Concept Plan for a Residential, Commercial Retail Development. 78-90 Old Canterbury Road, Lewisham

Flora and Fauna Survey and Assessment

Prepared For :

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EXECUTIVE SUMMARY

S1 OVERVIEW

Lewisham Estates Pty Ltd (The Applicant) proposes to develop 78-90 Old Canterbury Road, Lewisham (the subject site) for the purposes of a mixed-use development. The proposed Concept Plan has been classified by the Department of Planning as a Part 3A Project under the *Environmental Planning and Assessment Act, 1979* (EP&A Act, 1979).

Approval is sought for a Concept Plan for a Major Project comprising a mixed use development for residential, commercial and retail land uses over basement car parking, generally in accordance with the building envelopes, floor space ratio (FSR) and land uses as illustrated on the plans prepared by Tony Owen Partners. The concept plan is for building's ranging in height from 4 to 9 storeys with a maximum FSR of 3.5:1. Public domain improvements include the creation of new streets, open space areas and pedestrian access points. The subject site and proposed concept plan is located on the northern portion of the McGill Street Precinct at 78-90 Old Canterbury Road, Lewisham.

The present report assesses the current value of the subject site as habitat for flora and fauna. It also predicts the impacts of the proposed development on the status of listed threatened species and populations, and migratory species, and proposes measures for minimising or avoiding those impacts.

S2 METHOD OF ASSESSMENT

Existing literature relevant to the study area, in particular technical environmental reports produced by DECCW, other consultancies and Marrackville and Leichhardt Councils, 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).

A diurnal survey of flora and fauna species, and their habitats, on and adjacent to the subject site was conducted from 0830 to 1515 hrs on 20 July 2009. Nocturnal surveys (spotlighting for mammals and birds, anabat surveys) were conducted on three successive evenings (20-22 July 2009), from 1830 to 2130 hrs. Hair-tubes and remote motion sensor cameras were used on the subject site and adjacent areas for 14 successive days and nights (20 July to 3 August 2009). These survey efforts and techniques are in accordance with the *DECC 'Threatened Species Assessment Guidelines 2007'.*

S3 FLORA AND THEIR HABITATS

The natural environment of the subject site consists of poorly-maintained landscaped gardens that are dominated largely by exotic plants and cultivars. Thirty-two (32) species and varieties were recorded, comprising 28 exotic species (87.5% of total plant species/varieties), two locally native species (6.3%), one cosmopolitan species (3.1%), and one non locally-native species (3.1%). Fifteen (15) plant species (53.8% of the exotic species on the subject site) are invasive weed species. These include Fishbone Fern (*Nephrolepis cordifolia*), Crofton Weed (*Ageritina adenophora*), Balloon Vine (*Cardiospermum grandiflorum*) and Wandering Jew (*Tradescantia fluminensis*).

No threatened plant species or populations, or endangered ecological communities, listed under the schedules of the *Threatened Species Conservation Act, 1995* (TSC Act) or *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) were detected on or adjacent to the subject site.

S4 FAUNA AND THEIR HABITATS

Seventeen (17) fauna species (two reptile species, 10 bird species and five mammal species) were recorded on the subject sit. All of these species are common urban-generalist species that have a widespread distribution throughout the Sydney metropolitan area. Six fauna species (35.3% of the total number of species observed) are exotic species, whereas the other 11 species (64.7%) are native species.

Twelve threatened fauna species, listed under the schedules of the TSC and/or EPBC Acts have been recorded within a 5 km radius of the subject site. Two of these species, the Eastern Bentwing-bat (*Miniopterus schebersii oceanensis*) and Large-footed Mouse-eared Bat (*Myotis adversus*) may potentially roost in the roofs or between walls in buildings on the subject site. However, neither of these species was recorded on the subject site, despite targeted surveys for them. Grey-headed Flying-foxes (*Pteropus poliocephalus*) may occasionally fly over the subject site, but there are no favoured food trees of this species on the site. The subject site is roughly equidistant between the three known Grey-headed Lying-fox roost and maternity camps (Royal Botanic Gardens in Sydney CBD, the Ku-ring-gai Flying-fox Reserve in Gordon, and along Camden Creek in Camden). It is only likely to be used very occasionally as a resting spot for Grey-headed Flying-foxes *en route* between camps and usual foraging grounds. Seven-part Tests of Significance concluded that the proposed development would not significantly impact on the status of these species or their habitats.

Individuals belonging to the Endangered Inner Western Population of Long-nosed Bandicoots, *Perameles nasuta* (listed under the TSC Act) are known from other studies to use the rail freight corridor adjacent to the subject site and other nearby areas. Long-nosed Bandicoots could potentially den under buildings and forage in landscaped areas on the subject site. However, none were detected on the subject site or in adjacent rail corridor areas, despite targeted surveys for them (use of remote motion-sensor cameras and baited hair-tubes, spotlighting at night and searches under buildings by day). No bandicoot diggings or scats were observed in landscaped areas or under buildings within the subject site. It is unlikely that the bandicoots use the subject site because high brick walls and cyclone fencing occurs around the site's boundaries. There were no holes in the boundary fences that bandicoots could use to enter the subject site and there were no signs of bandicoots burrowing under the fences. The proposed development is unlikely to impact significantly on the endangered Long-nosed Bandicoot population and its habitat provided that the recommendations listed below are implemented.

The Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) are migratory species listed under the EPBC Act that may occasionally forage within the canopy in treed areas of the subject site, but these species are likely to be, at best, very occasional vagrants to the site. Latham's Snipe (*Gallinago hardwicki*) may very occasionally forage in grassed or weedy boundary 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. Therefore, the proposed development will not significantly impact on the status of these species or their habitats.

S5 ECOLOGICAL RECOMMENDATIONS

S5.1 Avoiding Potential Impacts on Long-nosed Bandicoots

The Long-nosed Bandicoot is unlikely to currently occur on the subject site. However, as a precaution, the following measures should be implemented:

- construction workers on the subject site should be instructed as part of their worksite induction program about the importance of the site and the surrounding landscape as potential habitat for the inner western Sydney Population of the Long-nosed Bandicoot. The induction program should ensure that workers are able to identify Long-nosed Bandicoots and indirect signs of their activity, areas within and adjacent to the subject site that are potential habitat for this species, and know what actions to take in the event of a Long-nosed Bandicoot occurring on the site during the pre-construction and construction periods.

- just prior to demolition or construction activities, the subject site (including under buildings and landscaped areas) should be checked by an appropriately qualified and experienced ecologist for signs of occupancy of the site by bandicoots;

- bandicoot-proof fencing should be erected around the entire perimeter of the subject site once the qualified ecologist is satisfied that there are no Long-nosed Bandicoots on the subject site.

- if Long-nosed Bandicoots are found on the subject site just prior or during construction, then construction must stop and the landowner must contact the Department of Planning and the Department of Environment (DoP), Climate Change and Water (DECCW) immediately about the best course of action to take to prevent injury or mortality to individual bandicoots; and

- pet cats and dogs (potential predators of Long-nosed Bandicoots) should be prohibited from the subject site during the construction and post-construction periods.

S5.2 Avoiding Potential Impacts on Threatened Bat Species

The roof and internal spaces between walls of the buildings on the subject site should be checked for the presence of roosting bat species immediately prior to the demolition of the buildings. These inspections must be carried out by an appropriately qualified and experienced ecologist, who would be responsible for evacuating any bats from the buildings on site prior the buildings' demolition.

S5.3 General Mitigation Measures

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.

CONTENTS

1

INTRODUCTION

1.1 INTRODUCTION

The purpose of this report is to provide a flora and fauna assessment of the potential impacts of the proposed commercial, retail and residential development of the existing industrial site at 72-90 Old Canterbury Road, Lewisham ("the subject site") in the Marrickville Local Government Area (Marrickville 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 and Fauna

The EA shall address impacts on flora and fauna, including threatened species, populations, and endangered ecological communities and their habitats, and steps take to mitigate any identified impacts to protect the environment, both marine and land in accordance with DECC 'Threatened Species Assessment Guidelines 2007'.

"In this regard, the EA shall include a detailed survey (using a variety of survey methods by a suitably qualified person) of the endangered Long-nosed Bandicoot population which occurs in this area, and determine whether and how they are using the site and adjoining areas, and assess any potential impact or threat on the population."

