ASSESSMENT | PLANNING | MANAGEMENT

Microchiropteran and Megachiropteran Bat Survey

Western Sydney Parklands Bungarribee Precinct Project
(Project No. 087-013)

Report prepared for:
Landcom/APP

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1. Introduction

1.1 Background

Targeted microchiropteran (echo locating) and megachiropteran (fruit-bat) bat surveys were conducted as a direct response to the recommendations within the Western Sydney Parkland Bungarribee Parklands Precinct Project Ecological Impact Assessment produced by Eco Logical Australia in August 2007. This assessment recommended further ecological investigation prior to project approval under Part 3A of the *Environmental Planning and Assessment Act 1979* due to seasonal constraints at the time of assessment. The surveys were conducted across the vegetated areas of the Doonside Residential Parcel and adjacent areas of the Bungarribee Parklands Precinct within the Western Sydney Parklands in February 2008.

1.2 Aim of this Report

The aim of this survey is to determine which threatened species of microchiropteran and megachiropteran bats occur within the area to be impacted by the proposed development footprint, to determine whether any roosting sites exist within the proposed development footprint, and to determine the overall activity of microchiropteran and megachiropteran bats in the broader context of the parklands adjacent to the Doonside Residential Parcel.

The report provides background information on microchiropteran and megachiropteran bat distribution and ecology, and details the methods utilised to survey microchiropteran and megachiropteran bats within the study area. It assesses the impacts of the proposed development, and discusses and recommends potential mitigation measures.

1.3 Study Area

The Doonside Residential Parcel is located adjacent to the Bungarribee Parklands Precinct of the Western Sydney Parklands. The Bungarribee Parklands Precinct will form the main community recreation hub for both active and passive recreation in the northern part of the parklands. Bushland is to be restored through the broad floodplain areas, with current rural landscapes retained on the valley slopes to allow open areas for intensive community use.

The Doonside Residential Parcel is defined by the following landscape features:

- Bungarribee Creek to the South;
- Eastern Creek to the West;
- Doonside Road to the East (which continues on to the Railway Station); and
- Eastern Road to the North.

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The Bungarribee Parklands Precinct is defined by the following landscape features:

- Great Western Highway to the South;
- M7 Motorway to the West;
- Eastern Creek to the East; and
- Eastern Road to the North.

Figure 1 illustrates the Concept Plan for development and the development site context.

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Figure 1: Western Sydney Parklands - Bungarribee Precinct Project Concept Plan

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2. Literature Review

2.1 Background

Previous surveys, literature reviews, database searches and legislative requirements were examined in order to scope the surveys and adequately address reporting requirements.

2.2 Database Searches

A search of the online EPBC Protected Matters Search Tool (DEH 2008), and Atlas of NSW Wildlife (DECC 2008) was performed on 07/08/07 and 4/02/08 to identify microchiropteran and megachiropteran bat species that have the potential to occur within a 5km radius of the study area. The search of the EPBC Protected Matters Search Tool used a radius of 5 km around coordinates -33.7693 150.85847. The search of the Atlas of NSW Wildlife covered the area from latitude -33.7192 to -33.8192, and longitude 150.8029 to 150.9131.

The database search revealed 15 microchiropteran bat species and one megachiropteran bat species that may potentially occur within the study area. These results are outlined in Table 1.

Table 1 Database search results.

Common Name	Species Name	Common/ Widespread	TSC Status	EPBC Status
Large-eared Pied Bat	*Chalinolobus dwyeri*		V	V
Gould's Wattled Bat	*Chalinolobus gouldii*	√		
Chocolate Wattled Bat	*Chalinolobus morio*	√		
Greater Broad-nosed Bat	*Scoteanax rueppellii*		V	
Eastern Broad-nosed Bat	*Scoteanax orion*	√		
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*		V	
Large-footed Myotis	*Myotis adversus*		V	
Eastern Bent-wing Bat	*Miniopterus schreibersii*		V	
Eastern Freetail Bat	*Mormopterus norfolkensis*		V	
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*		V	
White-striped Freetail-bat	*Tadarida australis*	√		
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	√		
Large Forest Bat Little Forest Bat	*Vespadelus darlingtoni* *Vespadelus vulturnus*	√ √		
Southern forest bat	*Vespedelus regulus*	√		
Grey-headed Flying-fox	*Pteropus poliocephalus*		V	V

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2.3 Previous Studies

In 2005, a targeted field survey was conducted within the entire Bungarribee Parklands Precinct to assess the broad range of vegetation and habitat types occurring in the study area. The study was undertaken by Lachlan Sutherland and Alex Debono of Eco Logical Australia. This field survey included Anabat detection devices and harp trapping.

An Anabat detector equipped with ZCAIM recording device was used to record resident microchiropteran bat species. A total of 13 microchiropteran bat taxa were identified during the survey including 4 threatened species. Anabat detection and harp trapping were both utilised to identify bat species in the study area and the results are discussed below.

