore, the subject site represents only between 0.4 and 5.8% of a potential territory of a single pair of birds. The proposed development will be landscaped with trees, which will still attract potential prey items of the Powerful Owl (e.g. possums, medium- to large-sized birds and flying-foxes).

Therefore, the proposed development will not adversely affect the lifecycles of Barking and Powerful Owls to the extent that local viable populations are placed at risk of extinction.

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

Not applicable. Barking and Powerful Owls are listed as threatened species rather than as endangered populations.

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

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

Not applicable. Barking and Powerful Owls are listed as threatened species rather than as endangered or critically endangered ecological communities.

(d) In relation to a 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.**

- (i) The proposed development will result in the removal or proposed modification of up to 8.7 ha of potential foraging habitats of both the Barking Owl and Powerful Owl. This represents between only 0.4 and 2.7% of the usual territory size of a single pair of Barking Owls and between only 0.4 and 5.8% of the usual territory size of a single pair of Powerful Owls.
- (ii) The proposed development will not fragment or isolate habitat of Barking or Powerful Owls.
- (iii) There is no potential nesting habitat for the Barking Owl or Powerful Owl on the subject site. The subject site represents a negligible proportion of potential foraging habitat of a single pair of Barking Owls or Powerful Owls.

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

No critical habitats for Barking or Powerful Owls occur in the locality.

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

A draft recovery for large forest owls (including Barking Owls) was released by the Department of Environment & Conservation in May 2005. The objective or actions of this plan are:

- ☐ Management and protection of habitat off reserves and State forests.
- ☐ Mitigation of development-related threats.
- ☐ Modelling and mapping of habitat and validation with surveys.

- ❑ Monitoring owl population parameters.
- ❑ Auditing of forestry prescriptions.
- ❑ Encouragement of research.
- ❑ Increasing community awareness and involvement in owl conservation.
- ❑ Provision of organisational support and integration of the objectives and actions of the recovery plan.

The proposed development is consistent with these objectives and actions of each of this recovery plan.

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

The proposed development would result in the loss of potential foraging habitat of the Barking Owl and Powerful Owl, which is a key threatening process for both of these species. However, this habitat is, at best, very marginal habitat for both owl species. The proposed development will remove a negligible amount of potential foraging habitat for owls that occur in the locality. Neither species was recorded on the subject site, despite targeted surveys for them. Therefore, the proposed development is not likely to result in the operation of, or increase the impact of, a key threatening process for threatened owl species.

3. CONCLUSION

The proposed development will not significantly impact on the status of Barking Owls or Powerful Owls, or their habitats. Therefore, a Species Impact Statement is NOT required for these species in relation to the proposed development.

4. REFERENCES

- Barrett, G.W., Ford, H.A. & Recher, H.F. (1994). Conservation of woodland birds in a fragmented rural landscape. *Pacific Conservation Biology*. 1: 245-256
- Debus, S.J.S (1997). The Barking Owl in New South Wales. *Australian Birds*. 30: 53-80.
- Debus, S.J.S. & Chafer, C.J. (1994). The Powerful Owl *Ninox strenua* in New South Wales. *Australian Birds*. 28 (Suppl.): S21-S38.
- Higgins, P.J. (1999) (ed). Handbook of Australian, New Zealand and Antarctic Birds. Vol 4: Parrots to Dollarbird (Oxford University Press, Melbourne).
- Kavanagh, R.P., Debus, S.J., Rose, A.B. & Tweedle, T. & Webster, R. (1995). Distribution of nocturnal forest birds and mammals in north-eastern New South Wales: relationships with environmental variables and management history. *Wildlife Research*. 22: 359-377.
- NPWS (1999). Draft Barking Owl *Ninox connivens* Recovery Plan (National Parks & Wildlife Service, Hurstville).
- Parker, S.A. (1977). Records of the Barking Owl from South Australia. *South Australian Ornithologist*. 27: 204-206

Pizzey, G. & Doyle, F. (1996). *A Field Guide to Birds of Australia* (Angus & Robertson, Sydney).

Robinson, D. & Traill, B.J. (1996). Conserving woodland birds in the wheat and sheep belts of southern Australia. *RAOU Conservation Statement* 10.