The flora and fauna assessment:

- identifies key flora and fauna habitats within the subject site;
- reviews flora and fauna literature and databases relevant to the subject site;
- describes the methodology and results of the flora and fauna surveys;
- addresses potential impacts on flora and 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.

1.2 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

1.2.1 Existing Conditions

The subject site is approximately 13,000 m² (1.3 ha) in area, and is currently zoned 4(b) Light Industrial, with several warehouse facilities and a large open bitumen area occurring there. Vegetated areas on the subject site are narrow areas restricted largely to perimeter areas of the site, and consist largely of lawned areas with scattered trees and bushes.

The subject site is bounded to the north, south and east by residential housing (allotments contain small garden areas) and to the west by Old Canterbury Road. On the western side of Old Canterbury Road is a mix of commercial and residential development. The subject site is near the intersection of the Western Sydney freight rail line (which occurs along the western boundary of the subject site) and the Western Sydney passenger rail line (which occurs about 200m to the north of the subject site). The Department of Environment, Climate Change and Water (DECCW) has identified both of these rail lines as potential dispersal corridors for individuals of the endangered western Sydney population of the Long-nosed Bandicoot.

1.2.2 Proposed Development

Approval is sought for a Concept Plan for a Major Project comprising a mixed-use development for residential, commercial and retail land uses over basement car parking, generally in accordance with the building envelopes, floor space ratio (FSR) and land uses as illustrated on the plans prepared by Tony Owen Partners. The concept plan is for building's ranging in height from 4 to 9 storeys with a maximum FSR of 3.5:1. Public domain improvements include the creation of new streets, open space areas and pedestrian access points. The subject site and proposed concept plan is located on the northern portion of the McGill Street Precinct at 78-90 Old Canterbury Road, Lewisham.

1.3 STATUTORY FRAMEWORK

1.3.1 NSW Legislation

Section 78A of the *Environmental Planning and Assessment Act, 1979* (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.

Figure 1 **PROPOSED MASTER PLAN**

12.4_SUBJECT SITE MASTER PLAN

LAND USE DIAGRAM

Mixed use area predominantly residential with ground floor and lower level retail and commercial space

Concentration of retail to the north to address Lewisham Station and the major pedestrian route to the Greenway. Concentration of commercial space to the south to reinforce existing commercial patterns

Lower level retail allows for communal open space above. Level changes on site allow retail to be on grade in the centre of the site and beneath ground level at the perimeter of the site

Ground floor shop – top housing at the northern end of Old Canterbury Road to activate the streetscape

Ground floor home office at the southern end of Old Cantebury Road to activate the streetscape.

GREENWAY

OPEN SPACE

LIGHT RAIL STATION

MIXED USE WITH GROUND FLOOR COMMERCIAL RESIDENTIAL ABOVE

MIXED USE WITH GROUND FLOOR RETAIL/ COMMERCIAL + RESIDENTIAL ABOVE

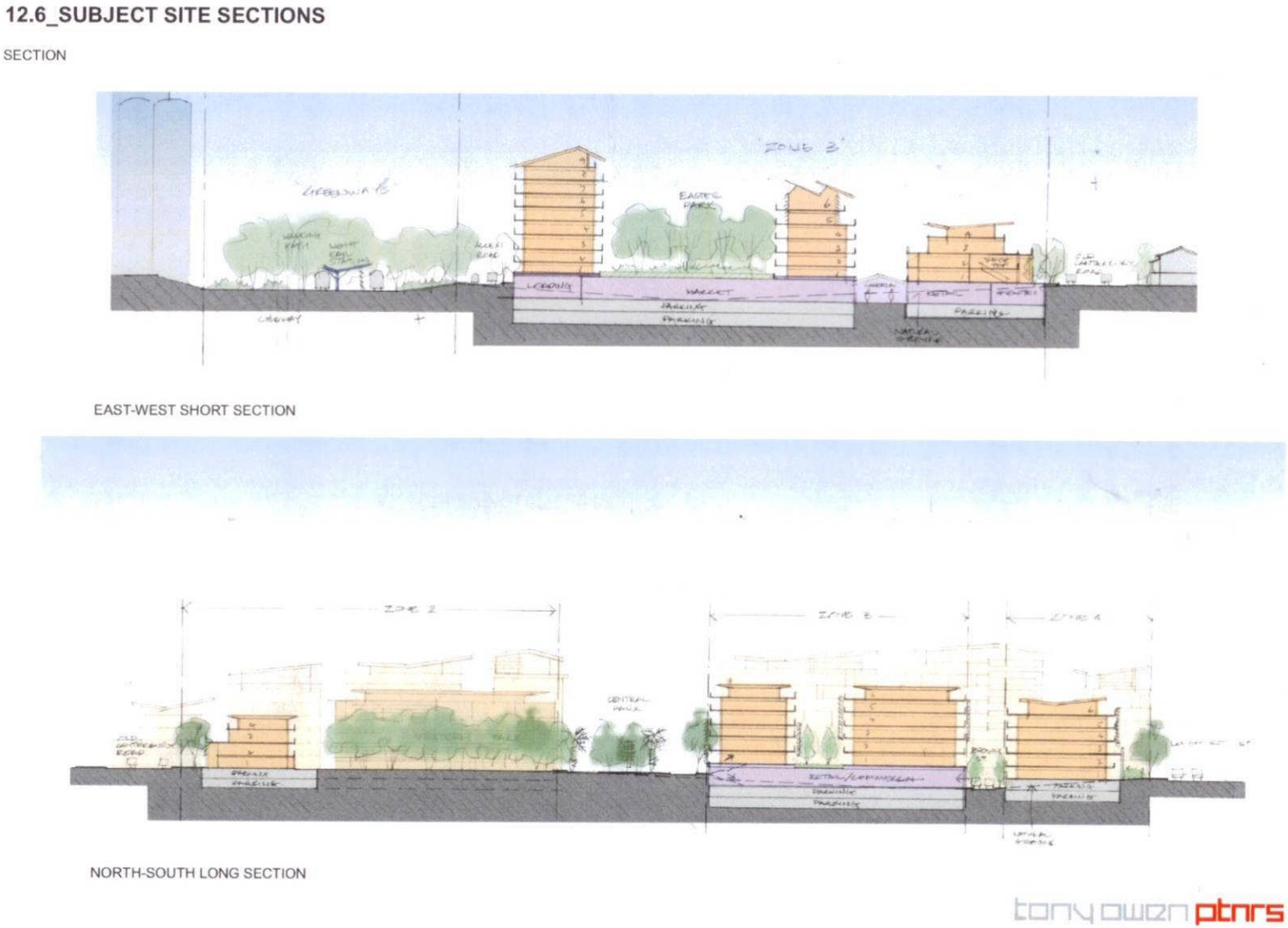
MIXED USE RESIDENTIAL WITH BASEMENT RETAIL

RESIDENTIAL

MIXED USE RESIDENTIAL WITH GROUND FLOOR LIVE/WORK

tony owen ptnrs

Figure 2 **CONCEPT DRAWINGS OF PROPOSED DEVELOPMENT**



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.

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 flora and 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 flora and 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 flora and 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 flora and fauna species and populations that would be potentially impacted by the proposed development.

2

METHODOLOGY

2.1 OVERVIEW

Flora and 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 Marrackville and Leichhardt Councils, 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 flora and fauna species and populations, listed under the schedules of the TSC and EPBC Acts and species of regional conservation significance, were obtained from databases for the Marrickville and Leichhardt LGAs. The databases searched were:

- DECCW Wildlife Atlas Database;
- Rare or Threatened Australian Plants Database (RoTAP), National Herbarium, Royal Botanic Gardens, Sydney)
- 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 km^2 recording grid.

2.3 TAXONOMY

Robinson (1991), Lord & Willis (1999), Lamp *et al*. (2001) and Richardson *et al.* (2007) and Pellow *et al*. (2009) assisted in the identification of plant species on the subject site.

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);
- reptiles – Cogger (2000), Cronin (2001), Swan *et al*. (2004); and
- Scats, diggings, animal tracks and markings – Triggs (1996)

2.4 FIELD SURVEYS

2.4.1 Overview

A diurnal survey of flora and fauna species, and their habitats, on and adjacent to the subject site was conducted from 0830 to 1515 hrs on 20 July 2009.

Nocturnal surveys (spotlighting for mammals and birds, anabat surveys) were conducted on three successive evenings (20-22 July 2009), from 1830 to 2130 hrs.