Anabat detection recorded a large number bat passes. A total of 13 species including 4 threatened bat species. The threatened species, common bent-wing bat (*Miniopterus schreibersii*), eastern free-tail bat (*Mormopterus nofolkensis*), fishing bat (*Myotis adversus*) and greater broad-nosed bat (*Scoteanax rueppellii*) were confidently identified.

Harp trapping captured a total of 8 individuals consisting 4 species (*Chalinolobus morio*, *Nyctophylus geoffroyi*, *Vespadelus darlingtoni* and *Vespadelus vulturnus*). These species are considered to be common in the Sydney Basin.

2.4 Representation in Western Sydney

Regionally, threatened microchiropteran and megachiropteran bat species are well represented throughout Western Sydney and correspond to remnant native vegetation, as shown within Figure 2. Table 2 lists the number of records as identified through the NSW Wildlife Atlas threatened microchiropteran and megachiropteran bat species as occurring within a number of Council LGA's within western and north-western Sydney. All threatened microchiropteran and megachiropteran bat species occur over multiple LGA's, with good representation particularly in the neighbouring LGA's of Penrith, Baulkham Hills, Hawkesbury, and Fairfield.

Table 2: NSW Wildlife Atlas recordings for TSC & EPBC listed bats within Council LGA's of Western Sydney.

Bat Species	TSC Status	EPBC Status	Previously Recorded	Potential Roost Habitat on Site	Foraging Habitat	Total No. of Atlas Recordings in Surrounding LGA's*
Large-eared Pied Bat	V	V			√	39
Eastern False Pipistrelle	V			√	√	26
Eastern Bent-wing Bat	V		√		√	128
Large-footed Myotis	V		√	√	√	42
Greater Broad-nosed Bat	V		√	√	√	48
Eastern Freetail Bat	V		√	√	√	100
Yellow-bellied Sheathtail-bat	V	V		√	√	9
Grey-headed Flying-fox	V	V	√		√	192

* Surrounding Council's including Blacktown, Penrith, Hawkesbury, Fairfield, Holroyd, Liverpool, and Parramatta.

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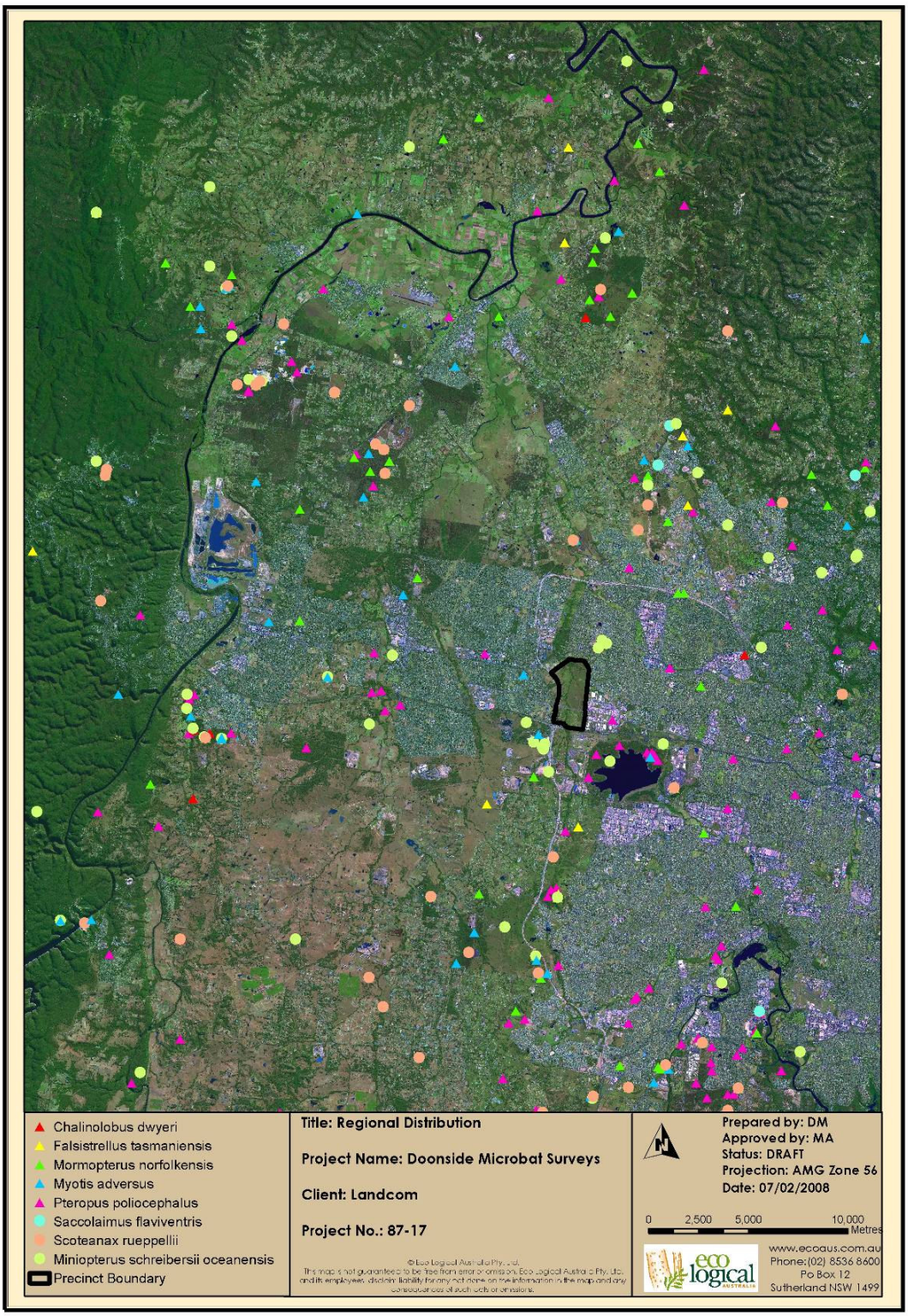
Figure 2: Threatened microchiropteran and megachiropteran bat species locations within Western Sydney.



