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Australian Catholic University, Strathfield: Terrestrial Flora and Fauna Assessment

December 2011

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Report prepared for:

Hassell Pty Ltd

Australian Catholic University, Strathfield: Terrestrial Flora and Fauna Assessment

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ABBREVIATIONS/DEFINITIONS

ACU	Australian Catholic University
CAMBA	China-Australia Migratory Bird Agreement
DECCW	NSW Department of Environment, Climate Change and Water (formerly NSW Department of Environment and Conservation, now DPC-OEH)
DGR	Director-General Requirements
DPC-OEH	Department of Premier and Cabinet – Office of Environment and Heritage (formerly DECCW)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (formerly Department of Environment, Heritage, Water and the Arts)
EEC	Endangered Ecological Community
EP&A Act	*Environmental Planning and Assessment Act* 1979
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
FM Act	*Fisheries Management Act* 1994
JAMBA	Japan-Australia Migratory Bird Agreement
LGA	Local Government Area
Locality	5 km radius of study area
MNES	Matter of National Environmental Significance
NPWS	NSW National Parks and Wildlife Service (now part of DECCW)
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
SIS	Species Impact Statement
Study area	Area of direct impact and any areas subject to potential indirect impacts
Subject site	Area of direct impact
TSC Act	*Threatened Species Conservation Act* 1995
sp.	species (singular)
spp.	species (plural)
ssp.	subspecies
var.	variety

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EXECUTIVE SUMMARY

Biosis Research Pty. Ltd. was commissioned by Hassell to undertake a terrestrial flora and fauna assessment for the Concept Plan application for the Australian Catholic University, Strathfield Campus. The main campus is bounded by Barker and South Streets, while the Edward Clancy building is located adjacent to the main campus along Albert Road.

The proposed Concept Plan for the Australian Catholic University upgrades proposes additional car-parking to be constructed across the campus. The main additional underground car-park to be constructed is located at the north western corner of the campus beneath part of the existing sports oval. Smaller areas of established car-spaces throughout the campus will be reconfigured to allow for additional parking.

The Concept Plan also proposes the establishment of new university buildings, including a new library located to the front of the campus grounds at the south-eastern corner of Barker Street and Albert Road.

As part of this proposal, the removal of some planted trees would be required. However, the proposed landscaping indicates that mature trees will continue to be an important landscaping feature within the Australian Catholic University campus grounds. Where possible mature trees that may be removed as part of the works may be transplanted and/or retained elsewhere on campus. As the success rate of transplanting mature trees is generally quite low it is recommended that young trees endemic to the locality are planted to replace all mature trees that will be removed as part of the proposed works.

No threatened fauna species were recorded during the current survey. Potential habitat exists for four threatened fauna species (Eastern Freetail Bat (*Mormopterus norfolkensis*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bentwing-bat (*Miniopterus australis*) and Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)), four migratory species (White-bellied Sea-eagle (*Haliaeetus leucogaster*), Fork-tailed Swift (*Apus pacificus*), White-throated Needletail (*Hirundapus caudacutus*) and Cattle Egret (*Ardea ibis*)) and one endangered fauna population (Long-nosed Bandicoot (*Perameles nasuta*) inner western Sydney). The proposal is considered unlikely to result in negative impacts to any of these species.

No Endangered Ecological Communities (EECs) or threatened flora species were recorded in the study area. Further, the study area does not support potential habitat for any EECs. The study area does not support potential habitat for any threatened flora species, due to the largely modified nature of the Australian Catholic University grounds. Consequently the proposal will not result in significant impacts to any threatened flora species and/or population.

The proposal is considered unlikely to have a significant impact on terrestrial threatened species, populations or ecological communities listed under the TSC and/or the EPBC Acts. A Species Impact Statement (TSC Act) or a Referral (EPBC Act) is not considered necessary for any threatened or migratory flora or fauna as a result of the proposal.

While the proposal is considered unlikely to have a significant impact on threatened species, populations or ecological communities, a number of recommendations have been made to ensure any potential impacts on the flora and fauna of the study area are minimised, including:

- That all mature trees that are to be removed as part of the proposal be replaced. Where possible, native trees which naturally occur within the locality are recommended for replacement planting, to ensure that there is no net loss of biodiversity as a result of the proposal;

- Mature planted trees should be retained where possible and adequate tree protection measures should be implemented to ensure retained trees are not impacted by the proposal during the construction phase;

- Naturally occurring, remnant trees including the Fine Leaved Ironbark and Turpentine's should be retained where possible and adequate tree protection measures should be implemented to ensure retained trees are not impacted by the proposal during the construction phase; and,

- The Noxious Weeds Large Leaved Privet and Green Cestrum should be treated according to the legal requirements of noxious weed Class 3 and 4 respectively as detailed in Section 5.2.

1.0 INTRODUCTION

1.1 Background

Biosis Research Pty. Ltd. was commissioned by Hassell Pty. Ltd. to undertake a terrestrial flora and fauna assessment for a proposed Concept Plan application at the Australian Catholic University (ACU), Strathfield (hereafter referred to as 'the proposal').

This report evaluates the impact of the proposal in accordance with the requirements of the Part 3A Guidelines for Threatened Species Assessment (DEC & DPI 2005) of the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act) for threatened biota as listed under the NSW *Threatened Species Conservation Act* 1995 (TSC Act), and evaluates the impacts of the proposal on Matters of National Environmental Significance (MNES) as listed under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) through consideration of the Significant Impact Guidelines (DEWHA 2009b).

1.1.1 Description and Features of the Study area

The ACU campus is located in Strathfield, within the Strathfield LGA (Figure 1). The main campus is accessed via Barker Street to the south, with the affiliated Edward Clancy building lying adjacent to the main campus and is accessed from Albert Road to the south.

The landscape within the ACU grounds like much of the surrounding area is highly modified. The ACU grounds themselves are picturesque featuring grand heritage buildings, extensive lawn areas, mature trees, rose gardens and manicured hedges.

For the purposes of this assessment, the **subject site** (area of *direct* impact) is defined as the entire ACU campus grounds. This larger than necessary subject site has been considered given: the range of improvements that are proposed to be undertaken across the campus; that at some point during the staged construction phases each part of the campus may be temporarily affected; and, that this report has been based on the current Concept Plan which may be adjusted before the Final Design Plans for the upgrades at ACU are finalised.

Indirect impacts resulting from the proposal are likely to be minimal and are expected to be contained within the ACU campus grounds. Therefore, the total **study area** (subject site inclusive of areas of indirect impacts) is considered to be contained within the ACU campus grounds (Figure 2).

The **locality** is defined as the area located within a 5 km radius of the study area.

1.1.2 Proposed Development

The major upgrades considered within the ACU Concept Plan proposes the establishment of additional car-parking across the campus grounds to service the predicted student and staff requirements for 2016 (Hassell 2011). The proposal also includes upgrades to existing buildings and the construction of additional buildings within the main campus grounds.

The proposal would take place entirely within the ACU campus grounds (Figure 2). Details of these major upgrades include the following:

- The main additional car-park to be constructed is located at the north western corner of the campus. This underground car-park is proposed beneath part of the existing sports oval. Smaller areas of established car-spaces throughout the campus will be reconfigured to allow for additional parking.

- A new library building is proposed to be constructed at the south-eastern corner of the main campus grounds on the corner of Barker and South Streets. Currently this area is a large car-park for the University students.

- Access to the proposed library and learning commons will be facilitated from the south-east corner of the ACU campus and will require the removal of several mature Turpentine trees.

- As part of this proposal, the removal of some planted trees would be required. However, the landscaping within the Concept Plan indicates that mature trees will continue to be an important landscaping feature within the ACU campus grounds. Where feasible mature trees that are removed as part of the works will be transplanted or replaced elsewhere on campus.

1.2 Aims

The general aim of this report is to undertake a terrestrial flora and fauna assessment of the study area and to determine the impact of the proposal on matters of conservation significance.

The specific aims are to:

- Conduct a literature review and database search for the study area focussing on threatened species, populations and ecological communities;
- Examine the nature, extent and condition of fauna habitats and vegetation associations within the study area, through a combination of desktop research and field survey;
- Undertake targeted field surveys for habitat of threatened terrestrial species, populations and ecological communities listed under the schedules of the TSC and/or EPBC Acts that are known or likely to occur within the study area;
- Assess the potential and actual occurrence of flora and fauna species and populations of conservation significance, in particular, threatened species, populations and Endangered Ecological Communities (EECs);
- Map the locations of significant flora and fauna;
- Where required, evaluate the impact of the proposal by undertaking impact assessments following the Part 3A Guidelines for Threatened Species Assessment (DEC & DPI 2005) of the EP&A Act for threatened biota as listed under the TSC Act;

- Where required, evaluate the impact on MNES listed under the EPBC Act for the proposal through consideration of the Significant Impact Guidelines for threatened biota and migratory species as outlined in *EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance* (DEWHA 2009b); and,
- Provide recommendations to minimise environmental impacts from the proposal on the natural environment, including in particular threatened species and their habitats.

2.0 LEGISLATIVE REQUIREMENTS

NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act)

The EP&A Act provides the statutory context for environmental assessment of the proposal and ultimately planning approval. The current proposal is to be assessed under Part 3A and other relevant provisions of the EP&A Act. One objective of the EP&A Act is to encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities and their habitats. A second objective is to encourage the principles of ecologically sustainable development, including the precautionary principle as defined under the *Protection of the Environment Administration Act* 1991.

On 16 June 2011, the NSW Government introduced a Bill into the Parliament to repeal Part 3A EP&A Act and replace it with an alternative system for the assessment of projects of genuine State significance. The Bill, which has now been passed by the Parliament, is known as the *Environmental Planning and Assessment Amendment (Part 3A Repeal) Bill* 2011. Transitional provisions have been designed to include current part 3A applications that have environmental assessments notified, such as the current project. The current project will be determined by the Minister under Part 3A.

***Threatened Species Conservation Act* 1995 (NSW)**

The TSC Act protects all threatened plants and animals native to NSW (with the exception of fish and marine plants). It provides for the identification, conservation and recovery of threatened species and their populations and communities. It also aims to reduce the threats faced by those species.

If a planned development or activity is likely to have an impact on a threatened species, population or ecological community this must be taken into account in the development approval process. In some cases, the Minister for the Environment will also need to be consulted.

***Environment Protection and Biodiversity Conservation Act* 1999 (Commonwealth)**

The EPBC Act is a Commonwealth mechanism that requires proposed actions to be assessed in terms of their potential impact upon “Matters of National Environmental Significance” (MNES). MNES currently listed under the EPBC Act are:

- World Heritage properties;
- Natural heritage places;
- Wetlands of international importance (Ramsar wetlands, CAMBA, JAMBA and ROKAMBA);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and,

- Nuclear actions (including uranium mining).

Where a potential impact on a MNES is likely to occur as a result of a proposed action, the significance of that impact must be assessed. Guideline criteria for determining whether an impact is significant are provided under the Act. Where a proposed action will, or is likely to, have a significant impact on a MNES, a Referral to the Commonwealth Environment Minister must be prepared. The purpose of the Referral is to determine whether a proposed action requires approval and/or controls under the EPBC Act.

3.0 METHODOLOGY

The study area was inspected on 2nd June 2011 by a zoologist and a botanist. The general condition of the site was assessed and observations made of plant communities, habitats and plant and animal species (as detailed below). During the site inspection the weather was warm and sunny (approximately 23^{o}C), with an occasional breeze.

3.1 Taxonomy

The plant taxonomy (method of classification) used in this report follows the most recent Flora of New South Wales (Harden 1990; Harden 1992a; Harden 1993; Harden 2002). In the body of this report plants are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the scientific name only. Common and scientific names are included in the Appendices.

Names of vertebrates follow the Census of Australian Vertebrates (CAVs) maintained by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (DEWHA 2009a). In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only. Common and scientific names are included in the Appendices.

3.2 Literature and Database Review

A list of the documents used to prepare this report is located in *References*.

Records of threatened species, populations and communities were obtained from the OEH Atlas of NSW Wildlife from within a 10 km radius of the study area, using the Sydney 1:100,000 map sheet.

Records of threatened species, populations and ecological communities listed on the EPBC Act were obtained from the DSEWPaC Online EPBC Protected Matters Database from within a 10 km radius of the study area.

Finally, records of threatened and migratory birds occurring within 10 km of the study area were obtained from Bird's Australia's Atlas of Australian Birds.

All database searches were conducted in May 2011.

3.3 Flora Survey

Plant species and their habitat were surveyed by undertaking general habitat assessments and targeted searches for threatened species previously recorded within the locality. A species inventory for the site was compiled and noxious weeds recorded.

3.3.1 Flora Habitat Assessment

The condition of the vegetation was assessed according to the degree to which it resembled relatively natural, undisturbed vegetation using the following criteria:

- species composition (species richness, degree of weed invasion); and,
- vegetation structure (representation of each of the original layers of vegetation).

The four categories used to evaluate general vegetation community condition were Good, Moderate, Poor and Unnatural as detailed below:

Good: containing a high number of indigenous species; no weeds present or weed invasion restricted to edges and track margins; vegetation community contains original layers of vegetation; vegetation layers (ground, shrub, canopy etc) are intact;

Moderate: containing a moderate number of indigenous species; moderate level of weed invasion; weeds occurring in isolated patches or scattered throughout; one or more of original layers of vegetation are modified; vegetation layers (ground, shrub, canopy etc) are largely intact;

Poor: containing a low number of indigenous species; high level of weed invasion; weeds occurring in dense patches or scattered throughout; one or more of the original layers of vegetation are highly modified; one or more original vegetation layers (ground, shrub, canopy etc) are modified or missing; and,

Unnatural landscape: highly modified landscape containing few or no indigenous species; exotic species dominant; original native vegetation layers removed; natural soil profile disturbed; unable to be regenerated to natural condition; high input intervention required to revegetate.

3.4 Fauna Survey

Terrestrial animal species and their habitats were surveyed by undertaking general habitat assessments and active searching and listening, as well as recording incidental observations.

3.4.1 Fauna Habitat Assessment

Fauna habitat assessments were based on the presence of one or more of the following features:

- vegetation cover;
- specific feed trees;
- size range and abundance of tree hollows;
- rock outcrops, overhangs or crevices;
- freestanding water bodies, ephemeral drainage or seepage areas;

- disturbances, including weed invasion, clearing, rubbish dumping or fire;
- potential foraging, nesting or roosting resources;
- connectivity to off site habitats; and,
- surrounding habitat.

The three categories used to evaluate habitat value were Good, Moderate or Poor, as detailed below:

Good: ground flora containing a high number of indigenous species; vegetation community structure, ground, log and litter layer intact and undisturbed; a high level of breeding, nesting, feeding and roosting resources available; a high richness and diversity of native animal species;

Moderate: ground flora containing a moderate number of indigenous species; vegetation community structure, ground log and litter layer moderately intact and undisturbed; a moderate level of breeding, nesting, feeding and roosting resources available; a moderate richness and diversity of native fauna; and,

Poor: ground flora containing a low number of indigenous species, vegetation community structure, ground log and litter layer disturbed and modified; a low level of breeding, nesting, feeding and roosting resources available; a low richness and diversity of native animal species.

3.5 Threatened and migratory species likelihood of occurrence criteria

The likelihood of occurrence assessment for threatened flora and fauna and migratory species was based on previous records collated from database searches, data collected during the field survey, the current (known) distribution range of these species, and the presence and condition of suitable habitat in the Study Area. The criteria to assess the likelihood of threatened flora and fauna or migratory fauna species to occur within the study area is presented in Table 1.

The likelihood of occurrence assessments for threatened flora and fauna are provided in Table 2 and Table 3.

Table 1 Likelihood of occurrence criteria for threatened flora and fauna or migratory fauna species.

Likelihood of occurrence	Assessment Criteria
Low	Species considered to have a low likelihood of occurrence include species not recorded in the field surveys that fit one or more of the following criteria: • Have not been recorded previously in the study area or locality and the study area is beyond the known distribution or range. • Are dependant on a narrow range or specific habitats that do not or are not likely to occur in the study area. • Are considered locally extinct.