Hair-tubes and remote motion sensor cameras were used on the subject site and adjacent areas for 14 successive days and nights (20 July to 3 August 2009).

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 Flora Survey and Assessment

During the site inspection, a flora species list was compiled, and the distribution and overall condition of vegetation communities and other habitats were documented.

Vegetated areas were limited to the perimeter areas of the subject site and consisted of lawned areas, with landscape trees planted along the northern, western and southern boundaries of the site. Tree and shrub species were identified while traversing the boundary areas where they occurred. Grass and herb species were recorded in two 5 x 5 metre and four 2 x 5 metre flora quadrats within landscaped sections of the subject site.

2.4.3 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, presence of 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 subject site as movement corridors for fauna, especially birds and mammals (e.g. the Long-nosed Bandicoot, microchiropteran bats) & amphibians.

(b) Fauna Survey

A summary of the fauna survey techniques and effort for the survey period is shown in Table 2.1.

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 considered likely to occur on the subject site 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.

Table 2.1 **FAUNA SURVEY TECHNIQUES AND SURVEY EFFORT AT SUBJECT SITE, 20 JULY – 3 AUGUST 2009**

FAUNA GROUP TARGETED	SURVEY TECHNIQUE	SURVEY EFFORT
Reptiles	Use of reptile funnel traps: 4 funnels used for 3 days (20-22 July 2009).	12 trap days.
	Active search during walk through subject site.	3 person hours
	Incidental surveys.	30 person hours
Nocturnal birds (Powerful, Sooty, Masked, Barking, Boobook & Barn Owls, Tawny Frogmouth, Owlet Nightjar)	Spotlighting/taped playback of calls (nocturnal surveys).	3 hrs/night for 3 nights: 9 person hours
	Incidental surveys of signs of presence of owls (e.g. owl pellets at base of trees).	3 person hours
Other bird species	Incidental surveys.	8 person hours
Bats	Ultrasonic bat detection (one held-held Anabat II bat detector used during nocturnal surveys).	3 hrs/night for 3 nights: 9 person hours
	Stationary Anabat detector	1 sampling site throughout 3 nights.
Arboreal and ground-dwelling mammals	Spotlighting (nocturnal surveys)	3 hrs/night for 3 nights: 9 person hours.
	Incidental surveys of signs of presence of mammals (e.g. scats, diggings, tree scratchings).	6 person hours.
	Use of hair-tube funnels: 16 hair-tubes used (12 on site; four in freight rail corridor) for 14 nights (20 July to 3 August 2009).	224 trap nights.
	Use of remote-sensor cameras: 6 cameras (four on site; two in freight rail corridor) used for 14 nights (20 July to 3 August 2009)	64 camera nights.

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 20 July 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 compone*nt". 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
Eucalyptus albens	White Box
Eucalyptus camaldulensis	River Red Gum
Eucalyptus haemastoma	Broad-leaved Scribbly Gum
Eucalyptus microcorys	Tallowwood
Eucalyptus populnea	Bimble Box
Eucalyptus punctata	Grey Gum
Eucalyptus robusta	Swamp Mahogany
Eucalyptus signata	Scribbly Gum
Eucalyptus tereticornis	Forest Red Gum
Eucalyptus viminalis	Ribbon Gum

3

RESULTS

3.1 OVERVIEW

This chapter describes the native flora and 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 FLORA

3.2.1 Flora Species Recorded on Subject Site

The natural environment of the subject site consists of poorly-maintained landscaped gardens that are dominated largely by exotic plants and cultivars. Plant species and cultivated varieties that were recorded on the subject site are listed in Table 3.1.

A total of 32 species and varieties were recorded, comprising 28 exotic species (87.5% of total plant species/varieties), two locally native species (6.3%), one cosmopolitan species (3.1%), and one non locally-native species (3.1%).

Fifteen (15) plant species (53.8% of the exotic species on the subject site) are invasive weed species. These include Fishbone Fern (*Nephrolepis cordifolia*), Crofton Weed (*Ageritina adenophora*), Balloon Vine (*Cardiospermum grandiflorum*) and Wandering Jew (*Tradescantia fluminensis*).

Table 3.1 **FLORA SPECIES RECORDED ON SUBJECT SITE**

Legend:
* locally-native species; **Australian species not local to the Marrickville LGA; *** non-weedy exotic species; **** invasive weed species; # cultivar

PLANT FAMILY	SCIENTIFIC NAME	COMMON NAME
FERNS & ALLIES		
Dryopteridaceae	*Nephrolepis cordifolia* ****	Fishbone Fern
DICOTS		
Apocynaceae	*Nerium oleander* ***	Dwarf Oleander
Asteraceae	*Ageratina adenophora* ****	Crofton Weed
Asteraceae	*Bidens pilosa* ****	Cobbler's Pegs
Asteraceae	*Delairea odorata* ****	Cape Ivy
Asteraceae	*Sonchus oleraceus* ****	Sow Thistle
Basellaceae	*Anredera cordifolia* ****	Madeira Vine
Fabaceae	*Senna pendula* ****	Cassia
Fabaceae	*Wisteria sinensis* ***	Wisteria
Moraceae	*Ficus elastica* ****	Rubber Tree
Myrtaceae	*Callistemon sp.* #	Bottlebrush sp.

PLANT FAMILY	SCIENTIFIC NAME	COMMON NAME
Nyctaginaceae	*Bougainvillea sp.* ***	Bougainvillea
Oleaceae	*Ligustrum lucidum* ****	Large-leaved Privet
Plantaginaceae	*Plantago major* ****	Greater Plantain
Rhamnaceae	*Coleonema sp.* ***	Diosma
Rosaceae	*Cotoneaster sp.* ***	Cotoneaster
Rosaceae	*Rosa sp.* ***	Rose
Rosaceae	*Rosia sp.* ***	Climbing Rose
Sapindaceae	*Cardiospermum grandflorum* ****	Balloon Vine
Theaceae	*Camellia japonica* ***	Camellia
MONOCOTS		
Araceae	*Monstera deliciosa* ***	Fruit Salad Plant
Araceae	*Philodendron "Xanadu"* ***	Philodendron
Arecaceae	*Chamaedorea elegans* ***	Parlour Palm
Arecaceae	*Dypsis lutescens* ***	Golden Cane Palm
Arecaceae	*Livistona australis* *	Cabbage Tree Palm
Arecaceae	*Phoenix sp.* ***	Dwarf Date Palm
Commelinaceae	*Commelina cyanea* ***	Scurvey Weed
Commelinaceae	*Tradescantia fluminensis* ****	Wandering Jew
Liliaceae	*Asparagus aethiopicus* ****	Asparagus Fern
Poaceae	*Pennisetum clandestinum* ****	Kikuyu
Poaceae	*Cynodon dactylon***	Couch
Poaceae	*Panicum repens* ***	Panicum

3.2.2 Endangered Ecological Communities

One Endangered Ecological Community, Sydney-Turpentine Ironbark Forest (STIF), has been recorded in the Marrickville LGA. This does not occur on the subject site.

3.2.3 Threatened Flora Species

The following threatened flora species have been recorded in the Marrickville LGA:

- Thick Lip Spider Orchid (*Caladenia tesselata*) (listed as Vulnerable under both the EPBC and TSC Acts)
- Deane's Melaleuca (*Melaleuca deanei*) (listed as Vulnerable under the TSC Act).
- Hairy Geebung (*Persoonia hirsuta*) (listed as Endangered under the TSC Act).

None of these species occurs on the subject site.

3.2.4 Threatened Flora Populations

No threatened flora populations occur within the Marrickville LGA and, thus, do not occur on the subject site.

3.3 FAUNA HABITATS

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

- Treed (landscaped) areas;
- Lawn/grassy areas; and
- Buildings and car park areas.

Each of these habitats is discussed in detail below.

(a) Treed Areas (Plates 1 & 2)

Occurrence: Along the southern and western boundaries of the subject site..

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

A moderate amount of leaf litter and fallen timber (branches and twigs) under and around individual trees provide potential foraging habitat for ground-foraging birds (e.g. fairy-wrens and firetail finches) and mammals (e.g. rats) and shelter and refuge areas for reptiles (e.g. skinks and geckoes).

The rail corridors to the west and north of the subject site are likely to be used by fauna as wildlife corridors through the urban landscape (Plate 3). The subject site is unlikely to be part of this corridor because of its industrial nature, lack of natural habitats, and because high brick walls and security fencing occur around the entire boundary of the site.