Schodde, R. and Tiedemann, S. (1993) *Readers Digest Complete Book of Australian Birds*. (Readers Digest, Sydney).

Silveira, C.E., Yen, A.L., Bennett, A.F., Brown, G.W., Hinkley, S.D., Loyn, R.H., Lumsden, L.F. & Smith, W. (1997). Fauna of the Box-Ironbark study area. Report to the Land Conservation Council, Melbourne.

Taylor, I.R. & Kirsten, I. (1999). Population declines of predatory birds coincident with the introduction of Klerat rodenticide in north Queensland. *Australian Birdwatcher*. 17: 160-167.

BAT SPECIES

1. SPECIES PROFILES

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

Historically, Grey-headed Flying-foxes had a greater range in Australia and numbers were estimated as being in the millions. Counts of flying-foxes over the past decade suggest that the national population may have declined up to 30% (Birt 2000; Richards 2000). Regular visits to flying-fox camps during this period have shown a marked decline in the numbers using these camps (Eby 2000; Parry-Jones 2000). It has also been estimated that the population will continue to decrease by at least 20% in the next three generations given the continuation of the current rate of habitat loss and culling (Martin 2000).

This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, *Melaleuca* swamps and *Banksia* woodlands. It plays an important ecosystem function by providing a means of seed dispersal and pollination for many indigenous tree species (Eby 1996; Pallin 2000). The species also feed on introduced trees including commercial fruit crops.

Grey-headed Flying-foxes congregate in large numbers at roosting sites (camps) that may be found in rainforest patches, *Melaleuca* stands, mangroves, riparian woodland or modified vegetation in urban and rural areas. Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring (Lunney & Moon 1997; Augee & Ford 1999). They forage opportunistically, often at distances from camp of up to 60-70 km per night, in response to patchy food resources (Augee & Ford 1999).

Grey-headed Flying-foxes show a regular pattern of seasonal movement. Much of the population concentrates in May and June in northern NSW and Queensland where animals exploit winter-flowering trees such as Swamp Mahogany *Eucalyptus robusta*, Forest Red Gum *E. tereticornis* and Paperbark *Melaleuca quinquernervia* (Eby *et al.* 1999). Food availability, particularly nectar flow from flowering gums, varies between places and from year to year. Movement patterns of Grey-headed Flying-foxes are also irregular and unpredictable towards the edges of their distributional range. For instance, it appears that numbers in Victoria are highest in years when flowering of eucalypts in the coastal forests of southern NSW is poor. Conversely, in years when flowering in southern NSW is prolific, the number visiting Victoria is very low (Aston 1987; Parry-Jones 1987).

Grey-headed Flying-foxes are relatively long-lived mammals, with a generation length of six to 10 years. They have a low rate of reproduction because sexual maturity is reached after at least three years and generally only one offspring is produced each year (Martin *et al.* 1996). Although mating can be observed throughout the year, males are apparently fertile only for a short period during March and April, and breeding is highly seasonal (Nelson 1965a; Martin *et al.* 1987).

Gestation lasts about six months and most females give birth to a single young each September or October. For the first four or five weeks of life they cling to their mothers' belly fur. For a further 12 weeks young are flightless and are left in the camp while their mother forages and are suckled on return. Young are weaned at five or six months (Martin *et al.* 1987). At the end of summer food becomes scarce and the large camps break up. Many adults then lead a dispersed nomadic existence (Nelson 1965a,b), but others travel hundreds of kilometres to congregate at winter camps near reliable food supplies.

The main threat to Grey-headed Flying-foxes in NSW is the clearing or modification of native vegetation. This removes appropriate camp habitat and limits the availability of natural food resources, particularly winter feeding habitat in north-eastern NSW. The urbanisation of coastal plains of south-eastern Queensland and northern NSW has seen the removal of critical feeding sites, and this threatening process continues (Catterall *et al.* 1997; Pressey & Griffith 1992).