Likelihood of occurrence	Assessment Criteria
	• Are a non-cryptic perennial flora species that were targeted during field surveys. • Are flora species that have a very limited range and highly specific dispersal mechanisms.
Moderate	Species considered to have a moderate likelihood of occurrence include species not recorded in the field surveys that fit one or more of the following criteria: • There are infrequent records for the species in the study area and locality. • Preferential habitats of the species are present in the study area but these are mainly in a poor or modified condition. • May use or occur in habitats within the study area opportunistically during seasonal migration but are unlikely to be present on permanent basis as a populations or vagrant individuals. • Are cryptic flowering flora species that were not seasonally targeted during surveys.
High	Species considered to have a high likelihood of occurrence include species recorded during the field surveys or species not recorded that fit one or more of the following criteria: • Have a high incidence of previous records in the study area and locality. • Preferentially use habitats that are present in the study area which are abundant and/or in good condition. • Resident populations are known in the study area or locality. • Are known to regularly use habitats of the site or locality or are highly likely to visit the site during seasonal dispersal or migration.

3.6 Limitations

Some plant species that occur within the locality are annuals (completing their life cycle within a single season) and are present only in the seed bank for much of the year. Other plant species are perennial, but are inconspicuous unless flowering or in fruit. Furthermore, some animal species are only detectable at certain times of the year. Therefore, as the field surveys were conducted over one day in June it is likely that some species that are present on the site were not detected.

Despite these limitations, the assessment of impact is based on the presence or absence of suitable habitat for threatened flora and fauna, and as such, species are taken into account during the assessment even though they may not have been detected during the survey.

4.0 RESULTS

A list of the flora and fauna recorded during the current survey is provided in Appendix 1 and Appendix 2 respectively.

4.1 Plant Communities

4.1.1 Vegetation mapping

The Native Vegetation of the Sydney Metropolitan CMA (2009) as shown in Figure 5 identifies the study area as 'Urban Exotic/Native'. This indicates that the vegetation occurring is a derived plant community and is characterised by planted native and exotic species.

4.1.2 Current Survey

Study area

The native vegetation within the study area has predominately been removed in all structural layers. The vegetation within the study area is characterised by planted trees, lawns and landscaped gardens.

Turpentine (*Syncarpia glomilifera*) occurs sparsely as individual trees throughout the site, particularly at the south-eastern corner of the campus grounds. These are mature specimens and may be naturally occurring as a remnant of the original vegetation community, however this is difficult to determine as the species is widely planted around Sydney and there are planted exotic species within the study area of a similar age. One mature Fine Leaved Ironbark (*Eucalyptus crebra*) was observed on the western boundary of the study area. This tree is considered to be naturally occurring and representative of the original native vegetation of the area.

Planted trees common throughout the study area are Broad Leaved Paperbark (*Melaleuca quinquenervia*), Lemon Scented Gum (*Eucalyptus citriodora*) and Brush Box (*Lophostemon confertus*). The grounds of the Edward Clancy Building were included within the survey. The vegetation throughout consists of planted exotic species dominated by Camphor Laurel (*Cinnamomun camphora*), Jacaranda (*Jacaranda mimosifolia*) and Crepe Myrtle (*Lagestroemia indica*).

The midstorey vegetation over the entire study area is restricted to landscaped garden areas and is comprised of exotic planted species including rose gardens, shrubs, hedges and screening plants. Hedging and screening species include Orange Jasmine (*Murraya panniculata*), Lilly Pilly (*Amena smithii*)*, Xylosma sp* Japanese Box (*Buxus microphylla var. japonica*) and Cypress *Cuppressus sp*.

The ground layer vegetation is predominately maintained as lawn with a mixture of species including Buffalo Grass (*Stenotaphrum secundatum*), Couch (*Cynadon daxctylon*) and Kikuyu (*Pennisetum clandestinum*). Native species occurring within the lawns are Kidney Weed (*Dichondra repens*) and Weeping Meadow Grass (*Microlina stipoides*).

According to the flora habitat assessment criteria detailed in Section 4.3 the vegetation within the study area is classed as being an Unnatural Landscape.

4.2 Flora

A list of flora species recorded from the subject site and within the study area is provided in Appendix 1.

A total of 52 flora species were recorded from the subject site (including the main campus and the Edward Clancy Building), comprising 19 native species (one and possibly two of which are naturally occurring), and 24 exotic species (including 8 weed species).

Two of the exotic species recorded in the study area are listed under the *Noxious Weeds Act* 1993 and the *Noxious Weeds Amendment Act* 2005 for the Strathfield LGA. These species and their control classes are:

- Broad Leafed Privet *(Ligustrum lucidum)*: Class 4. The legal requirement for the control of a Class 4 weed is: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. Evidence of control measures targeting this species were observed during the site visit.

- Green Cestrum *(Cestrum parquai)*: Class 3. The legal requirement for the control of a Class 3 weed is: The plant must be fully and continuously destroyed.

4.2.1 Significant Flora

A total of 34 threatened flora species or their habitat, and four endangered populations, have been previously recorded within a 10 km radius of the study area (DPC-OEH Atlas of NSW Wildlife and DSEWPaC Online EPBC Database) (Table 2). Of these, 31 species and the four endangered populations are listed under the TSC Act and 27 under the EPBC Act. Threatened flora species recorded within 10 km of the study area and are shown in Figure 3.

Two threatened flora species were recorded in the study area during the current survey, Magenta Lilly Pilly (*Syzygium paniculatum*) and Narrow Leaved Black Peppermint (*Eucalyptus nicholii*). These species are both widely planted throughout Sydney and are within landscaped gardens and are not naturally occurring within the study area. The distribution of naturally occurring Narrow Leaved Black Peppermint is restricted to the New England Tablelands of NSW. Magenta Lilly Pilly is a rainforest tree that naturally occurs within littoral rainforest, subtropical rainforest and rainforest gullies near the coast between Lake Conjola and Bulahdelah. As the study area is outside of the natural distribution for Narrow Leaved Black Peppermint and does not provide suitable habitat for Magenta Lilly Pilly to occur naturally these species are considered to be planted and are therefore not considered further under the EPBC or the TSC Acts. All other threatened plants and endangered plant populations are considered to have a low likelihood of occurrence within the study area.

Table 2: Terrestrial flora listed on the TSC and/or EPBC Acts that may occur in the local area

Key: 1) Listed on the EPBC Act as Extinct (X), Endangered (E) or Vulnerable (V)
2) Listed on the TSC Act as Endangered (E1), Endangered Population (E2), Presumed Extinct (E4) or Vulnerable (V)

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Pultenaea parviflora	V	E1	*Pultenaea parviflora* is endemic to the Cumberland Plain, with a core distribution from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce. *P. parviflora* may be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays and in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland (NPWS 2002d). Often found in association with other threatened species such as *Dillwynia tenuifolia, Dodonaea falcata, Grevillea juniperina, Micromyrtus minutiflora, Persoonia nutans* and *Styphelia laeta*. Flowering may occur between August and November depending on environmental conditions (DEC 2005‖).	Low
Marsdenia viridiflora ssp. viridiflora Native Pear	-	E2	This species has a wide distribution in subcoastal and southern Queensland but has been recorded rarely in NSW and from a disjunct occurrence near Sydney where it occurs as very scattered plants in areas of remnant vegetation (NSW Scientific Committee 2003). Grows in woodland and scrub (Harden 1992a) and is typically found in Sydney Turpentine Ironbark Forest (NSW Scientific Committee 2003). Grows in vine thickets and open shale woodland. Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range (DEC 2005s).	Low
Wahlenbergia multicaulis Tadgell's Bluebell	-	E2	Grows in forest, woodland and grassland, chiefly in coastal and tablelands districts south from Sydney and the Blue Mountains, west along the Murray River to Mathoura (Harden 1992a). This listing covers 13 known sites, two of which are in northern Sydney on the Hawkesbury soil landscape (Thornleigh and Mt Ku-Ring-Gai) with the remainder in inner-western Sydney on the Villawood soil landscape (Rookwood, Chullora, Bass Hill, Bankstown, Georges Hall, Campsie, South Granville and Greenacre). Found in damp, disturbed sites and grows in a variety of habitats including forest, woodland, scrub, grassland and the edges of watercourses and wetlands. In Hornsby LGA it occurs in or adjacent to sandstone gully forest. In Western Sydney it is found in remnants of Cooks River/ Castlereagh Ironbark Forest (DEC 2005†).	Low

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Wilsonia backhousei Narrow-leafed Wilsonia	-	V	In NSW *Wilsonia backhousei* is found in the Southern Rivers and Sydney Metropolitan Catchment Area, specifically on the coast between Mimosa Rocks National Park and Wamberal north of Sydney (Nelson's Lake, Potato Point, Sussex Inlet, Wowly Gully, Parramatta River at Ermington, Clovelly, Voyager Point, Wollongong and Royal National Park) (DEC 2005‡). This is a species of the margins of salt marshes and lakes, both coastal and inland, chiefly in the Sydney district, also common at Jervis Bay (Harden 1992a). Flowering occurs in spring and summer (DEC 2005‡).	Low
Hibbertia sp. Bankstown	Z	-	*Hibbertia sp. Bankstown* is only known to occur from the Bankstown Airport within the Bankstown LGA south west of Sydney NSW (DEC 2005s).	Low
Epacris purpurascens var. purpurascens	-	V	Located in the Hawkesbury/Nepean, Hunter/Central Rivers/and Sydney Metropolitan catchment authority region - from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South (DEC 2005j). *Epacris purpurascens var. purpurascens* grows in Dry Sclerophyll forests, scrub and swamps (Harden 1992a). Specifically this species is thought to require wet heath vegetation (T. James pers. comm.). Characteristically found in a range of habitat types, most of which have a strong shale soil influence. These include ridge top drainage depressions supporting wet heath within or adjoining shale cap communities (including Shale Sandstone Transition Forest, Turpentine Ironbark Margin Forest, Stringybark/Scribbly Gum Woodland and Scribbly Gum/Grey Gum/Red Bloodwood Woodland). Also occurs in riparian zones draining into Sydney Sandstone Gully Forest, shale lenses within sandstone habitats and colluvial areas overlying or adjoining sandstone or tertiary alluvium (NPWS 2002f).	Low

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Dillwynia tenuifolia	-	V	The core distribution is the Cumberland Plain from Windsor to Penrith east to Deans Park. Other populations in western Sydney are recorded from Voyager Point and Kemps Creek, Luddenham and South Maroota. Disjunct localities include: the Bulga Mountains, Kurrajong Heights and Woodford (DEC 2005i). In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland (DEC 2005i). Eucalyptus fibrosa is likely to be a dominant canopy species. *Eucalyptus globoidea, E. longifolia, E. parramattensis, E. sclerophylla* and *E. sideroxylon* may also be present or codominant (NPWS 2002b). Flowering occurs sporadically from August to March depending on environmental conditions. Surveys should initially concentrate in open areas within woodland/open forest, particularly targeting areas possessing laterised gravels, or low rises which have a well developed or regenerating low shrub layer (NPWS 2002b).	Low
Pultenaea pedunculata Matted Bush-pea	-	E1	Restricted to the Cumberland Plain and near Merimbula where it grows in dry sclerophyll forest and disturbed sites (Harden 2002). In western Sydney it occurs in three locations: within industrial and residential areas at Villawood and Prestons, and north-west of Appin between the Nepean River and Devines Tunnel No. 2(NPWS 2002e). Associated with Hawkesbury/Nepean, Southern Rivers and Sydney Metropolitan Catchment areas. It occurs in clay or sandy clay soils (Blacktown soil landscape) on Wianamatta shale, close to localised patches of Tertiary alluvium (Liverpool) or the shale/sandstone influence (west of Appin) (DEC 2005}). At all sites there is a lateritic influence in the soil with characteristic ironstone gravels present (DEC 2005}). This species is known to occur in remnants of Cooks River Clay Plain Scrub Forest (James *et al.* 1999).	Low

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Acacia bynoeana Bynoe's Wattle	V	E1	*Acacia bynoeana* is found in central eastern NSW, in the following catchment regions – Hawkesbury/Nepean, Hunter/Central Rivers, Southern Rivers, and Sydney Metropolitan. More specifically it is found from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra (DEC 2005a). It seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and recently burnt patches (DEC 2005a). It grows in sandy clay soils often containing ironstone gravels (Fairley 2004). Main vegetation types include heath or dry sclerophyll forest on sandy soils (DEC 2005a). Associated overstorey species include *Corymbia gummifera, Corymbia maculata, Eucalyptus parramattensis, Banksia serrata* and *Angophora bakeri* (DEC 2005a). Flowering period is mainly summer.	Low
Acacia prominens Gosford Wattle	-	E2	Occurs at a few sites along the railway line at Penshurst, at Carss Bush Park, Carss Park and there is an unconfirmed siting at Oatley Park, Oatley. Grows in open situations on clayey or sandy soils. Flowers from July to September and pods are produced in September-October (DEC 2005b).	Low
Acacia pubescens Downy Wattle	V	V	*Acacia pubescens* is found in Sydney Metropolitan, and Hawkesbury/Nepean Catchment Management Region, with concentrated populations around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon (NPWS 2003a). It occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravelly soils, often with ironstone. The species occurs in open woodland and forest, in a variety of plant communities, including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland (NPWS 2003a). Flowers from August to October. The pods mature in October to December (NPWS 2003a).	Low
Acacia terminalis ssp. Terminalis Sunshine Wattle	E	E1	Occurs in the Sydney Metropolitan Catchment Authority Region. It has very limited distribution between Botany Bay to the northern foreshore of Port Jackson (DEC 2005c). *Acacia terminalis subsp. terminalis* occurs in Coastal scrub and Dry Sclerophyll woodland on sandy soils. Most sites where it occurs are highly modified or disturbed due to surrounding urban development (DEC 2005c). Seed viability is high and recruitment occurs mainly after fire. Seeds mature in November and are dispersed by ants. Flowers in autumn (DEC 2005c).	Low

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Grammitis stenophylla Narrow-leaf Finger Fern	-	E1	Occurs in eastern NSW in the Sydney Metropolitan, Hawkesbury/Nepean, and Northern Rivers Catchment. It has been found on the south, central and north coasts and as far west as Mount Kaputar National Park near Narrabrai (DEC 2005m). Grows in small colonies in moist places, usually on rocks or trees near streams in rainforest and moist eucalypt forest (DEC 2005m). Common vegetation communities associated are Dry Sclerophyll Forest, Forested wetlands, Freshwater wetlands, Rainforests, and wet sclerophyll forests (DEC 2005m).	Low
Prostanthera marifolia	X	E4	Grows in sclerophyll forest and woodland, usually near the coast, in sandy loamy soils, overlying sandstone; confined to the Sydney district (Harden 1992b). This species was previously recorded from the Sydney harbour region and was presumed extinct. All attempts to recollect this species were unsuccessful until 2001. Woodland dominated by *Eucalyptus sieberi* and *Corymbia gumnifera.* In deeply weathered clay soil with ironstone nodules.	Low
Hypsela sessiliflora	X	E1	Grows in damp areas on the Cumberland Plain (Harden 1992a). Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Previous sightings are all from western Sydney, at Homebush and at Agnes Banks. May be an early successional species that benefits from some disturbance. Possibly out competed when overgrown by some species such as *Cyndon dactylon* (DEC 2005q).	Low
Callistemon linearifolius	-	V	Occurs chiefly from Georges River to the Hawkesbury River where it grows in dry sclerophyll forest (Harden 2002), open forest, scrubland (Fairley and Moore 2000) or woodland on sandstone. Found in damp places, usually in gullies (Robinson 1994). Flowers in Spring.	Low
Darwinia biflora	V	V	Occurs in the following Catchment Management Authority Regions - Hawkesbury/Nepean and Sydney Metropolitan. Is found on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Most sites are on the Lucas Heights Soil Landscape where this intergrades with either the Gymea or the Hawkesbury Soil Landscapes (NPWS 2003b). Vegetation communities include: Sydney Coastal Dry Sclerophyll Forest and Sydney Coastal Heaths. Associated overstorey species include *Eucalyptus haemastoma, Corymbia gummifera* and/or *E. squamosa* (NPWS 2003b). Prefers moist shallow depressions (Robinson 1994). Flowering occurs throughout the year but is concentrated in autumn, with mature fruits being produced from May to August.	Low

