

Flora and Fauna Survey & Assessment

Proposed Residential Subdivision
Convent of St Joseph Site,
Barina Downs Road,
Baulkham Hills Local Government Area

Prepared For:

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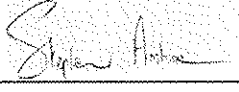
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INTRODUCTION

1.1 PURPOSE OF REPORT

The purpose of this report is to provide a flora and fauna assessment of the potential ecological constraints of the proposed residential subdivision and development of the Convent of St Joseph's Site, Barina Downs Road, Castle Hill ("the subject site": Figure 1) in the Baulkham Hills Local Government Area (Baulkham Hills LGA).

More specifically, the assessment:

- reviews ecological literature and databases relevant to flora and fauna habitats on the subject site;
- describes the methods used in field surveys of flora and fauna and their habitats;
- identifies key flora and fauna habitats, including areas of conservation significance, on the subject site;
- addresses potential impacts on native flora, fauna, ecological communities and their habitats resulting from the proposed development;
- proposes appropriate impact mitigation measures; and
- assesses the importance of the subject site as habitat for threatened flora and fauna species and populations, endangered ecological communities, and migratory species that are listed under the schedules 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); and

1.2 GENERAL SITE DESCRIPTION

The subject site is approximately rectangular in shape, about 18.5 ha in area, and is bounded to the:

- north by Barina Downs Road and further north by residential development;
- south and west by residential development; and
- east by Mackillop Drive and further east by residential development (Figures 1 and 2).

The subject site is currently used as a function centre and residential accommodation for the Sisters of St Joseph. The majority of the buildings are located near the south-western corner of the subject site and a small cottage is located at the eastern end. The majority of the native vegetation has been cleared from the subject site for grazing livestock, but areas along the access road from Barina Downs Road (that is, the driveway) and around the heritage-listed buildings have been landscaped with exotic plants (Figure 2).

The subject site slopes gently to the south and moderately to the north from the centrally-located driveway. There are no drainage lines on the subject site.

The subject site is located on an elevated Hawkesbury sandstone ridge top, surrounded by a Luddenham soil landscape. The dark podzolic soils or massive earthy clays are underlain by Ashfield and Bringelly Shales of the Wianamatta Group (Hazelton *et al.* 1989).

Small remnants of native vegetation occur on the subject site, which NPWS (2002) maps as Sydney Turpentine Ironbark Forest (STIF). This vegetation type is currently listed as a Critically Endangered Ecological Community under the EPBC Act and as an Endangered Ecological Community under the TSC Act. According to NPWS (2002), small remnants of this community still occur on the subject site (Figure 3).

However, Baulkham Hills Council has mapped remnant vegetation on the subject site as Cumberland Plain Woodland (CPW) (Figure 4). This vegetation type is currently listed as a Critically Endangered Ecological Community under the schedules of both the TSC and EPBC Acts.

1.3 PROPOSED DEVELOPMENT

The Applicant proposes to subdivide the majority of the subject site for residential development, while retaining both the existing natural and cultural heritage values of the site. This means that the existing conference centre, areas of remnant vegetation and planted trees along the existing driveway will be retained (Figure 5).

Residential development will be a mix of two-storey medium-sized dwellings, two-storey townhouses and a low rise apartment building (Figure 5). The proposed subdivision and tree-planting plan is shown in Figure 6. Proposed conservation areas, where native vegetation will be retained and enhanced through the implementation of a Bushland Rehabilitation Management Plan is shown in Figure 7.

1.4 STATUTORY FRAMEWORK

1.4.1 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 5 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). If a significant impact is likely to occur then a species impact statement (SIS) must be prepared in accordance with Division 2 of Part 6 of the TSC Act.

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

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

1.4.2 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 DEH.

1.4.3 Planning Instruments

The relevant planning instruments that are also considered in the present report are:

- ☐ State Environmental Planning Policy No. 19 (SEPP 19)–Protection of Urban Bushland
- ☐ State Environmental Planning Policy No. 44 (SEPP 44) – Koala Habitat Protection.

1.5 STRUCTURE OF THE REPORT

The remainder of this report presents the results of field and desk top surveys of native flora and fauna that occur or potentially occur on the subject site, an analysis of the subject site's importance for native flora and fauna, and predicts the potential impacts of the proposed development on native flora and fauna species and habitat values of the site and neighbouring bushland areas. The structure of the remaining chapters is outlined below:

Chapter 2 presents the methods used in conducting the flora and fauna survey and assessment of the conservation importance of the subject site.

Chapter 3 presents the results of the surveys and analyses of the flora and fauna values of the subject site.

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

Appendix A contains Seven-part Tests of Significance for threatened species and endangered ecological communities that may be impacted on by the proposed development.

Figure 1 LOCATION OF SUBJECT SITE



Figure 2 AERIAL VIEW OF SUBJECT SITE



Figure 3 NPWS (2002) MAPPING OF VEGETATION COMMUNITIES IN AND AROUND THE SUBJECT SITE

Map Units:

15: Sydney Turpentine-Ironbark Forest. 43: Sydney Turpentine-Ironbark Margin Forest.