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2.5 Habitat, Ecology and Distribution

2.5.1 Microchiropteran Bats

Large-eared Pied Bat (*Chalinolobus dwyeri*)

The large-eared pied bat is a small to medium-sized bat with long, prominent ears and glossy black fur. This species roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Hirundo ariel*). They are found in well-timbered areas containing gullies and probably forage for small, flying insects below the forest canopy (DECC 2008a).

The large-eared pied bat is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW (DECC 2008a). The study area may provide periodic foraging habitat for this species.

Gould's Wattled Bat (*Chalinolobus gouldii*)

The Gould's wattled bat is a small to medium-sized bat and is the largest lobe-lipped bat in Australia. The fur is distinctly bicoloured, with a blackish head and brown body. This species roosts in hollows and occasionally in ceilings or basements of buildings. They roost together in colonies of approximately 30 bats. They forage on a variety of insects, (including scarab beetles, caterpillars, crickets and moths) depending on the time of year (Menkhorst & Knight 2004).

The Gould's wattled bat inhabits most habitats except treeless deserts. This species is common throughout Australia, apart from Cape York Peninsula (Menkhorst & Knight 2004). The study area has the potential to contain roosting and foraging habitat for this species.

Chocolate Wattled Bat (*Chalinolobus morio*)

The chocolate wattled bat is a small to medium-sized bat with short, rounded ears and rich brown fur. This species mainly roosts in hollows, as well as disused birds' nests. They roost together in colonies of 20 to a few hundred bats. They forage mainly on small moths (Menkhorst & Knight 2004).

The chocolate wattled bat inhabits a variety of habitats, from subalpine woodland to arid plains. This species can be found throughout southern Australia, along the east coast and in the Pilbara of Western Australia (Menkhorst & Knight 2004). The study area has the potential to contain roosting and foraging habitat for this species.

Greater Broad-nosed Bat (*Scoteanax rueppellii*)

The greater broad-nosed bat is a large bat with a broad head and dark reddish-brown fur. This species is mainly found in moist gullies in mature coastal forests or rainforests and roosts in hollow tree trunks and branches (DECC 2008b). The greater broad-nosed bat is a large bat that feeds on moths and other large insects along the edges of forest, cleared paddocks and tree-lined water courses. This species uses mostly tree hollows for roosting and they have been recorded in a variety of vegetation types from woodland to rainforest (Churchill 1998).

The greater broad-nosed bat is found mainly in gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tablelands in

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Queensland (DECC 2008b). The study area has the potential to contain roosting and foraging habitat for this species.

Eastern Broad-nosed Bat (*Scoteanax orion*)
The eastern broad-nosed bat is a small bat with warm brown fur. This species roosts in hollows, occasionally in ceilings or basements of buildings. They forage on a variety of insects, (including scarab beetles, caterpillars, crickets and moths) depending on the time of year (Menkhorst & Knight 2004).

The eastern broad-nosed bat inhabits mainly wet and dry sclerophyll forests of the Great Diving Range and adjacent coastal plains (Menkhorst & Knight 2004). The study area has the potential to contain roosting and foraging habitat for this species.

Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
The eastern false pipistrelle is a large bat with long slender ears set well back and has dark to reddish-brown fur. This species prefers moist habitats, and roosts in hollows, occasionally under loose bark on trees or in buildings. This species forages for beetles, moths, weevils and other flying insects above or just below the tree canopy (DECC 2008c).

The eastern false pipistrelle inhabits tall forests of the Great Dividing Range and adjacent coastal plains. This species is found from southern Queensland to Victoria and Tasmania (DECC 2008c). The study area has the potential to contain roosting and foraging habitat for this species.

Large-footed Myotis (*Myotis adversus*)
The large-footed myotis maybe encountered in a variety of habitats, but always near open water. This species feeds on water insects and other small animals by 'raking' them from the water surface with its enlarged feet (Churchill 1998). Roost sites are located within the vicinity of waterways, and include caves, anthropogenic features, tree hollows and clumps of vegetation (Churchill 1998).