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Eucalyptus nicholii Narrow-leaved Black Peppermint	V	V	This species is widely planted as an urban street tree and in gardens but is quite rare in the wild. It is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property. Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite (DEC 2005k).	Recorded – planted specimen
Leptospermum deanei	V	V	The species grows on sandy alluvial soils and sand over sandstone on lower hill slopes and riparian zones. Associated vegetation communities include riparian shrubland, woodland and open forest. Associated species in riparian scrub are *Tristaniopsis laurina* and *Baeckea myrtifolia;* woodland species include *Eucalyptus haemastoma;* and open forest species are *Angophora costata, Leptospermum trinervium,* and *Banksia ericifolia* (DEWHA 2008). This species occurs within the Hawkesbury/Nepean and Sydney Metro (NSW) Natural Resource Management Regions (DEWHA 2008). Main occurrences around Hornsby, Warringah, Ku-ring-gai and Ryde LGAs (DEC 2005r). Flowers October-November. Probably killed by fire (DEC 2005r).	Low
Melaleuca biconvexa Biconvex Paperbark	V	V	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Catchment regions include: Hunter/Central Rivers, Hawkesbury/Nepean, Southern Rivers, and Northern River Catchments (DEC 2005u). Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October (DEC 2005u).	Low
Melaleuca deanei Dean's Melaleuca	V	V	*Melaleuca deanei* occurs in Catchment Management Regions Hawkesbury/Nepean, Southern Rivers, and Sydney Metropolitan. Distinctly it occurs in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas (DEC 2005v). The species grows in wet heath on sandstone (Harden 1991) and Dry Sclerophyll Forests. Flowers appear in summer but seed production appears to be small and consequently the species exhibits a limited capacity to regenerate (DEC 2005v).	Low

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Syzygium paniculatum Magenta Lilly Pilly	V	V	Subtropical and littoral rainforest on sandy soils or stabilised dunes near the sea (Harden 1991). Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities (DEC 2005,). The species occurs in the following Catchment Authority Regions - Hunter/Central Rivers, Hawkesbury/Nepean, Sydney Metropolitan, and Southern Rivers.	Recorded - planted specimen
Caladenia tessellate Tessellated Spider Orchid	V	E1	*Caladenia tessellata* is found in the following Catchment Management Regions Sydney Metropolitan, Southern Rivers, Hawkesbury/Nepean, and Hunter/Central Rivers. Currently known from three disjunct areas: Braidwood on southern tablelands, Ulladulla on the south coast and three populations in Wyong area on the Central Coast (DEC 2005f). It is generally found in grassy, dry sclerophyll forests/woodland, particularly those associated with clay loam, or sandy soils. However, there is one population at Braidwood in lowland on stony soil (DEC 2005f). This species only grows in very dense shrubbery in coastal areas (Bishop 1996). Flowers appear between September and November, but generally late September or early October in extant southern populations (DEC 2005f).	Low
Cryptostylis hunteriana Leafless Tongue Orchid	V	V	This species typically grows in swamp-heath on sandy soils chiefly in coastal districts (Harden 1993) but has also been recorded on steep bare hillsides (Bishop 1996). Within the Central Coast bioregion, this species has been recorded within Coastal Plains Smooth-barked Apple Woodland and Coastal Plains Scribbly Gum Woodland (Bell 2001). This species does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by *Eucalyptus sclerophylla, E. sieberi, Corymbia gummifera* and *Allocasuarina littoralis;* appears to prefer open areas in the understorey of this community and is often found in association with the *Cryptostylus subulata* (DEC 2005g). It occurs in the following Catchment Management Regions Hawkesbury/Nepean, Hunter/Central Rivers, Northern Rivers and Southern Rivers.	Low

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Genoplesium bauera Bauer's Midge Orchid	-	V	This terrestrial orchid species grows in open sclerophyll forest or moss gardens on sandstone. Typically the habitat is a drier heathy forest (Harden 1993) (Bishop 1996). The species has been recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. Flowers Dec. - Mar (DEC 2005l).	Low
Pterostylis saxicola Sydney Plains Greenhood	E	E1	Restricted to western Sydney between Freemans Reach in the north and Picton in the south (Hawkesbury/Nepean and Sydney Metropolitan Catchment) (DEC 2005…). Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils (DEC 2005…). All species of Pterostylis are deciduous and die back to fleshy, rounded underground tuberoids. The time of emergence and withering has not been recorded for this species, however flowering occurs from October to December and may vary due to climatic conditions. The above ground parts of the plant whither and die following seed dispersal and the plant persists as a tuberoid until the next year (DEC 2005…).	Low
Thelymitra sp. Kangaloon	Z	-	*Thelymitra sp. Kangaloon* is a terrestrial orchid endemic to New South Wales, and is known from three locations near Robertson in the Southern Highlands. The swamp habitat in which the species occurs has an extent of occurrence of 300 km2 and an area of occupancy of 10 km2. The three swamps are Butlers Swamp, Stockyard Swamp and Wildes Meadow Swamp, and are all located above what is known as the Kangaloon aquifer. It flowers in late October and early November. The species grows amongst tall sedges and rushes in seasonally swampy sedgeland on grey silty clay loam at 600-700 m above sea level (Threatened Species Scientific Committee 2008).	Low
Bothriochloa biloba Lobed Blue-grass	V	-	Found in woodland on nutrient poor soils (Harden 1993). This species has a strong preference for heavier textured soils and has previously been recorded on volcanic soils. Restricted levels of grazing and growth of *Aristida ramosa* have been found to cause reduction and exclusion of this species (Bean 1999).	Low

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Deyeuxia appressa	E	E1	Only occurs in Sydney Metropolitan Catchment Region. A highly endemic known only from two pre-1942 records in the Sydney area. Was first collected in 1930 at Herne Bay, Saltpan Creek. Was then collected in 1941 from Killara, near Hornsby. Has not been collected since and may now be extinct (DEC 2005h). Given that *D. appressa* hasn't been seen in over 60 years, almost nothing is known of the species' habitat and ecology. Flowers spring to summer and is mesophytic (grows in moist conditions) (DEC 2005h).	Low
Grevillea parviflora ssp. Parviflora Small-flower Grevillea	V	V	Located in Hawkesbury/Nepean, Hunter/Central Rivers and Sydney Metropolitan Catchment. Sporadically distributed throughout the Sydney Basin with the main occurrence centred in Picton, Appin, Wedderburn and Bargo. Northern populations are found in the Lower Hunter Valley. To the west of Sydney, small populations occur at Kemps Creek & Voyager Point (DEC 2005o). *Grevillea parviflora ssp. parviflora* grows on sandy clay loam soils, often with ironstone gravels. Soils are mostly derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine-grained sandstones (NPWS 2002c). *Grevillea parviflora subsp. parviflora* is found on crests, upper slopes or flat plains in both low-lying areas and on higher topography. The plant prefers open habitat conditions with the largest populations in open woodland and along exposed roadside areas (NPWS 2002c). *G. parviflora subsp. parviflora* has been recorded in a range of vegetation types from heath and shrubby woodland to open forest. Canopy species vary greatly with community type but generally are species that favour soils with a strong lateritic influence including *Eucalyptus fibrosa, E. parramattensis, Angophora bakeri* and *Eucalyptus sclerophylla* (NPWS 2002c).. Flowering has been recorded between July to December as well as April-May (NPWS 2002c).	Low
Persoonia hirsute Hairy Geebung	E	E1	Occurs from Gosford to Royal NP and in the Putty district from Hill Top to Glen Davis where it grows in woodland to dry sclerophyll forest on sandstone (Harden 2002) or rarely on shale (NSW Scientific Committee 1998). Two subspecies are recognised, *P. hirsuta ssp. hirsuta* (Gosford to Berowra and Manly to Royal NP) and *P. hirsuta ssp. evoluta* (Blue Mountains, Woronora Plateau and Southern Highlands). Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone and shale-sandstone transition areas (DEC 2005w).	Low

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Persoonia nutans Nodding Geebung	E	E1	Occurs in Hawkesbury/Nepean and Sydney Metropolitan Catchment. Restricted to the Cumberland Plain between Richmond in the north and Macquarie Fields in the south. Core distribution occurs within the Penrith LGA, and to a lesser extent, Hawkesbury LGA. Small populations also occur in the Liverpool, Campbelltown, Bankstown and Blacktown LGAs (DEC 2005x). Confined to aeolian and alluvial sediments and occurs in a range of sclerophyll forest and woodland vegetation communities with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland (DEC 2005x). *P. nutans* also occurs on Shale/Gravel Transition Forest and Cooks River Castlereagh Ironbark Forest (DEC 2005x). In Castlereagh Scribbly Gum Woodlands it is found in open woodland with dominant overstorey species being *Angophora bakeri, Eucalyptus sclerophylla* and *Melaleuca decora.* The Agnes Banks Woodlands have a similar array of tree species, with the addition of *Banksia serrata* and *Banksia aemula* (DEC 2005x). *Persoonia nutans* is found on the Agnes Banks and Berkshire Park soil landscapes. Drainage appears to influence the distribution of *P. nutans* as the species is more common on the deeper sands at Agnes Banks. At other locations on the Cumberland Plain it occurs on low rises as opposed to swales or other low lying areas (DEC 2005x).	Low
Pomaderris prunifolia	-	E2	Known from only three sites within the listed local government areas, at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown. At Rydalmere it occurs along a road reserve near a creek, among grass species on sandstone. At Rookwood Cemetery it occurs in a small gully of degraded Cooks River / Castlereagh Ironbark Forest on shale soils (DEC 2005z).	Low
Thesium austral Austral Toad-flax	V	V	Found in very small to large populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. *Thesium australe* is a root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass (DEC 2005„). It is often found in damp sites in association with *Themeda australe*, but also found on other grass species at inland sites (G. Leonard pers. obs.). Occurs on clay soils in grassy woodlands or coastal headlands (James *et al.* 1999).	Low

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Pimelea curviflora var. curviflora	V	V	Occurring in Hawkesbury/Nepean and Sydney Metropolitan Catchment Authority Areas. Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west (DEC 2005y). Occurs on lateritic soils and shale-sandstone transition soils on ridge tops in woodland. Associated with Dry Sclerophyll forests and Coastal valley grassy woodlands. Has an inconspicuous cryptic habit as it is fine and scraggly and often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots (DEC 2005y). Flowers October to May.	Low
Pimelea spicata Spiked Rice-flower	E	E1	Once widespread on the Cumberland Plain, *Pimelea spicata* occurs in two disjunct areas, the Cumberland Plain and the Illawarra. Catchment areas are Hawkesbury/Nepean, Southern Rivers, and Sydney Metropolitan Catchment (NPWS 2000a). In western Sydney, *P. spicata* occurs on an undulating topography of substrates derived from Wianamatta Shale in areas supporting, or that previously supported, the Cumberland Plain Woodland Vegetation Community (NPWS 2004). Associated species include*: Eucalyptus moluccana, E. tereticornis, E.crebra, Bursaria spinosa,* and *Themeda australis* (NPWS 2004). In the Illawarra region, *P. spicata* is found in open woodland and also in coastal grassland communities with emergent shrubs. Dominant species within the woodland habitat include *Eucalyptus tereticornis, E. eugenioides, Themeda australis,* and *Lomandra longifolia*. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a more well developed shrub and grass understorey (NPWS 2004). *Pimelea spicata* flowers sporadically throughout the year, with flowering likely to depend upon climatic conditions, particularly rainfall. Flowering times recorded for *P. spicata* vary. Rye (1990) noted flowering period as May - January; Benson and McDougall (2001) noted peak flowering period as March/ April (NPWS 2000a).	Low

Scientific Name/ Common Name	EPBC Act[1]	TSC Act[2]	Habitat	Likelihood of Occurrence?
Tetratheca glandulosa	V	V	Occurs in Hawkesbury/Nepean, Hunter/Central Rivers, Sydney Metropolitan Catchment Authority Regions. Restricted to the following Local Government Areas: Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong (DEC 2005*f*). Associated with shale-sandstone transition habitat where shale-capping occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops (DEC 2005*f*). Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities correspond broadly to Benson & Howell's (2004) Sydney Sandstone Ridgetop Woodland. Common woodland tree species include: *Corymbia gummifera, C. eximia, Eucalyptus haemastoma, E. punctata, E. racemosa,* and/or *E. sparsifolia,* with an understorey dominated by species from the families Proteaceae, Fabaceae, and Epacridaceae (DEC 2005*f*). Flowers July-November however residual flowers may persist until late December (DEC 2005*f*).	Low
Tetratheca juncea Black-eyed Susan	V	V	*Tetratheca juncea* occurs in the Hunter/Central Rivers catchment. Specifically to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock (NPWS 2000b). It generally prefers well-drained sites and occurs on ridges, although it has also been found on upper slopes, mid-slopes and occasionally in gullies (NPWS 2000b). Vegetation types associated with *Tetratheca juncea* include sandy or swampy heath, and dry sclerophyll forests (Fairley and Moore 1995; Harden 1992a). Most populations occur in woodland on poor nutrient sandy soils with good drainage and low moisture levels (NPWS 2000b). The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape (NPWS 2000b). Typically found in dense understorey of grasses and canopy species including *Angophora costata, Corymbia gummifera, Eucalyptus haemastoma* and *E. capitellata* (NPWS 2000b). Flowers mostly July to Dec (Harden 1992a).	Low

4.3 Terrestrial Fauna

4.3.1 Terrestrial Fauna Habitat

Suitability, size and configuration of terrestrial vertebrate fauna habitats broadly correlate to the structure, connectivity and quality of local and regional vegetation types (see Section 5.1). The terrestrial fauna habitat within the study area consists of mature Eucalypts, fruiting palms, hedges and planted garden beds and the surrounding vegetation. Finer scale habitat features are limited within the study area but include campus buildings, fruit bearing and flowering trees and mown lawn. Animal species may utilise some of these features wholly or partly, in conjunction with one another, or may depend entirely on one specific habitat type.

Study site

The campus grounds of the Australian Catholic University provide habitats for a range of mobile species through the well maintained landscaped features, extensive lawns and mature trees found on site. Rows of planted Lemon-scented Gum (*Eucalyptus citriodora*) provide abundant blossoms and sap for a range of honeyeaters and sap feeders including Rainbow Lorikeets (*Trichoglossus haematodus*) and Grey-headed Flying-foxes (*Pteropus poliocephalus*). Scattered mature trees including fig species, fruiting Palms, Lilly Pilly trees and mature Turpentine trees also provide food sources for a variety of native and exotic fauna species, including Ring-tailed Possums (*Pseudocheirus peregrinus*).

Scratchings were observed beneath a row of planted conifers along the southern boundary of the campus. It is likely that the scratchings are from Ring-tailed Possums which favour densely foliaged conifers for sheltering and drey sites.

The extensive lawn areas of the sporting oval were favoured by the Australian White Ibis (*Threskiornis molucca*) and Welcome Swallows (*Hirundo neoxena*) which were observed foraging in the grassy areas following the recent rains (Plate 4).

The habitats available on site for fauna are limited however it is apparent that conscientious efforts are made to encourage the presence of wildlife within the campus grounds. This is evident through the abundance of native and fruiting trees selected as landscaping features and through what appears to be habitat enrichment efforts, through the installation of artificial shelters for resident possums (Plate 6).

Terrestrial fauna habitats within the subject site are considered to be in Poor condition for fauna habitats, given the lack of diversity of habitat features including ground and shrub layers; low abundance of remnant trees; absence of tree hollows; absence of ground log and litter layer; and, the highly modified urban nature of the site.

4.3.2 Terrestrial Animal Species

Fifteen species of bird were recorded during the current field survey including corvids, honeyeaters and pigeons (Appendix 2).

4.3.3 Significant Terrestrial Animal Species

A total of 83 threatened and/or migratory terrestrial animal species or their habitat (including two listed as endangered populations) have been previously recorded within a 10 km radius of the study area (DPC-OEH Atlas of NSW Wildlife, Birds Australia's Atlas of Australian Birds and DSEWPC Online EPBC Database) (Table 3). Of these, 45 animal species are listed under the TSC Act and 61 animal species are listed under the EPBC Act (16 threatened and 65 migratory)[1]. Forty-five threatened and/or migratory terrestrial species and two threatened populations have been previously recorded within 10 km of the study area (Figure 4).