Solid Colour: Canopy > 10% cover. Hatched Colour: Canopy < 10% cover

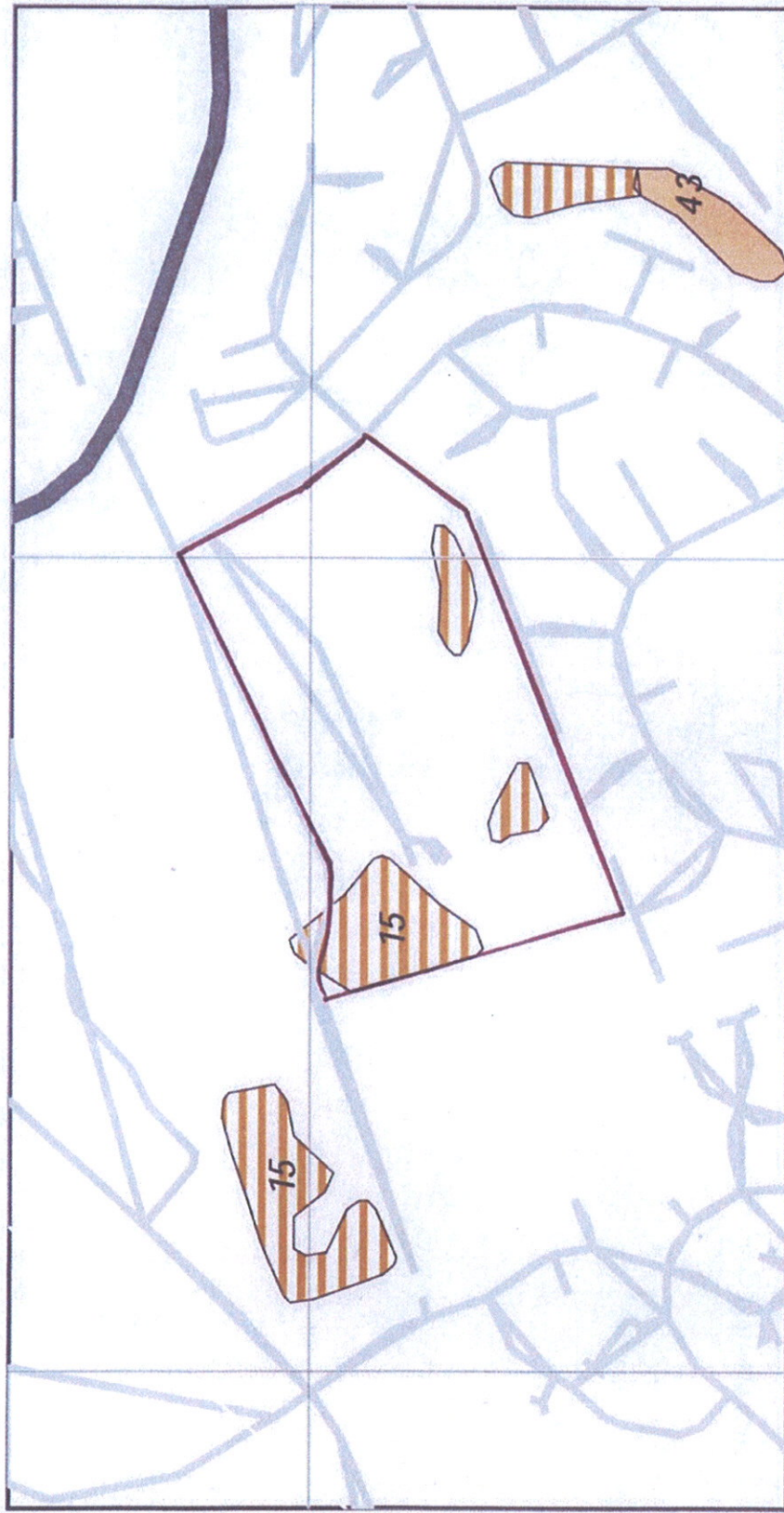


Figure 4 BAULKHAM HILLS COUNCIL MAP OF VEGETATION COMMUNITIES ON AND AROUND THE SUBJECT SITE

Orange shading: Cumberland Plain Woodland



Figure 5 PROPOSED DEVELOPMENT CONCEPT

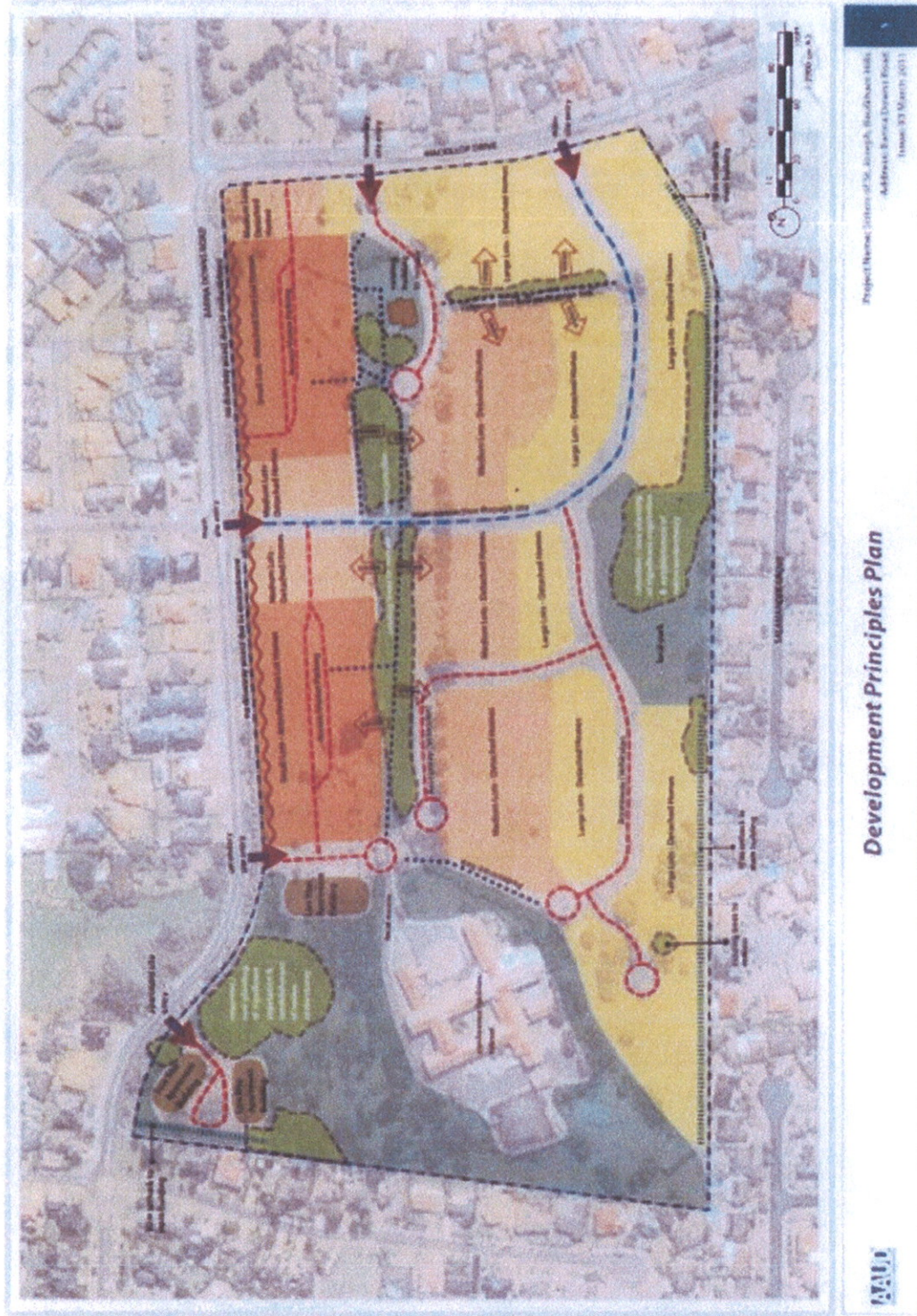


Figure 6 PROPOSED RESIDENTIAL SUBDIVISION AND ROAD PLAN



Figure 7 PROPOSED VEGETATION CONSERVATION AREAS



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 subject site, in particular technical environmental reports produced by DECC, other consultancies and Baulkham Hills Council, were reviewed to determine the presence of terrestrial habitats, and fauna species of conservation significance, within the locality (a 5 km radius around the subject site).

- NPWS Wildlife Atlas Database;
- Rare or Threatened Plants of Australia (RoTAP) Database;
- NSW Field Ornithologists' Club Atlas Database;
- Birds Australia Atlas Database (1977-81) and (1998 onwards);
- EPBC database; and
- Australian Museum specimen collection database;

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

2.3 FIELD SURVEY

2.3.1 Overview

Diurnal surveys of fauna and their habitats on the subject site were conducted on 3 July 2007 (1000 to 1330 hrs) and on 11 February 2008 (0845 to 1400 hrs).

Nocturnal surveys of fauna (owls, bats and arboreal mammals) were conducted from 1730-1930 hrs on 3, 4 & 5 July 2007 and from 2000-1030 hrs on 11, 12 & 13 February 2008.

Flora surveys were conducted on the subject site from 0930 to 1630 hrs on 9 July 2008.

2.3.2 Flora Surveys

Flora surveys were conducted across the subject site using quadrat survey techniques. This involved recording plant species within nineteen (19) 25 x 25 m quadrats (total sample area: 11,875 m²) that represented all major habitats within the subject site. The location of each of

these quadrats is shown in Figure 8. Herb and shrub species were recorded within a single 5 x 5 m sub-quadrat within each of the larger quadrats. The structure of the plant communities by the numbers of individuals and the heights of all species greater than 2 m were also recorded in each quadrat.

Additional species that were observed outside the surveyed transects and quadrats were also recorded. Targeted searches for plant species of conservation significance and detailed mapping of boundaries of vegetation communities were also part of the flora survey.

2.3.3 Fauna Habitat Surveys

It was not possible to determine with certainty all the fauna that utilise habitats in 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:

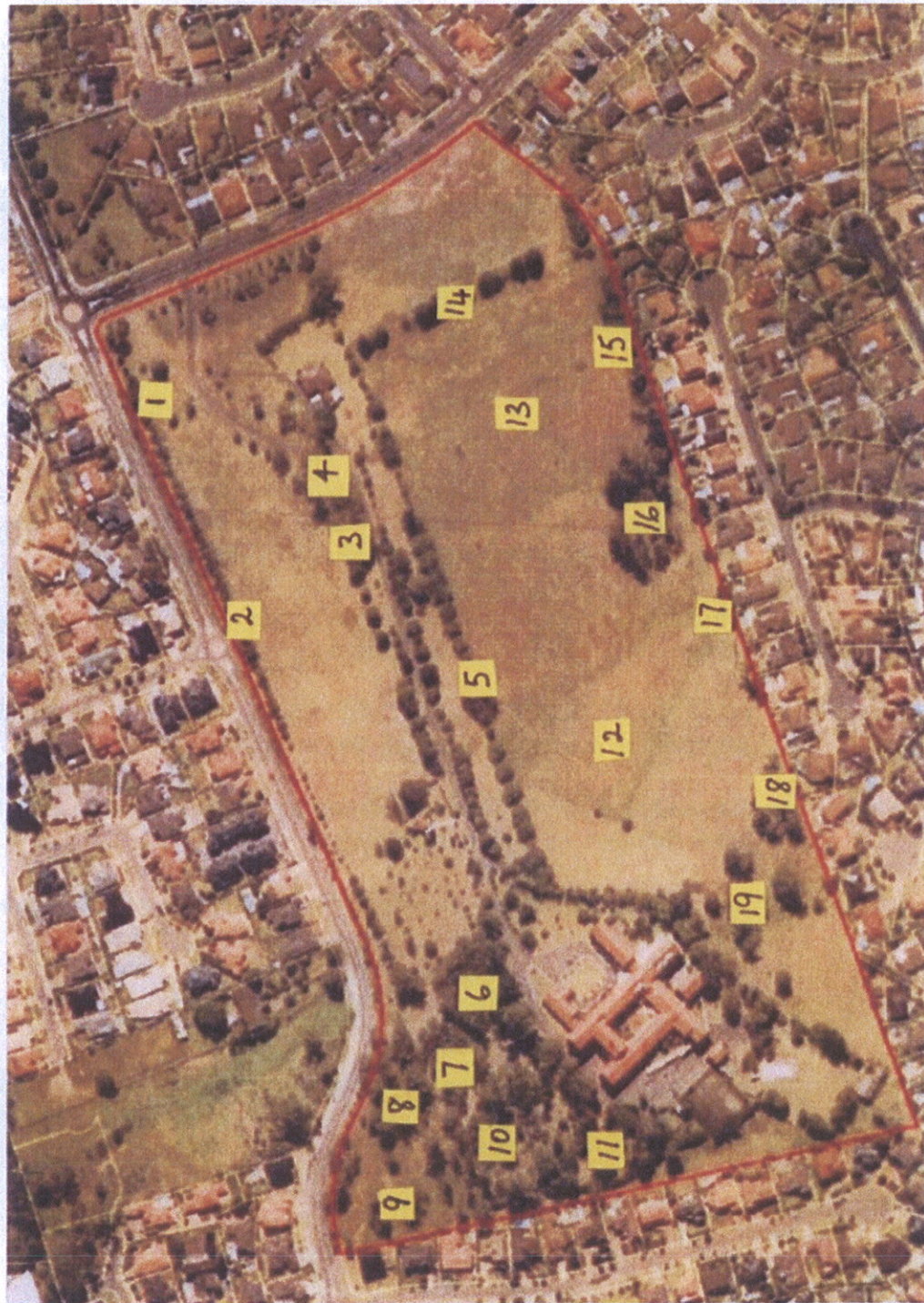
<i>Mammals:</i>	extent of ground cover, shrub layer and tree canopy, hollow-bearing trees, substrate type (for burrowing etc), evidence such as droppings, diggings, footprints, scratches on trees, nests, burrow paths and runways.
<i>Birds:</i>	structural features such as the extent and nature of the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

2.3.4 Fauna Survey

Information collected during the fauna survey was used in conjunction with other surveys and records in determining fauna use of the subject site and, in particular, use or potential use of the subject site by threatened species.

Weather conditions were recorded during the time of the survey. In addition to fauna habitat assessment, the results of systematic surveys and incidental sightings of terrestrial vertebrates were used to determine faunal assemblages on the subject site. These techniques are described in greater detail below:

Figure 8 LOCATIONS OF FLORA QUADRATS



(i) Bird Surveys

Area searches for birds were conducted in which the observer walked at random through the subject site, stopping at will, with a search effort equivalent to a 2 ha coverage over a 30-minute period. All bird species that were observed or heard during the survey were noted. Opportunistic observations in the subject site were also recorded.

Owl presence was investigated at night by playing the calls of owls that could potentially occur in the locality and subsequently searching for owls that may be responding to these calls.