The use of non-destructive deterrents, such as netting and noise generators, to limit flying-fox damage to fruit crops is not universal in the horticultural industry. While licences are issued to cull limited numbers of Grey-headed Flying-foxes, uncontrolled culling using destructive methods such as shooting and electrocution occurs and large numbers of bats are culled (Vardon & Tidemann 1995; Richards 2000). The impacts of destructive methods has not been measured, but is greatest when natural food is scarce. Also, culling has a disproportionate impact on lactating and pregnant females (Parry-Jones 1993).

The species is also threatened by direct harassment at roosts, the destruction of their camps and by being possible carriers for viral pathogens (Tidemann 1999).

Grey-headed Flying-foxes face potential competition and hybridisation from Black Flying-foxes (*Pteropus alecto*), because this latter species is extending its range south into northern NSW (Webb & Tidemann 1995).

Eastern Freetail Bat (*Mormopterus norfolkensis*)

This species is found in sclerophyll forests, woodlands and occasionally in rainforests along the east coast of Australia from south-east Qld through to Sydney. Active mainly at night, East-coast Freetail Bats roost by day alone or in small colonies in tree hollows and crevices, under loose bark, in caves and in buildings. They hunt for insects over the forest canopy and in clearings, flying fast and direct but with limited manoeuvrability. They also forage on the ground, scurrying around searching for terrestrial insects. The species' breeding biology has not been studied but, like other freetail bats, individuals probably give birth to a single young that suckles from a teat in the mother's armpit (Cronin 2000).

Eastern Bent-wing Bat (*Miniopterus schreibersii*)

The Little Bentwing-bat is distributed along the entire eastern seaboard from Cape York Peninsula, Queensland to South Australia (Dwyer, 1995). The species is highly mobile, migrating over large distances and utilising different roosts for different seasonal needs (Ferrier *et al.*, 1992). This species is found in a range of habitats from grasslands through to subtropical rainforest but are typically found in well timbered valleys. Colonies are established often in

caves to meet breeding and over-wintering needs (NPWS 1996). The diet consists of small airborne insects including moths and mosquitoes (NPWS, 1996). Females form colonies during spring and summer to give birth and nurture young. They give birth to a single young around December. Maternity caves serve animals from a radius of several hundred kilometres (Dwyer 1995).

Large-footed Myotis (*Myotis adversus*)

The Large-footed Myotis is a microchiropteran species that forages on fish and insects from the permanent freshwater rivers, dams and creeks of coastal eastern and northern Australia. The species makes maternity roosts in caves close to freshwater, under bridges and buildings and other such structures, and among dense foliage and pandanus leaves. Its preferred natural habitats are sclerophyll forests, mangroves, paperbark swamps, woodlands and rainforests near slow-flowing creeks, lakes and estuaries. Individual colonies usually consist of 10-15 bats, but may have as many as 200 individuals.

Males are territorial and form harems of up to 12 females when breeding. At other times the males roost alone. A single litter is produced in November-December. The single young suckles for about 8 weeks from a teat in the mother's armpit, and remains with her until independent 3-4 weeks later.

Greater Broad-nosed Bat (*Scoteanax ruepelli*)

Found in sclerophyll forests, rainforests, woodlands and moist gullies below 500 m above sea level. Active from dusk to dawn, Greater Broad-nosed Bats are one of the first bat species to emerge after sunset.

Their flight path is low and direct, and they hunt 3-6 m above ground, making only slight deviations from their flight path to catch moths, beetles and other large, slow-flying insects. They forage in forests and woodlands, utilising openings in the forest and corridors above creeks and small rivers, hawking back and forth looking for prey, taking small animals from the ground and foliage. They roost by day in tree hollows and the roof spaces of abandoned buildings.

Pregnant females congregate at maternity sites in suitable trees where they give birth and raise their young, apparently excluding males. Little is known about the reproductive biology of this species, however, it is known that a single young is produced in January and it suckles from a teat in the mother's armpit.

(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.

Grey-headed Flying-fox

This species roosts in large colonies, none of which are located within the locality. Small numbers of individuals may occasionally visit the subject site when mature trees are flowering.

Removal of some of these trees will not significantly result in significantly limiting food resources for local populations of flying-foxes. Therefore, proposed development will not place local populations of this species at risk of extinction.