No threatened or migratory animal species were recorded during the current survey however a number of threatened and migratory species have been previously recorded within and surrounding the study area (Figure 4). Eight threatened or migratory species and one endangered population (Table 3) are considered to have a moderate likelihood of occurrence within the study area: White-bellied Sea-eagle (*Haliaeetus leucogaster*), Fork-tailed Swift (*Apus pacificus*), White-throated Needletail (*Hirundapus caudacutus*), Cattle Egret (*Ardea ibis*), Eastern Freetail Bat (*Mormopterus norfolkensis*), Long-nosed Bandicoot (*Perameles nasuta*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bentwing-bat (*Miniopterus australis*) and Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*). Species with a moderate to high likelihood of occurrence within the study area have been considered further in Section 6.0 (Impact Assessment) of this report.

[1] An individual species may be listed under one or both Acts and may be listed as threatened and/or migratory.

Table 3: Terrestrial fauna listed on the TSC and/or EPBC Acts that may occur in the local area

Key: 1) Listed on the EPBC Act as Endangered (E), Vulnerable (V) or covered under migratory provisions (M) on the EPBC Act.
2) Listed on the TSC Act as Endangered (E1), Critically Endangered (C1), Endangered Population (E2) or Vulnerable (V).

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Amphibians				
Litoria aurea Green and Golden Bell Frog	V	E1	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VIC (NSW Government 2009). The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks (NPWS 1999d; White and Pyke 1996), although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take approximately 10-12 weeks to develop (DECC 2008), feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species (DEC 2005n).	Low
Litoria raniformis Southern Bell Frog	V	E1	In NSW the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral swamps or billabongs with an abundance of bulrushes and other emergent vegetation along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. Outside the breeding season animals disperse away from the water and take shelter beneath ground debris such as fallen timber and bark, rocks, grass clumps and in deep soil cracks (Robinson 1993; DEC 2005).	Low
Heleioporus australiacus Giant Burrowing Frog	V	V	Prefers hanging swamps on sandstone shelves adjacent to perennial non-flooding creeks (Daly 1996) (Recsei 1996). Can also occur within shale outcrops within sandstone formations. Known from wet and dry forests and montane woodland in the southern part range (Daly 1996). Individuals can be found around sandy creek banks or foraging along ridge-tops during or directly after heavy rain. Males often call from burrows located in sandy banks next to water (Barker *et al.* 1995). Spends the majority of its time in non-breeding habitat 20-250m from breeding sites (Penman *et al.* 2008).	Low
Mixophyes balbus Stuttering Frog	V	E1	This species is usually associated with mountain streams, wet mountain forests and rainforests (Barker *et al.* 1995). It rarely moves very far from the banks of permanent forest streams, although it will forage on nearby forest floors. Eggs are deposited in leaf litter on the banks of streams and are washed into the water during heavy rains (Barker *et al.* 1995).	Low

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Pseudophryne australis Red-crowned Toadlet	-	V	Occurs on wetter ridge tops and upper slopes of sandstone formations on which the predominant vegetation is dry open forests and heaths. This species typically breeds within small ephemeral creeks characterised by a series of shallow pools that feed into larger semi-perennial streams (Thumm and Mahony 1997). Breeds all year round (Thumm and Mahoney 2002).	Low
Birds				
Haliaeetus leucogaster White-bellied Sea-eagle	M	-	A migratory species that is generally sedentary in Australia, although immature individuals and some adults are dispersive (Marchant and Higgins 1993). Found in terrestrial and coastal wetlands; favouring deep freshwater swamps, lakes and reservoirs; shallow coastal lagoons and saltmarshes. It hunts over open terrestrial habitats. Feeds on birds, reptiles, fish, mammals, crustaceans and carrion. Roosts and makes nest in trees (Marchant and Higgins 1993).	Moderate, may fly over site
Hieraaetus morphnoides Little Eagle	-	V	The Little Eagle is most abundant in lightly timbered areas with open areas nearby providing an abundance of prey species (NSW Scientific Committee 2009a). It has often been recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. The Little Eagle nests in tall living trees within farmland, woodland and forests (Marchant and Higgins 1993).	Low
Pandion haliaetus Osprey	M	V	Found in coastal waters, inlets, estuaries and offshore islands. Occasionally found 100 km inland along larger rivers (Pizzey and Knight 1997). It is water-dependent, hunting for fish in clear, open water. The Osprey occurs in terrestrial wetlands, coastal lands and offshore islands. It is a predominantly coastal species, generally using marine cliffs as nesting and roosting sites. Nests can also be made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea (Marchant and Higgins 1993).	Low
Stictonetta naevosa Freckled Duck	-	V	The freckled duck breeds in permanent fresh swamps that are heavily vegetated. Found in fresh or salty permanent open lakes, especially during drought. Often seen in groups on fallen trees and sand spits (Simpson and Day 1996).	Low

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Apus pacificus Fork-tailed Swift	M	-	Almost exclusively aerial (foraging). The Fork-tailed Swift breeds in Asia but migrates to Australia from September to April (Higgins 1999). Individuals or flocks can be observed hawking for insects at varying heights from only a few metres from the ground and up to 300 metres high (Boehm 1944).	Moderate, may fly over site
Hirundapus caudacutus White-throated Needletail	M	-	An aerial species found in feeding concentrations over cities, hilltops and timbered ranges. Breeds in Asia (Pizzey and Knight 1997).	Moderate, may fly over site
Ardea alba Great Egret	M	-	Terrestrial wetlands, estuarine and littoral habitats and moist grasslands. Inland, prefer permanent waterbodies on floodplains; shallows of deep permanent lakes (either open or vegetated), semi-permanent swamps with tall emergent vegetation and herb dominated seasonal swamps with abundant aquatic flora. Also regularly use saline habitats including mangrove forests, estuarine mudflats, saltmarshes, bare saltpans, shallows of salt lakes, salt fields and offshore reefs. Breeding requires wetlands with fringing trees in which to build nests including mangrove forest, freshwater lakes or swamps and rivers (Marchant and Higgins 1990).	Low
Ardea ibis Cattle Egret	M	-	Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands (Marchant and Higgins 1990).	Moderate
Ixobrychus flavicollis Black Bittern	-	V	The Black Bittern is found along the coastal plains within NSW, although individuals have rarely being recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation (DEC 2005e; NPWS 1999a). The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates (DEC 2005e). The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.	Low
Burhinus grallarius Bush Stone-curlew	-	E1	Lightly timbered open forest and woodland, or partly cleared farmland with remnants of woodland, with a ground cover of short sparse grass and few or no shrubs where fallen branches and leaf litter are present (Marchant and Higgins 1993).	Low
Charadrius bicinctus Double-banded Plover	M	-	Tidal mudflats, beaches, exposed reefs, salt marshes, freshwater wetlands, inland salt lakes, short grass on golf courses, airfields (Morcombe 2003).	Low

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Charadrius leschenaultia Greater Sand Plover	M	V	Entirely coastal in NSW, foraging on intertidal sand and mudflats in estuaries and roosting during high tide on sandy beaches or rocky shores. Individuals have been recorded on inshore reefs, rock platforms, small rocky islands and sand cays on coral reefs, within Australia. Occasional sightings have also occurred on near-coast saltlakes, brackish swamps, shallow freshwater wetlands and grassed paddocks (NPWS 1999c).	Low
Charadrius mongolus Lesser Sand Plover	M	V	In Australia, the species is known to favour coastal environs including beaches, mudflats and mangroves. Within NSW, individuals have been observed on intertidal sand and mudflats in estuaries or roosting on sandy beaches or rocky shores at high tide (NPWS 1999e).	Low
Charadrius ruficapillus Red-capped Plover	M	-	Habitat is coastal – sheltered estuaries, salt marsh lagoons; also inland on salty edges of waterways, brackish pools and claypans. Greatest numbers can occur on inland lakes (Morcombe 2003).	Low
Pluvialis fulva Pacific Golden Plover	M	-	Migratory species that visits estuaries mudflats, saltmarshes and ocean shores as well as paddocks, grasslands and swamps near the coast (Pizzey and Knight 1997).	Low
Pluvialis squatarola Grey Plover	M	-	Almost entirely coastal, but occasionally recorded on inland wetlands. Mainly on marine shores, inlets, estuaries and lagoons where there are nearby large tidal mudflats or sandflats for feeding and sandy beaches for roosting (Marchant and Higgins 1993).	Low
Ptilinopus superbus Superb Fruit-Dove	-	V	The Superb Fruit Dove's NSW distribution ranges from northern NSW to as far south as Moruya (DEC 2005€). It is found in rainforests, closed forests (including mesophyll vine forests) and sometimes in eucalypt and acacia woodlands where there are fruit-bearing trees (Higgins and Davies 1996). It forages in the canopy of fruiting trees such as figs and palms. Nests are constructed high in the canopy throughout September to January (DEC 2005€).	Low

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Monarcha melanopsis Black-faced Monarch	M	-	A migratory species found during the breeding season in damp gullies in temperate rainforests. Disperses after breeding into more open woodland (Pizzey and Knight 1997).	Low
Myiagra cyanoleuca Satin Flycatcher	M	-	Migratory species that occurs in coastal forests, woodlands and scrubs during migration. Breeds in heavily vegetated gullies (Pizzey and Knight 1997).	Low
Rhipidura rufifrons Rufous Fantail	M	-	Migratory species that prefers dense, moist undergrowth of tropical rainforests and scrubs. During migration it can stray into gardens and more open areas (Pizzey and Knight 1997).	Low
Haematopus longirostris Pied Oystercatcher	-	E1	An intertidal forager found on undisturbed sandy beaches and spits, tidal mudflats and estuaries. Its food supply (beach macroinvertebrates) have been negatively affected by human impacts (NSW Scientific Committee 2010a). The Pied Oystercatcher is restricted to the littoral zone of beaches and estuaries, nesting on the ground above the tideline. A pair will re-nest in the same spot each year, rarely shifting their territory (NSW Scientific Committee 2010a). Occasionally the Pied Oystercatcher is found in paddocks near the coast (Pizzey and Knight 1997).	Low
Sterna albifrons Little Tern	M	E1	The Little Tern favours sheltered coasts, harbours, bays, lakes, inlets, estuaries, coastal lagoons and ocean beaches especially with sand-spits and sand islets (Higgins and Davies 1996; Morcombe 2003). It forages over shallow waters close inshore or over sandbars and reefs (Morcombe 2003).	Low
Sterna caspia Caspian Tern	M	-	Usually coastal, with a preference for sheltered estuaries, inlets, bays, harbours, lagoons with muddy or sandy shores. Keeps close inshore, not out beyond reef line. Also extends well inland on fresh or salt lakes, temporary floodwaters, large rivers, reservoirs, sewage ponds (Morcombe 2003).	Low
Sterna hirundo Common Tern	M	-	Marine, typically well offshore, but also in coastal waters, sheltered bays, estuaries, and on ocean beaches (Morcombe 2003).	Low

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Anthochaera Phrygia Regent Honeyeater	E	C1	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests (NPWS 1999f; Pizzey and Knight 1997). Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: *E. microcarpa, E. punctata, E. polyanthemos, E. mollucana, Corymbia robusta, E. crebra, E. caleyi, C. maculata, E. mckieana, E. macrorhyncha, E. laevopinea* and *Angophora floribunda.* Nectar and fruit from the mistletoes *A. miquelii, A. pendula, A. cambagei* are also eaten during the breeding season (DEC 2005~). Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and sheoaks. Also nest in mistletoe haustoria. An open cup-shaped nest is constructed of bark, grass, twigs and wool by the female (DEC 2005~).	Low, no preferred feed trees on site and no preferred breeding habitat
Epthianura albifrons White-fronted Chat	-	E2	The White-fronted Chat occupies foothills and lowlands below 1000 m above sea level. In NSW it occurs mostly in the southern half of the state, occurring in damp open habitats along the coast, and near waterways in the western part of the state (Higgins *et al.* 2001). The White-fronted Chat is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands. Along the coastline, they are found in estuarine and marshy grounds with vegetation less than 1 m tall. The species is also observed in open grasslands and sometimes in low shrubs bordering wetland areas. Inland, the species is often observed in open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways (Higgins *et al.* 2001). In Victoria White-fronted Chats have been observed breeding from late July through to early March. Nests are built in low vegetation and in the Sydney region nests have also been observed in low isolated mangroves (NSW Scientific Committee 2009b). An Endangered Population occurs in the Sydney Metropolitan CMA area, at Newington Nature Reserve near Homebush and at Towra Point Nature Reserve (NSW Scientific Committee 2009c).	Low
Merops ornatus Rainbow Bee-eater	M	-	Usually occurs in open or lightly timbered areas, often near water. Nest in embankments, including banks of creeks and rivers, in sand dunes, in quarries and in roadside cuttings. Breeding occurs from November to January. It has complex migratory movements in Australia. NSW populations migrate north for winter (Higgins 1999).	Low

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Acrocephalus australis Australian Reed-Warbler	M	-	This species lives singly or in pairs usually in wetlands with reeds. It feeds on insects (Blakers *et al.* 1984).	Low
Daphoenositta chrysoptera Varied Sittella	-	V	The Varied Sittella is a sedentary species which inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands, paperbarks or mature Eucalypts (Higgins and Peter 2002; NSW Scientific Committee 2010b). The Varied Sittella feeds on arthropods gleaned from bark, small branches and twigs. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (NSW Scientific Committee 2010b).	Low
Glossopsitta pusilla Little Lorikeet	-	V	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes (NSW Scientific Committee 2008b).	Low
Lathamus discolor Swift Parrot	E	E1	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects (Forshaw and Cooper 1981). The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW (Shields and Crome 1992). Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis* (DEC 2005). This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability (Pizzey and Knight 1997).	Low, no preferred feed trees on site and no preferred breeding habitat

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Neophema chrysogaster Orange-bellied Parrot	ZM	C1	A single breeding population of fewer than 200 individuals occurs in a narrow coastal strip of south-west Tasmania. Adult birds depart Tasmania for the mainland in February. The first adults begin leaving the mainland for Tasmania in September with the last birds having departed by November. It is a coastal species inhabiting saltmarshes, sedgeplains, coastal dunes, pastures, shrublands and moorlands, generally within 10 km of the coast (OBPRT 1998). Critical winter habitat for the species includes natural saltmarshes dominated by *Sarcocornia quinqueflora* (Beaded Glasswort) and *Sclerostegia arbuscula* (Shrubby Glasswort), as well as the associated grassy or weedy pastures (DECC 2007). Historical records indicate that the Orange-bellied Parrot was formerly more abundant and widespread in NSW than it is now, however the species' distribution continues to extend into south-eastern NSW where suitable habitat is still available (DECC 2007).	Low
Neophema pulchella Turquoise Parrot	-	V	Occurs in open woodlands and eucalypt forests with a ground cover of grasses and understorey of low shrubs (Morris 1980). Generally found in the foothills of the Great Divide, including steep rocky ridges and gullies (Higgins 1999). Nest in hollow-bearing trees, either dead or alive; also in hollows in tree stumps. Prefer to breed in open grassy forests and woodlands, and gullies that are moist (Higgins 1999).	Low
Himantopus himantopus Black-winged Stilt	M	-	Prefers shallow, open freshwater wetlands especially those with dense growth of short grass or similar emergent vegetation (Marchant and Higgins 1993).	Low
Rostratula australis Australian Painted Snipe	VM	E1	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, ephemeral or permanent, although they have been recorded in brackish waters (Marchant and Higgins 1993).	Low
Actitis hypoleucos Common Sandpiper	M	-	Inhabits a wide range of coastal and inland wetlands, often with muddy or rocky margins. Also known to occur at estuaries, billabongs, dams, pools and lakes, often associated with mangroves (Higgins and Davies 1996).	Low
Arenaria interpres Ruddy Turnstone	M	-	Inhabits tidal reefs, sandy beaches mudflats and exposed or shallow seaweed beds (Pizzey and Knight 1997).	Low
Calidris acuminate Sharp-tailed Sandpiper	M	-	Inland waters, coastal (Simpson and Day 1996).	Low