(b) Landscaped Area/Grassland/Cleared Land (Plate 4)

Occurrence: North-eastern corner of subject site (east of the car park).

Habitat Elements: Grassed areas of the subject site provide potential foraging habitat for common ground-foraging bird species, such as Masked Lapwings (*Vanellus miles*), Sulphur-crested Cockatoos (*Cacatua galerita*), Galahs (*Cacatua roseicapilla*), Australian Ravens (*Corvus coronoides*), Magpie-larks (*Grallina cyanoleuca*) and Australian Magpies (*Gymnorhina tibicen*).

Disturbance: Artificially created habitats with low native biodiversity value. Weeds and exotic grasses dominate these grassy areas as a result of dumped soils and other fill material (Plate 4).

(c) Buildings and Car Park Area (Plate 6)

The inside areas of buildings (e.g. warehouses) provide potential foraging and shelter areas for exotic rodents (rats and mice) and possums. They also provide potential shelter and nesting areas for some bird species e.g. Feral Pigeons (*Columba livia*), Welcome Swallows (*Hirundo neoxena*), House Sparrows (*Passer domesticus*) and Common Starlings (*Sturnus vulgaris*).

Outside walls provide potential foraging and basking habitat for common skinks and geckoes.

Plate 1 Treed Area Along the Western Boundary of the Subject Site

Plate 2 Treed Area Along the Southern Boundary of the Subject Site

Plate 3 Freight Rail Corridor Near Western Boundary of Subject Site

Plate 4 Grassed Area in North-eastern Corner of Subject Site (North of Car Park).

Plate 5 View From Old Canterbury Road of Buildings on Subject Site

Plate 6 Feral Cat (*Felis catus*) Detected on Subject Site by Remote Motion-sensor Camera.

3.4 FAUNA

3.4.1 Fauna Recorded on Subject Site

Seventeen (17) fauna species (two reptile species, 10 bird species and five mammal species) were recorded on the subject site (Table 3.2). All of these species are common urban-generalist species that have a widespread distribution throughout the Sydney metropolitan area. Six fauna species (35.3% of the total number of species observed) are exotic species, whereas the other 11 species (64.7%) are native species.

The Feral Cat (*Felis catus*) was the only species recorded on the subject site and in the adjoining freight rail corridor by the remote motion-sensor cameras (e.g. Plate 6).

Table 3.2 **FAUNA SPECIES RECORDED ON THE SUBJECT SITE, 20 JULY TO 3 AUGUST 2009**

Methods of Detection:

A: Anabat detection.
Ca: Remote motion-sensor camera.
Ht: Hair-tube
RF: Reptile Funnel
C: Call identification.
O: Observation.
Sc: Scat, track or sign.
Sp: Spotlighting

Family	Scientific Name	Common Name	Methods of Detection
REPTILES			
Scincidae	*Lampropholis guichenoti*	Grass Sun-skink	RF, O
	Eulamprus quoyi	Eastern Water Skink	O
BIRDS			
Columbidae	*Streptopelia chinensis* *	Spotted Turtledove	O, C
	Ocyphaps lophotes	Crested Pigeon	O
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet	O, C
Meliphagidae	*Manorina melanocephala*	Noisy Miner	O, C
	Anthochaera carunculata	Red Wattlebird	O, C
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	O
	Strepera graculina	Pied Currawong	O, C
	Gymnorhina tibicen	Australian Magpie	O, C
Sturnidae	*Acridotheris tristis* *	Indian Mynah	O, C
	Sturnus vulgaris *	Common Starling	O, C
MAMMALS			
Phalangeridae	*Trichosurus vulpecula*	Brushtail Possum	Sp
Muridae	*Mus musculus* *	House Mouse	Ht, O
	Rattus rattus *	Black Rat	Ht, Sc
Felidae	*Felis catus* *	Cat	Ht, O, Sp, Ca
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	An

3.4.2 Threatened Fauna Species

No threatened fauna species were recorded on the subject site. Threatened species that have been recorded within a 5 km radius of the subject site are shown in Figure 3.

There are no aquatic or marine habitats on the subject site. Terrestrial threatened fauna species that have been recorded within a 5 km radius of the subject site (Figure 5) include:

- Green and Golden Bell Frog (*Litoria aurea*) (listed as Endangered under the TSC Act and Vulnerable under the EPBC Act);
- Glossy Black-Cockatoo (*Calyptorhynchus lathamus*) (listed as Vulnerable under the TSC Act);
- Turquoise Parrot (*Neophema pulchella*) (listed as Vulnerable under the TSC Act);
- Superb Fruit-Dove (*Ptilinopus superbus*) (listed as Vulnerable under the TSC Act)
- Powerful Owl (*Ninox strenua*) (listed as Vulnerable under the TSC Act);
- Masked Owl (*Tyto novaehollandiae*) (listed as Vulnerable under the TSC Act);
- Regent Honeyeater (*Anthochaera phrygia*) (listed as Endangered under both the EPBC and TSC Acts);
- Diamond Firetail (*Stagonopleura guttata*) (listed as Vulnerable under both the TSC and EPBC Acts);
- Spotted-tailed (Eastern) Quoll (*Dasyurus maculatus*) (listed as Vulnerable under both the TSC and EPBC Acts);
- Grey-headed Flying-fox (*Pteropus policephalus*) (listed as Vulnerable under both the EPBC and TSC Acts);
- Eastern Bentwing-bat (*Miniopterus schreibersii*) (listed as Vulnerable under the TSC Act); and
- Large-footed Mouse-eared Bat (*Myotis adversus*) (listed as Vulnerable under the TSC Act).

There is no significant habitat for the Green and Golden Bell Frog, Glossy Black-Cockatoo, Superb Fruit-Dove, Regent Honeyeater or Diamond Firetail on the subject site. Therefore, the status' of these species will not be impacted by the proposed development. The urbanised nature of the subject site and the surrounding landscape suggests that the Spotted-tailed Quoll is also unlikely to use the subject site.

Extremely marginal habitat occurs on the subject site for the Turquoise Parrot, Powerful Owl and Masked Owl. The Turquoise Parrot is, at most, a potential vagrant that would rarely occur on the subject site, and would only do so to feed on the seeds of grasses and weeds in grassy areas of the site. No owls were recorded on the subject site, despite targeted surveys for them over a three-night period, so are unlikely to occur there. There are no potential nesting or roosting sites for Powerful or Masked Owls on the subject site. However, Powerful and Masked Owls may occasionally occur on the site in search for potential prey items (Powerful Owls prey largely on arboreal mammals, e.g. possums and gliders; Masked Owls prey largely on ground-dwelling mammals such as rodents, and rabbits, and birds).

Buildings on the subject site are potential roost sites for Eastern Bentwing-bats and Large-footed Mouse-eared Bats. Neither of these species was recorded on the subject site, despite targeted surveys for them. Grey-headed Flying-foxes may occasionally fly over the subject site, but there are no favoured food trees of this species on the site. The subject site is roughly equidistant between the three known Grey-headed Lying-fox roost and maternity camps (Royal Botanic Gardens in Sydney CBD, the Ku-ring-gai Flying-fox Reserve in Gordon, and along Camden Creek in Camden). It is

only likely to be used very occasionally as a resting spot for Grey-headed Flying-foxes *en route* between camps and usual foraging grounds.

The potential impacts of the proposed development on the status of the Turquoise Parrot, Powerful Owl, Masked Owl, Grey-headed Flying-fox, Eastern Bentwing-bat and Large-footed Mouse-eared Bat, and their habitats, are discussed in detail in Chapter 4 and in Appendix A (Seven-part Tests of Significance).

3.4.3 Threatened Fauna Populations

One threatened fauna population listed under the TSC Act, the Inner Western Sydney Population of the Long-nosed Bandicoot (*Perameles nasuta*), occurs within a 5 km radius of the subject site.

In 2002, a Long-nosed Bandicoot was trapped in the backyard of a house on New Canterbury Road, Dulwich Hill. Since then seven dead Long-nosed Bandicoots have been reported in the vicinity; six from an area that includes the suburbs of Dulwich Hill, Lewisham and Marrickville, and a single bandicoot from the suburb of Five Dock. Seven live animals have also been confirmed in the suburbs of Dulwich Hill and Lewisham, including two individuals which were radio-tracked by ecologists. The newly discovered population in inner western Sydney is disjunct from the nearest records of the Long-nosed Bandicoot, which occur north of the Parramatta River or much further south at the Holsworthy Military Reserve. The exact area occupied by this population is not yet clearly understood by government authorities, but the known locations within the locality (Leary *et al*., in press) are shown in Figure 4.