The large-footed myotis is found mainly in areas along the coastline, from Kimberley in the Northern Territory and along the east coast of Australia to the lower Murray River (Menkhorst & Knight 2004). The study area has the potential to contain roosting and foraging habitat for this species.

Eastern Bent-wing Bat (*Miniopterus schreibersii*)
The eastern bent-wing bat is a wide ranging species and is essentially an obligate cave rooster that utilises a wide variety of habitats for foraging (Churchill 1998). The eastern bent-wing bat forages above forested areas, feeding upon moths and other flying insects above the tree tops (DECC 2008d).

The eastern bent-wing bat inhabits areas generally within 300km of areas containing caves or other potential roosting sites. This species is found along the east and north-west coasts of Australia (DECC 2008d). The study area may provide periodic foraging habitat for this species.

Eastern Freetail-bat (*Mormopterus norfolkensis*)

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The eastern freetail-bat is thought to use tree hollows for roosting and the majority of records are from dry eucalypt forests and woodland on the east coast (Churchill 1998). Based on the wing morphology of this bat, this species is thought to forage for insects among canopy gaps and on edges of vegetation (DECC 2008e).

The eastern freetail bat is most common within wet and dry sclerophyll forest habitats. This species is found along the east coast of Australia, from the Illawarra in New South Wales to Brisbane (DECC 2008e). The study area has the potential to contain roosting and foraging habitat for this species.

Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
The yellow-bellied sheathtail bat occurs in almost all habitats from wet and dry sclerophyll forests, open woodland, acacia shrubland, mallee, grasslands and desert (DECC 2008f). This species uses mostly tree hollows for roosting although they have also been recorded using anthropogenic structures (Churchill 1998). Churchill (1998) noted that this is a wide-ranging bat that forages high over the canopy in a variety of vegetation types.

The yellow-bellied sheathtail-bat inhabits a wide variety of habitats from deserts to wet forests, including urban areas. This species is a wide-ranging species found across northern and eastern Australia (Menkhorst & Knight 2004). The study area has the potential to contain roosting and foraging habitat for this species.

White-striped Freetail-bat (*Tadarida australis*)
The white-striped freetail-bat is a large bat with chocolate brown fur and white stripes along the flanks under its wings. This species roosts in tree hollows, and occasionally under loose bark, or in the ceilings of buildings. Up to several hundred bats can live together in a colony. This species forages above the tree canopy for flying insects (Menkhorst & Knight 2004).

The white-striped freetail-bat inhabits a wide verity of habitats, including urban areas. This species is common throughout the southern areas of Australia, apart from Tasmania (Menkhorst & Knight 2004). The study area has the potential to contain roosting and foraging habitat for this species.

Lesser Long-eared Bat (*Nyctophilus geoffroyi*)
The lesser long-eared pied bat is a small to medium-sized bat with long, prominent ears and pale grey-brown fur. This species roosts in tree hollows and fissures of trees, under bark, in old fairy marten (*Hirundo ariel*) nests, and occasionally in caves. This species forages near the ground, catching flying insects in flight and snatching insects off the ground or leaves (Menkhorst & Knight 2004).

The lesser long-eared bat inhabits a wide variety of habitats from deserts to wet forests, including urban areas. This species is common throughout Australia, apart from Cape York Peninsula (Menkhorst & Knight 2004). The study area has the potential to contain roosting and foraging habitat for this species.

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Large Forest Bat (*Vespadelus darlingtoni*)
The large forest bat is a small to medium-sized bat with short, rounded ears and rich brown fur. This species roosts in tree hollows, and occasionally under loose bark, or in the ceilings of buildings. Up to 60 bats can live together in a colony. This species forages on flying insects, including moths, beetles, flies, bugs, lacewings, termites, ants and spiders (Menkhorst & Knight 2004).

The large forest bat inhabits forest and woodland areas of the Great Dividing Range and coastal plains from south-east Queensland to the Adelaide Hills (Menkhorst & Knight 2004). The study area has the potential to contain roosting and foraging habitat for this species.

Little Forest Bat (*Vespadelus vulturnus*)
The little forest bat is a small bat with a distinct raise in the forehead and mid-brown to grey-brown fur. This species roosts in tree hollows, and occasionally in the ceilings of buildings. Up to 50 bats can live together in a colony. This species forages on small flying insects within forests (Menkhorst & Knight 2004).

The little forest bat inhabits a variety of forest and woodland habitats. This species is found mainly within the south-eastern corner of Australia (Menkhorst & Knight 2004). The study area has the potential to contain roosting and foraging habitat for this species.

Southern Forest Bat (*Vespedelus regulus*)
The southern forest bat is a small bat with a flat, triangular shaped head when viewed form above and has brownish fur. This species roosts in tree hollows, with colonies often being occupied by a single sex (Menkhorst & Knight 2004).

The southern forest bat inhabits a variety of forest and woodland habitats. This species is found mainly within the southern Australia (Menkhorst & Knight 2004). The study area has the potential to contain roosting and foraging habitat for this species.