(ii) Reptiles and Amphibians

Reptiles and amphibians were identified using indirect observation methods. Species were searched for in fallen logs, suitable rock basking substrates and underneath other fallen material. At night, responses to playback recordings, together with spotlighting, helped identify frog species that could have potentially occurred in within the creek and its riparian zone on the subject site.

(iii) Microchiropteran Bats

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

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

(iv) Other Mammals

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

2.3.5 *Biota of Conservation Significance*

Biota (flora and fauna species and populations, and endangered ecological communities) 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 must be conducted for all those threatened species detected on a site or for those considered likely to occur there due to the availability of habitat.

2.4 ASSESSMENT OF CONSERVATION VALUE

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

- ☐ *representativeness* - whether the vegetation communities of the site are unique, typical or common in the bioregion. In addition, the criteria takes into account whether or not such vegetation units are presently held in conservation reserves;

- ❑ the presence of threatened or regionally significant species on the site;
- ❑ The extent of human influence on the natural environment of the site and the condition of habitats (e.g. the presence of weeds, fire frequency etc.);
- ❑ the uniqueness of the natural values of the site;
- ❑ the amount of native vegetation to be cleared or modified by the proposed development in relation to what remnant vegetation will remain in the locality; and
- ❑ the relative importance of a site as a corridor for the movement of wildlife.

2.5 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 3 July 2007 as part of the overall fauna survey and assessment.

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

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

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

In assessing the potential of the subject site as Koala habitat, a search for preferred roosting trees, according to Schedule 2 of SEPP 44 (Table 2.1)

Table 2.1 KOALA FOOD AND ROOST TREES LISTED IN SCHEDULE 2 OF SEPP 44

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

RESULTS

3.1 INTRODUCTION

This chapter presents the results of the field and database surveys for threatened species and endangered ecological communities on the subject site. It also analyses the conservation values of the subject site.

3.2 VEGETATION COMMUNITIES

3.2.1 Flora Species Richness and Diversity

Plant species and cultivated varieties that were recorded on the subject site are listed in Table 3.1. A total of 115 species and varieties were recorded, comprising 52 exotic species (45.2% of total plant species/varieties), 30 locally native species (26.1%), 17 non locally-native species (14.8%) and 16 cultivars (13.9%).

Table 3.1 PLANT SPECIES DETECTED ON THE SUBJECT SITE, 9 JULY 2008

Legend: * Exotic species; # Non locally-native species; @ Horticulturally cultivated

Family	Scientific Name	Common Name
PALMS & FERNS		
Arecaceae	<i>Syagrus romanzoffianum</i> *	Cocos Palm
Asparagaceae	<i>Protasparagus aethiopicus</i> *	Asparagus Fern
GYMNOSPERMS		
Araucariaceae	<i>Araucaria heterophylla</i> #	Norfolk Island Pine
Cupressaceae	<i>Cupressocypris leylandii</i> *	Leyland Cypress
Pinaceae	<i>Cedrus deodora</i> *	Deodar Cedar
	<i>Pinus radiata</i> *	Monterey Pine
Podocarpaceae	<i>Podocarpus elatus</i> #	Illawarra Plum
DICOTYLEDONS		
Aceraceae	<i>Acer palmatum</i> *	Japanese Maple
	<i>Calodendron capense</i> *	Cape Chestnut
Asteraceae	<i>Ageratina adenophora</i> *	Crofton Weed
	<i>Bidens pilosa</i> *	Cobbler's Pegs
	<i>Hypochaeris radicata</i> *	Catsears
	<i>Sonchus oleraceus</i> *	Milk-thistle
Balsaminaceae	<i>Impatiens</i> sp. *	Impatiens
Bignoniaceae	<i>Jacaranda mimosifolia</i> *	Jacaranda
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black She-oak
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed
	<i>Ipomoea indica</i> *	Morning Glory

Family	Scientific Name	Common Name
Euphorbiaceae	<i>Hevea brasiliensis</i> *	Rubber Tree
Fabaceae	<i>Acacia fimbriata</i> #	Brisbane Golden Wattle
	<i>Acacia parramattensis</i>	Parramatta Green Wattle
	<i>Bauhinia variegata</i> *	Orchard Tree
	<i>Castanospermum australe</i> #	Moreton Bay Chestnut
	<i>Erythrina sykesii</i> *	Coral Tree
	<i>Gleditsia 'Sunburst'</i> @	Golden Honey Locust
	<i>Ligustrum lucidum</i> *	Large-leaved Privet
	<i>Ligustrum sinense</i> *	Small-leaved Privet
	<i>Robinia pseudoacacia frisia</i> *	Black Locust
	<i>Wisteria</i> sp. *	Wisteria
Fagaceae	<i>Quercus palustris</i> *	Pin Oak
Hamamelidaceae	<i>Liquidamber styraciflua</i> *	Liquidamber
Lamiaceae	<i>Prostanthera lasianthos</i> #	Australian Christmas Bush
Lauraceae	<i>Cinnamomum camphora</i> *	Camphor Laurel
Lythraceae	<i>Lagerstroemia indica</i> *	Crepe Myrtle
Malvaceae	<i>Lagunaria patersonia</i> *	Norfolk Island Hibiscus
	<i>Sida rhombifolia</i> *	Paddy's Lucerne
Melastomataceae	<i>Tibouchina</i> sp. *	Tibouchina
Moraceae	<i>Ficus benjamina</i> #	Weeping Fig
	<i>Ficus microcarpa</i> *	Chinese Banyan
Myoporaceae	<i>Myoporum floribundum</i>	Weeping Boobialla
Myrtaceae	<i>Angophora costata</i>	Sydney Red Gum
	<i>Angophora floribunda</i>	Rough-barked Apple
	<i>Callistemon 'Glasshouse Country'</i>	
	<i>Callistemon 'Hannah Ray'</i> @	
	<i>Callistemon 'Red Reika'</i> @	
	<i>Callistemon 'Mary MacKillop'</i> @	
	<i>Callistemon 'Mauve'</i> @	
	<i>Callistemon 'Mr Foster'</i> @	
	<i>Callistemon viminalis</i>	Weeping Bottlebrush
	<i>Corymbia citriodora</i> #	Lemon-scented Gum
	<i>Eucalyptus cinerea</i> #	Argyle Apple
	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
	<i>Eucalyptus eugenoides</i>	Thin-leaved Stringybark
	<i>Eucalyptus globoides</i>	White Stringybark
	<i>Eucalyptus grandis</i>	Flooded Gum
	<i>Eucalyptus scorparia</i> #	Willow Gum
	<i>Eucalyptus leucoxylon</i> #	Yellow Gum
	<i>Eucalyptus maculata</i>	Spotted Gum
	<i>Eucalyptus microcorys</i> #	Tallowwood
	<i>Eucalyptus punctata</i>	Grey Gum
	<i>Eucalyptus sideroxylon</i>	Red Ironbark
	<i>Eucalyptus tereticornis</i>	Forest Red Gum
	<i>Leptospermum petersonii</i>	Lemon-scented Tea Tree
	<i>Lophostemon confertus</i> #	Brush Box
	<i>Pittosporum undulatum</i>	Sweet Pittosporum
	<i>Syzigium australe 'Dwarf'</i> @	Dwarf Bush Cherry
	<i>Syzigium 'Cascade'</i> @	Weeping Lilly Pilly

Family	Scientific Name	Common Name
Ochnaceae	<i>Ochna serrulata</i> *	Mickey Mouse Plant
Oleaceae	<i>Fraxinus griffithii</i> *	Griffith's Ash
	<i>Fraxinus pennsylvanica</i> *	Green Ash
	<i>Fraxinus</i> 'Raywood' @	Claret Ash
	<i>Olea europaea</i> *	Olive Tree
Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum
Plantaginaceae	<i>Plantago lanceolata</i> *	Plantain
Polygonaceae	<i>Rumex crispus</i> *	Curley Dock
Ranunculaceae	<i>Ranunculus repens</i> *	Creeping Buttercup
Rosaceae	<i>Cotoneaster</i> sp. *	Cotoneaster
	<i>Prunus cerasifera</i> 'Nigra' *	Purple-leaved Cherry-plum
	<i>Rosa multiflora</i> *	Rose
Sterculiaceae	<i>Brachychiton acerifolius</i> #	Illawarra Flame Tree
Ulmaceae	<i>Ulmus parvifolia</i> *	Chinese Elm
Verbenaceae	<i>Citharexylum spinosum</i> *	Fiddlewood Tree
	<i>Lantana camara</i> *	Lantana
MONOCOTYLEDONS		
Iridaceae	<i>Crocasmia x crocosmiiiflora</i> *	Montbretia
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
Meliaceae	<i>Melia azedarach</i> #	White Cedar
	<i>Toona australis</i>	Red Cedar
Poaceae	<i>Austrodanthonia racemosa</i>	Wallaby Grass
	<i>Anthoxanthum odoratum</i> *	Sweet Vernal Grass
	<i>Avena sativa</i>	Wild Oats
	<i>Bromus catharticus</i> *	Prairie Grass
	<i>Chloris gayana</i> *	Rhodes Grass
	<i>Dactylus glomerata</i> *	Cocksfoot Grass
	<i>Entolasia stricta</i>	Bordered Panic
	<i>Holcus lanatus</i> *	Yorkshire Fog
	<i>Lolium perenne</i> *	Perennial Ryegrass
	<i>Microlaena stipoides</i>	Weeping Meadow Grass
	<i>Oplismenus aemulus</i>	Bordered Panic
	<i>Paspalum dilatatum</i> *	Paspalum
	<i>Pennisetum clandestinum</i> *	Kikuyu
	<i>Poa pratensis</i>	Kentucky Bluegrass
	<i>Sida rhombifolia</i> *	Paddys Lucerne
	<i>Themeda australis</i>	Kangaroo Grass
Proteaceae	<i>Banksia ericifolia x spinulosa</i> @	Banksia 'Giant Candles'
	<i>Grevillea 'Firespite'</i> @	
	<i>Grevillea 'Honey Gem'</i> @	
	<i>Grevillea 'Sylvia'</i> @	
	<i>Grevillea 'Molly'</i> @	
	<i>Grevillea 'Moonlight'</i> @	
	<i>Grevillea 'Ned Kelly'</i> @	
	<i>Hakea multilinea</i> #	Grass-leaved Hakea
	<i>Hakea salicifolia</i>	Willow Leaf Hakea
	<i>Stenocarpus sinuatus</i> #	Queensland Firewheel Tree
	<i>Telopea speciosissima</i> #	Waratah
Rutaceae	<i>Flindersia australis</i> #	Crows Ash

3.2.2 Remnant Vegetation

Most of the original vegetation on the subject site has been removed, with remnant vegetation being restricted to the north-western corner (Area A: Plate 1) and near the southern boundary (Areas B and C: Plates 2 & 3) of the subject site (Figure 9).