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Calidris canutus Red Knot	M	-	Typically located within intertidal mudflats, sandflats and sandy beaches of sheltered coasts. Occasionally found on sandy open beaches or shallow pools, or in saline wetlands close to the coast (Higgins and Davies 1996).	Low
Calidris ferruginea Curlew Sandpiper	M	-	Inhabits sheltered intertidal mudflats. Also non-tidal swamps, lagoons and lakes near the coast. Infrequently recorded inland (Higgins and Davies 1996).	Low
Calidris mauri Western Sandpiper	M	-	Found in tidal mudflats, and tidal wetlands (Pizzey and Knight 2007).	Low
Calidris melanotos Pectoral Sandpiper	M	-	Scarce, but regular visitor, usually recorded in summer from November to March (Slater *et al.* 2003). Widespread but scattered records in Australia. Usually found in fresh to saline wetlands, floodplains, swamps, estuaries and lagoons, sometimes with emergent or fringing vegetation such as grass (Higgins and Davies 1996).	Low
Calidris ruficollis Red-necked Stint	M	-	Inhabits mainly coastal environments; saltmarshes, tidal mudflats, saline and freshwater wetlands, sandy or shelly beaches and sewage ponds (Higgins and Davies 1996).	Low
Calidris tenuirostris Great Knot	M	V	Mainly found on intertidal mudflats, sandflats and sandy beaches (Higgins and Davies 1996).	Low
Gallinago hardwickii Latham's Snipe	M	-	Typically found on wet soft ground or shallow water with good cover of tussocks. Often found in wet paddocks, seepage areas below dams (Pizzey and Knight 1997).	Low
Gallinago megala Swinhoe's Snipe	M	-	A vagrant visitor to northern and north-western Australia. A rare visitor to southern Australia (Morcombe 2003).	Low
Heteroscelis brevipes Grey-tailed Tattler	M	-	Found in estuaries, mangroves and tidal mudflats. Also in shallow river margins, both coastal and inland (Pizzey and Knight 1997).	Low
Limicola falcinellus Broad-billed Sandpiper	M	V	Occurs in sheltered parts of coasts, such as estuaries, harbours, embayments and lagoons, which have shell or sandbanks nearby (Higgins and Davies 1996).	Low

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Limosa lapponica Bar-tailed Godwit	M	-	Coastal species, usually inhabiting intertidal sandflats, spits and banks. Less frequently found in mudflats, estuaries, coastal lagoons and harbours (Higgins and Davies 1996).	Low
Limosa limosa Black-tailed Godwit	M	V	Mainly coastal, usually in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats (Higgins and Davies 1996).	Low
Numenius madagascariensis Eastern Curlew	M	-	Occurs in sheltered coasts, especially estuaries, embayments, harbours, inlets and coastal lagoons with large intertidal mudflats or sandflats often with beds of seagrass (Higgins and Davies 1996).	Low
Numenius minutus Little Curlew	M	-	Short, dry grasslands and sedgelands, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools. Mostly feed in dry grassland or sedgeland, either natural or artificial. Foraging sites usually occur within 5km of daytime roosting sites (Higgins and Davies 1996).	Low
Numenius phaeopus Whimbrel	M	-	Occurs in intertidal mudflats of sheltered coasts (Higgins and Davies 1996). Also in estuaries, mangroves, coral clays and exposed reefs. Roosts in trees and mangroves (Pizzey and Knight 1997).	Low
Philomachus pugnax Ruff	M	-	Rare migrant from northern Eurasia (Slater *et al.* 2003) regularly visits fresh, brackish or saline wetlands with exposed mudflats at edges, usually terrestrial but sometimes found in sheltered coast habitats (Higgins and Davies 1996).	Low
Tringa glareola Wood Sandpiper	M	-	Freshwater swamps, lakes, flooded pasture; less frequently on brackish waters, occasionally in mangroves (Morcombe 2003).	Low
Tringa nebularia Common Greenshank	M	-	Widely distributed throughout a range of inland wetlands and sheltered coastal habitats. Occurs in habitats with varying salinity (Higgins and Davies 1996).	Low
Tringa stagnatilis Marsh Sandpiper	M	-	Inhabits permanent or ephemeral wetlands, including swamps, billabongs, lagoons, saltmarshes and estuaries. Forages at the edge of wetlands in shallow water (Higgins and Davies 1996).	Low
Xenus cinereus Terek Sandpiper	M	V	Mainly found on saline intertidal mudflats in sheltered estuaries, embayments, harbours and lagoons (Higgins and Davies 1996).	Low

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Ninox connivens Barking Owl	-	V	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country (Pizzey and Knight 1997). Territories are typically 2000 ha in NSW habitats (DEC 2005d).	Low
Ninox strenua Powerful Owl	-	V	The Powerful Owl occupies wet and dry eucalypt forests and rainforests. It may inhabit both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas (Debus and Chafer 1994b; Debus and Chafer 1994a). Large mature trees with hollows at least 0.5 m deep are required for nesting (Garnett 1992). Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials (Gibbons and Lindenmayer 1997). Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm (Gibbons and Lindenmayer 1997). It has a large home range of between 450 and 1450 ha (DEC 2005{).	Low
Plegadis falcinellus Glossy Ibis	M	-	Terrestrial wetlands, and occasionally wet grasslands and sheltered marine habitats. Forage in shallow water over soft substrate or on grassy or muddy verges of wetlands, preferring those providing variety of water depths; avoid dry ground (Marchant and Higgins 1990).	Low
Tyto capensis Grass Owl	-	V	Occurs mainly in open tussock grassland, usually in treeless areas. Can also occur in marshy areas with tall dense tussocks of grass. Occasionally occurs in densely vegetated agricultural lands such as sugarcane fields (Higgins 1999).	Low
Tyto novaehollandiae Masked Owl	-	V	The Masked Owl may be found across a diverse range of wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting (Higgins 1999). It has mostly been recorded in open forests and woodlands adjacent to cleared lands. They nest in hollows, in trunks and in near vertical spouts or large trees, usually living but sometimes dead (Higgins 1999). The nest hollows are usually located within dense forests or woodlands (Gibbons and Lindenmayer 1997). Masked Owls prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of the diet (Gibbons and Lindenmayer 1997; Higgins 1999). It has a large home range of between 500 to 1000 ha (DEC 2005t).	Low
Invertebrates				
Meridolum corneovirens Cumberland Plain Land Snail	-	E1	Most likely restricted to Cumberland Plain, Castlereagh Woodlands and boundaries between River-flat Forest and Cumberland Plain Woodland. It is normally found beneath logs, debris and amongst accumulated leaf and bark particularly at the base of trees. May also use soil cracks for refuge (NPWS 1999b).	Low

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Mammals				
Dasyurus maculatus maculatus Spotted-tailed Quoll (southeastern mainland)	E	V	Occurs along the east coast of Australia and the Great Dividing Range (Belcher *et al.* 2008). Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests (Dickman and Read 1992). Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas (NPWS 1999k). Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage (Edgar and Belcher 1995). 70% of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require large areas of relatively intact vegetation through which to forage (NPWS 1999g). The home range of a female is between 180 – 1000 ha, while males have larger home ranges of between 2000 – 5000 ha. Breeding occurs from May to August (Belcher *et al.* 2008).	Low
Dasyurus viverrinus Eastern Quoll	-	E1	This species occurs in a variety of habitats including scrub, heathland, cultivated land and dry sclerophyll forest (Strahan 1995; NPWS 1999). Den sites can consist of a number of chambers in range of structure from underground burrows, hollow logs, rock piles and hay sheds. The Eastern Quoll is a solitary feeder with males often travelling over a kilometre in a night to forage (Strahan 1995). Females restrict their movements to a few hundred metres around their dens. This species feeds on agricultural pests, insects and large animals including ground-nesting birds and small mammals (NPWS 1999).	Low
Saccolaimus flaviventris Yellow-bellied Sheathtail Bat	-	V	Found throughout NSW (Richards 2008). They have been reported from southern Australia between January and June (Churchill 1998). Reported from a wide range of habitats throughout eastern and northern Australia, including wet and dry sclerophyll forest, open woodland, acacia shrubland, mallee, grasslands and desert (Churchill 1998). They roost in tree hollows in colonies of up to 30 (but more usually two to six) and have also been observed roosting in animal burrows, abandoned Sugar Glider nests, cracks in dry clay, hanging from buildings and under slabs of rock. It is high-flying, making it difficult to detect. It forages above the canopy of eucalypt forests, but comes lower to the ground in mallee or open country (Churchill 2008; Richards 2008).	Low
Petrogale penicillata Brush-tailed Rock-wallaby	V	E1	Occurs along the Great Dividing Range south to the Shoalhaven, and also occurs in the Warrumbungles and Mt Kaputar. Habitats range from rainforest to open woodland. It is found in areas with numerous ledges, caves and crevices, particularly where these have a northerly aspect. Individuals defend a specific rock shelter, emerging in the evening to forage on grasses and forbs, as well as browse in drier months. Home sizes range from 2-30 ha (Eldridge and Close 1995).	Low

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Mormopterus norfolkensis Eastern Freetail Bat	-	V	Distribution extends east of the Great Dividing Range from southern Queensland to south of Sydney (Churchill 1998). Most records are from dry eucalypt forests and woodland. Individuals tend to forage in natural and artificial openings in forests, although it has also been caught foraging low over a rocky river within rainforest and wet sclerophyll forest habitats. The species generally roosts in hollow spouts of large mature eucalypts (including paddock trees), although individuals have been recorded roosting in the roof of a hut, in wall cavities, and under metal caps of telegraph poles. Foraging generally occurs within a few kilometres of roosting sites (Churchill 2008; Hoye *et al.* 2008).	Moderate
Pseudomys novaehollandiae New Holland Mouse	V	-	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. The home range of the New Holland Mouse can range from 0.44 ha to 1.4 ha. The New Holland Mouse is a social animal, living predominantly in burrows shared with other individuals. The species is nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal. It is likely that the species spends considerable time foraging above-ground for food, predisposing it to predation by native predators and introduced species. Breeding typically occurs between August and January, but can extend into autumn (Threatened Species Scientific Committee 2010).	Low
Isoodon obesulus obesulus Southern Brown Bandicoot	E	E1	This species prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burn from time to time (Braithwaite 1995). A mosaic of post fire vegetation is important for this species (Maxwell *et al.* 1996).	Low
Perameles nasuta Long-nosed Bandicoot (inner western Sydney)	-	E2	The Long-nosed Bandicoot (inner west population) is found within the LGAs of Marrickville and Canada Bay and may extend into the surrounding LGAs of Canterbury, Ashfield and Leichardt (DECCW 2010). Individuals mostly shelter under older houses and buildings, and forage for invertebrates, plant roots, and hypogeal fungi in parklands and back-yards. The population is threatened by collision with vehicles; predation by dogs, cats and foxes; renovation of old buildings preventing access to nest sites; removal of vegetation; and is at risk of extinction due to local fluctuations in mortality and fecundity (NSW Scientific Committee 2008a).	Low- Moderate

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Potorous tridactylus Long-nosed Potoroo	V	V	Occurs from Queensland to Victoria, normally within 50 km of the coast (Claridge *et al.* 2007). Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy. Known to eat fungi, arthropods, fleshy fruit, seeds and plant tissue. It is solitary and sedentary, buts tends to aggregate in small groups. It has two breeding seasons, one in late winter-early spring and the other in late summer (Johnston 2008). This species appears to benefit from a lack of recent disturbance (Claridge *et al.* 2007).	Low
Pteropus poliocephalus Grey-headed Flying-fox	V	V	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies (camps), commonly in dense riparian vegetation. Bats commute daily to foraging areas, usually within 15 km of the day roost (Tidemann 1995) although some individuals may travel up to 70 km (Augee and Ford 1999).	Moderate
Chalinolobus dwyeri Large-eared Pied Bat	V	V	Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley (van dyck and Strahan 2008). Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands (Churchill 2008; Hoye and Schulz 2008). Forages on small, flying insects below the forest canopy. Roosts in colonies of between three and 80 in caves, Fairy Martin nests and mines, and beneath rock overhangs, but usually less than 10 individuals. Likely that it hibernates during the cooler months (Churchill 2008). The only known existing maternity roost is in a sandstone cave near Coonabarabran (Pennay 2008).	Low
Miniopterus australis Little Bentwing-bat	-	V	Occurs from Northern Queensland to the Hawkesbury River near Sydney. Roost sites encompass a range of structures including caves, tunnels and stormwater drains (van dyck and Strahan 2008). Young are raised by the females in large maternity colonies in caves in summer. Shows a preference for well timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. The Little Bentwing bat forages for small insects (such as moths, wasps and ants) beneath the canopy of densely vegetated habitats (Churchill 2008; Hoye and Hall 2008b).	Moderate
Miniopterus schreibersii oceanensis Eastern Bentwing-bat	-	V	Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred kilometres to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the tree canopy and along waterways (Churchill 2008; Hoye and Hall 2008a).	Moderate

Scientific Name/ Common Name	EPBC[1] Act	TSC[2] Act	Habitat	Likelihood of occurrence?
Reptiles				
Hoplocephalus bungaroides Broad-headed Snake	V	E1	Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer (Webb 1996; Webb and Shine 1998).	Low

4.4 Endangered Populations

An Endangered Population is a population listed under Part 2 of Schedule 1 of the TSC Act and is defined as a population that, in the opinion of the NSW Scientific Committee, is facing a very high risk of extinction in NSW in the near future. A population is not eligible to be listed as an Endangered Population if it is a population of a species already listed in Schedule 1 or 1A (i.e. already listed as an Endangered or Critically Endangered species).

Four Endangered Populations of plant and two Endangered Populations of animal have been previously recorded within 10 km of the study area:

- Tadgell's Bluebell in the LGAs of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield;
- *Acacia prominens* Gosford Wattle confirmed from a few sites along the railway line at Penshurst, Carss Bush Park and Carss Park.
- *Pomaderris prunifolia* (a shrub) population in the Parramatta, Auburn, Strathfield and Bankstown LGAs;
- *Marsdenis viridifora ssp. Viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith Local Government Areas;
- White-fronted Chat population in the Sydney Metropolitan Catchment Management Authority Area; and,
- Long-nosed Bandicoot population in the inner western Sydney within the Local Government Areas of Canterbury, Ashfield, Leichhardt, Marrickville and Canada Bay.

As shown above in Tables 2 and 3, all but the Long-nosed Bandicoot Endangered Population are considered to have a low likelihood of occurrence within the study area. Potential impacts of the proposal on the bandicoot population are discussed in Section 6.0 (Impact Assessment) of this report.

4.5 Critical habitat

Critical habitat can de declared under both the EPBC and TSC Acts. Under the EPBC Act, it is an offence for a person to take an action that the person knows will significantly damage the critical habitat of a listed threatened species. Under the TSC Act, the declaration of critical habitat serves primarily as a guide for planning under Part 3 of the EP&A Act and a trigger which ensures a rigorous environmental assessment of all activities and developments proposed, and any other action that has the potential to damage the species or its habitat (NPWS 2002a).

No areas of critical habitat for flora or fauna have been declared within the locality.

5.0 IMPACT ASSESSMENT

The primary direct impact on terrestrial flora and fauna values will be through the removal of planted vegetation and lawn areas. The likelihood of indirect impacts to result from the proposal is considered low, however these indirect impacts may include some weed invasion and increased erosion potential. Further discussions of impacts that are considered relevant to the proposal are provided below.

5.1 Potential impacts of the proposal

5.1.1 Vegetation clearing and habitat loss

No areas classified as native plant community will be removed or disturbed by the proposal. The proposal will include the removal of some planted native and exotic species. Being planted, this vegetation is considered to be of lesser conservation significance than naturally occurring vegetation. This vegetation does have some habitat value for fauna species, however this value is limited and is likely to be restricted to the provision of habitat resources to common cosmopolitan fauna species. While this vegetation is not protected by threatened species legislation, TSC Act or the EPBC Act, recommendations are made in Section 7.0 to minimise impacts.