2.5.2 Megachiropteran Bats

Grey-headed Flying-fox (*Pteropus poliocephalus*)
The grey-headed flying-fox utilises a wide variety of habitats (including disturbed areas) for foraging, and are recorded as travelling long distances on feeding forays (Churchill 1998). Fruits and flowering plants of a wide variety of species are the main food source. The species roosts in large 'camps' of up to 200 000 individuals. Camps are usually formed close to water and along gullies however the species has been known to form camps in urban areas (Churchill 1998).

The grey-headed flying-fox is found along the east coast of Australia, from Gladstone in Queensland south to Melbourne in Victoria (Menkhorst & Knight 2004). The study area may provide periodic foraging habitat for this species.

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2.6 Legislative Requirements

2.6.1 Environmental Planning and Assessment Act, 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. Various legislative instruments, such as the NSW *Threatened Species Conservation Act 1995* (TSC Act), are integrated with EP&A Act and have been reviewed separately.

The Bungarribee Precinct Project is being considered under Part 3A of the EP&A Act.

2.6.2 Threatened Species Conservation Act, 1995

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The TSC Act is integrated with the EP&A Act and requires consideration of whether a development (Part 3A or Part 4 of the EP&A Act 1974) or an activity (Part 5 of the EP&A Act) is likely to significantly affect threatened species, populations and ecological communities or their habitat.

The schedules of this Act list species, populations and communities as endangered or vulnerable. New species, populations and communities are continually being added to the schedules of the TSC Act. All developments, land use changes or activities need to be assessed to determine if they will have a significant impact on species, populations or communities listed on these schedules.

The potential impact of development of the site on any threatened species, populations or communities is assessed under Part 3A of the EP&A Act by meeting the 'maintain or improve' threshold.

There are a number of microchiropteran and megachiropteran bat species that potentially occur within the study area that are listed as Vulnerable under Schedule 2 of the NSW *Threatened Species Conservation Act 1995*. These species include the Yellow-bellied Sheathtail-bat, Eastern Freetail-bat, Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing-bat, Large-footed Myotis, Greater Broad-nosed Bat, and Grey-headed Flying-fox.

2.6.3 Environment Protection and Biodiversity Conservation Act, 1999

The Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) stipulates that approval from the Commonwealth Environment Minister is required if a development is likely to have a significant impact on matters considered to be of national environmental significance.

If the proposed action is likely to have an impact on the matters of 'national environmental significance', the proponent may make a 'Referral' to the Commonwealth Department of Environment, Water, Heritage and the Arts. The Department will then determine if the action is a controlled or a non controlled action.

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Controlled actions are actions that will have, or are likely to have, a significant impact on a matter of national environmental significance (NES). Controlled actions require assessment under Part 8 of the Act and approval under Part 9. Non controlled actions may proceed without further assessment or approval by the Commonwealth.

The Large-eared Pied Bat, and Grey-headed Flying-fox are list as vulnerable under the Federal *Environment Protection and Biodiversity Conservation Act 1999*, and potentially occur within the area.

2.7 Key Threatening Processes

There are several key threatening process that have been declared by DECC for the threatened microchiropteran and megachiropteran bat species that occur within the Western Sydney Parklands. These include:

- the clearing and degradation of Cumberland Plain remnants;
- the loss of hollow bearing trees;
- predation by feral cats;
- predation by European red fox; and
- the removal of deadwood and dead trees.

There are numerous threatening processes identified by DECC that may affect threatened bats. Of these, the following are relevant to the Bungarribee Precinct project:

- Loss of foraging habitat;
- Disturbance to roosting and summer breeding sites;
- Electrocution on power lines; and
- Changes to water regimes are likely to impact food resources, as is the use of pesticides and herbicides near waterways.

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3. Methods

3.1 Data Audit

An audit of digital data was undertaken to assist in locating potential habitat for the microchiropteran and megachiropteran bat species targeted during this survey. This included vegetation mapping and Atlas records. Vegetation communities within the study area were reviewed (NSW NPWS, 2002) along with aerial photography of the study area (LPI, 1998 approx.) prior to field survey. Data from the NSW National Parks and Wildlife Service Atlas of NSW Wildlife was reviewed, identifying the regional distribution of microchiropteran and megachiropteran bat species across Western Sydney.

3.2 Field Survey

Targeted field surveys were conducted over a period of 4 nights, from the 11th to 14th of February 2008. The area surveyed is shown in Figure 3. The surveys were undertaken by Daniel Magdi, Simon Tweed, Will Introna, and Ailsa Kerswell of Eco Logical Australia Pty Ltd (ELA). Approximately 100 person hours were utilised in completing the survey.

The weather conditions during the targeted field surveys are outlined in Table 1. Ideal surveying weather conditions were experienced.

Table 2 Weather conditions during field surveys

Date	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)
11th February	13.8	25.2	0
12th February	16.6	27.7	0
13th February	16.8	23.7	0
14th February	16.6	27.7	0

Weather observations were taken from Prospect Dam (www.bom.gov.au)

Four survey techniques were used during the field surveys. These techniques included:

1. active searching for hollows and excreta;
2. Anabat detection;
3. Harp trapping; and
4. spotlighting.