The native canopy of Area A is dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*) with the occasional Flooded Gum (*Eucalyptus grandis*).

Native canopy trees in Areas B and C include Flooded Gums, Rough-barked Apples (*Angophora floribunda*), White Stringybarks (*Eucalyptus globoides*) and Black She-oaks (*Allocasuarina littoralis*).

Native shrub and groundcover species in these remnants are scarce because of grazing by livestock and replacement with exotic grasses and some weed species. Native species that occur there include Wallaby Grass (*Austrodanthonia racemosa*), Kangaroo Grass (*Themeda australis*), Kidney-weed (*Dichondra repens*) and Weeping Meadow Grass (*Microlaena stipoides*). Exotic grass species include Sweet Vernal Grass (*Anthoxanthum odoratum*), Prairie Grass (*Bromus catharticus*), Cocksfoot Grass (*Dactylus glomerata*), Yorkshire Fog (*Holcus lanatus*) and Perennial Ryegrass (*Lolium perenne*) and common exotic herb species include Catsear (*Hypochaeris radicata*) and Plantain (*Plantago lanceolata*).

It is probable that the 28 Forest Red Gums (*Eucalyptus tereticornis*) that occur on the northern side of the driveway (Area D) are also remnant trees, rather than occurring there as part of a landscaping program.

The subject site is located near the western edge of the distribution of Sydney Turpentine-Ironbark Forest (STIF) and only about one kilometre south-east of the eastern-most area of Cumberland Plain Woodland (CPW) (Figure 10). Therefore, it is within a geographical transition zone between these two endangered ecological communities. Both these communities grow on Wianamatta shale.

Remnant vegetation on the subject site has been mapped by NPWS (2002) as STIF. However, the remnant vegetation has 13 plant species that Tozer (2003) concludes is representative of STIF and nine species that are representative of CPW (Table 3.2). Therefore, remnant vegetation on the subject site is likely to be a transition between these two communities, rather than one or the other, although it is difficult to say definitively because so few shrub and groundcover species have been retained.

3.2.3 Landscaped Areas

Other areas of the subject site, particularly along the driveway, memorial gardens north of the driveway, landscaped gardens around the building and the boundary areas of the subject site, have been landscaped with a mix of exotic and non-locally native plant species (Plates 4 to 7). Trees that commonly occur in these areas include Jacaranda (*Jacaranda mimosifolia*), Deodar Cedar (*Cedrus deodora*), Fiddlewood Tree (*Citharexylum spinosum*),

Figure 9 REMNANT VEGETATION AREAS ON SUBJECT SITE



Figure 10 LOCATION OF SUBJECT SITE IN RELATION TO THE DISTRIBUTION OF SYDNEY TURPENTINE-IRONBARK FOREST AND CUMBERLAND PLAIN WOODLAND

Map Units:

15: Sydney Turpentine-Ironbark Forest (dark brown). 43: Sydney Turpentine-Ironbark Margin Forest (light brown).

9 (Turquoise) & 10 (Yellow): Cumberland Plain Woodland.

Solid Colour: Canopy > 10% cover. Hatched Colour: Canopy < 10% cover

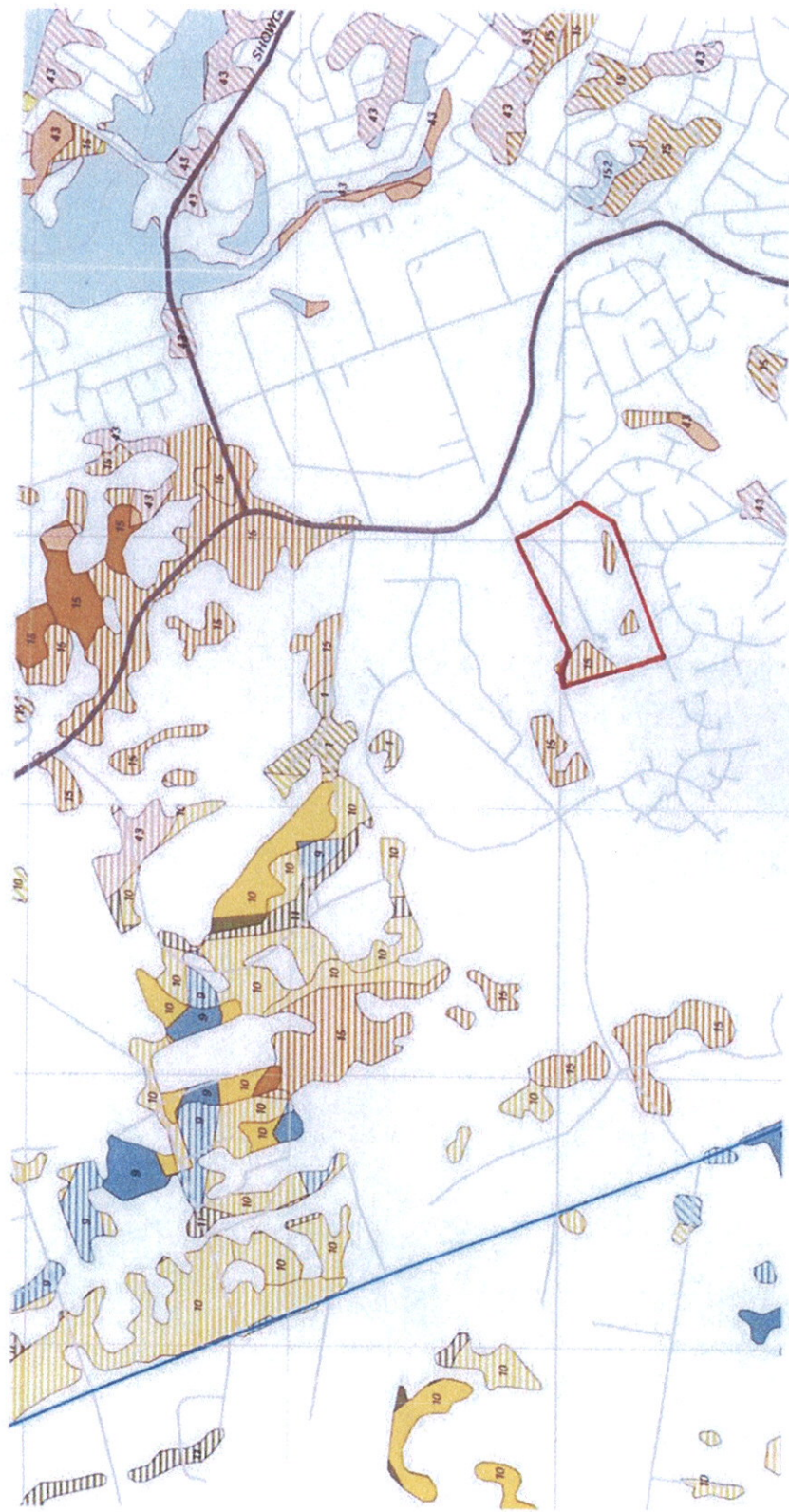


Table 3.2 PLANT SPECIES ON THE SUBJECT SITE THAT ARE REPRESENTATIVE OF STIF AND CPW (ACCORDING TO TOZER 2003)

Characteristic STIF Species in Remnants	Characteristic CPW Species in Remnants
Canopy Species	
<i>Angophora costata</i>	<i>Angophora floribunda</i>
<i>Angophora floribunda</i>	<i>Eucalyptus crebra</i>
<i>Eucalyptus eugenoides</i>	<i>Eucalyptus eugenoides</i>
<i>Eucalyptus globoidea</i>	<i>Eucalyptus globoidea</i>
<i>Eucalyptus punctata</i>	<i>Eucalyptus punctata</i>
<i>Eucalyptus tereticornis</i>	<i>Eucalyptus tereticornis</i>
Understorey Species	
<i>Pittosporum undulatum</i>	None
<i>Acacia parramattensis</i>	
Groundcover Species	
<i>Dichondra repens</i>	<i>Austrodanthonia racemosa</i>
<i>Entolasia stricta</i>	<i>Themeda australis</i>
<i>Lomandra longifolia</i>	<i>Microlaena stipoides</i>
<i>Microlaena stipoides</i>	
<i>Opismenus aemulus</i>	

Plate 1 Remnant Vegetation North-west Corner of Subject Site (Area A) Dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*).



Plates 2 and 3 Remnant Vegetation Along the Southern Boundary of the Subject Site (Areas B and C), dominated by White Stringybark (*Eucalyptus globoidea*) and Flooded Gum (*E. grandis*).



Plate 4 **Row of Planted Brush Box Along Eastern Boundary of Paddock**



Plate 5 **Crows Ash (*Flindersia australis*) Along the Northern Side of Driveway**



Plate 6

Forest Red Gums (*Eucalyptus tereticornis*) on Northern side of Driveway.



Plate 7

Coral Trees (*Erythrina x sykesii*) on Southern Side of Driveway.