Eastern Bentwing Bat, East Coast Freetail Bat, Yellow-bellied Sheathtail Bat and Greater Broad-nosed Bat

There are only three trees on the subject site that contain hollows which are large enough to be used as roost sites by microchiropteran bats. These occur along the northern boundary of the subject site, one near the north-eastern corner of the site, and two occurring in forested areas near the north-eastern corner of the helipad. These will be retained as part of the proposed development. No bridges or culverts, which are other potential nest sites for Eastern Bentwing Bats will be removed as part of the proposed development.

Potential foraging habitat for the each of these bat species is available in treed areas and around the wetland on the subject site. Each species are highly mobile and are likely to fly between woodland and forested areas throughout the locality to forage on insects. Therefore, the subject site represents a negligible proportion of potential foraging habitat for these species in the locality.

Given these factors, it is most unlikely that the proposed development will adversely affect the lifecycles of the Eastern Bent-wing Bat, East Coast Freetail Bat, Yellow-bellied Sheathtail Bat and Greater Broad-nosed Bat to the extent that it will place local populations at risk of extinction.

Large-footed Mouse-eared Bat

The Large-footed Mouse-eared Bat roosts in caves, mines, tunnels and under bridges. These structures do not occur on the subject site. Therefore, the proposed development will not impact on the roosting habitat of this species.

Potential foraging habitat for the Large-footed Mouse-eared Bat is available in treed areas and around the wetland on the subject site. This species is highly mobile and is likely to fly between woodland and forested areas throughout the locality to forage on insects. Therefore, the subject site represents a negligible proportion of potential foraging habitat for this species in the locality.

Given these factors, it is most unlikely that the proposed development will adversely affect the lifecycle of the Large-footed Mouse-eared Bat to the extent that it will place a local population at risk of extinction.

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

Not applicable. Each bat species listed as a threatened species rather than as an endangered population.

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

Not applicable. Each bat species is listed as a threatened species rather than as an endangered or critically endangered ecological community.

- (d) In relation to a 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.**

(i) No roosting or nesting habitat of bats will be removed as part of the proposed development. Up to 8.7 ha of potential foraging habitat will be removed or modified, representing a negligible proportion of the total foraging habitat for bat species that is available in the Sydney Basin Bioregion.

(ii) No area of habitat of threatened bat species will be fragmented or isolated as a result of the proposed development.

(iii) See comments in Point d(i).

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

No critical habitats for threatened bat species occur in the locality.

- (f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.**

There are currently no recovery plans or threat abatement plans for threatened bat species in NSW.

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

The proposed development would result in the loss of potential foraging habitat of threatened bat species, which is a key threatening process. However, the proposed development would not remove more than a negligible amount of potential foraging habitat for these species in the locality, and no known roosting habitat. Therefore, the proposed development is not likely to result in the operation of, or increase the impact of, a key threatening process for threatened bird species.

3. CONCLUSION

The proposed development will not significantly impact on the status of Grey-headed Flying-foxes, Eastern Freetail Bats, Eastern Bentwing-bats, Large-footed Mouse-eared Bats or Greater Broad-nosed Bats, or their habitats. Therefore, a Species Impact Statement is NOT required for these species in relation to the proposed development.

4. REFERENCES

- Aston, H. (1987). Influx of the Grey-headed Flying-fox *Pteropus poliocephalus* (Chiroptera: Pteropidae) to the Melbourne area, Victoria, in 1986. *Victorian Naturalist*. 104: 9-13.
- Augee, M.L. & Ford, D. (1999). Radio-tracking studies of Grey-headed Flying-foxes, *Pteropus poliocephalus* from the Gordon colony, Sydney. *Proceedings of the Linnaean Society of NSW*. 121: 61-70.
- Birt, P. (2000). In "Proceedings of a Workshop to Assess the Status of the Grey-headed Flying-fox". (Eds. G. Richards and L. Hall) (Australasian Bat Society, Canberra).
- Churchill, S. (1998) *Australian Bats*. New Holland Publishers.
- Cronin, L. (2000). *A Field Guide to Mammals of Australia*. Envirobooks, Sydney.
- Dwyer, P.D. (1965). Flight patterns of some eastern Australian bats. *Victorian Naturalist*. 82: 36-41.
- Dwyer, P.D. (1968). The biology, origin and adaptation of *Miniopterus australis* in New South Wales. *Australian Journal of Zoology*. 16: 49-68.
- Dwyer, P. D. (1995) Common Bentwing-bat. In: *The Complete Book of Australian Mammals*, pps 494-495. (Ed. R. Strahan). Reed Books. Sydney.
- Dwyer, P. D. (1995) Large-eared Pied Bat. In: *The Complete Book of Australian Mammals*, pps 510-511. (Ed. R. Strahan). Reed Books. Sydney.
- Eby (2000). In "Proceedings of a Workshop to Assess the Status of the Grey-headed Flying-fox". (Eds. G. Richards and L. Hall) (Australasian Bat Society, Canberra).