One tree, a large Narrow-leaved Ironbark on the western boundary of the study area is considered to be naturally occurring and a remnant of the original vegetation community of the study area. Turpentine trees within the study area may also be naturally occurring. Figure 2 shows the locations of these potential remnant trees. The proposal does require the removal of some Turpentine trees from the south-east corner of the campus grounds to accommodate access to the proposed library building and commons. The Narrow-leaved Ironbark may also be removed to allow for the underground car-park to be built beneath the north western portion of the existing sports fields. While these trees are not protected by threatened species legislation, TSC Act or the EPBC Act, they are of conservation value both as habitat and as a representation of the original vegetation community. Recommendations within this report include measures to ameliorate these potential impacts.

5.1.2 Weed invasion

Invasion of native plant communities by exotic perennial grasses is listed as a Key Threatening Process (KTP) under Schedule 3 of the TSC Act. The subject site is largely devoid of intact native vegetation however it does contain some native and exotic plants. Weed invasion has the potential to occur in all areas cleared and disturbed by the proposal. The dominant weed species present in the subject site include both herbaceous weeds and exotic perennial grasses.

Weed propagules may be dispersed during construction phases at the ACU. Apart from altering local flora assemblages and competitively displacing native plant species, weed invasion also has the potential to modify habitat features for local fauna species. However, given that the subject site is mostly cleared of native vegetation and boasts well maintained landscaping, the proposal

is considered unlikely to significantly increase the prevalence of weeds. Therefore, it is also unlikely that the proposal would result in the invasion of native plant communities by weeds.

5.1.3 Erosion

Erosion can result from vegetation clearing and soil disturbance associated with construction. Given the highly altered nature of the subject site, the likelihood of erosion impacting terrestrial flora and fauna habitats is considered to be negligible. Standard erosion control practices are expected to be employed throughout each phase of construction where necessary.

5.2 Part 3A guidelines for threatened species assessment (EP&A Act)

The impacts of the proposal on threatened species, populations and ecological communities listed under the TSC Act have been undertaken following the Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act (DEC & DPI 2005). Where threatened species, populations and/or communities **are recorded** within a study area, an impact assessment is required under the EP&A Act. When threatened species, populations and/or communities **are not recorded** during a survey, the presence of potential habitat for a species (or population or community) is used to determine the need to undertake an impact assessment under the EP&A Act. Where there is no potential habitat in the study area for threatened species, populations and/or communities, there is unlikely to be any impact and therefore these species (or populations or communities) are not required to be considered further.

Key Thresholds

The Part 3A Guidelines of the EP&A Act (DEC & DPI 2005) set out a number of key thresholds which need to be addressed to justify the impacts of the proposal on threatened species, populations and ecological communities. The key thresholds are (DEC & DPI 2005):

- Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts, will maintain or improve biodiversity values;
- Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community;
- Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction; and,
- Whether or not the proposal will adversely affect critical habitat.

Maintenance of Biodiversity Values

The subject site is a highly modified urban environment which contributes to biodiversity within the locality through the provision of foraging resources for fauna through the mature trees which occur on site. This contribution to biodiversity is not large, however the ACU recognises that

mature trees are an asset to the campus grounds and, where possible, commits to retaining all mature trees or if removal is unavoidable, attempts to transplant and relocate trees will be undertaken (where trees are likely to survive transplantation). In addition to this commitment, where trees do not survive translocation, or are considered unlikely to survive translocation, native tree species which are naturally occurring within the locality be established as replacement plantings.

Through these commitments, there should be no net loss of trees on site. Provided that the mitigation measures detailed in Section 7.0 are implemented, the biodiversity values of the locality are likely to be maintained, if not improved.

5.2.1 Potential Impacts on Endangered Ecological Communities

No EECs were detected within the study area. Furthermore the study area does not support habitat for any EECs given its highly modified nature.

Consequently the proposal will not reduce the long-term viability of any ecological community.

5.2.2 Potential impacts on Endangered Populations

The study area is considered to provide potential habitat to the inner west endangered population of Long-nosed Bandicoot. However, no individuals of this species have been previously recorded within the study area.

During the site visit no evidence of Long-nosed Bandicoot foraging activity was detected, and no sheltering or nesting habitat in the form of sub-floor spaces was observed throughout the ACU campus grounds.

Given that no records of this population have occurred within the study area and that there is no evidence of habitats being used by this species, the proposal is considered unlikely to:

- reduce the long-term viability of this local population;
- accelerate the extinction of this population or place it at risk of extinction; or,
- adversely affect critical habitat.

5.2.3 Potential Impacts on Threatened Flora Species

No threatened flora species as listed under the TSC Act were recorded in the study area. Furthermore, no threatened flora species listed on the TSC Act, are considered to have potential habitat in the study area and consequently, impacts to threatened flora species are considered negligible due to the following:

- Impacts resulting from the proposal will be contained to the previously modified landscape of the ACU campus grounds;

- The proposal will not result in the isolation or fragmentation of potential habitat; and,
- The proposal is unlikely to interfere with the pollination and dispersal of remnant native flora species.

On the basis of the above, detailed impact assessments for threatened flora species are not considered, and as such, no threatened flora species have been considered further.

5.2.4 Potential Impacts on Terrestrial Fauna

Where there is potential habitat (foraging or breeding resources) for threatened species in the study area, further consideration must be given to the potential impact of the proposal on these species. The proposal may impact on threatened species by causing any of the following:

- death or injury of individuals;
- loss or disturbance of limiting foraging resources; and/or,
- loss or disturbance of limiting breeding resources.

Limiting resources are specialised habitat components that species are dependent on for their ongoing survival. Such limiting resources are predominantly associated with specialised breeding habitats (such as tree hollows or suitable nest/maternity roost sites) that occur at low densities, with high levels of competition from a range of species. However, for some species, limiting resources include specialised foraging habitats that have a restricted distribution (e.g. Koalas feeding only on specific tree species).

Table 4 summarises the possible impacts from the proposal on the five TSC Act-listed threatened fauna with known and/or potential habitat in the study area, and determines the need for Part 3A impact assessments. Based on the nature of the proposal (see Section 2.1.2), database interrogation, literature review regarding the ecology of each species, and information gathered during the field survey within the study area, each of these species are considered as unlikely to be subject to negative impacts resulting from the proposal. Accordingly, no Part 3A impact assessments have been prepared for these species.

Table 4: Potential impact and Part 3A impact assessment requirements for threatened fauna listed on the TSC Act with potential habitat in the study area

	EPBC Act	TSC Act	Potential Impacts on Threatened Species			Impact Assessment required?	Reasoning
			Individual death or injury?	Loss or disturbance of limiting foraging resources?	Loss or disturbance of limiting breeding resources?		
Mammals							
Eastern False Pipistrelle *Mormopterus norfolkensis* Eastern Freetail Bat *Mormopterus norfolkensis*	-	V	Unlikely	No	No	No	The Eastern False Pipistrelle and Eastern Freetail Bat have been grouped based on their similar habitat requirements. Both these species depend on tree hollows in which to roost and breed. The study area does not support any tree hollows and no tree hollows will be disturbed as part of the proposal. These species forage over a range of habitats for insects and may forage throughout the study area within the ACU grounds. However the foraging habitat to be impacted by the proposal is not considered limiting for these species. Given that the habitat to be disturbed is not considered limiting, the impacts to these species are considered negligible and the Eastern False Pipistrelle and Eastern Freetail Bat have not been assessed further.
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	-	V	Unlikely	No	No	No	The Eastern Bentwing-bat has been previously recorded within the locality of the study area. This species requires caves or culverts in order to breed which are not found on the ACU campus. This species forages for insects throughout a range of habitats and may forage throughout the study area within the ACU grounds. Foraging habitats for this species are not considered limiting and given that the proposal will not impact limiting habitat for this species, the Eastern Bentwing-bat has not been considered further.

	EPBC Act	TSC Act	Potential Impacts on Threatened Species			Impact Assessment required?	Reasoning
			Individual death or injury?	Loss or disturbance of limiting foraging resources?	Loss or disturbance of limiting breeding resources?		
Long-nosed Bandicoot (Inner west population)	-	E2	Unlikely	No	No	No	Long-nosed Bandicoots have been recorded within the adjacent LGAs, however have not been recorded within the locality of the study area. Long-nosed Bandicoots forage on lawns and may shelter beneath buildings, particularly within sub-floor spaces which are well protected. No access to sub-floor areas was observed during the site visit which would provide protected sheltering and nesting sites. Poison baits are also routinely used on campus to control for rodents which further limits the suitability of the site for bandicoots. No evidence of bandicoot foraging was observed within the extensive lawn areas of the ACU campus. There are no records within the locality to suggest this species uses resources within the ACU campus grounds. As such it is considered unlikely that individuals of the inner west population regularly forage on the campus grounds and hence are unlikely to be negatively impacted as a result of the proposal and has not been considered further.

	EPBC Act	TSC Act	Potential Impacts on Threatened Species			Impact Assessment required?	Reasoning
			Individual death or injury?	Loss or disturbance of limiting foraging resources?	Loss or disturbance of limiting breeding resources?		
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Unlikely	No	No	No	The Grey-headed Flying-fox is a large and conspicuous species and no evidence of a roost site was observed on site. Numerous records of this species occur within the locality and in proximity to the ACU campus. Grey-headed Flying-foxes may forage within flowering and fruiting mature trees found throughout the study area. The species is highly mobile; known to forage up to 50 km from the roost site (DEC 2005p), feeding on a range of fruits and blossoms. The feeding resources provided within the ACU campus are not considered to be a limiting resource for this species. No limiting breeding or foraging resources would be impacted by the proposal. Given the proposal would not impact limiting breeding or foraging resources, that mature trees will be replaced or translocated, and the high mobility of this species, it is considered unlikely that the proposal would impact on the Grey-headed Flying-fox and therefore an Assessment under Part 3A is not recommended for this species.

5.3 Commonwealth Significant Impact Criteria (EPBC Act)

Under the Commonwealth EPBC Act, if the proposal has the potential to have an adverse impact on threatened species, populations and/or ecological communities as listed under the Act, the proposal must be referred to the Federal Minister for the Environment for further consideration. The Significant Impact Criteria are used to assess the likelihood of impact in accordance with the former Department of Environment, Heritage, Water and the Arts (DEWHA) publication *EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance* (DEWHA 2009b).

5.3.1 Potential Impacts on Endangered Ecological Communities

No EECs listed under the EPBC Act were recorded in or adjoining the study area.

5.3.2 Potential Impacts on Threatened Flora Species

No threatened flora species listed under the EPBC Act were recorded in the study area, or are considered to have potential habitat within the study area.

5.3.3 Potential Impacts on Terrestrial Fauna

Endangered Fauna

No fauna species listed as Endangered under the EPBC Act are considered to have potential habitat within the study area.

Vulnerable Fauna

One species listed as Vulnerable under the EPBC Act, the Grey-headed Flying-fox has potential habitat in the study area. As shown above (Table 4) no limiting breeding habitat or foraging habitat for this species is expected to be impacted. If present within the study area, individuals of this species are not considered 'important populations' as they are not likely to be key source populations either for breeding or dispersal; populations that are necessary for maintaining genetic diversity; and/or populations that are near the limit of the species range. In addition, the proposal is not likely to:

- Adversely affect habitat critical to the survival of this species;
- Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that any of this species are likely to decline;
- Result in invasive species that are harmful to this Vulnerable species becoming established in this Vulnerable species' habitat;
- Introduce disease that may cause any of this species to decline; or
- Interfere substantially with the recovery of any of this species.

As such, no assessment has been carried out for the Grey-headed Flying-fox, in accordance with the Significant Impact Criteria (DEH 2006).

A Referral to the Federal Environment Minister is not considered necessary for any threatened fauna.

Migratory Fauna

The list of migratory species under the EPBC Act is a compilation of species listed under four international conventions: China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA), Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Four species listed under the 'migratory' provisions of the EPBC Act listed are considered to have a moderate likelihood of occurring within the study area and have been previously recorded within 10 km of the study area. These species; White-bellied Sea-eagle (*Haliaeetus leucogaster*), Cattle Egret (*Ardea ibis*), Fork-tailed Swift (*Apus pacificus*) and White-throated Needletail (*Hirundapus caudacutus*) have been given further consideration. Individuals of these species that may be recorded in the study area are not considered likely to be an ecologically significant proportion of the population. Potential habitat in the study area is not considered important[2] for these migratory species. Minimal impact is expected on the potential habitat for these species in the study area. As such, no Assessments of Significance have been carried out for the White-bellied Sea-eagle, Cattle Egret, Fork-tailed Swift or the White-throated Needletail in accordance with the Significant Impact Criteria (DEWHA 2009b).

[2] Where 'important' habitat for a migratory species is defined by SEWPaC (2009b).

6.0 RECOMMENDATIONS

The following recommendations have been made to reduce the impact of the proposal on native flora and fauna occurring in the study area:

- That all mature trees that are to be removed as part of the proposal be replaced. Where possible native trees which are naturally occurring within the locality are recommended as replacement plantings, to ensure that there is no net loss of biodiversity as a result of the proposal;

- Mature planted trees should be retained where possible and adequate tree protection measures should be implemented to ensure retained trees are not impacted by the proposal during the construction phase;

- Naturally occurring, remnant trees including the Fine Leaved Ironbark and Turpentine trees should be retained where possible and adequate tree protection measures should be implemented to ensure retained trees are not impacted by the proposal during the construction phase; and,

- Noxious Weeds Large Leaved Privet and Green Cestrum should be treated according to the legal requirements of noxious weed Class 3 and 4 respectively as detailed in Section 5.2.

7.0 CONCLUSION

This report assesses the ecological significance of threatened flora and fauna species, endangered populations and Endangered Ecological Communities that occur, or have the potential to occur, within the area affected by the proposed Concept Plan at the Australian Catholic University, in accordance with the EP&A Act, TSC Act and the EPBC Act.

The vegetation within the study area is predominately planted exotic and native species with the exception of one Fine Leaved Ironbark on the Western Boundary. Mature turpentine's sparsely occurring in garden areas throughout the study area are potentially naturally occurring. The flora habitat assessment has found the study area to be considered an Unnatural Landscape.

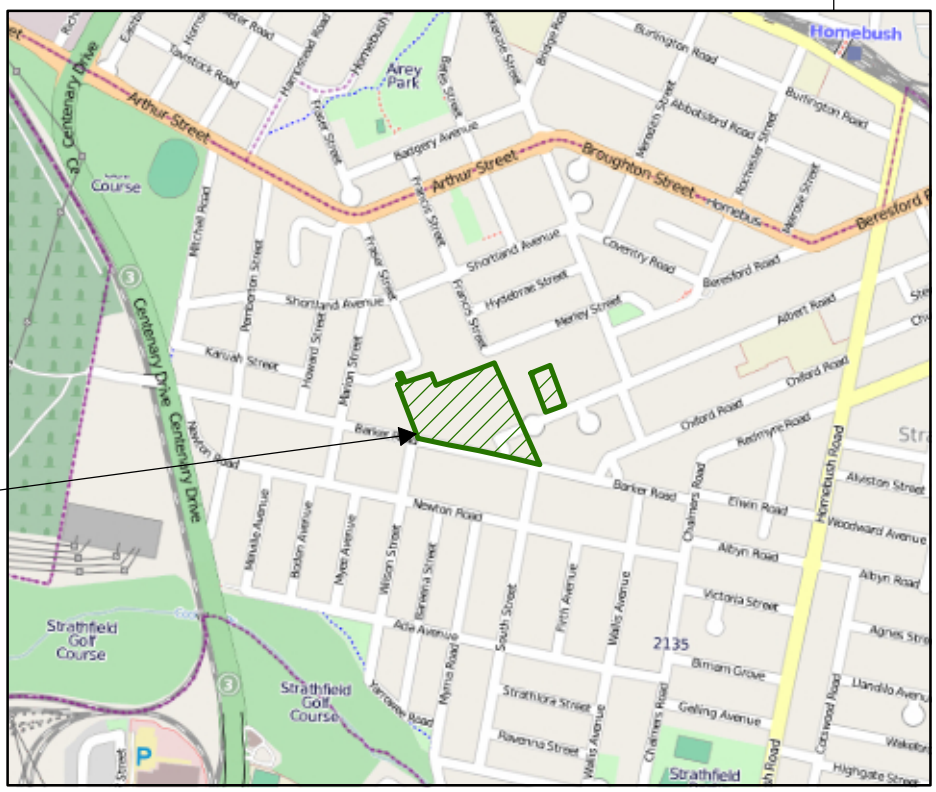
While planted and naturally occurring vegetation within the study area is of some habitat value, no vegetation occurs that requires further consideration with regard to the TSC Act or the EPBC Act.