Liquidamber (*Liquidamber styraciflua*), Coral Tree (*Erythrina x sykesii*), Chinese Banyan (*Ficus microcarpa*), Japanese Maple (*Acer palmatum*), Cotoneaster (*Cotoneaster* sp.), Pin Oak (*Quercus palustris*), Monterey Pine (*Pinus radiata*), Green Ash (*Fraxinus pennsylvanica*) and Griffith's Ash (*Fraxinus griffithsii*). Non-locally native trees that have been planted include Brush Box (*Lophostemon confertus*), Crows Ash (*Flindersia australis*), Lemon-scented Gum (*Corymbia citriodora*), Queensland Firewheel Tree (*Stenocarpus sinuatus*), White Cedar (*Melia azederach*) and Norfolk Island Pine (*Araucaria heterophylla*).

The memorial garden (John Webber Park) to the north of the function centre and driveway contains a broad range of planted mostly exotic and non-locally native trees and shrubs, including Weeping Lilly Pilly (*Syzigium 'cascade'*), Dwarf Brush Cherry (*Syzigium australe*), several horticultural varieties of *Grevillea* and *Callistemon*, Banksia 'Giant Candles' (*Banksia ericifolia x spinulosa*), Golden Honey Locust (*Gleditsia sunburst*), Jacaranda, Liquidamber, Grass-leaved Hakea (*Hakea multilineata*), Willow Leaf Hakea (*Hakea salicifolia*), Weeping Boobialla (*Myoporum floribundum*), Black Locust (*Robinia pseudoacacia frisia*), Wisteria (*Wisteria* sp.), Brisbane Golden Wattle (*Acacia fimbriata*), Orchard Tree (*Bauhinia variegata*), Lemon-scented Tea-tree (*Leptospermum petersonii*), Rubber Tree (*Hevea brasiliensis*), Australian Christmas Bush (*Prostanthera lasianthos*), Weeping Fig (*Ficus benjamina*), Red Cedar (*Toona australis*), Pin Oak, Tibouchina (*Tibouchina* sp.), Olive Tree (*Olea europaea*), Waratah (*Telopea speciosissima*), Rose (*Rosa multiflora*), Yellow Gum (*Eucalyptus leucoxylon*), Spotted Gum (*Eucalyptus maculata*), Red Ironbark (*Eucalyptus sideroxylon*), Argyle Apple (*Eucalyptus cinerea*), Impatiens (*Impatiens* sp.), Firewheel Tree (*Stenocarpus sinuatus*) and Claret Ash (*Fraxinus 'Raywood'*).

3.2.4 Cleared Paddocks

Paddocks that have been used by grazing livestock occur in the southern half of the subject site. Exotic grasses in these areas include Sweet Vernal Grass, Prairie Grass, Cocksfoot Grass, Yorkshire Fog, Kentucky Bluegrass (*Poa pratensis*) and exotic herbs include Montbretia (*Crocsmia x crocosmiiiflora*), Plantain, Wild Oat (*Avena sativa*), Creeping Buttercup (*Ranunculus repens*) and Milk-thistle (*Sonchus oleraceus*). A small number of privet bushes (*Ligustrum sinense* and *Ligustrum lucidum*) have germinated in small gullies where the land slopes near the north-western boundary of the paddock and where there are occasional fallen trees. Parramatta Green Wattles (*Acacia parramattensis*) are sparsely distributed near the southern boundary of the subject site.

3.3 FAUNA AND THEIR HABITATS

3.3.1 Fauna Habitat Assessment

The treed areas of the subject site offer the greatest value as habitat for native terrestrial fauna. The tree canopy has the potential of producing nectar and/or fruits for nectarivorous and frugivorous birds and bats, and arboreal mammals. The tree canopy provides potential nesting sites for common native birds such as honeyeaters, Pied Currawongs and Australian Magpies. There are no tree hollows large enough on the subject site that may potentially provide roosting and breeding habitat and shelter for microchiropteran bats, hollow-dependent birds (e.g. owls, cockatoos and parrots) or arboreal mammals (e.g. possums and gliders).

The lawned, cleared or disturbed areas of the subject site provide potential foraging habitat for common ground-foraging bird species, such as Masked Lapwings (*Vanellus miles*), Australian Wood Ducks (*Chenonetta jubata*), raptors (e.g. Australian Kestrel *Falco cenchroides* and Black-shouldered Kite *Elanus notatus*), Galahs (*Cacatua roseicapilla*), Crested Pigeon (*Ocyphaps lophotes*), Magpie-larks (*Grallina cyanoleuca*) and Australian Magpies (*Gymnorhina tibicen*).

Paved areas and buildings provide potential foraging habitat, shelter and basking sites for small reptiles such as skinks.

The subject site is surrounded by residential development and is not part of a local or regional wildlife corridor.

3.3.2 Fauna Species

The extremely modified nature of natural habitats on the subject site and the site's isolation from bushland remnants in the locality, suggests that it has limited value as habitat for native fauna.

Thirty-eight fauna species (three reptile species, 31 bird species and four mammal species) were recorded on the subject site during the site inspection (Table 3.3). All of these species are urban-generalists and are relatively common and widespread throughout the locality and Sydney Basin Bioregion.

Four of these species, the Spotted Turtle dove, Indian Mynah, Common Starling and Domestic Cat are introduced species. One species, the Grey-headed Flying-fox is listed as threatened under both the TSC and EPBC Acts.

Table 3.3 FAUNA SPECIES RECORDED ON SUBJECT DURING INSPECTIONS, 3-5 JULY 2007 AND 11-13 FEBRUARY 2008

Methods of Detection:

C: Call identification.

O: Observation.

Sp: Spotlighting

An: Anabat Detection

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

Family	Scientific Name	Common Name	Methods of Detection
REPTILES			
Scincidae	<i>Lampropholis guichenoti</i>	Grass Sun-skink	O
	<i>Eulamprus quoyi</i>	Eastern Water Skink	O
	<i>Ctenotus taeniolatus</i>	Copper-tailed Skink	O
BIRDS			
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing	O, C
Columbidae	<i>Streptopelia chinensis</i> *	Spotted Turtle dove	O, C

Family	Scientific Name	Common Name	Methods of Detection
	<i>Ocyphaps lophotes</i>	Crested Pigeon	O
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	O, C
	<i>Cacatua roseicapilla</i>	Galah	O, C
Psittacidae	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	O, C
	<i>Afsterus scapularis</i>	Australian King-Parrot	O, C
	<i>Platycercus elegans</i>	Crimson Rosella	O, C
	<i>Platycercus eximius</i>	Eastern Rosella	O, C
	<i>Ninox novaeseelandiae</i>	Southern Boobook	Sp
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth	Sp
Cuculidae	<i>Eudynamys scolopacea</i>	Common Koel	C
Alcedinidae	<i>Eurystomus orientalis</i>	Dollarbird	O, C
Halcyonidae	<i>Dacelo novaeguinea</i>	Laughing Kookaburra	O, C
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner	O, C
	<i>Anthochaera carunculata</i>	Red Wattlebird	O, C
	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	O
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren	O, C
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote	O, C
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail	O, C
	<i>Rhipidura leucophrys</i>	Willie Wagtail	O, C
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	O
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow	O
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird	O, C
	<i>Strepera graculina</i>	Pied Currawong	O, C
	<i>Gymnorhina tibicen</i>	Australian Magpie	O, C
Corvidae	<i>Corvus coronoides</i>	Australian Raven	O, C
Estrildidae	<i>Neochmia temporalis</i>	Red-browed Firetail Finch	O, C
Zosteropidae	<i>Zosterops lateralis</i>	Silvereye	O, C
Sturnidae	<i>Acridotheris tristis</i> *	Indian Mynah	O, C
	<i>Sturnus vulgaris</i> *	Common Starling	O, C
MAMMALS			
Phalangeridae	<i>Trichosurus vulpecula</i>	Brushtail Possum	Sp
Felidae	<i>Felis catus</i> *	Cat	O, Sp
Pteropidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	O
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	An

3.4 THREATENED AND REGIONALLY SIGNIFICANT SPECIES

3.4.1 Threatened Species and Populations

Thirty-three (33) threatened flora species have been recorded within a 10 km radius of the subject site. These species and their habitat requirements are shown in Table 3.3. There are no threatened flora populations within the locality.

Twenty-eight (28) threatened fauna species have been recorded within a 10 km radius of the subject site. These species and their habitat requirements are shown in Table 3.4. There are no threatened fauna populations in the locality.

No threatened flora species or populations were detected on the subject site. Therefore no Seven-part Tests are required for threatened flora species in relation to the proposed development.

One threatened fauna species, the Grey-headed Flying-fox, was observed flying over the subject site during the nocturnal survey period on 12 February 2008. There are no roosting colonies of Grey-headed Flying-foxes nor significant foraging areas for this species on the subject site.

Treed areas on the subject site, especially the remnant forest/woodland areas are potential habitat for the following threatened fauna species that occur in the locality:

Bird Species:

- ☐ Bush Stone-curlew (*Burhinus grallarius*);
- ☐ Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- ☐ Swift Parrot (*Lathamus discolor*);
- ☐ Turquoise Parrot (*Neophema pulchella*);
- ☐ Barking Owl (*Ninox connivens*);
- ☐ Masked Owl (*Tyto novaehollandiae*);

Mammal Species:

- ☐ Spotted-tailed Quoll (*Dasyurus maculatus*);
- ☐ Grey-headed Flying-fox (*Pteropus poliocephalus*);
- ☐ Yellow-bellied Sheath-tail Bat (*Saccolaimus flaviventris*);
- ☐ East Coast Freetail Bat (*Mormopterus norfolkensis*);
- ☐ Large-eared Pied Bat (*Chalinolobus dwyeri*);
- ☐ Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- ☐ Eastern Bentwing Bat (*Miniopterus schreibersii*);
- ☐ Large-footed Mouse-eared Bat (*Myotis adversus*); and
- ☐ Greater Broad-nosed Bat (*Scoteanax ruepellii*).

Most of the potential habitat on the subject site for threatened fauna species would be protected if remnant vegetation areas on the subject site are retained and adequately buffered from the impacts of development. Potential impacts of the proposed development on the status of threatened fauna species and their habitats are discussed in Chapter 4 and in Appendix A.