Long-nosed Bandicoots in inner western Sydney shelter under older houses and buildings mostly, and forage in parkland and backyards. The closest known locations of the Long-nosed Bandicoot in relation to the subject site are:

- within the freight rail corridor along the site's eastern boundary (about 400 metres south of the subject site); and
- at the intersection of the freight rail line and passenger line corridors, about 250 metres north of the subject site).

Long-nosed Bandicoots could potentially den under buildings and forage in landscaped areas on the subject site. However, no Long-nosed Bandicoots were detected on the subject site or in adjacent rail corridor areas, despite targeted surveys for them (use of remote motion-sensor cameras and baited hair-tubes, spotlighting at night and searches under buildings by day). No bandicoot diggings or scats were observed in landscaped areas or under buildings within the subject site. It is unlikely that the bandicoots use the subject site because high brick walls and cyclone fencing occurs around the site's boundaries. There were no holes in the boundary fences that bandicoots could use to enter the subject site and there were no signs of bandicoots burrowing under the fences.

The potential impacts of the proposed development on the status of the Long-nosed Bandicoot Population of Inner Western Sydney, and its habitat, are discussed in detail in Chapter 4 and in Appendix A (Seven-part Tests of Significance).

Figure 3 **THREATENED FAUNA RECORDS WITHIN 5 KM RADIUS OF SUBJECT SITE**

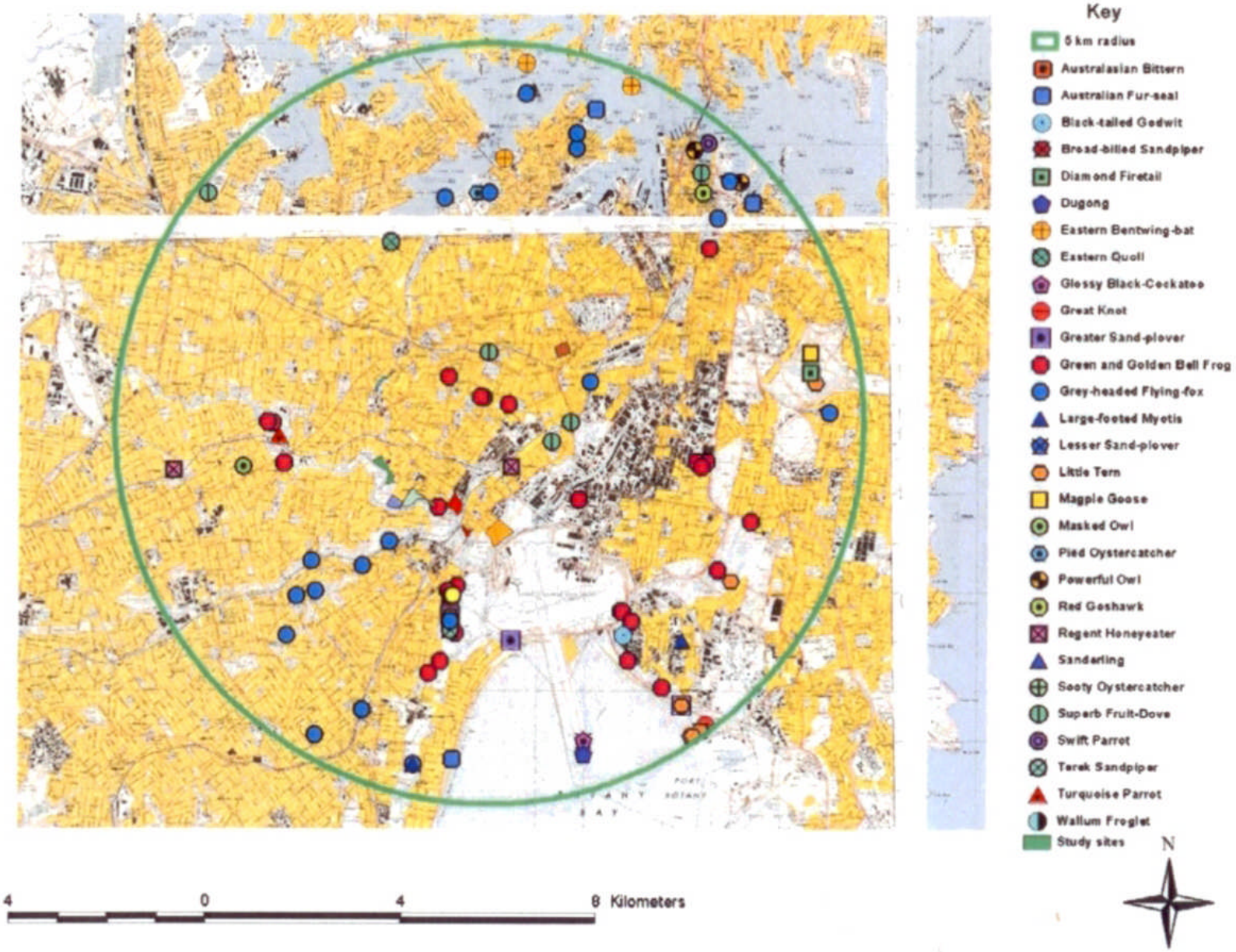
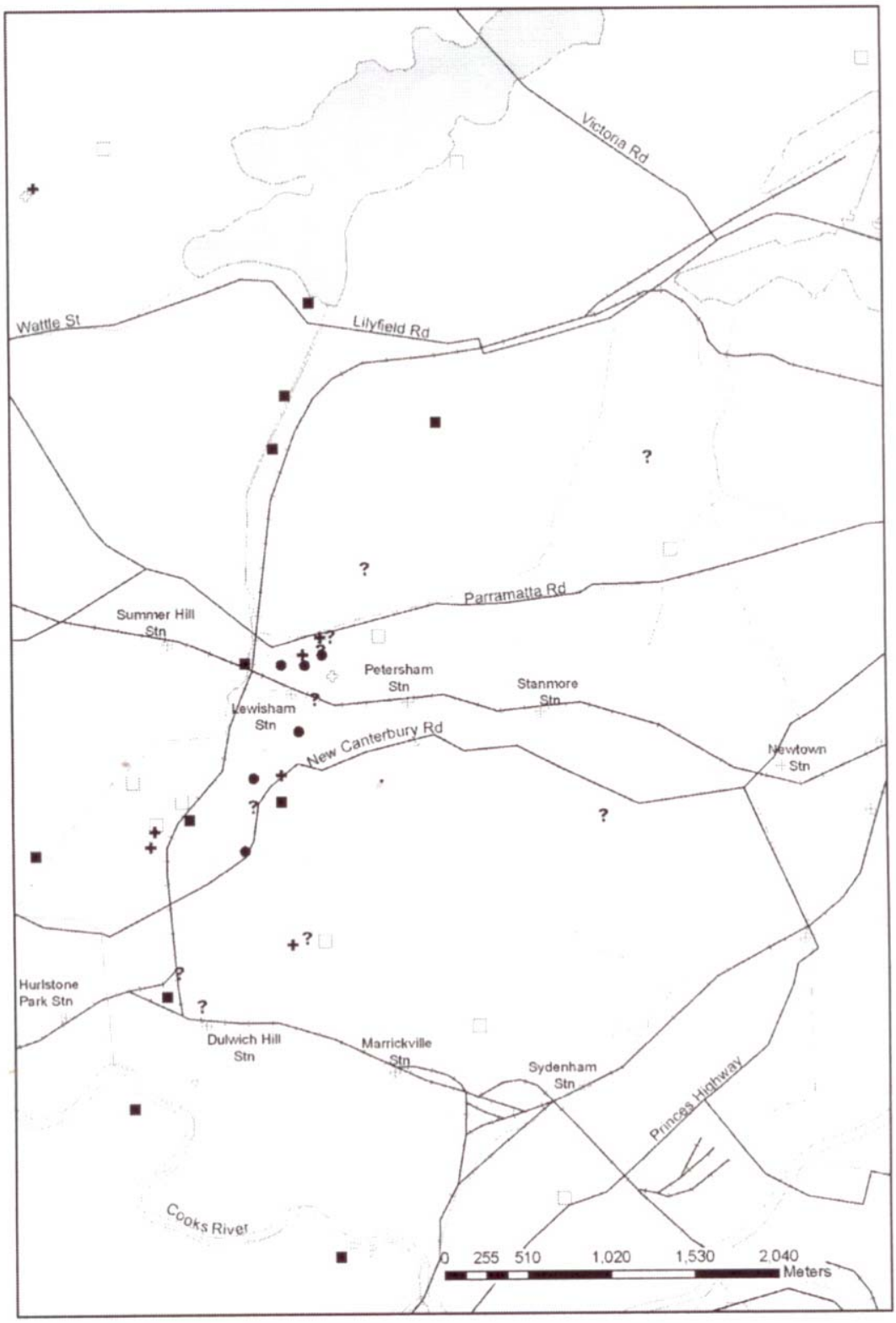


Figure 4 KNOWN SIGHTINGS OF LONG-NOSED BANDICOOTS WITHIN THE LOCALITY (FIGURE 3 OF LEARY *ET AL.*, IN PRESS)

Solid circles = trapped or radio-tracked individuals; crosses = bandicoot carcasses; squares = parks where possible bandicoot diggings occur; question marks = unconfirmed sightings made by members of the general public.