The survey techniques were based on those outlined within the Threatened *Biodiversity Survey and Assessment: Guidelines for Development and Activities (Working Draft)* by DEC (2004).

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Figure 3: Field survey locations.

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Hollow Searches
Active searches for roosting sites were conducted within the area shown in Figure 3. Observations at the entrance of potential roosting sites were conducted at dusk. Hollow-bearing trees (previously identified) will be targeted during this part of the survey.

Anabat Detection
Anabat detection devices were used to detect and record the high frequency calls that are used by microchiropteran bat species to navigate and detect prey, these recordings were analysed by a specialist (Anna Lloyd, Echo Location). Anabat recording devises were placed at strategic locations (as shown in Figure 3). These units were left at each location for a period of five hours on two consecutive nights. Sixteen locations within the target area were surveyed.

In total, approximately 180 hours of Microbat activity was recorded. Figure 4 depicts a typical fly-way within the study area, where Anabat's were strategically placed.

Figure 4: Typical fly-way within the study area.

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Harp Trapping

Harp trapping was used in conjunction with the Anabat's, given that some of the microchiropteran bat species are difficult to record. Four harp traps were placed at four strategic locations within the study area over two consecutive nights. Figure 5 depicts a harp trap located in a fly-way within the study area.

The harp traps were checked at 2 am each morning; any trapped specimens were identified and released. The Harp traps were moved to another four locations for two more consecutive nights, giving a total of 8 survey locations. A total of approximately 100 trapping hours was undertaken. The location of the Harp traps is shown in Figure 3.

Figure 5: Harp trap set in a fly-way.

Spotlighting

Spotlighting was undertaken to identify megachiropteran bat species along a transect line within the study area over four consecutive nights. Two transects were randomly selected within the study area, in which spotlighting occurred over a period of one hour. The transect lines that were undertaken during the field survey are shown in Figure 3.

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4. Results

4.1 Active Search

Active searches at dusk for roosting sites within the proposed development footprint produced no results. There were no microchiropteran bats observed entering or existing from hollows within the proposed development footprint. A total of 8 trees and 16 hollows were surveyed.

4.2 Anabat

Anabat detection devices were analysed by Anna Lloyd. The microchiropteran bats surveys that occurred over four nights, detected a total of 3942 files of which 1594 were suitable for analysis. Analysis was completed on 1461 files. The species identified form the Anabat detection devices are shown in Table 3 below.

Table 3 Results from Anabat detection devices.

Scientific Name	Common Name	TSC Status	EPBC Status	2008 Survey	
				Definite	Probable/ Possible
Chalinolobus dwyeri	Large-eared pied bat	V	V	0	1
Chalinolobus gouldii	Gould's wattled bat			661	549
Chalinolobus morio	Chocolate wattled bat			4	10
Myotis macropus	Large footed myotis	V		1	42
Mormopterus sp 2.	East-coast freetail bat			6	113
Mormopterus norfolkensis	Eastern freetail bat	V		4	94
Nyctophilus spp.	Long-eared bat			132	62
Saccolaimus flaviventris	Yellow-bellied sheathtail bat	V		2	0
Scotorepens orion	Eastern broad-nosed bat			117	83
Tadarida australis	White-striped freetail bat			28	0
Vespadelus darlingtoni	Large forest bat			11	12
Vespadelus vulturnus	Little forest bat			158	36

4.3 Harp Trap

Harp trapping for microchiropteran bats was conducted over four nights. Two microbats were caught during these trapping nights. The two microbats that were caught were eastern broad-nosed bats. These bats were caught outside the proposed development footprint at the location shown within Figure 6.

4.4 Spotlighting

Whilst undertaking the spotlight transect for megachiropteran bat species, several Grey-headed flying-fox's were identified foraging within flowering *Eucalyptus moluccana* (Grey Box) and using the study area as a fly over. The location along the spotlighting transect where the Grey-headed Flying fox's were observed are shown within Figure 6.

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Figure 6: Observed bat species (spotlighting and harp traps).

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5. Discussion

The targeted microchiropteran and megachiropteran bat surveys within the Doonside Residential Parcel and adjacent areas within the Bungarribee Parklands resulted in the identification of foraging habitat for a wide range species.

The microchiropteran and megachiropteran bat surveys completed in 2008, differ from a previous survey completed in 2005. Table 4 below details the differences in species recorded during the two surveys. Threatened species recorded during the two surveys, differed, with the 2005 recording the eastern bent-wing bat, eastern free-tail bat, large-footed myotis, and greater broad-nosed bat, and the 2008 survey recording the large-eared pied bat, eastern free-tail bat, large-footed myotis, and yellow-bellied sheathtail bat. These differences in results between the two surveys conducted provide evidence of the cryptic nature of microchiropteran bats, given the presence and absence of species between the two surveys.