3.4.2 Regionally Significant Species

Flora species that are considered rare in the north-western regions of Sydney's coastal plain include Pitted Bluegrass (*Bothriochloa decipiens*), Windmill Grass (*Chloris ventricosa*), Yellow Buttons (*Chrysocephalum apiculatum*), Cymbonotus lawsonianus, Hop Bush (*Dodonaea viscosa* ssp. *viscosa*), *Glossogyne tannensis*, *Glycine microphylla*, *Oxalis exilis*, *Phyllanthus virgatus*, *Senecio quadridentatus*, Slender Rat's Tail Grass (*Sporobolus elongatus*) and *Vittadinia cuneata*. None of these species was detected on the subject site.

Fauna species that are considered rare in the north-western regions of Sydney's coastal plain include the Buff-rumped Thornbill (*Acanthiza reguloides*), White-winged Chough (*Corcorax melanorhamphos*), Eastern Grey Kangaroo (*Macropus giganteus*), Swamp Wallaby (*Wallabia*

bicolor) and Red-necked Wallaby (*Macropus rufogriseus*). No regionally significant fauna species were observed during the field surveys.

3.5 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 Black-faced Monarch (*Monarcha melanopsis*), Satin Flycatcher (*Myiagra cyanoleuca*), Rufous Fantail (*Rhipidura rufifrons*) and Regent Honeyeater, may occasionally forage within the canopy in forested areas of the subject site. The Swift Parrot (*Lathamus discolor*) may occasionally forage within the canopy in woodland areas of the subject site, but this species is likely to be, at best, occasional vagrants to the site. Latham's Snipe (*Gallinago hardwicki*), Cattle Egrets (*Ardea ibis*) and Great Egrets (*Ardea alba*) may occasionally forage in the disturbed, cleared areas of the subject site. Fork-tailed Swifts (*Apus pacificus*) and White-throated Needletails (*Hirundapus caudacutus*) may occasionally fly high over the subject site. The areas of habitat on the subject site are negligible amounts available to these species.

3.6 KOALA HABITAT ASSESSMENT

Three potential food and roost tree species, as defined under Schedule 2 of SEPP 44, the Forest Red Gum (*Eucalyptus tereticornis*), Tallowwood (*E. microcorys*) and Grey Gum (*E. punctata*), occur on the subject site.

However, there are no known records of Koalas using the subject site. 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 the surrounding residential areas with busy roads), the site's isolation from other remnant areas of bushland and the lack of recent records of Koalas occurring in the locality in recent times.

Table 3.4 THREATENED AND REGIONALLY SIGNIFICANT FLORA SPECIES DETECTED IN THE LOCALITY

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	RoTAP STATUS	Habitat and likelihood of occurrence	Seven Part Test required?
<i>Acacia bynoeana</i>		V*	V	3VC-	Heath and woodland in the Sydney District. No available habitat. Not detected on site.	No
<i>Acacia gordonii</i>			V	2K	Open forest in sandy soils. No available habitat. Not detected on site.	No
<i>Acacia pubescens</i>	Downy Wattle	V*	V	3VCa	Found in open sclerophyll forest and woodland on clay soils. No available habitat. Not detected on site.	No
<i>Acacia terminalis</i> ssp. <i>terminalis</i>	Sunshine Wattle	E*	E		Dry open forest and scrubland, on sandy soils. No available habitat. Not detected on site.	No
<i>Acrophyllum australe</i>		V*	V	2VCi	Drip-ledges and wet rock crevices beneath sandstone cliffs. Not detected on site.	No
<i>Ancistrachne maidonii</i>			V	2KC-	A sprawling or creeping grass found on moist creek banks of the Berowra Creek, Cowan Creek and nearby parts of the Hawkesbury River. Not detected on site.	No
<i>Asterolasia elegans</i>		E*	E	2ECa	Only known location is a moist gully north of Maroota. Not detected on site.	No
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E*	E	3ECi	Grows mainly in dry vine thickets on richer clay soils, although it has also been recorded in littoral forest, open forest and on sand. Not detected on site.	No
<i>Dillwynia tenuifolia</i>		V*	V	2RCa	Open forest and heath, on deep sands and alluvium. Not detected on site.	No
<i>Epacris sparsa</i>		V*	V	2VCi	Found only at four sites along the lower Grose River, including Avoca Vale (Burrallow Creek) and Linden Creek below Faulconbridge Point. It grows only in sandy clay soils derived from shell lenses between Hawkesbury sandstone beds at the base of rock faces and platforms in the river flood zone. Not detected on site.	No
<i>Eucalyptus benthamii</i>	Bentham's Gum	V*	V	2VCi	On sandy flats or ridges near streams. Not detected on site.	No
<i>Grammitis stenophylla</i>			E		On rocks and tree trunks in rainforest. Not detected on site.	No
<i>Grevillea juniperina</i>	Prickly Spider-flower		V		Open forest and cleared areas, on shale. Not detected on site.	No

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	RoTAP STATUS	Habitat and likelihood of occurrence	Seven Part Test required?
<i>Haloragodendron lucasii</i>		E*	E	2RCa	Restricted to a small geographical area, possibly a single gully, in Davidson State Recreation Area, St Ives. Not detected on site.	No
<i>Kennedia retrorsa</i>		V*	V	2VCa	Known only from the Mount Dangar area and the adjacent Goulburn River Catchment. Occurs in a variety of habitats from mountain sides to riparian zones, from sheltered forest to steep, exposed rocky ridgelines. Not detected on subject site.	No
<i>Kernudrenia corollata</i> var <i>denticulata</i> (Hawkesbury population)	Velvet-flower		EP		Forest, in sheltered rocky areas. Not detected on site.	No
<i>Lasiopetalum joyceae</i>		V*	V	2RC-	Found in heath in the northern parts of the Sydney region, e.g. near Berowra, Ku-ring-gai Chase National Park and Annangrove. No available habitat. Not detected on site.	No
<i>Leucopogon exolasius</i>		V*	V		Rocky river banks. Not detected on site.	No
<i>Micromyrtus blakelyi</i>		V*	V	2VC-	Found in crevices or depressions on sandstone platforms near Cowan and in Muogamarra Nature Reserve. Not detected on site.	No
<i>Micromyrtus multiflora</i>		V*	V	2V	Open forest, on consolidated river sediments. Not detected on site.	No
<i>Olearia cordata</i>		V*	V	2VCi	Grows only between Wiseman's Ferry, Yengo and east Wollemi to the north-west of Sydney in dry eucalypt forest, woodland and shrubland on hillsides and rocky ridges. Not detected on subject site.	No
<i>Persoonia acerosa</i>		V*	V	2VC-	Dry open forest, woodland and heath, on sandy soils. No available habitat. Not detected on site.	No
<i>Persoonia hirsute</i>		E*	E	3KCi	Found in heath and woodland on sandstone from the Georges River to Gosford. Not detected on site.	No
<i>Persoonia nultans</i>		E*	E	2ECi	Open forest on clay soils and old alluviums on the Cumberland Plain. Not detected on site.	No
<i>Pimelea spicata</i>		E*	E	3ECi	Found in Grey Box and ironbark woodland, on coastal headlands or in Cumberland Plain Woodland. No	No

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	RoTAP STATUS	Habitat and likelihood of occurrence	Seven Part Test required?
<i>Pomaderris brunnea</i>		V*	V	2VC-	available habitat. Not detected on site.	No
<i>Prostanthera cineolifera</i>		V*	V	2K	Woodland and semi-cleared scrub, on clay and alluvial soils of floodplain and creek lines. Not detected on site. The species is restricted to the Ourimbah - Narara area near Gosford on the Central Coast of NSW where it is currently known to exist in five populations. None of these populations are in reserves. It prefers sunny edges of woodlands. Not detected on site.	No
<i>Prostanthera junonis</i>		E*	E	2E	Grows only in the Somersby-Mangrove Mountain-Girrakool area near Gosford in sandy soils in eucalypt woodland and heath, often on the edge of sandstone outcrops near seepage areas. Not detected on site.	No
<i>Pterostylis saxicola</i>		E*	E		Occurs from the Hawkesbury region, south to Campbelltown and Picton and west to Glenbrook. Favours areas away from the coast, growing in flat areas, either on top of stony ridges or on mossy rocks in gullies. Not detected on site.	No
<i>Pultenaea parviflora</i>		E*	E	2E	Open forest, on heavier clay soils. Restricted to the western part of the Cumberland Plain. Not detected on site.	No
<i>Syzigium paniculatum</i>		V*	V	3ECi	Restricted to rainforest areas around Botany Bay. Not detected on site.	No
<i>Tetralthea glandulosa</i>	Black-eyed Susan	V*	V	2VC-	Grows in sandy or rocky heath or scrub, from Mangrove Mtn to the Blue Mtns and Sydney. Not detected on site.	No
<i>Velleia perfoliata</i>		E*	V	2VC-	The species is only known from the Hawkesbury District and Upper Hunter Valley. Favours river banks and moist forests.	No
<i>Zieria involucrate</i>		V*	V	2VC-	Moists gullies near Maroota and Marramatta National Park. Not detected on subject site.	No

Notes: 1. Habitat requirements for plants taken from Harden (1990, 1991, 1992, 1993).

* = Listed under the Commonwealth Endangered Species Protection Act, 1992.

E = Endangered under Schedule 1 of the TSC Act 1995.

E* = Endangered under the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999.

V = Vulnerable under Schedule 2 of the TSC Act 1995.

V* = Vulnerable under the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999.

E** = Endangered under Schedule 4 of the TSC Act 1995.

ROTaP CONSERVATION CODES

Distribution:

2 = Geographic range in Australia less than 100 km;

3 = Geographic range in Australia greater than 100 km.

Conservation Status:

E = Endangered;

V = Vulnerable;

R = Rare;

K = Poorly known;

C = Reserved.

Size Class of all Reserved Populations:

a = 1,000 or more are known to occur within a conservation reserve(s);

j = Less than 1,000 are known to occur within a conservation reserve(s);

- = Reserved population size is not accurately known;

t = Total known population reserved;

+ = Overseas occurrence.