3.4.4 Regionally-significant Fauna Species

Fauna species that are considered rare in the inner western suburbs of Sydney and which have been recorded in the locality include the Lace Monitor (*Varanus varius*), Diamond Python (*Morelia spilota* ssp. *spilota*), Black Swan (*Cygnus atratus*), Striated Heron (*Butoroides striatus*), White-bellied Sea-eagle (*Haliaeetus leucogaster*), Whistling Kite (*Haliastus sphenurus*), Pheasant Coucal (*Centropus phasianus*) and Fuscous Honeyeater (*Lichenostomus fuscus*).

No regionally-significant species were observed on the subject site during the field surveys. The Pheasant Coucal and Fuscous Honeyeater are the only two regionally-significant species that may occasionally occur on the subject site, but the site is a negligible amount of marginal habitat for these species.

3.4.5 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 Bird Agreement (ROKAMBA) are listed under the schedules of the EPBC Act.

The Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) may occasionally forage within the canopy in treed areas of the subject site, but these species are likely to be, at best, very occasional vagrants to the site. Latham's Snipe (*Gallinago hardwicki*) may very occasionally forage in grassed or weedy boundary 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.

3.5 KOALA HABITAT ASSESSMENT

There are no known records of Koalas occurring on the subject site or in the nearby rail corridors. 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; and
- impacts on threatened biota and migratory species.

Each of these impacts already exists 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 onto 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 subject site is only 1.3 ha in area and provides habitat for flora and fauna species that are urban-generalists and widespread throughout the Sydney Basin Bioregion. Therefore, removal or

modification of habitat on the subject site as a result of the proposed development is unlikely to result in the loss of biodiversity at a local, regional, state or national level.

4.2.2 Impacts on Wildlife Corridor

The subject site is not part of a wildlife corridor. The proposed development will not fragment, clear or degrade habitat within the freight and passenger rail lines adjacent or near to the subject site. These rail corridors are the major wildlife corridors through the inner western suburbs of Sydney.

4.2.3 Impacts on Threatened Biota

No threatened flora species or populations, or endangered ecological communities, occur on or adjacent to the subject site. Therefore the proposed development will not impact on the status of these biota or their habitats.

Seven-part tests for the Inner Western Sydney Population of the Long-nosed Bandicoot, the Turquoise Parrot, Masked Owl, Powerful Owl, Grey-headed Flying-fox, Eastern Bentwing-bat and Large-footed Mouse-eared Bat (Appendix A) concluded that the proposed development would not significantly impact on threatened fauna or their habitats provided that the recommendations listed in Section 4.3 of the present report are implemented. Therefore, Species Impact Statements are not required for these biota.

One nationally vulnerable fauna species, the Grey-headed Flying-fox, may potentially use the treed areas of the subject site for resting when travelling between roost camps and foraging areas. 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 Swift Parrot and Regent Honeyeater may occasionally forage within the canopy in treed areas of the subject site, but these species are likely to be, at best, very occasional vagrants to the site. Latham's Snipe may very occasionally forage in grassed or weedy boundary 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 or their habitats.

4.3 RECOMMENDATIONS

4.3.1 Avoiding Potential Impacts on Long-nosed Bandicoots

The Long-nosed Bandicoot is unlikely to currently occur on the subject site. However, as a precaution, the following measures should be implemented:

- construction workers on the subject site should be instructed as part of their worksite induction program about the importance of the site and the surrounding landscape as potential habitat for the inner western Sydney Population of the Long-nosed Bandicoot. The induction program should ensure that workers are able to identify Long-nosed Bandicoots and indirect signs of their activity, areas within and adjacent to the subject site that are potential habitat for this species, and know what actions to take in the event of a Long-nosed Bandicoot occurring on the site during the pre-construction and construction periods.

- just prior to demolition or construction activities, the subject site (including under buildings and landscaped areas) should be checked by an appropriately qualified and experienced ecologist for signs of occupancy of the site by bandicoots;

- bandicoot-proof fencing should be erected around the entire perimeter of the subject site once the qualified ecologist is satisfied that there are no Long-nosed Bandicoots on the subject site.

- if Long-nosed Bandicoots are found on the subject site just prior or during construction, then construction must stop and the landowner must contact the Department of Planning and the Department of Environment (DoP), Climate Change and Water (DECCW) immediately about the best course of action to take to prevent injury or mortality to individual bandicoots; and

- pet cats and dogs (potential predators of Long-nosed Bandicoots) should be prohibited from the subject site during the construction and post-construction periods.

4.3.2 Avoiding Potential Impacts on Threatened Bat Species

The roof and internal spaces between walls of the buildings on the subject site should be checked for the presence of roosting bat species immediately prior to the demolition of the buildings. These inspections must be carried out by an appropriately qualified and experienced ecologist, who

would be responsible for evacuating any bats from the buildings on site prior the buildings' demolition.

4.3.3 General Mitigation Measures

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.

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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 development at 72-90 Old Canterbury Road, Lewisham..

Birds:

- Turquoise Parrot (*Neophema pulchella*);
- Powerful Owl (*Ninox strenua*);
- Masked Owl (*Tyto novaehollandiae*)

Endangered Fauna Populations

- Inner Western Sydney Population of the Long-nosed Bandicoot

Bats:

- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Eastern Bentwing-bat (*Miniopterus schreibersii*); and
- Large-footed Mouse-eared Bat (*Myotis adversus*);

BIRD SPECIES

1. SPECIES PROFILES

Turquoise Parrot (*Neophema pulchella*)

The Turquoise Parrot is endemic to eastern Australia. The species range extends from north-eastern Vic., through NSW to the granite belt of south-east Qld. In NSW, the Turquoise Parrot is typically recorded west of the escarpment in the tablelands and on the western slopes, extending to coastal districts through the dry forest corridor of the Hunter Valley (Crome & Shields 1992). Once common near Sydney, this population crashed early in the 1900s and at one stage the Sydney population was thought to be extinct (Garnett 1992). Recent records indicate that the species now occurs in scattered populations near Sydney and throughout eastern and central NSW (Blakers *et al*. 1984).

The species is an inhabitant of the steep, rocky ridges and gullies, rolling hills, valleys and river-flats and nearby plains of the Great Dividing Range. It occurs in eucalypt woodlands and open forests with a ground cover of grasses and low understorey of shrubs (Jarman 1973; Morris 1980). It feeds on seed of grasses, herbaceous plants and shrubs and requires a reliable supply of drinking water (Higgins 1999). The species seldom forms large flocks and is commonly encountered as pairs or small parties of 6-8 birds (Higgins 1999).
Threats to this species include:

- Loss of habitat through clearing, intensive logging, burning and grazing;
- destruction of sites containing hollows which may be used for nesting; and
- inappropriate fire regimes which remove nesting and feeding resources.

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 Tidemann, 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.