Table 4 2005 and 2008 Survey results.

Scientific Name	Common Name	TSC Status	EPBC Status	2008 Survey		2005 Survey	
				Definite	Probable / Possible	Definite	Probable / Possible
Chalinolobus dwyeri	Large-eared pied bat	V	V		√		
Chalinolobus gouldii	Gould's wattled bat			√	√	√	√
Chalinolobus morio	Chocolate wattled bat			√	√	√	√
Myotis adversus	Large footed myotis	V		√	√	√	√
Mormopterus sp 2.	East-coast freetail bat			√	√	√	√
Mormopterus norfolkensis	Eastern freetail bat	V		√	√	√	√
Nyctophilus spp.	Long-eared bat			√	√		√
Saccolaimus flaviventris	Yellow-bellied sheathtail bat	V		√			
Scotorepens orion	Eastern broad-nosed bat			√	√	√	
Tadarida australis	White-striped freetail bat			√		√	
Vespadelus darlingtoni	Large forest bat			√	√		
Vespadelus vulturnus	Little forest bat			√	√	√	√
Miniopterus schreibersii	Eastern bent-wing bat	V				√	√
Scoteanax rueppellii	Greater broad-nosed bat	V					√

This microchiropteran and megachiropteran bat survey has identified the Bungarribee Parklands as foraging habitat for bat species. This foraging habitat consisting of Shale Plains Woodland will be impacted by the proposed development. No roosting sites were identified during the hollow searches.

The results of the survey give no discernable trend in microchiropteran and megachiropteran bat habitat preferences within the remnant woodlands on site. There is a strong link in presence/absence correlating to the intact woodland areas. The lack of roosting sites (caves, bridges etc) on, or near, the site indicates that the Large-eared pied bat and Eastern bent-wing bat are traveling to the Parklands to forage.

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Woodland bats or those that favor roosting in hollows are most likely at risk given the impacts on woodlands within the Doonside Residential Precinct. The hollows on site were surveyed and returned nil results. A nil result for roosting site in hollows does not mean that these hollows do not have the potential to be used in the future, or may have been used in the past. The hollow dependent bats recorded on site namely, Eastern freetail bat, Large footed myotis, Yellow-bellied sheathtail bat, and Greater broad-nosed bat, will therefore be most likely to be impacted by the proposed development.

Given the protection of similar habitat on site, including the majority of hollows, and the protection and improvement of foraging habitat for these woodland bats, the extent of the impact is limited spatially. Temporal impacts will occur given that it will take approximately 100 years for trees to develop suitable hollows (Gibbons and Lindenmayer, 2002).

Large-footed Myotis will preference the riparian areas. The creation of artificial wetlands and detention basins in addition to WSUD practices on site to improve water quality and flow regimes will potentially increase the area and condition of habitat on site for this species.

Flowering and fruits utilised by the Grey-headed Flying-fox will be reduced through the clearing of some portions of the remnant vegetation, however given the limited area of clearing and the large foraging areas used by these species, these impacts are not expected to be significant.

The location of the development footprint will result in the removal of 2.43 ha of Shale Plain Woodlands in relatively good condition and 2.14 ha of Shale Plain Woodlands in relatively poor condition, and 0.37ha of good condition Alluvial Woodland. This survey confirms that woodland to be removed is foraging habitat for microchiropteran and megachiropteran bats. The loss of this foraging habitat accounts for 7% of good condition Shale Plain Woodland, 9% of poor condition Shale Plains Woodland, and 0.8% of good condition Alluvial Woodland within the Bungarribee Parklands precinct.

As a result of the clearing of these woodlands within the Doonside Residential Parcel, revegetation will occur within the Bungarribee Parklands which will result in an increase of approximately 70% of the foraging habitat for microchiropteran and megachiropteran bat species. The extent of offsets is shown in Table 5 below.

Table 5: Extent of Offsets

Community	Condition*	Area (ha) Impacted	Offset Ratio	Type of Offset	Area (ha) Required
Alluvial Woodlands	ABC	0.37	3:1	Recreation	1.11
		0.37			**1.11**
Shale Plains Woodland	ABC	2.43	3:1	Revegetation	7.29
	TX	2.14	2:1	Revegetation	4.28
		4.47			**11.57**
Total		**4.84**	**(2.7:1)**		**12.68**

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The results of the survey indicate that the proposed development is unlikely to impact on roosting or breeding sites of any of the bats recorded onsite during the 2005 and 2008 surveys. The spatial loss of foraging habitat is likely to be more than adequately compensated by the protection and enhancement of remnant vegetation. Although there were no roosts in hollows recorded during the survey, the proposed development will impact on potential roosting sites. The compensation of hollows will be temporally delayed through the proposed offsets.

The lack of known roosting sites, the negligible impact on foraging habitat, combined with the proposed extent of habitat protection and enhancement within the Bungarribee Parklands, means that the proposal meets the 'maintain or improve' threshold under Part 3A of the *EP&A Act*.