Table 3.5 THREATENED FAUNA SPECIES DETECTED IN THE LOCALITY (5 KM RADIUS AROUND SUBJECT SITE)

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Habitat Requirements and Likelihood of Occurrence	Seven Part Test required?
AMPHIBIANS					
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V*	V	Mostly restricted to Hawkesbury Sandstone, usually found around sandy creek banks, with crayfish burrows in this area. No potential habitat on subject site. Not detected on site.	No
<i>Pseudophryne australis</i>	Red-crowned Toadlet		V	Restricted to Hawkesbury Sandstone and may be found beside temporary creeks, gutters and soaks within this area, and under rocks and logs.	No
<i>Litoria aurea</i>	Green and Golden Bell Frog	V*	E	No potential habitat on subject site. Not detected on site. Large permanent swamps and ponds with plenty of emergent vegetation, especially bullrushes. In areas free of the Mosquito Fish (<i>Gambusia affinis</i>).	No
<i>Mixophyes iteratus</i>	Giant-barred Frog		V	No potential habitat on subject site. Not detected on site. Rainforests, Antarctic Beech forests and wet sclerophyll forests. Ranges from Bunya Mtns, Qld, and coast and ranges of south-eastern Qld and northern NSW south to about Narooma.	No
REPTILES					
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	V*	E	No potential habitat on subject site. Not detected on site. An aggressive, nocturnal snake largely confined to the Hawkesbury sandstone, where it is usually found under large slabs or rocky ridges, or in rocky crevices.	No
<i>Varanus rosenbergi</i>	Heath Monitor		V	No potential habitat on subject site. Not detected on site. Coastal heaths, humid woodlands and both wet and dry sclerophyll forests. A mostly terrestrial species which shelters in burrows, hollow logs and rock crevices.	No
BIRDS					
<i>Nettion coromandelianus</i>	Cotton Pygmy-goose		E	No potential habitat on subject site. Not detected on site. Found in deep lagoons, swamps and dams, particularly with water lilies and other floating vegetation.	No
<i>Stictonetta naevosa</i>	Freckled Duck	V		No available habitat. Not detected on site. Breeds in heavily vegetated freshwater swamps; moves to	No

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Habitat Requirements and Likelihood of Occurrence	Seven Part Test required?
<i>Botaurus poeciloptilus</i>	Australasian Bittern		V	freshwater or salty permanent open lakes, especially in droughts. No available habitat. Not detected on site.	No
<i>Ixobrychus flavicollis</i>	Black Bittern		V	Roosts and breed in rush- and reed-filled marshes. No potential habitat on site. Rest in waterside vegetation and emerges at dusk and dawn to hunt for fish, amphibians, molluscs and insects.	No
<i>Lophoictinia isura</i>	Square-tailed Kite			No potential habitat on subject site. Not detected on site. Open forests, riverine woodlands, scrubs and heathlands, mostly in inland NSW. May very occasionally occur in the locality as a vagrant when inland populations disperse during drought periods. The proposed development of the subject site will not limit resources for this species.	No
<i>Falco hypoleucos</i>	Grey Falcon		V	Occurs in open grassy woodlands of inland Australia. Vagrants may very occasionally disperse to coastal regions, especially in periods of prolonged drought. No limiting resources in the locality. Therefore, species is unlikely to be impacted by development.	No
<i>Burhinus grallarius</i>	Bush Stone-curlew		E	Occurs in lightly timbered open forest or grassy woodland habitat. Often associated with woodlands of casuarina, eucalyptus, acacia and epolycarpa. Also found in dry, open grassland and cropland with cover nearby. Potential habitat occurs in forest remnants within the subject site.	Yes
<i>Charadrius leschenaulti</i>	Greater Sand Plover		V	Forages on intertidal sand and mudflats in estuaries, and roosts during high tide on sandy beaches or rocky shores. Occasional sightings have also occurred on near-coast salt lakes, brackish swamps, shallow freshwater wetlands and grassed paddocks. No available habitat on site.	No
<i>Charadrius mongolus</i>	Lesser Sand Plover		V	Favours coastal habitats including beaches, mudflats and mangroves. In NSW, most often seen on intertidal sand and mudflats in estuaries or roosting on sandy beaches or rocky shores at high tide. No available habitat on site.	No

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Habitat Requirements and Likelihood of Occurrence	Seven Part Test required?
<i>Irediparra gallinacea</i>	Comb-crested Jacana		V	Swamps, lakes and lagoons. Walks on floating plants. No available habitat on site.	No
<i>Rostratula benghalensis</i>	Painted Snipe		V	Occurs in shallow freshwater (occasionally brackish) wetlands, including inundated or waterlogged grassland or saltmarsh. No available habitat on site.	No
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork		E	River pools, swamps and intertidal flats. Potential habitat occurs in wetlands and aquatic herbfields of the subject site. The Hunter region is outside the core distribution of this species and the small number of individuals recorded in the region are of vagrants. No limiting resources on subject site.	No
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo		V	Eucalypt forests of eastern Australia. Feeds exclusively on <i>Allocasuarina</i> (sheoak) seeds, particularly <i>A. littoralis</i> and <i>A. torulosa</i> . Potential foraging habitat in remnant treed areas of the subject site.	Yes
<i>Lathamus discolor</i>	Swift Parrot	E*	V*	Breeds in Tasmania and migrates to mainland between March and September to feed on eucalypt blossoms. Potential foraging habitat occurs in forested areas of the subject site, but is likely to be an infrequent visitor to the site.	Yes
<i>Neophema pulchella</i>	Turquoise Parrot		V	Steep, rocky ridges and gullies, rolling hills, valleys and river flats and the nearby plains of the Great Dividing Plain. Potential foraging habitat in and near remnant vegetation on the subject site.	Yes
<i>Polytelis swainsonii</i>	Superb Parrot	V*	V	Woodlands of western watershed of Great Dividing Range, NSW. Vagrants may very occasionally disperse to coastal regions, especially in periods of prolonged drought. No limiting resources in the study area. Therefore, species is unlikely to be impacted by development.	No
<i>Ninox connexa</i>	Barking Owl		V	Inhabits forest, woodland and most common in savannah. Potential foraging and roosting habitat in treed areas of subject site.	Yes
<i>Ninox strenua</i>	Powerful Owl		V	Wet sclerophyll forest along coast hills and Great Dividing Range. No available habitat on subject site. Not detected on site.	No

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Habitat Requirements and Likelihood of Occurrence	Seven Part Test required?
<i>Tyto novaehollandiae</i>	Masked Owl		V	Occurs in forest, savanna woodland and treeless areas with caves over much of Australia except central Australia and arid areas of Western Australia. Potential foraging and roosting habitat in treed areas of subject site.	Yes
<i>Tyto tenebriosa</i>	Sooty Owl		V	Rainforests, particularly rainforest gullies overtopped by eucalypts, along eastern scarp of Great Dividing Range. No available habitat on subject site. Not detected on site.	No
<i>Xanthomyza phrygia</i>	Regent Honeyeater	E*	E	Semi-nomadic, occurring in temperate eucalypt woodland forest in south-eastern Australia. Most records are from box-ironbark forests dominated by Swamp Mahogany, Spotted Gum and Riverina Casuarina woodlands. No limiting resources in the subject site. Therefore, species is unlikely to be impacted by development.	No
MAMMALS					
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V*	V	Wet and dry sclerophyll forests, rainforests, woodlands and coastal heaths. No recent records of this species in the locality. However, potential marginal habitat occurs within treed areas of subject site.	Yes
<i>Phascogale cinereus</i>	Koala		V	Eucalypt forests and woodlands. No core or potential foraging or roosting habitat in the study area. Highly unlikely to occur in the subject site as a result of the past history of clearing and the surrounding residential development.	No
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V*	V	Wet and dry sclerophyll forests, rainforests, paperbark swamps and mangroves to 700 m elevation. One Grey-headed Flying-fox observed flying over the subject site on 12 February 2008.	Yes
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathail Bat		V	Most habitats from rainforests, sclerophyll forests and woodlands, to grasslands and deserts. Potential foraging habitat occurs in the forested areas of the subject site.	Yes
<i>Mormopterus norfolkensis</i>	East Coast Freetail Bat		V	Sclerophyll forests, woodlands and, occasionally, rainforests. Potential foraging habitat occurs in the forested areas of the subject site.	Yes

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Habitat Requirements and Likelihood of Occurrence	Seven Part Test required?
<i>Chalinolobus davyeri</i>	Large-eared Pied Bat	V*	V	Occurs in drier habitats such as dry sclerophyll forests and woodland, although they have been detected in tall open eucalypt forest with an understorey of scattered small trees and palms. It roosts in caves and mines in colonies of 3 to 37, clustered in indentations in the ceiling. Potential foraging habitat occurs in the forested areas of the subject site.	Yes
<i>Falstirellus tasmaniensis</i>	Eastern False Pipistrelle		V	Wet forests and woodlands, preferring gullies and highland areas up to 1500 m above sea level.	Yes
<i>Miniopterus schreibersii</i>	Eastern Bent-wing Bat		V	From Kimberly to the Top End and from Cape York Peninsula on eastern side of the Great Dividing Range through to the south-east corner of South Australia. Found in rainforest, wet and dry sclerophyll forests, woodland and grasslands. Roosts in culverts and mines. Potential foraging habitat occurs in the forested areas of the subject site.	Yes
<i>Myotis adversus</i>	Large-footed Mouse-eared Bat		V	Sclerophyll forests, mangroves, paperbark swamps, woodlands and rainforests near slow-moving creeks, lakes and estuaries. Potential foraging habitat occurs in the forested areas of the subject site.	Yes
<i>Scoleanax ruepellii</i>	Greater Broad-nosed Bat		V	Found in sclerophyll forests, rainforests, woodlands and moist gullies below 500 m above sea level. Potential foraging habitat occurs in the forested areas of the subject site.	Yes
INVERTEBRATES					
<i>Meridolum corneocinctum</i>	Cumberland Land Snail		E	Restricted to the Cumberland Plain and Castlereagh Woodlands of Western Sydney and also along the fringes of River Flat Forest, especially where it meets Cumberland Plain Woodland. Subject site is east of the known range of this species and is most unlikely to occur on the subject site. No detected on the site, despite targeted surveys for it.	No

Notes: Habitat requirements for birds taken from Simpson & Day (1996).
Habitat requirements for reptiles and amphibians taken from Cogger (2000), Cronin (2001) & Saam et al. (2004).