Masked Owl (*Tyto novaehollandiae*)

The southern subspecies of the Masked Owl occupies a home range of 5 –10 km^2 within a diverse range of wooded habitats that provide large hollow-bearing trees for roosting and nesting and nearby open areas for foraging (Kavanagh & Murray 1996; Higgins 1999). This can include forests, remnants within agricultural land or almost treeless plains. Nests and roost sites are usually in hollows of large trees, often in riparian forest. Clutch size is usually 3 or 4 (Schodde & Mason 1980; Kavanagh 1996). Masked Owls also roost, and less commonly nest, in caves (Debus 1993; Peake et al. 1993; Debus & Rose 1994). Prey are principally terrestrial mammals, including rodents and marsupials (Debus 1993; Kavanagh 1996), although possums, gliders, bats, birds, lizards and rabbits may be taken opportunistically (Higgins 1999).

Habitat clearance is the principle reason for the decline in the range of this species (Higgins 1999). The reason for the low density of Masked Owls, however, is unknown. Although food does not appear to be limiting on the east coast (Kavanagh 1996),the apparent decline in arid Australia may be linked to the decline in the abundance of small mammals (Burbidge & McKenzie 1989). Within forests on the east coast, the availability of nest trees could be declining (Peake *et al*. 1993; Kavanagh 1996), but the scarcity of Masked Owls in logged forests is more likely to be because the vigorous regrowth after logging makes the habitat less suitable for foraging (Kavanagh *et al*. 1995).

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.

Turquoise Parrot

The Turquoise Parrot is, at most, a potential vagrant that would rarely occur on the subject site, and would only do so to feed on the seeds of grasses and weeds in grassy areas of the site. There is only one record of this species from within the locality, which is from habitat along the Cooks River, approximately 4 km to the west of the subject site. The amount of potential foraging habitat on the subject site for Turquoise Parrots is less than 200 m^2 (0.02 ha), which is a negligible amount of foraging habitat for local viable populations of this species.

There are no tree hollows on the subject site that could potentially be used by Turquoise Parrots for nesting.

Therefore, the proposed development will not adversely affect the lifecycle of the Turquoise Parrot to the extent that a local viable population is placed at risk of extinction.

Owl Species

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

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

Masked Owls are usually found in pairs, which occupy 300-2000 ha territories all year round (Higgins 1999). The nearest known Masked Owl record from within the locality is in the Royal Botanic Gardens, Sydney, approximately 4.5 km ENE of the subject site. The subject site is 1.3 ha in area, representing only between 0.06 and 0.4% 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 Masked 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 Masked Owl record from within the locality is in the Royal Botanic Gardens, Sydney, approximately 4.5 km ENE of the subject site. Therefore, the subject site represents only between 0.08 and 0.4% 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 Masked 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. The Turquoise Parrot, and Masked 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. The Turquoise Parrot, and Masked and Powerful Owls are listed as threatened species rather than as endangered or critically endangered ecological communities.

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(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 1.3 ha of potential foraging habitats of both the Masked Owl and Powerful Owl, and less than 0.02 ha of potential foraging habitat for the Turquoise Parrot. This represents a negligible amount of potential foraging habitat that is available for these species within the locality and the broader geographical area. No potential nesting habitat for these species will be removed or modified.

(ii) The proposed development will not fragment or isolate habitat of Turquoise Parrots, or Masked and Powerful Owls.

(iii) There is no potential nesting habitat for the Turquoise Parrot, Masked Owl or Powerful Owl on the subject site. The subject site represents a negligible proportion of potential foraging habitat of a single pair of Masked Owls or Powerful Owls, and it is only extremely marginal foraging habitat for Turquoise Parrots

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

No critical habitats for Turquoise Parrots, or Masked 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.

<u>Turquoise Parrot</u>

The priority actions for the protection of the Turquoise Parrot in NSW are stated below:

1. Select targeted areas where large populations occur and liaise with landholders to protect hollow-bearing trees.
2. Develop an Expression of interest targeted towards private landowners to locate new sites and from this negotiate, develop and implement conservation management agreements for high priority sites.
3. Identify sites where the species is commonly observed and target for incentives and habitat management.
4. Control feral cats and foxes near high density populations (best practice: locally efficient and effective).
5. Control feral goats and pigs of known or potential habitat.
6. Encourage management of livestock grazing so as to improve understorey (foraging) habitat at priority sites.
7. Implement sympathetic habitat management in conservation reserves, council reserves and crown reserves where the species occurs.
8. Control weeds at priority sites.
9. Encourage bird observer groups to undertake spot monitoring surveys at previously recorded locations. Enter data collected into Wildlife Atlas.
10. Identify three targeted populations (per year over initial three years); focus recovery actions and adaptive management at these sites.

The proposed development is consistent with the priority actions for the recovery of the Turquoise Parrot in NSW.

Owl Species

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.

There proposed development will not result in the operation of, or increase the impact of, a key threatening process that is known to act on Turquoise Parrots, Masked Owls, Powerful Owls, or their habitats.

3. CONCLUSION

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

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INNER WESTERN SYDNEY POPULATION OF THE LONG-NOSED BANDICOOT (*PERAMELES NASUTA*)

1. POPULATION PROFILE

The Long-nosed Bandicoot is a medium-sized (adults: 850 to 1100 g), omnivorous, ground-dwelling marsupial (Stodart1995). Long-nosed Bandicoots forage for invertebrates on the soil surface and for invertebrate larvae, plant roots and hypogeal fungi by digging characteristic conical holes in the soil. Foraging is preferred in areas with an open understorey (Chambers and Dickman 2002). It typically shelters during the day in one of several nests made with dry grass, twigs and leaves in a shallow depression or hidden amongst dense vegetation. Home ranges of animals at North Head Sydney cover 4.4 ± 0.8 (s.e.) ha for males and 1.7 ± 0.2 ha for females (Scott *et al*. 1999). Breeding is seasonal at North Head with a peak of reproductive activity in late spring and early summer, and a cessation of breeding during late autumn and early winter. Up to four litters are produced per year with a mean litter size of 2.3. Very few sub-adult animals have been captured at North Head, suggesting a high rate of juvenile mortality (Scott *et al.* 1999). A pattern of high reproductive output with few successful recruits into the local population is common among bandicoots, in which juveniles disperse widely in an attempt to colonise habitat away from their mother's home range (Cockburn 1990).

The current geographic distribution of the Long-nosed Bandicoot spans the east coast of Australia from Ravenshoe in northern Queensland south to Bass Strait. In New South Wales, this species is common in a range of habitats occurring east of the Great Divide. Its former distribution also included the western slopes (Marlow 1958). Until the early 1960's, the Long-nosed Bandicoot was common throughout the Sydney region (Marlow 1962), but increased urbanisation has caused a widespread decline in its occurrence. Currently, populations in the Sydney region occur at Royal and Heathcote National Parks and the Holsworthy Military Reserve in the south; Lane Cove River, Ku-ring-gai Chase and Garigal National Parks, Manly Dam and the Pittwater Local Government Area in the north; and the Blue Mountains to the west. A small disjunct population occurs at North Head (NPWS 2000) and is listed as an Endangered Population on the *Threatened Species Conservation Act* 1995.

In 2002, a Long-nosed Bandicoot was trapped in the backyard of a house on New Canterbury Road in the suburb of Dulwich Hill. Since then, seven dead Long-nosed Bandicoots have been reported in the vicinity: six from an area including the suburbs of Dulwich Hill, Lewisham and Marrickville, and a single bandicoot from the suburb of Five Dock. Seven live animals have also been confirmed in the suburbs of Lewisham and Dulwich Hill, including two animals which were radio-tracked. This newly discovered population in inner western Sydney is disjunct from the nearest records of the Long-nosed Bandicoot, which occur north of the Parramatta River or much further south at Holsworthy Military Reserve. The exact area occupied by the population is not clearly defined. For the purpose of this determination, the population includes the local government areas (LGA) of Marrickville and Canada Bay, with the likelihood that it also includes Canterbury, Ashfield and Leichhardt LGAs. Future research may better define the population and possibly indicate a wider distribution.

Long-nosed Bandicoots in inner western Sydney shelter mostly under older houses and buildings, and forage in parkland and back-yards (T. Leary pers. comm. August 2007; Australian Museum Business Services 2007; Leary *et al*. unpubl. data, ms submitted). The sub-adult and adult bandicoots presently living around the Dulwich Hill area may have dispersed from a source population occupying a larger area of remnant vegetation, such as Wolli Creek to the south. There

are apparently no large blocks of suitable habitat, likely to support a large source population, on the Cooks River to the south, or along the southern foreshore of Parramatta River and Sydney Harbour to the north.