The *EPBC Act* lists threatened microchiropteran and megachiropteran bats that occur on the site. These include the grey-headed flying-fox and large-eared pied bat. These assessments against the Commonwealth significant assessment criteria are outlined in Appendix 1.

A referral under the EPBC Act is not considered necessary for the proposed development given that:

- the majority of remnant vegetation on the site will be retained;
- additional areas of vegetation will be recreated;
- significant impacts on matters of national environmental significance are considered highly unlikely (as discussed in Appendix 1); and
- a recent referral (EPBC number 2007/3718) for the removal of 4.47ha of Cumberland Plain Woodland within the site was considered to be a non-controlled action.

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6. Recommendations

As a result of this microchiropteran and megachiropteran bat survey, several recommendations have been made to further minimise the potential impacts on known foraging and potential roosting habitat within the Doonside Residential Parcel and adjacent areas within the Bungarribee Parklands. The recommendations have been based on protecting and increasing foraging habitat within the Bungarribee Parklands Precinct, and managing the human interference within foraging areas.

6.1 Staged Offset Implementation

The reduction in foraging habitat due to the removal of vegetation within the development footprint will need to be addressed before construction works begin. Offsets will need to be staged, so that there is not a sudden loss of available foraging habitat for microchiropteran and megachiropteran bats. This staged implementation of offsets should occur prior to construction, in order to allow for a short transitional period where both habitats are available.

6.2 Tree Clearing Protocol

The removal of larger habitat trees (>60cms diameter breast height or any trees with hollows) should occur under a Tree Clearance Protocol (TCP). This measure is recommended to reduce direct impacts to any tree dwelling fauna species, particularly bats that may be dwelling in the remnant vegetation or in isolated paddock trees during the construction phase. The TCP involves the following stages:

1. Day 1 – Pre-clearing survey by qualified expert/s identifies "habitat" trees (those that have potential roost hollows for bats).

2. Night 1 – Habitat trees are assessed for fauna presence (bat detectors operated for one hour after dusk, trees with large hollows are spotlighted at dusk).

3. Day 2 – Trees with fauna present are felled with a heavy bulldozer that pushes from the same side as the roost in question so that the roost entrance is uppermost when the tree is lying on the ground. The tree is "tapped" several times with the bulldozer blade to alert any resident fauna and is then pushed using the base of the blade at approximately 1 -2 metres from the ground until it starts to lean. The blade is then lowered to the base of the trunk where major roots protrude, and the tree is then held in position. The tree is then gently lowered to the ground by raising the blade and the machine operator can control the rate of fall to reduce damage. It is assumed that resident fauna will depart of its own accord.

4. Habitat trees with nesting birds are not felled until they are fledged, but if this is not possible they are taken to a WIRES wildlife carer.

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6.3 Lighting

The use of down-lighting for buildings, and public access areas adjacent to the Bungarribee Parklands Precinct should be utilised. Artificial lighting can have negative impacts on some fauna such as bats. However, lights can attract prey for microchiropteran bats, however the literature on these impacts is not conclusive (see Rich and Longcore 2005).

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Appendix 1 – EPBC Significance Assessment

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

Grey-headed Flying-fox was observed foraging within the remnant vegetation on site. The nearest camp site is at Cabramatta Creek with a mating and breeding population estimated at 18,000 individuals. The majority of the remnant areas on the development site will be protected including areas where the species were recorded, and additional areas of vegetation will be recreated within the riparian corridor consolidating the Eastern Creek regional habitat corridor which the species is known to use.

Grey-headed Flying-fox (*Pteropus poliocephalus*) is a listed vulnerable species under the EPBC Act. According to the "EPBC Act Significant Impact Guidelines", an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

In 2002, the Commonwealth Department of the Environment, Water, Heritage and the Arts (at that time Environment Australia) released additional guidelines on significance specifically for the Grey-headed Flying-fox (see: http://www.environment.gov.au/epbc/publications/greyheadedflyingfox/index.html). These supplementary guidelines primarily provide advice in relation fruit production and culling to protect crops.

Given that the majority of foraging habitat will be retained on site and additional vegetation corridors will be recreated, it is considered unlikely that the proposed development will have a significant impact on an important population or interfere substantially with the recovery of the species.

Large-eared Pied Bat (*Chalinolobus dwyeri*)

The large-eared pied bat was probably/possibly detected by an Anabat recording device within the remnant vegetation on site. The majority of the remnant areas on the development site will be protected including areas where the species may potentially forage recorded, and additional areas of vegetation will be recreated within the riparian corridor consolidating the Eastern Creek regional habitat corridor

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which the species is known to use. No roosting habitat occurs within the site, given the absence of caves, crevices in cliffs, and old mine workings.

The large-eared pied bat (*Chalinolobus dwyeri*) is listed as a vulnerable species under the *EPBC Act*. According to the "EPBC Act Significant Impact Guidelines", an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

Given that the majority of foraging habitat will be retained on site and additional vegetation corridors will be recreated, it is considered unlikely that the proposed development will have a significant impact on an important population or interfere substantially with the recovery of the species.

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