Habitat requirements for mammals taken from Cronin (2000b) and Monkhorst & Knight (2001).
* = Listed under the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).
E = Endangered under Schedule 1 of the NSW Threatened Species Conservation Act 1995 (TSC Act).
E* = Endangered under Schedule 1 of the TSC Act and EPBC Act.
V = Vulnerable under Schedule 2 of the TSC Act.
V* = Vulnerable under Schedule 2 of the TSC Act and EPBC Act.

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, 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 and modification of part of an endangered ecological community (CPW/STIF);
- impacts on threatened biota; and
- impacts on nationally-listed migratory species.

Each of these impacts already occur on the subject site and in neighbouring areas 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 *Endangered Ecological Communities*

About 1.318 ha of CPW/STIF occurs on the site (Figure 7). A total of 1.262 ha of this will be retained and an additional 1.290 ha (1.15 ha near the north-western corner of the subject site and 0.14 ha along the southern boundary) will be planted with CPW and STIF species. Therefore, the nett increase in CPW/STIF on the subject site after subdivision would be 1.234 ha.

A buffer of at least 10 metres will be maintained around the edge of each of the remnants within the areas labelled as Conservation Area A in Figure 8. Remnant vegetation retained elsewhere on the subject site may be impacted by stormwater runoff from residential areas. Polyweb fencing will be erected around the remnants during construction periods to prevent damage to CPW and STIF vegetation from trampling, vehicles and use of heavy machinery.

Therefore, 0.667 ha of remnant CPW/STIF and 1.290 ha of newly-created conservation areas (containing CPW and STIF species) (a total of 1.957 ha of native vegetation) will be adequately buffered against the impacts of the proposed urban development, whereas an additional 0.595 ha of remnant CPW/STIF is likely to be modified (e.g. increased weed invasion) as a result of stormwater runoff.

A Bushland Rehabilitation Management Plan (Ambrose 2009) proposes planting schedules for areas to be landscaped with CPW and STIF species and means by which weeds and other exotic plants can be controlled in both the short- and long-term in the remnant vegetation and landscape areas.

Therefore, the proposed development is unlikely to have an adverse effect on the extent of CPW or STIF or substantially and adversely modify CPW to the extent that their local or broader geographical occurrences are likely to be placed at risk of extinction.

4.2.2 Impacts on Threatened Species and Populations

Not threatened flora species or populations were detected on the subject site.

Seven-part tests of Significance for the Bush Stone-curlew, Glossy Black-Cockatoo, Swift Parrot, Barking Owl, Masked Owl Spotted-tailed Quoll, Yellow-bellied Sheath-tail Bat, East Coast Freetail Bat, Large-eared Pied Bat, Eastern False Pipistrelle, Eastern Bentwing Bat, Large-footed Mouse-eared Bat and Greater Broad-nosed Bat (Appendix A) concluded that the proposed development would not significantly impact on the status of NSW-threatened fauna or their habitats. Therefore, Species Impact Statements are not required for these species.

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

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

There are no Grey-headed Flying-fox camps (roosts) on the subject site or in neighbouring areas. 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.

Although the Spotted-tailed Quoll has been recorded in the locality, it is unlikely to occur on the subject site because of the urbanised nature of the site and its surrounding environment, and the likely high density of introduced predators (e.g. foxes and domesticated cats). If quolls do occasionally occur on the subject site, they are likely to forage in or near the treed areas, nearly all of which will be retained on the site.

A single Spotted-tailed Quoll utilises numerous dens within its home range (NPWS 2000). The home range of this species is unknown, but estimates are between 0.08 km² and 20 km²

(NPWS 2000). It is a highly mobile species and there are numerous records of overnight movements of several kilometres (Edgar & Belcher 1995). Therefore the loss of potential habitat for this species as a result of the proposed development of the subject site would be negligible.

Two nationally endangered fauna species, the Swift Parrot and Regent Honeyeater, may potentially use the treed areas of the subject site for foraging or roosting. Under the EPBC Act, a nationally endangered species is significantly impacted on if a proposal is likely to:

- lead to a long-term decrease in the size of a population; or
- reduce the area of occupancy of a species; or
- fragment an existing population into two or more populations; or
- adversely affect habitat critical to the survival of a species; or
- disrupt the breeding cycle of a 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 endangered species becoming established in the endangered species' habitat; or
- interfere substantially with the recovery of a species.

Only 0.1 ha of potential marginal foraging habitat of both of these species will be removed as part of the proposed development. An additional 1.29 ha of foraging habitat will be added to the subject site as part of the site's Bushland Rehabilitation Management Plan. Therefore, the proposed development will not negatively impact on the national status of the Swift Parrot or Regent Honeyeater, or their habitats.

4.2.3 Impacts on Nationally-listed Migratory Species

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

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

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

4.3 RECOMMENDATIONS

- Retain native vegetation remnants shown in Figure 7 and create buffer zones at least 10 metres in width around them within the areas depicted in Figure 7 as "Conservation Area A" to protect them from potential impacts of development that may occur on the subject site.
- Silt fences and sediment ponds should be appropriately placed around construction areas on the subject site to prevent runoff of sediment and nutrient-enriched waters into nearby drainage lines and bushland areas. The effectiveness of these traps should be closely monitored during construction, ensuring that treated site run-off meets EPA guidelines.
- Implement the recommendations outlined in the Bushland Rehabilitation and Management Plan (Ambrose 2009) to protect remnant vegetation during the design and construction phases of the proposed development of the subject site and to appropriately bush regenerate these areas and maintain them, including ongoing weed control, during subsequent occupation of the site. This will help improve the quality of the habitat of a Critically Endangered/Endangered Ecological Community (STIF/CPW) and consequently improve the quality of habitats for native flora and fauna species.

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Appendix A

Seven-part Tests of Significance

APPENDIX A SEVEN-PART TESTS OF SIGNIFICANCE

INTRODUCTION

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

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

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

Appendix A provides Seven-part tests for the following threatened biota in relation to the proposed development:

Endangered Ecological Communities:

- Cumberland Plain Woodland (CPW); and
- Sydney Turpentine-Ironbark Woodland (STIF).

Bird Species:

- Bush Stone-curlew (*Burhinus grallarius*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Swift Parrot (*Lathamus discolor*);
- Turquoise Parrot (*Neophema pulchella*);
- Barking Owl (*Ninox connexa*);
- Masked Owl (*Tyto novaehollandiae*);

Mammal Species:

- Spotted-tailed Quoll (*Dasyurus maculatus*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Yellow-bellied Sheath-tail Bat (*Saccolaimus flaviventris*);
- East Coast Freetail Bat (*Mormopterus norfolkensis*);
- Large-eared Pied Bat (*Chalinolobus dwyeri*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Eastern Bentwing Bat (*Miniopterus schreibersii*);
- Large-footed Mouse-eared Bat (*Myotis adversus*); and
- Greater Broad-nosed Bat (*Scoteanax ruepellii*).

ENDANGERED ECOLOGICAL COMMUNITIES

1. COMMUNITY DESCRIPTIONS

Cumberland Plain Woodland

Cumberland Plain Woodland (CPW) was gazetted as an endangered ecological community under the schedules of the Threatened Species Conservation Act, 1995 on 13 July 1997. It comprised the Spotted Gum (*Corymbia maculata*) Forest (Map Unit 9b), Grey Box (*Eucalyptus moluccana*) Woodland (Map Unit 10c) and Grey Box-Ironbark Woodland (Map Unit 10d) that were described in the natural vegetation 1:100,000 map sheets of Penrith (Benson 1992) and Sydney (Benson & Howell 1994).

NPWS (2000) identified and mapped two forms of CPW: Shale Plains Woodland (SPW) and Shale Hills Woodland (SHW). Shale Hills Woodland occurs mainly on the elevated and sloping southern half of the Cumberland Plain and Shale Plain Woodland occurs on other parts of the Cumberland Plain and is thus more widely distributed.

The dominant canopy trees of SHW include Grey Box (*Eucalyptus moluccana*), Forest Red Gum (*E. tereticornis*) and Narrow-leaved Ironbark (*E. crebra*). It has a shrub layer dominated by Blackthorn (*Bursaria spinosa*), with other shrubs, such as *Acacia implexa*, *Indigofera australis* and *Dodonaea viscosa* ssp. *cuneata*.

Bursaria spinosa is the dominant shrub species of SPW and there are canopy trees such as Grey Box (*E. moluccana*), Forest Red Gum (*E. tereticornis*), Spotted Gum (*Corymbia maculata*) and Thin-leaved Stringybark (*E. eugenoides*).

The diverse understorey layer is similar for both forms of CPW. It is common to find grasses, such as Kangaroo Grass (*Themeda australis*), Weeping Meadow Grass (*Microlaena stipoides* var. *stipoides*) and herbs such as Kidney Weed (*Dichondra repens*), Blue Trumpet (*Brunoniella australis*) and *Desmodium varians*.

Before European settlement, CPW was extensive across western Sydney, covering 122,000 ha. Today, there is only 8% of the original extent, with a further 13% remaining as scattered trees across the landscape. It occurs on well structure clay soils that are derived from the Wianamatta Shale.

There are bushland remnants of CPW in an area bounded by Scheyville (north), Penrith (west), Parramatta (east) and Thirlmere (south). CPW occurs in Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly local government areas.

Clearing for agriculture and urban development is the greatest threat to CPW. Because it presently exists only as isolated fragments, CPW is vulnerable to disturbances, such as weed invasion, increased soil nutrients, rubbish dumping and fire. Weeds such as African Lovegrass, African Olive Bridal Veil Creeper and Rhodes Grass are a major threat.