- Eby, P., Collins, L., Richards, G. and Parry-Jones, K. (1999). The distribution, abundance and vulnerability to population reduction of a nomadic nectarivore, *Pteropus policephalus* during a period of resource concentration. *Australian Zoologist*. 31: 240-253.
- Ferrier, S., Shields, J., Lemkert, F. L., Wilson, P., Mackowski, C. M. and Saxon, M. (1992) *Fauna Impact Statements - a standard methodology for surveying endangered species*. A joint report for the NPWS & NSW Forestry Commission.
- Hall, L.S. and Richards, G.C. (1979). *Bats of Eastern Australia*. Queensland Museum Booklet No. 12.
- Lunney, D. & Moon, C. (1997). Flying-foxes and their camps in the remnant forests of north-east New South Wales. In "Australia's Ever-Changing Forests. Vol. III. Proceedings of the Third National Conference of Australian Forest History" (Ed. J. Dargavel). Pp. 247-277 (Centre for Resource and Environmental Studies, Australian National University, Canberra).
- Martin, L. (2000). In "Proceedings of a Workshop to Assess the Status of the Grey-headed Flying-fox". (Eds. G. Richards and L. Hall) (Australasian Bat Society, Canberra).
- Martin, L., Kennedy, J.H., Little L., Luckhoff, H., O'brien, G.M., Pow, C.S.T., Towers, P.A., Waldon, A.K. and Wang, D.Y. (1996). The reproductive biology of Australian flying-foxes (genus *Pteropus*). *Symposium of the Zoological Society of London*. 67: 167-184.
- Nelson, J.E. (1965a). Behaviour of Australian Pteropidae (Megachiroptera). *Australian Behaviour*. 13: 544-557.
- Nelson, J.E. (1965b). Movements of Australian Flying-foxes (Pteropidae: Megachiroptera). *Australian Journal of Zoology*. 13: 735-759.
- Nelson, J.E. (1965a). Behaviour of Australian Pteropidae (Megachiroptera). *Australian Behaviour*. 13: 544-557.
- Nelson, J.E. (1965b). Movements of Australian Flying-foxes (Pteropidae: Megachiroptera). *Australian Journal of Zoology*. 13: 735-759.
- Parnaby, H. (2002). Issues relating to clearing operations and the habitat of the Little Bent-wing Bat near Nabyac, NSW. Affidavit sworn before the NSW Land & Environment Court, 26 July 2002.
- Richards, G. (2000). In "Proceedings of a Workshop to Assess the Status of the Grey-headed Flying-fox". (Eds. G. Richards and L. Hall) (Australasian Bat Society, Canberra).
- Tidemann, C.R. (1999). Biology and management of the Grey-headed Flying-fox, *Pteropus poliocephalus*. *Acta Chiropterologica*. 1: 151-164.

Vardon, M.J. and Tidemann, C.R. (1995). Harvesting of Flying-foxes (*Pteropus* spp.) in Australia: could it promote the conservation of endangered Pacific Island species? In "Conservation Through the Sustainable Use of Wildlife." (Eds G. Grigg, P. Hale and D. Lunney). Pp. 82-85. (University of Queensland, Brisbane).

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

Williams, R. & Hoyer, G. (2000). New information on the southern limit of distribution of the Little Bent-wing Bat *Miniopterus australis* in New South Wales. Abstract of paper presented at 9th Australasian Bat Conference, Paterson, NSW.