The study area contains potential habitat for five threatened, four migratory fauna species and one endangered population. There will be no loss of potential breeding and or foraging habitat for any of these species. Consequently, it is unlikely that the proposal would result in a substantial impact to any fauna species with potential habitat within the study area.

The proposal is considered unlikely to have a significant impact on terrestrial threatened species, populations or ecological communities listed under the TSC and/or the EPBC Acts. A Species Impact Statement (TSC Act) or a Referral (EPBC Act) is not considered necessary for any threatened or migratory flora or fauna as a result of the proposal.

A range of mitigation measures are proposed (Section 6.0) to reduce the impacts of the proposal on biodiversity.

FIGURES



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Alexandria
NEW SOUTH WALES
2015

Figure 1: Location of the Study Area within a regional context

Date: 09 Dec 2011	Drawn By: JMS
File ID: 12989	Checked By: JKD
Location: P:\12900s\12989\Mapping\12989_F1_Locality.mxd	

0 200 400 800
Metres

N

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2015

Figure 2: Overview of the Study Area

Date: 09 Dec 2011	Drawn By: JMS
File ID: 12989	Checked By: JKD
Location: P:\12900s\12989\Mapping\12989_F2_Overview_091211.mxd	

0 20 40 80
Metres

N

Northmead
Rogans Hill
Carlingford
Lindfield
Toongabbie
Roseville
Eastwood
Model Farms
Telopea
Pendle Hill
Denistone
Chatswood
Wentworthville
Westmead
Dundas
West Ryde
Willoughby
Rydalmere
Ryde
Artarmon
Parramatta
Camellia
Hardies
Meadowbank
Lane Cove
Sandown
Harris Park
Rosehill
St Leonards
Granville
Rhodes
Merrylands
Clyde
North Sydney
Wollstonecraft
Clyburn
Waverton
Olympic Park
Auburn
Concord West
Guildford
Drummoyne
Milsons Point
Concord
Pippita
North Strathfield
Yennora
Lidcombe
Rookwood
Fairfield
Flemington
Homebush
Sydney
Berala
Strathfield
Wynyard
Villawood
Leightonfield
Martin Place
St James
Carramar
Chester Hill
Regents Park
Burwood
Town Hall
Museum
Canley Vale
Sefton
Boshops
Croydon
Leichhardt
Central
Cabramatta
Welders
Delec
Summer Hill
Birrong
Elcar
Lewisham
Stanmore
Redfern
Hope Street
Petersham
Yagoona
Newtown
Enfield South
Erskineville
Warwick Farm
Campsie
Hurlstone Park
Dulwich Hill
Marrickville
St Peters
Green Square
Bankstown
Belmore
Canterbury
Marrickville
Sydenham
Lakemba
Tempe
Punchbowl
Mascot
Turrella
Bardwell Park
Arncliffe
International Terminal
Domestic Terminal
Bexley North
Kingsgrove
Revesby
Padstow
Narwee
Beverly Hills
Riverwood
Banksia
Panania
Rockdale
Holsworthy
East Hills
Penshurst
Hurstville
Kogarah
Botany
Mortdale
Allawah
Carlton
Holsworthy

Legend

Threatened Flora

- Acacia bynoeana
- Acacia prominens
- Acacia pubescens
- Acacia terminalis subsp. terminalis
- Caladenia tessellata
- Callistemon linearifolius
- Darwinia biflora
- Deyeuxia appressa
- Dillwynia tenuifolia
- Epacris purpurascens var. purpurascens
- Eucalyptus nicholii
- Eucalyptus scoparia
- Genoplesium baueri
- Grammitis stenophylla
- Hibbertia sp. Bankstown
- Hypsela sessiliflora
- Leptospermum deanei
- Marsdenia viridiflora subsp. viridiflora
- Melaleuca deanei
- Persoonia hirsuta
- Persoonia nutans
- Pimelea curviflora var. curviflora
- Pimelea spicata
- Pomaderris prunifolia
- Prostanthera marifolia
- Pultenaea parviflora
- Pultenaea pedunculata
- Syzygium paniculatum
- Tetratheca glandulosa
- Tetratheca juncea
- Wahlenbergia multicaulis
- Wilsonia backhousei
- 10 km Search Area
- Study Area

Figure 4:
Threatened Flora recorded within 10km of the Study Area

N

0 0.5 1 2 3 4

Kilometres

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New South Wales 2015

BIOSIS RESEARCH

Offices also in: Ballarat, Sydney, Wollongong, Canberra, Wangaratta

Date: 12 May 2011, File number: 12989
Checked by: JKD, Drawn by: JMS
Location: P:\12900s\12989\Mapping\12989_F3_ThrFlora.mxd

Granville
Clyde
Clyburn
Auburn
Olympic Park
Rhodes
Concord West
Concord
North Strathfield
Pippita
Lidcombe
Rookwood
Flemington
Homebush
Strathfield
Berala
Regents Park
Sefton
Boshops
Burwood
Ashfield
Croydon
Welders
Delec
Birrong
Elcar
Summer Hill
Hope Street
Yagoona
Enfield South
Campsie
Hurlstone Park
Dulwich Hill
Canterbury
Bankstown
Belmore
Lakemba
Wiley Park
Punchbowl

Legend

- Study Area

Vegetation Communities

- Sydney Turpentine-Ironbark Forest
- Cumberland Shale Plains Woodland
- Castlereagh Ironbark Forest
- Castlereagh Shale-Gravel Transition Forest
- Coastal Sandstone Sheltered Peppermint-Apple Forest
- Castlereagh Scribbly Gum Woodland
- Coastal Freshwater Reedland
- Estuarine Reedland
- Coastal Flats Swamp Mahogany Forest
- Hinterland Riverflat Paperbark Swamp Forest
- Cumberland Riverflat Forest
- Estuarine Swamp Oak Forest
- Estuarine Mangrove Forest
- Estuarine Saltmarsh
- Seagrass Meadows
- Urban Exotic/Native
- Weeds and Exotics
- Artificial Wetland
- Water
- 5km Locality

Figure 5:
Vegetation within 5km of the Study Area

N

0 0.25 0.5 1 1.5 2
Kilometres

18- 20 Mandible Street
Alexandria
New South Wales 2015

BIOSIS RESEARCH
Offices also in: Ballarat, Sydney, Wollongong, Canberra, Wangaratta

Date: 12 May 2011, File number: 12989
Checked by: JKD, Drawn by: JMS
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PLATES

Plate 1: Planted conifers along southern boundary of campus bordering Barker Street.

Plate 2: South – western carpark along Barker Street with planted Figs.

Plate 3: Looking north-west over the exsiting sports fields to be retained.

Plate 4: Australian White Ibis forging on wet sports field

Plate 5: North-western boundary of campus where an additional car park is proposed.

Plate 6: Artificial shelter installed for possums in Chinese Elm tree on Albert Road near Edward Clancy Building

Plate 7: Eastern car park near Edward Clancy Building on Albert Road.

APPENDICES

APPENDIX 1

Flora Results

Flora species recorded in the study area:

	Family Name	Latin Name	Common Name	EPBC Act	TSC Act
Native	Chenopodiaceae	*Einadia trigonos*	Fishweed		
	Convolvulaceae	*Dichondra repens*	Kidney Weed		
	Moraceae	*Ficus microcarpa*			
	Moraceae	*Ficus rubiginosa*	Port Jackson Fig		
	Myrtaceae	*Acmena smithii*	Lilly Pilly		
	Myrtaceae	*Eucalyptus botryoides*	Bangalay		
	Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark		
	Myrtaceae	*Eucalyptus microcorys*	Tallowwood		
	Mytaceae	*Eucalyptus citriodora*	Lemon Scented Gum		
	Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V
	Myrtaceae	*Lophostemon confertus*	Brush Box		
	Myrtaceae	*Melaleuca quinquenervia*	Paperbark		
	Myrtaceae	*Syncarpia glomulifera*	Turpentine		
	Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	V	V
	Oxalidaceae	*Oxalis sp.*			
	Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum		
	Poaceae	*Microlaena stipoides*			
	Rosaceae	*Rosa sp.*			
	Sterculiaceae	*Brachychiton acerifolius*	Illawarra Flame Tree		

	Family Name	Latin Name	Common Name
Exotic	Alliaceae	*Agapanthus praecox subsp. orientalis*	African Lily*
	Araliaceae	*Hedera helix*	English Ivy
	Arecaceae	*Phoenix canariensis*	Canary Island Date Palm
	Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern*
	Bignoniaceae	*Jacaranda mimosifolia*	Jacaranda
	Buxaceae	*Buxus Microphylla var. japonica*	Japanese Box
	Cupressaceae	*Cupressus sp*	Cypress
	Fabaceae (Caesalpinioideae)	*Senna pendula*	
	Flacourtiaceae	*Xylosma sp*	

Exotic	Family Name	Latin Name	Common Name
	Lauraceae	*Cinnamomum camphora*	Camphor Laurel
	Lythraceae	*Lagerstroemia indica*	Crepe Myrtle
	Malaceae	*Cotoneaster glaucophyllus*	
	Malvaceae	*Modiola caroliniana*	Red-flowered Mallow*
	Moraceae	*Ficus pumila*	Creeping Fig
	Oleaceae	*Ligustrum lucidum*	Large-leaved Privet* (N4)
	Oleaceae	*Olea europaea ssp. africana*	
	Pinaceae	*Pinus sp.*	
	Poaceae	*Cynodon dactylon*	Common Couch
	Poaceae	*Ehrharta erecta*	Panic Veldtgrass*
	Poaceae	*Pennisetum clandestinum*	Kikuyu Grass
	Poaceae	*Stenotaphrum secundatum*	Buffalo Grass
	Rutaceae	*Murraya paniculata*	Orange Jasmine
	Solanaceae	*Cestrum parqui*	Green Cestrum* (N3)
	Solanaceae	*Solanum nigrum*	Black-berry Nightshade*
	Solanaceae	*Solanum seaforthianum*	Brazilian Nightshade*

* weed species, (N3/4) noxious weed class

APPENDIX 2

Fauna Results

Fauna species recorded in the study area:

Family Name	Latin Name	Common Name	Observation type
Columbidae	*Columba livia*	Rock Dove*	O
	Streptopelia chinensis	Spotted Turtle-Dove*	O
Sturnidae	*Acridotheres tristis*	Common Myna*	OH
	Sturnus vulgaris	Common Starling*	O
Artamidae	*Grallina cyanoleuca*	Magpie-lark	OH
	Gymnorhina tibicen	Australian Magpie	H
	Strepera graculina	Pied Currawong	OH
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	OH
	Cacatua sanguinea	Little Corella	OH
Columbidae	*Ocyphaps lophotes*	Crested Pigeon	O
Corvidae	*Corvus coronoides*	Australian Raven	H
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	O
Meliphagidae	*Manorina melanocephala*	Noisy Miner	OH
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet	OH
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis	O

Key: O = observed;
H = heard; and,
* = introduced species

REFERENCES

Augee M and Ford D (1999) Radio-tracking studies of Grey-headed Flying-foxes, *Pteropus poliocephalus*, from the Gordon colony, Sydney. *Proceedings of the Linnaean Society of New South Wales* 121**,** 61-70.

Barker J *et al.* (1995) 'A Field Guide to Australian Frogs.' Surrey Beatty and Sons, Sydney.

Bean JM (1999) *Bothriochloa biloba* (Poaceae) in natural grasslands on slopes of the Liverpool Plains, New South Wales. *Cunninghamia* 6**,** 383-388.

Belcher C *et al.* (2008) Spotted-tailed Quoll *Dasyurus maculatus*. Pp. 60-62 In 'The Mammals of Australia' (Eds S Van Dyck and R Strahan). Reed New Holland, Sydney.

Bell SAJ (2001) Notes on population size and habitat of the vulnerable *Cryptostylis hunteriana* (Orchidaceae) from the Central Coast of New South Wales. *Cunninghamia* 7**,** 195-204.

Bishop T (1996) 'Field Guide to the Orchids of New South Wales and Victoria.' UNSW Press, Sydney.

Blakers M *et al.* (1984) 'The Atlas of Australian Birds.' Melbourne University Press, Melbourne.

Boehm EF (1944) The Fork-tailed Swift in South Australia. *South Australian Ornithology* 15**,** 54-58.

Braithwaite RW (1995) Southern Brown Bandicoot. Pp. 176-177 In 'The Mammals of Australia' (Ed. R Strahan). Reed New Holland, Sydney.

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

Churchill S (2008) 'Australian Bats. Second Edition.' Allen & Unwin, Sydney.

Claridge A *et al.* (2007) 'Bettongs, Potoroos and the Musky Rat-kangaroo.' CSIRO Publishing, Melbourne.

Daly G (1996) Observations of the Eastern Owl Frog *Helioporous australiacus* (Anura: Myobatrachidae) in Southern NSW. *Herpetofauna* 26**,** 33-42.

Debus S and Chafer C (1994a) The Powerful Owl *Ninox strenua* in New South Wales. *Australian Birds* 28**,** 21-39.

Debus S and Chafer C (1994b) The Sooty Owl, *Tyto tenebricosa* & Powerful Owl, *Ninox strenua* in NSW. *Australian Birds* 28 Supplement**,** 2.

DEC (2005a). *Acacia bynoeana* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10006, Department of Environment and Conservation

DEC (2005b). *Acacia prominens* - Threatened Species Profile, http://threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10022, Department of Environment and Conservation

DEC (2005c). *Acacia terminalis* ssp. *terminalis* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10028,

DEC (2005d). Barking Owl: Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10561, Department of Environment and Conservation

DEC (2005e). Black Bittern: Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10441,

DEC (2005f). *Caladenia tessellata* - Threatened Species Profile, http://www.threatenedspecies.environment.

nsw.gov.au/tsprofile/profile.aspx?id=10124, Department of Environment and Conservation

DEC (2005g). *Cryptostylis hunteriana* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10187, Department of Environment and Conservation

DEC (2005h). *Deyeuxia appressa* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10220,

DEC (2005i). Dillwynia tenuifolia, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10226,

DEC (2005j). *Epacris purpurascens* var. *purpurascens* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10273,

DEC (2005k). *Eucalyptus nicholii* - Threatened Species Profile, http://threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10302,

DEC (2005l). *Genoplesium baueri* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10875, Department of Environment and Conservation

DEC (2005m). *Grammitis stenophylla* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10356, Department of Environment and Conservation

DEC (2005n). Green and Golden Bell Frog: Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10483, Department of Environment and Conservation

DEC (2005o). *Grevillea parviflora* subsp. *parviflora* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10373, Department of Environment and Climate Change

DEC (2005p). Grey-headed Flying-fox - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10697, Department of Environment and Conservation

DEC (2005q). *Hypsela sessiliflora*: Threatened Species Profiles, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10425, Department of Environment and Conservation

DEC (2005r). *Leptospermum deanei* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10394,

DEC (2005s). Marsdenia viridiflora R. Br subsp. viridiflora - Threatened Species Profile, http://threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10508,

DEC (2005t). Masked Owl: Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10820, Department of Environment and Conservation

DEC (2005u). Melaleuca biconvexa - Threatened Species Profile, http://threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10514,

DEC (2005v). *Melaleuca deanei* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10515, Department of Environment and Conservation

DEC (2005w). *Persoonia hirsuta* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10595,

DEC (2005x) '*Persoonia nutans*.R BR (Nodding Gebung) Recovery Plan.' NSW Department of Environment and Conservation, Hurstville, NSW.