This population lives in a highly urbanised environment and faces numerous threats, including collision with vehicles and predation by dogs, cats and foxes. Renovation of old buildings, by replacing footings with concrete slabs and by closure of ground-level cracks and crevices, prevents the bandicoots' access to nest sites in such 'crawl spaces'. Removal of weeds and dense vegetation along the freight rail corridor and in parks and gardens will reduce the value of this habitat for sheltering or dispersal. The population is small, fragmented and disjunct, and therefore at risk of extinction owing to local fluctuations in mortality and fecundity. 'Predation by the European Red Fox *Vulpes vulpes* (Linnaeus, 1758)' and 'Predation by the Feral Cat *Felis catus* (Linnaeus, 1758)' are listed as Key Threatening Processes under the *Threatened Species Conservation Act* 1995.

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.

Not applicable. The Inner Western Sydney Population of the Long-nosed Bandicoot is listed as an Endangered Population, rather than as a threatened species**.**

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

In 2002, a Long-nosed Bandicoot was trapped in the backyard of a house on New Canterbury Road in the suburb of Dulwich Hill. Since then, seven dead Long-nosed Bandicoots have been reported in the vicinity: six from an area including the suburbs of Dulwich Hill, Lewisham and Marrickville, and a single bandicoot from the suburb of Five Dock. Seven live animals have also been confirmed in the suburbs of Lewisham and Dulwich Hill, including two animals which were radio-tracked. Therefore, it is a critically small population, which appears to be geographically disjunct from other populations in the Greater Sydney Area.

Long-nosed Bandicoots in inner western Sydney shelter mostly under older houses and buildings, and forage in parkland and backyards. The closest known locations of the Long-nosed Bandicoot in relation to the subject site are:

- within the freight rail corridor along the site's eastern boundary (about 400 metres south of the subject site); and
- at the intersection of the freight rail line and passenger line corridors, about 250 metres north of the subject site).

Long-nosed Bandicoots could potentially den under buildings and forage in landscaped areas on the subject site. However, no Long-nosed Bandicoots were detected on the subject site or in adjacent rail corridor areas, despite targeted surveys for them (use of remote motion-sensor cameras and baited hair-tubes, spotlighting at night and searches under buildings by day). No bandicoot diggings or scats were observed in landscaped areas or under buildings within the subject site. It is unlikely that the bandicoots use the subject site because high brick walls and cyclone fencing occurs around the site's boundaries. There were no holes in the boundary fences

that bandicoots could use to enter the subject site and there were no signs of bandicoots burrowing under the fences.

The proposed development is unlikely to impact on the Inner Western Sydney Population of the Long-nosed Bandicoot to the extent that it places it at risk of extinction provided that:

- construction workers on the subject site are instructed as part of their worksite induction program about the importance of the site and the surrounding landscape as potential habitat for the inner western Sydney Population of the Long-nosed Bandicoot. The induction program should ensure that workers are able to identify Long-nosed Bandicoots and indirect signs of their activity, areas within and adjacent to the subject site that are potential habitat for this species, and know what actions to take in the event of a Long-nosed Bandicoot occurring on the site during the pre-construction and construction periods.

- just prior to demolition or construction activities, the subject site (including under buildings and landscaped areas) is checked by an appropriately qualified and experienced ecologist for any denning or foraging bandicoots;

- bandicoot-proof fencing is erected around the entire perimeter of the subject site once the qualified ecologist is satisfied that there are no Long-nosed Bandicoots on the subject site.

- if Long-nosed Bandicoots are found on the subject site just prior or during construction activities, then construction must stop and the landowner must contact the Department of Planning and the Department of Environment (DoP), Climate Change and Water (DECCW) immediately about the best course of action to take to prevent injury or mortality to individual bandicoots;

- cats, dogs and other domesticated animals are banned from the subject site during the construction and post-construction periods;

- silt fences and sediment ponds are appropriately placed around construction areas on the subject site to prevent runoff of sediment, pollutants and nutrient-enriched waters into the neighbouring areas, including the rail corridor. The effectiveness of these traps should be closely monitored during construction, ensuring that treated site run-off meets EPA guidelines.

(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. The Inner Western Sydney Population of the Long-nosed Bandicoot is listed as an Endangered Population, 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) The Long-nosed Bandicoot is known to occur in the local government areas (LGA) of Marrickville and Canada Bay, with the likelihood that it also includes Canterbury, Ashfield and Leichhardt LGAs. The proposed development will result in the modification of only 1.3 ha of potential habitat, which is a negligible amount of habitat available for this population. It will not impact on the potential dispersal corridors of this population within the nearby rail reserves.

(ii) No area of habitat of the Long-nosed Bandicoot will become fragmented or isolated as a result of the proposed development.

(iii) Long-nosed Bandicoots may potentially seek shelter under the buildings, and forage within the landscaped areas on the subject site from time to time. However, this species was not detected on the subject site, despite targeted surveys for them. It is unlikely that Long-nosed Bandicoots use the site because cyclone fencing and high walls currently occur around the site's perimeter, and there were no indirect signs of bandicoot activity (e.g. diggings) within landscaped areas.

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

No critical habitats for Long-nosed Bandicoots 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 Inner Western Sydney Population of the Long-nosed Bandicoot.

(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.

'Predation by the European Red Fox *Vulpes vulpes* (Linnaeus, 1758)' and 'Predation by the Feral Cat *Felis catus* (Linnaeus, 1758)' are listed as Key Threatening Processes under the *Threatened Species Conservation Act* 1995.

These Key Threatening Processes already occur to a significant degree in the locality. The proposed development is unlikely to significantly increase these processes provided that ownership of cats and dogs on the subject site is prohibited during the construction and post-construction (site occupancy) periods.

3. CONCLUSION

The proposed development will not significantly impact on the status of the Inner Western Sydney Population of the Long-nosed Bandicoot, or its habitat. Therefore, a Species Impact Statement is NOT required for these species in relation to the proposed development.

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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 Junes 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 quinqernervia* (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 mot 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 issue to cull limited numbers of Grey-headed Fly-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 have 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 in to northern NSW (Webb & Tidemann 1995).

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 Mouse-eared Bat (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.

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.

Grey-headed Flying-fox

Grey-headed Flying-foxes may occasionally fly over the subject site, but there are no favoured food trees of this species on the site. The subject site is roughly equidistant between the three known Grey-headed Flying-fox roost and maternity camps (Royal Botanic Gardens in Sydney CBD, the Ku-ring-gai Flying-fox Reserve in Gordon, and along Camden Creek in Camden). It is only likely to be used very occasionally as a resting spot for Grey-headed Flying-foxes *en route* between camps and usual foraging grounds.

Therefore, the proposed development is unlikely to have an adverse effect on the lifecycle of this species such that a viable local population would be placed at risk of extinction.

Microchiropteran Bats

Buildings on the subject site are potential roost sites for Eastern Bentwing-bats and Large-footed Mouse-eared Bats. Neither of these species was recorded on the subject site, despite targeted surveys for them. There are no tree hollows on the subject site that could potentially be used by microchiropteran bats for roosting or nesting.

The landscaped area of the subject site, which is less than 200 m^2 in area, is potential foraging habitat for threatened bat species. There are only two records of each of these species known from within the locality The nearest known records for the Eastern Bentwing-bat are 4.2 km SE and 4.4 km south of the subject site. For the Large-footed Mouse-eared Bat, there are known records 4.3 km ESE and 4.5 km east of the subject site. These individuals are likely to be part of a larger population that occurs throughout the Sydney Basin Bioregion.

Given these factors, it is most unlikely that the proposed development will adversely affect the lifecycles of the Eastern Bentwing-bat and Large-footed Mouse-eared Bat to the extent that it will place local populations at risk of extinction.

(d) 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

(e) 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.

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

(j) 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) Buildings on the subject site are potential roost sites for Eastern Bentwing-bats and Large-footed Mouse-eared Bats. These structures will be removed from the subject site. Neither of these species was recorded on the subject site, despite targeted surveys for them. There are no tree hollows on the subject site that could potentially be used by microchiropteran bats for roosting or nesting.

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

(iii) The subject site is a negligible amount of potential habitat that is available for threatened bat species within the locality and in the broader geographical area.

(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.

(g) 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.

There proposed development will not result in the operation of, or increase the impact of, a key threatening process that is known to act on Turquoise Parrots, Masked Owls, Powerful Owls, or their habitats.

3. CONCLUSION

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

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