DEC (2005y). *Pimelea curviflora* var. *curviflora* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10629,

DEC (2005z). *Pomaderris prunifolia* - Endangered Population (Inner Western Sydney) Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10655,

DEC (2005{). Powerful Owl: Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10562, Department of Environment and Conservation

DEC (2005|). *Pultenaea parviflora* - Threatened Species Profile, http://threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10715,

DEC (2005}). *Pultenaea pedunculat*a - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10716,

DEC (2005~). Regent Honeyeater: Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10841, Department of Environment and Conservation (NSW)

DEC (2005). Southern Bell Frog - threatened species profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10491, Department of Environment and Conservation

DEC (2005€). Superb Fruit-dove: Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10709, Department of Environment and Conservation

DEC (2005). Swift Parrot: Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10455, Department of Environment and Conservation

DEC (2005,). *Syzygium paniculatum* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10794,

DEC (2005ƒ). *Tetratheca glandulosa* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10798, Department of Environment and Conservation

DEC (2005„). *Thesium australe* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10802, Department of Environment and Conservation

DEC (2005…). Threatened Species Profile, Pterostylis saxicola, http://threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10705,

DEC (2005†). *Wahlenbergia multicaulis* - Endangered Population Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10831, Department of Environment and Climate Change and Water

DEC (2005‡). *Wilsonia backhousei* - Threatened Species Profile, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10838, Department of Environment and Climate Change and Water

DEC & DPI (2005) 'Draft Guidelines for Threatened Species Assessment - Part 3A of the Environmental Planning and Assessment Act 1979.' NSW Department of Environment and Conservation and Department of Primary Industries.

DECC (2007). Orange-bellied parrot - critically endangered species, http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Psittacidae_critically_endangered_species, Department of Environment and Climate Change

DECC (2008). Best Practice Guidelines Green and Golden Bell Frog Habitat, http://www.environment.nsw.gov.au/resources/threatenedspecies/08510tsdsgreengoldbfbpg.pdf, Department of Environment and Climate Change

DECCW (2010). Long-nosed Bandicoot population *Perameles nasuta* - Inner Western Sydney, http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=20107,

Department of Environment, Climate Change and Water

DEH (2006) 'EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Significance.' Department of Environment and Heritage, Canberra.

DEWHA (2008). Approved Conservation Advice for Leptospermum deanei, http://www.environment.gov.au/biodiversity/threatened/species/pubs/21777-conservation-advice.pdf, Department of Environment, Water, Heritage and the Arts

DEWHA (2009a). Census of Australian Vertebrates, http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/cavs/index.html, Department of the Environment, Water, Heritage and the Arts

DEWHA (2009b) 'Matters of National Environmental Significance Significant impact guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999*.' Department of the Environment, Water, Heritage and the Arts, Canberra.

Dickman CR and Read DG (1992) 'The biology & management of dasyurids of the arid zone in NSW.' NPWS, NSW, No. 11.

Edgar R and Belcher C (1995) Spotted-tailed Quoll. Pp. 67-68 In 'The Mammals of Australia' (Ed. R Strahan). Reed New Holland, Sydney.

Eldridge MDB and Close RL (1995) Brush-tailed Rock-wallaby. Pp. 383-385 In 'The Mammals of Australia' (Ed. R Strahan). Reed New Holland, Sydney.

Fairley A (2004) 'Seldom Seen - Rare Plants of Greater Sydney.' Reed New Holland Publishers,

Fairley A and Moore P (1995) 'Native Plants of the Sydney District: An Identification Guide.' Kangaroo Press, Sydney.

Fairley A and Moore P (2000) 'Native Plants of the Sydney District: An Identification Guide. Revised Edition.' Kangaroo Press, Sydney.

Forshaw JM and Cooper WT (1981) 'Australian Parrots (2nd Ed).' Lansdowne Press, Melbourne.

Garnett S (1992) 'Threatened and Extinct Birds of Australia.' York Press, Richmond.

Gibbons P and Lindenmayer DB (1997) Conserving Hollow-dependent Fauna in Timber Production Forest. *Environmental Heritage Monograph* 3**,** 110.

Harden G (1990) 'Flora of New South Wales Volume 1.' NSW University Press, Kensington.

Harden G (1991) 'Flora of New South Wales Volume 2.' NSW University Press, Kensington.

Harden G (1992a) 'Flora of New South Wales Volume 3.' NSW University Press, Kensington.

Harden G (1992b) 'Flora of NSW Volume 3.' New South Wales University Press, Sydney.

Harden GJ (1993) 'Flora of New South Wales Volume 4.' NSW University Press, Kensington.

Harden GJ (2002) 'Flora of New South Wales Volume 2 (Revised Edition).' University of New South Wales Press Ltd., Kensington.

Hassell (2011) Australian Catholic University Master Plan for North Sydney and Strathfield campuses.

Higgins PJ (1999) 'Handbook of Australian, New Zealand and Antarctic Birds. Volume 4: Parrots to Dollarbird.' Oxford University Press, Melbourne.

Higgins PJ and Davies SJJF (1996) 'Handbook of Australian, New Zealand and Antarctic Birds. Volume 3: Snipe to Pigeons.' Oxford University Press, Melbourne.

Higgins PJ and Peter JM (2002) 'Handbook of Australian, New Zealand & Antarctic Birds. Volume 6: Pardalotes to shrike -thrushes.' Oxford University Press, Victoria.

Higgins PJ *et al.* (2001) 'Handbook of Australian, New Zealand and Antarctic Birds. Volume 5: Tyrant-flycatchers to Chats.' Oxford University Press, Melbourne.

Hoye GA and Hall LS (2008a) Eastern Bent-winged Bat: *Miniopterus schreibersii oceanensis*. Pp. 507-508 In 'The Mammals of Australia' (Eds S Van Dyck and R Strahan). Reed New Holland, Sydney.

Hoye GA and Hall LS (2008b) Little Bent-winged Bat: *Miniopterus australis*. Pp. 503-504 In 'The Mammals of Australia' (Eds S Van Dyck and R Strahan). Reed New Holland, Sydney.

Hoye GA *et al.* (2008) East-coast Free-tailed Bat *Mormopterus norfolkensis*. Pp. 491-492 In 'The Mammals of Australia' (Eds S van dyck and R Strahan). Reed New Holland, Sydney.

Hoye GA and Schulz M (2008) Large-eared Pied Bat: *Chalinolobus dwyeri*. Pp. 531-532 In 'The Mammals of Australia' (Eds S Van Dyck and R Strahan). Reed New Holland, Sydney.

James T *et al.* (1999) 'Rare Bushland Plants of Western Sydney.' Royal Botantical Gardens,

Johnston PG (2008) Long-nosed Potoroo *Potorous tridactylus*. Pp. 302-304 In 'The Mammals of Australia' (Eds S Van Dyck and R Strahan). Reed New Holland, Sydney.

Marchant S and Higgins PJ (1990) 'Handbook of Australian, New Zealand and Antarctic Birds. Volume 1 Ratites to Ducks: Part B Australian Pelican to Ducks.' Oxford University Press, Melbourne.

Marchant S and Higgins PJ (1993) 'Handbook of Australian, New Zealand and Antactic Birds. Volume 2 Raptors to Lapwings.' Oxford University Press, Melbourne.

Maxwell S, Burbidge AA, and Morris K (1996) 'The Action Plan for Australian Masupials and Monotremes.' Australian Marsupial and Monotremes Specialist Group, IUCN Survival Commission, Environment Australia Endangered Species Program No. 500, Canberra.

Morcombe M (2003) 'Field Guide to Australian Birds.' Steve Parish Publishing, Brisbane.

Morris AK (1980) The status and distribution of the Turquoise Parrot in New South Wales. *Australian Birds* 14**,** 57-67.

NPWS (1999a). Black Bittern: Threatened Species Information, http://www.nationalparks.nsw.gov.au/PDFs/tsprofile_black_bittern.pdf, NSW National Parks and Wildlife Service

NPWS (1999b) 'Cumberland Plain Land Snail: Threatened Species Information.' NPWS, Hurstville.

NPWS (1999c). Greater Sand Plover: Threatened Species Information, http://www.environment.nsw.gov.au/resources/nature/tsprofileGreaterSandPlover.pdf, NSW National Parks and Wildlife Service

NPWS (1999d). Green and Golden Bell Frog: Threatened Species Information, http://www.nationalparks.nsw.gov.au/PDFs/tsprofile_green_golden_bell_frog.pdf, National Parks and Wildlife Service

NPWS (1999e) 'Lesser Sand Plover: Threatened Species Information.' NPWS, Hurstville.

NPWS (1999f). Regent Honeyeater: Threatened Species Information, http://www.nationalparks.nsw.gov.au/PDFs/tsprofile_regent_honeyeater.pdf, NSW National Parks and Wildlife Service

NPWS (1999g). Spotted-tailed Quoll: Threatened Species Information, http://www.nationalparks.nsw.gov.au/PDFs/tsprofile_spotted_tailed_quoll.pdf, New South Wales National Parks and Wildlife Service

NPWS (2000a) *Pimelea spicata* - Environmental Impact Assessment Guidelines.

NPWS (2000b). *Tetratheca juncea*: Threatened Species Information, http://www2.nationalparks.nsw.gov.au/PDFs/TSprofile_Tetratheca_juncea.pdf,

http://www2.nationalparks.nsw.gov.au/PDFs/TSprofile_Tetratheca_juncea.pdf

NPWS (2002a). Declaration of Critical Habitat for the Endangered Population of Little Penguins (*Eudyptula minor*) at Manly (pursuant to s.40 amd 43 of the *Threatened Species Conservation Act* 1995), http://www.environment.nsw.gov.au/resources/nature/crithabitatDeclarationLittlePenguinsManly.pdf

NPWS (2002b) '*Dillwynia tenuifolia* - Environmental Impact Assessment Guidelines.' NSW National Parks and Wildlife Service, Hurstville.

NPWS (2002c). *Grevillea parviflora* subsp. *parviflora* Environmental Impact Assessment Guidelines, http://www2.nationalparks.nsw.gov.au/PDFs/Gparviflora_eia_0802.pdf,

NPWS (2002d) 'Pultenaea parviflora: Threatened Species Information.'.

NPWS (2002e). Threatened Species Information - Pultenaea pedunculata, http://www.nationalparks.nsw.gov.au/PDFs/TSprofile_Pultenaea_pedunculata.pdf,

NPWS (2002f). Threatened Species Information, *Epacris purpurescens* var. *purpurescens*,

NPWS (2003a). *Acacia pubescens*: Threatened Species Information, http://www.environment.nsw.gov.au/resources/nature/tsprofileAcaciaPubescens.pdf, NSW National Parks and Wildlife Service

NPWS (2003b). *Darwinia biflora*: Threatened Species Information, NSW National Parks and Wildlife Service

NPWS (2004) '*Pimelea spicata:* Threatened Species Information.' NSW National Parks and Wildlife Service.

NSW Government (2009). BioNet, http://www.bionet.nsw.gov.au/Area.cfm , NSW Government

NSW Scientific Committee (1998). Final determination to list *Persoonia hirsuta* as an endangered species, http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Persoonia+hirsuta+a+spreading+to+decumbant+shrub+-+endangered+species+listing,

NSW Scientific Committee (2003) 'Final determination to list the population of *Marsdenia viridiflora* ssp *viridiflora* in Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith Local Government Areas as an Endangered Population.' NPWS, Hurstville.

NSW Scientific Committee (2008a). Final determination to list Long-nosed Bandicoot *Perameles nasuta* Geoffroy, 1804 in inner western Sydney as an endangered population, http://www.environment.nsw.gov.au/determinations/longnosedbandicootfd.htm , Department of Environment and Climate Change

NSW Scientific Committee (2008b). Little Lorikeet *Glossopsitta pusilla* - proposed vulnerable species listing, http://www.environment.nsw.gov.au/determinations/littlelorikeetpd.htm,

NSW Scientific Committee (2009a). Little Eagle *Hieraaetus morphnoides* - proposed vulnerable species listing, http://www.environment.nsw.gov.au/determinations/littleeaglepd.htm, NSW Scientific Committee

NSW Scientific Committee (2009b). White-fronted Chat *Epthianura albifrons* - proposed vulnerable species listing, http://www.environment.nsw.gov.au/determinations/whitefrontedchatpd.htm, Department of Environment and Climate Change and Water

NSW Scientific Committee (2009c). White-fronted Chat *Epthianura albifrons* population in the Sydney Metropolitan Catchment management Authority area - proposed endangered population listing, http://www.environment.nsw.gov.au/determinations/witefrontedchatpopulationpd.htm, Department of Environment and Climate Change and Water

NSW Scientific Committee (2010a). Pied Oystercatcher *Haematopus longirostris* - endangered species listing, http://www.environment.nsw.gov.au/determinations/piedoystercatcherFD.htm,

Department of Environment, Climate Change and Water

NSW Scientific Committee (2010b). Varied Sittella *Daphoenositta chrysoptera* - Final Determination of proposed vulnerable species listing, http://www.environment.nsw.gov.au/determinations/variedsittellaFD.htm, Department of Environment, Climate Change and Water

OBPRT (1998) 'Orange-bellied Parrot Recovery Plan 1998-2002.' Orange-bellied Parrot Recovery Team. Parks and Wildlife Service, Hobart.

Penman TD, Lemckert FL, and Mahony MJ (2008) Spatial ecology of the giant burrowing frog (*Heleioporus australiacus*): implications for conservation prescriptions. *Australian Journal of Zoology* 56**,** 179-186.

Pennay M (2008) A maternity roost of the Large-eared Pied Bat *Chalinolobus dwyeri* (Ryan) (Microchiroptera: Vespertilionidae) in central New South Wales Australia. *Australian Zoologist* 34**,** 564-569.

Pizzey G and Knight F (1997) 'The Field Guide to the Birds of Australia.' Angus and Robertson, Sydney.

Pizzey G and Knight F (2007) 'The Field Guide to the Birds of Australia.' Harper Collins Publishers, Sydney.

Recsei J (1996) Eastern Owl Frog, *Heleioporus australiacus*. Pp. 55-64 In 'Threatened Frogs of New South Wales: Habitats, Status and Conservation.' (Ed. H Ehmann). Frog and Tadpole Study Group of NSW, Sydney South.

Richards GC (2008) Yellow-bellied Sheath-tailed Bat *Saccolaimus flaviventris*. Pp. 472-473 In 'Mammals of Australia' (Eds S Van Dyck and R Strahan). Reed New Holland, Sydney.

Robinson L (1994) 'Field Guide to the Native Plants of Sydney.' Kangaroo Press, Sydney.

Robinson M (1993) 'A Field Guide to Frogs of Australia.' Reed New Holland, Sydney.

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

Simpson K and Day N (1996) 'Field guide to the birds of Australia.' Viking. Penguin Books Australia Ltd., Ringwood.

Slater P *et al.* (2003) 'The Slater Field Guide to Australian Birds.' New Holland Publishers, Australia.

Threatened Species Scientific Committee (2008). *Commonwealth Listing Advice on* Thelymitra sp. Kangaloon (D.L.Jones 18108), http://www.environment.gov.au/biodiversity/threatened/species/pubs/81971-listing-advice.pdf, Department of the Environment, Water, Heritage and the Arts

Threatened Species Scientific Committee (2010). Commonwealth listing advice on *Pseudomys novaehollandiae* (New Holland Mouse), http://www.environment.gov.au/biodiversity/threatened/species/pubs/96-listing-advice.pdf, Department of Environment, Water, Heritage and the Arts

Thumm K and Mahoney M (2002) Evidence for continuous iteroparity in a temperate-zone frog, the Red-crowned Toadlet, *Pseudophryne australis* (Anura: Myobatrachidae). *Australian Journal of Zoology* 50**,** 151-167.

Thumm K and Mahony M (1997) Red-crowned Toadlet *Pseudophryne australis*. Pp. 125-135 In 'Threatened Frogs of New South Wales: Habitats, Status and Conservation' (Ed. H Ehmann). Frog and Tadpole Study Group of NSW, Sydney South.

Tidemann CR (1995) Grey-headed Flying-fox. Pp. 439-440 In 'The Mammals of Australia' (Ed. R Strahan). Reed New Holland, Sydney.

van dyck S and Strahan R (2008) 'The Mammals of Australia Third Edition.' Reed New Holland, Sydney.

Webb JK (1996) Ecology and Conservation of the Threatened Broad-headed Snake *Hoplocephalus*

bungaroides.PhD Dissertation,' University of Sydney.

Webb JK and Shine R (1998) Ecological characteristic of an endangered snake species *Hoplocephalus bungeroides* (Sepentes: Elapidae). *Animal Conservation* 1**,** 185-193.

White AW and Pyke GH (1996) Distribution and conservation status of the Green and Golden Bell Frog *Litoria aurea* in New South Wales. *Australian Zoologist* 30**,** 177-189.